UNIVERSITAS INDONESIA

MODEL MATEMATIK GERAK ALIRAN AIR TANAH MENGGUNAKAN PENYELESAIAN TEMPORAL METODE NUMERIK *RUNGE-KUTTA* ORDE 4

SKRIPSI

Diajukan sebagai salah satu syarat untuk memperoleh gelar Sarjana

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PROGRAM STUDI TEKNIK SIPIL

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Tanggal   : 25 Juni 2012

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Judul Skripsi   : Model Matematik Gerak Aliran Air Tanah
                                  Menggunakan Penyelesaian Temporal Metode
                                  Numerik *Runge-Kutta* Orde 4

Telah berhasil dipertahankan di hadapan Dewan Penguji dan diterima sebagai bagian persyaratan yang diperlukan untuk memperoleh gelar Sarjana Teknik pada Program Studi Teknik Sipil, Fakultas Teknik, Universitas Indonesia

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Depok, 25 Juni 2012

Penulis

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ABSTRAK

Nama   : Triananda Pangestu Gusti
Program Studi   : Teknik Sipil
Judul   : Model Matematik Gerak Aliran Air Tanah Menggunakan Penyelesaian Temporal Metode Numerik *Runge-Kutta Orde* 4

Air tanah yang memiliki kualitas baik terbentuk dalam jangka waktu yang cukup lama den berbanding terbalik dengan jangka waktu pengambilan yang dilakukan oleh manusia. Untuk menghindari timbulnya permasalahan baru, diperlukan suatu simulator yang dapat mensimulasi gerak aliran air tanah pada suatu daerah sehingga dapat diprediksi dampak pengambilan air tersebut. Skripsi ini mengembangkan model gerak aliran air tanah secara dua dimensi dengan menggunakan *platform*dan penyelesaian sederhana, penyelesaian temporal metode numerik *Runge-Kutta Orde 4* untuk menjadi salah satu alternatif simulator gerak aliran air tanah yang dibutuhkan.

Kata kunci:
Air tanah, *Runge-Kutta Orde 4*

ABSTRACT

Name   : Triananda Pangestu Gusti
Study Program   : Civil Engineering
Title   : Mathematical Model of Groundwater Flow Motion Using Temporal Solution of Numerical Method Runge-Kutta 4th Order

Groundwater that has a good quality is formed in long time period inversely propotional to groundwater taken by humans. To avoid the emergence of new problems, we need a simulator that can simulate the movement of groundwater flow in a region that can predict the impact of taking water. This thesis is developing a groundwater flow model in two dimensions by using a simple platform and solution, temporal solution of numerical method Runge-Kutta 4th Order, to be an alternative simulator of groundwater flow that is needed.

Keyword:
Groundwater, Rung-Kutta 4th Order

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BAB 1
PENDAHULUAN

1.1 Latar Belakang

Permintaan akan air bersih yang menjadi hal pokok dalam memenuhi kebutuhan konsumsi dan sanitasi manusia meningkat seiring dengan pertambahan jumlah penduduk yang cukup pesat. Hal ini menyebabkan sumber air yang dimanfaatkan oleh manusia mulai beralih kepada air tanah, penggunaan air tanah menjadi alternatif yang sangat menguntungkan karena lebih ekonomis dibanding membeli air hasil olahan Perusahaan Air Minum yang relatif mahal.

Air tanah yang memiliki kualitas baik terbentuk dalam jangka waktu yang cukup lama berbanding terbalik dengan jangka waktu pengambilan air yang dilakukan oleh manusia sehingga untuk menghindari timbulnya permasalahan baru diperlukan suatu kebijakan yang dapat mengatur pengambilan air tanah tersebut.

Oleh karena itu diperlukan suatu simulator yang dapat mensimulasi gerak aliran air tanah pada suatu daerah sehingga dapat diprediksi dampak pengambilan air tersebut yang nantinya akan digunakan sebagai acuan bagi kebijakan yang akan dibuat dan diterapkan agar kelestarian air tanah sebagai sumber air bersih dapat terus terjaga.

Simulator ini dibuat menggunakan pendekatan model matematika dari gerak aliran air tanah yang memanfaatkan aplikasi komputer. Sampai dengan saat sekarang simulator yang dapat menggambarkan gerak aliran air tanah dibuat menggunakan penyelesaian spasial metode elemen beda hingga (*Finite Difference*) menggunakan skema *Iterative Alternating Direction Implicit* (IADI). Dalam metode ini dilakukan diskritisai ruang dan waktu yang dibagi menjadi sejumlah nodal atau sel persegi. Kemudian sesuai dengan skema yang digunakan pada metode ini iterasi bersifat implisit dimana membutuhkan sistem persamaan untuk dapat menyelesaikan persamaan gerak aliran air tanah.

Beberapa hal di atas menjadikan model ini memerlukan perhitungan aritmatika yang komplek dalam pembuatannya sehingga model gerak aliran air tanah menggunakan metode IADI memiliki harga yang cukup tinggi ketika

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dipasarkan. Keadaan ini membuat hanya sedikit badan atau perorangan yang dapat mengakses dan menggunakan model ini.

Untuk itu dibutuhkan model matematika gerak aliran air tanah yang memiliki harga murah, dapat dengan mudah diakses oleh semua orang karena bersifat *open source* dan *public domain*, serta menggunakan *platform* yang tersedia di hampir semua jenis komputer yaitu menggunakan *spread sheet*. Model ini dapat dibuat menggunakan penyelesaian yang lebih sederhana yaitu penyelesaian temporal metode numerik *Runge-Kutta* dengan angka orde yang cukup besar sehingga memiliki akurasi yang tinggi.

1.2 Tujuan

Tujuan dari tulisan ini adalah membuat model matematika dari gerak aliran air tanah secara dua dimensi dengan menggunakan penyelesaian temporal metode numerik *Runge-Kutta* orde 4 dan diverifikasi dengan cara menguji apakah hasilnya mendekati/sama dengan hasil penghitungan yang dilakukan dengan menggunakan skema *Iterative Alternating Direction Implicit* (IADI).

1.3 Ruang Lingkup

- Aliran *Unsteady*
- *Unconfined Aquifer*

1.4 Metodologi Penelitian

Permasalahan air tanah sangat berkaitan dengan kondisi di lapangan sehingga untuk dapat melakukan analisa terhadap permasalahan tersebut sangat dibutuhkan data-data lapangan, namun untuk saat ini data-data lapangan mengenai air tanah sulit untuk didapatkan sehingga penyelesaian dari masalah tersebut menjadi rumit dan komplek. Untuk itu dibuatlah model matematika dari gerak aliran air tanah yang dapat menjadi pendekatan terhadap kondisi di lapangan walaupun dengan data yang terbatas.

Model matematika ini dibuat berdasarkan persamaan-persamaan gerak aliran air tanah menggunakan penyelesaian temporal metode numerik *Runge-Kutta* orde 4 sehingga dapat menggambarkan pergerakannya dengan variabel-

variabel yang digunakan. Setelah model matematika ini selesai selanjutnya keluarannya akan di validasi terlebih dahulu menggunakan keluaran dari model matematika penyelesaian spasial metode elemen beda hingga (*Finite Difference*) dengan skema *Iterative Alternating Direction Implicit* (IADI).

Dari hasil validasi tersebut dapat dilihat apakah model matematika gerak aliran air tanah menggunakan penyelesaian temporal metode numerik *Runge-Kutta* orde 4 memiliki akurasi yang cukup tinggi mendekati kondisi dilapangan.

1.5 Sistematika Penulisan

Sistematika penulisan dari tulisan ini yang akan penulis kembangkan adalah sebagai berikut:

BAB 1. PENDAHULUAN

Bab ini berisi tentang latar belakang penulisan, tujuan penulisan, ruang lingkup, dan metode penelitian.

BAB 2. PENGEMBANGAN MODEL NUMERIK

Bab ini berisi tentang uraian lapisan air tanah tidak terkekang secara umum, pembahasan tentang metode numerik *Runge-Kutta*, metode elemen beda hingga (*Finite Difference*), variabel-variabel aliran air tanah seperti *Hydraulic Conductivity, Specific Strorage, Transmissivity* dan *Specific Yield Unconfined Aquifer* dan persamaan gerak aliran air tanah.

BAB 3. MODEL MATEMATIKA

Bab ini berisi tentang skenario model matematika gerak aliran air tanah secara dua dimensi menggunakan penyelesaian temporal metode numerik *Runge-Kutta* dan penyelesaian spasial metode elemen beda hingga (*Finite Difference*).

BAB 4. EKSPERIMENTAL MODEL MATEMATIKA

Bab ini berisi tantang hasil eksperimen menggunakan kedua model matematika gerak aliran air tanah menggunakan parameter-paramter gerak aliran air tanah yang terdapat dilapangan.

BAB 5. PENUTUP

Bab ini berisi tentang kesimpulan dan saran.

BAB 2
PENGEMBANGAN MODEL NUMERIK

2.1 Gambaran Umum

Gerak aliran air tanah yang akan ditinjau pada penulisan ini merupakan gerak aliran tanah dengan jenis aliran *unsteady* yang mengalir pada lapisan *unconfined aquifer*.

Aliran *unsteady* merupakan salah satu kondisi aliran dimana kecepatan dan penampang suatu aliran pada satu titik dapat berubah menurut waktu.

Unconfined Aquifer atau *Phreatic* merupakan akuifer yang terbatasi lapisan kedap air hanya pada bagian bawahnya saja, dimana permukaan air tanah (*water table*) pada lapisan ini dapat bebas bergerak naik turun sesuai dengan tinggi tekanan hidroliknya, sehingga akuifer ini sering disebut sebagai akuifer bebas/tidak terkekang. Jika dibuat sumur dengan kedalaman berada pada lapisan ini maka tinggi air (*water level*) didalam sumur akan sama dengan permukaan air tanah.
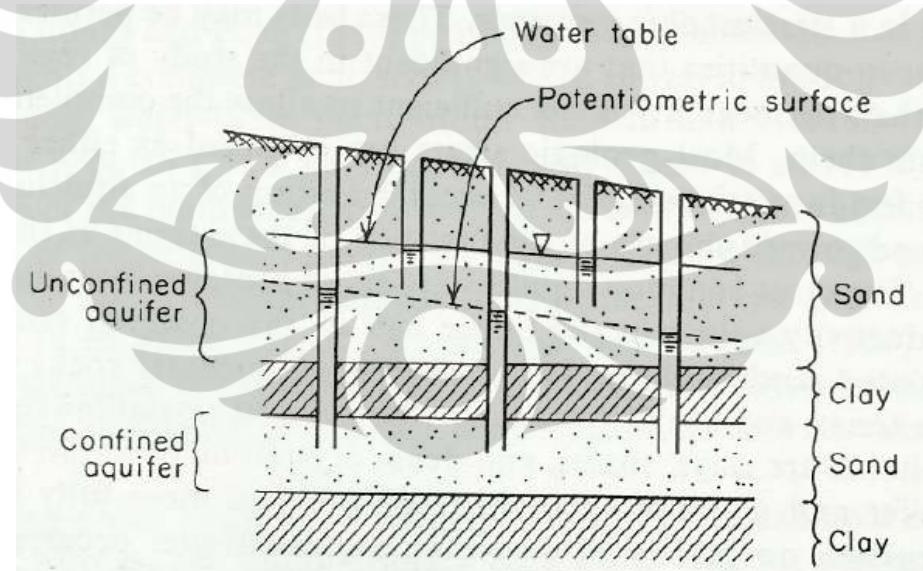
Gambar 2.1   Lapisan *unconfined aquifer* dan permukaan air tanah; lapisan *confined aquifer* dan permukaan potensiometrik.

Sumber: (Freeze & Cherry, 1979)

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2.2 Variabel Persamaan Gerak Aliran Air Tanah

Untuk menentukan perubahan tinggi tekanan hidrolik pada gerak aliran air tanah tidak terkekang diperlukan variabel-variabel hidrolik seperti *Hydraulic Conductivity (K), Transmissivity (T)* .

Persamaan gerak aliran air tanah dapat dijelaskan dengan prinsip dasar aliran melalui media berpori yang dikemukakan oleh Darcy (1856). Darcy mengemukakan bahwa besarnya debit aliran (Q) sebanding dengan penurunan tinggi tekanan dari dasar jaringan (Δh) dan berbading terbalik dengan panjang jaringan (Δl) untuk suatu jenis media berpori yang memiliki luas penampang (A) yang sama.
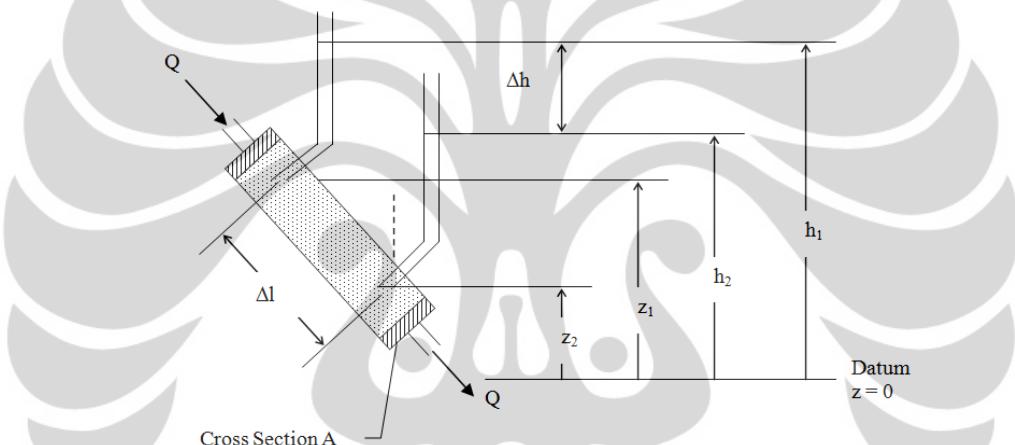
Gambar 2.2   Alat Percobaan *Darcy's Law*
Sumber: (Freeze & Cherry, 1979)

Specific discharge (v) aliran air yang melalui silinder pipa didefinisikan sebagai:

$$v = \frac{Q}{A} \qquad (2.2.1)$$

jika dimensi dari Q adalah $[L^3T^{-1}]$ dan A adalah $[L^2]$, maka v mempunyai dimensi kecepatan $[LT^{-1}]$.

Percobaan yang dilakukan oleh Darcy menunjukan bahwa v sebanding dengan $-\Delta h$ ketika Δl konstan dan kebalikannya sebanding dengan Δl ketika $-\Delta h$ konstan.

Pada percobaan ini juga diketahui bahwa v sebanding dengan permeabilitas tanah k, *specific wight* (ρg) dan berbanding terbalik dengan kinematik viskositas μ.

Dari keterangan di atas Hukum Darcy dapat ditulis sebagai berikut:

$$v = -\frac{k\rho g}{\mu}\frac{dh}{dl} \qquad (2.2.2)$$

dengan menghubungkan dengan konduktifitas hidrolik maka persamaan di atas dapat ditulis sebagai berikut:

$$v = -K\frac{dh}{dl} \qquad (2.2.3)$$

Paramerter K memiliki dimensi $[LT^{-1}]$ atau satuan *m/s*. Nilai dari koefisien K bergantung kepada kerapatan dan kemampuan meloloskan air dari media berpori, sehingga K memiliki nilai yang besar untuk media pasir dan memiliki nilai yang kecil untuk media lempung dan batuan.

Transmissivity pada akuifer tidak terkekang didefinisikan dengan persamaan $T = K.b$. Dimana K merupakan konduktivitas hidrolik dan b merupakan tebal akuifer jenuh air atau tinggi muka air tanah dari sisi atas lapisan kedap air. Tebal akuifer ini selalu berubah menurut waktu mengikuti perubahan tinggi tekanan hidrolik h. Perubahan ini mengakibatkan nilai T pada akuifer tidak terkekang juka ikut berubah menurut waktu sehingga dapat ditulis dalam persamaan berikut:

T = K.b

T = K.(h-z)

dengan   T = *Transmissivity* (m^2/s)

         K = Hydraulic conductivity (m/s)

         h = tinggi tekanan hidrolik (m)

         z = elevasi dasar akuifer tidak terkekang (m)

2.3 Persamaan Gerak Aliran Air Tanah
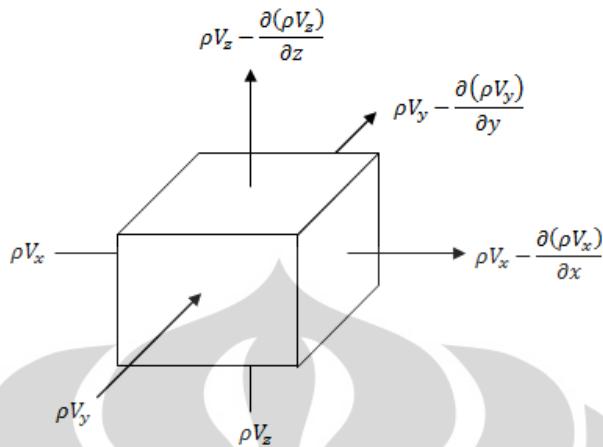
Gambar 2.3   Elemen volume kontrol untuk aliran melewati media berpori.

Sumber: (Freeze & Cherry, 1979)

Dari persamaan pengatur (*geoverning equation*) untuk aliran *unsteady* atau *transient saturated flow* pada media berpori dapat dinyatakan bahwa perubahan massa fluida yang mengalir ke dalam setiap elemen volume kontrol sama dengan perubahan tampungan massa fluida keseluruhan terhadap waktu. Berdasarkan Gambar 2.3, maka persamaan kontinuitas dari *transient saturated flow* dituliskan sebagai berikut:

$$-\frac{\partial(\rho V_x)}{\partial x} - \frac{\partial(\rho V_y)}{\partial y} - \frac{\partial(\rho V_z)}{\partial z} = \frac{\partial(\rho n)}{\partial t} \qquad (2.3.1)$$

dengan mengembangkan sisi kanan dari persamaan di atas,

$$-\frac{\partial(\rho V_x)}{\partial x} - \frac{\partial(\rho V_y)}{\partial y} - \frac{\partial(\rho V_z)}{\partial z} = n\frac{\partial \rho}{\partial t} + \rho\frac{\partial n}{\partial t} \qquad (2.3.2)$$

Bagian pertama dari sisi kanan persamaan merupakan tampungan massa fluida yang dipengaruhi oleh perubahan kerapatan ρ terhadap waktu, sedangkan pada bagian kedua merupakan tampungan massa fluida yang dipengaruhi oleh pemadatan media berpori atau perubahan porositas tanah n terhadap waktu. Jika dikaitkan dengan kompresibilitas (*compressibility*) maka bagian pertama dipengaruhi oleh kompresibilitas fluida β dan pada bagian kedua dipengaruhi oleh kompresibilitas media berpori α.

Dengan menghubungkan perubahan kerapatan air pada bagian pertama sebagai akibat adanya perubahan tekanan fluida, maka hal ini dapat ditulis sebagai persamaan berikut:

$$d\rho = \rho\beta dp \qquad (2.3.3)$$

dengan diketahui bahwa $dp = \rho gdh$ maka persamaan di atas menjadi:

$$d\rho = \rho\beta\rho gdh \qquad (2.3.4)$$

Pada bagian kedua perubahan porositas dapat dihubungkan dengan perubahan volume tanah total sebagai akibat adanya perubahan tegangan efektif tanah , maka hal ini dapat ditulis sebagai persamaan berikut:

$$dV_t = \alpha V_t d\sigma_e \qquad (2.3.5)$$

dengan diketahun bahwa $d\sigma_e = \rho gdh$ maka persamaan di atas menjadi:

$$dV_t = \alpha V_t \rho gdh \qquad (2.3.6)$$

perubahan volume tanah total sebanding dengan perubahan porositas, sehingga untuk volume tanah total sebesar satu satuan $V_t = 1$ maka persamaan di atas menjadi:

$$dn = \alpha\rho gdh \qquad (2.3.7)$$

dengan melakukan subtitusi persamaan perubahan kerapatan dan perubahan porositas, sisi kanan persamaan gerak aliran air tanah akan menjadi seperti berikut:

$$n\frac{\partial\rho}{\partial t} + \rho\frac{\partial n}{\partial t} = n\frac{\rho\beta\rho gdh}{\partial t} + \rho\frac{\alpha\rho gdh}{\partial t} = (n\beta + \alpha)\rho g\rho\frac{dh}{dt} \qquad (2.3.8)$$

Specific storage dapat didefinisikan sebagai volume air yang dilepaskan dari tampungan akuifer untuk menurunkan satu unit muka air tanah dalam satu unit tinggi tekanan hidrolik. Air yang dilepaskan terjadi akibat pengaruh dari dua mekanisme yaitu: (1) pemadatan akuifer akibat peningkatan tegangan efektif yang dikontrol oleh kompresibilitas media berpori dan (2) ekspansi air akibat penurunan tekanan fluida yang dikontrol oleh kompresibilitas fluida.

- Kompresibilitas media berpori (α)

Kompresibilitas media berpori (α) adalah perubahan volume tanah per volume tanah total akibat perubahan tengangan efektif tanah, dituliskan dalam persamaan berikut:

$$\alpha = -\frac{\frac{d(V_t)}{V_t}}{d\sigma_e}$$ (2.3.9)

jika luas penampang media berpori adalah sama maka persamaan di atas ditulis sebagai berikut:

$$\alpha = -\frac{\frac{db}{b}}{d\sigma_e}$$ (2.3.10)
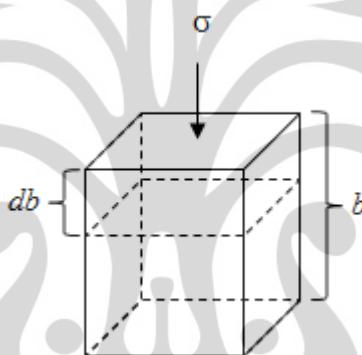
Gambar 2.4   Skematik kompresibilitas media berpori.
Sumber: (Freeze & Cherry, 1979)

Volume tanah total (V_t) terdiri dari volume butiran tanah (V_s) dan volume pori (V_v) sehingga dapat ditulis $V_t = V_s + V_v$. Diketahui bahwa volume butiran tanah tidak berubah meskipun terjadi perubahan pada nilai volume tanah total ($dV_s = 0$) sehingga perubahan pada volume tanah total dipengaruhi oleh perubahan pada volume pori $dV_t = dV_v$. Volume pori terdiri dari volume udara dan volume air, perubahan volume pori dipengaruhi oleh perubahan pada volume air sehingga $dV_t = dV_w$. Pengurangan pada volume tanah total dV_t bernilai negatif sementara volume air yang dilepaskan dV_w menjadi bernilai positif, sehingga apabila dihubungkan dengan kompresibilitas media berpori dapat ditulis menjadi persamaan berikut:

$$dV_w = -dV_t = \alpha V_t d\sigma_e$$ (2.3.11)

Perubahan tegangan efektif pada suatu titik terjadi akibat perubahan tinggi tekanan hidrolik pada titik tersebut, seperti pada persamaan berikut:

$$d\sigma_e = -\rho g dh \tag{2.3.12}$$

Untuk satu unit volume tanah total, $V_t = 1$ dan penurunan satu unit tinggi tekanan hidrolik, $dh = -1$ sehingga menjadi persamaan berikut:

$$dV_w = \alpha \rho g \tag{2.3.13}$$

- Kompresibilitas fluida (β)

    Kompresibilitas fluida (β) adalah perubahan volume air per volume air total akibat perubahan tekanan fluida, dituliskan dalam persamaan berikut:

$$\beta = -\frac{\frac{d(V_w)}{V_w}}{dp} \tag{2.3.14}$$

jika massa fluida adalah sama maka persamaan di atas ditulis sebagai berikut:

$$\beta = -\frac{\frac{d\rho}{\rho}}{dp} \tag{2.3.15}$$

Sehingga perubahan vlume air terhadap perubahan tekanan fluida dapa ditulis sebagai berikut:

$$dV_w = -\beta V_w dp \tag{2.3.16}$$

Perubahan tekanan fluida pada suatu titik terjadi akibat perubahan tinggi tekanan hidrolik pada titik tersebut, seperti pada persamaan berikut:

$$dp = \rho g dh \tag{2.3.17}$$

Volume air (V_w) pada volume tanah total merupakan (nV_t) dimana n adalah porositas tanah. Untuk satu unit volume tanah total, $V_t = 1$ dan penurunan satu unit tinggi tekanan hidrolik, $dh = -1$ sehingga persamaan di atas dapat ditulis menjadi persamaan berikut:

$$dV_w = \beta n \rho g \tag{2.3.18}$$

Specific storage (Ss) merupakan penjumlahan perubahan volume air akibat kedua mekanisme di atas sehingga dapat ditulis menjadi persamaan berikut:

$$S_s = \alpha \rho g + \beta n \rho g$$
$$S_s = \rho g (\alpha + \beta n) \tag{2.3.19}$$

diketahui bahwa $S_s = \rho g(\alpha + \beta n)$ maka persamaan gerak aliran air tanah pada persamaan (2.3.2) dapat ditulis menjadi:

$$-\frac{\partial(\rho V_x)}{\partial x} - \frac{\partial(\rho V_y)}{\partial y} - \frac{\partial(\rho V_z)}{\partial z} = \rho S_s \frac{dh}{dt} \qquad (2.3.20)$$

kemudian sisi kiri persamaan diuraikan menjadi seperti berikut:

$$\frac{\partial(\rho V_x)}{\partial x} = \rho \frac{\partial V_x}{\partial x} + V_x \frac{\partial \rho}{\partial x} \qquad (2.3.21)$$

karena perubahan kerapatan terhadap perubahan jarak memiliki nilai yang sangat kecil dibandingkan dengan nilai perubahan volume terhadap perubahan jarak maka $V_x \frac{\partial \rho}{\partial x}$ dapat diabaikan atau dianggap nol.

Sehingga persamaan gerak aliran air tanah ditulis sebagai berikut:

$$-\rho \frac{\partial V_x}{\partial x} - \rho \frac{\partial V_y}{\partial y} - \rho \frac{\partial V_z}{\partial z} = \rho S_s \frac{dh}{dt} \qquad (2.3.22)$$

atau

$$-\frac{\partial V_x}{\partial x} - \frac{\partial V_y}{\partial y} - \frac{\partial V_z}{\partial z} = S_s \frac{dh}{dt} \qquad (2.3.23)$$

Dengan melakukan subtitusi persamaan V_x, V_y, *dan* V_z dari rumus Darcy maka persamaan di atas menjadi:

$$\frac{\partial}{\partial x}\left[K_x \frac{\partial h}{\partial x}\right] + \frac{\partial}{\partial y}\left[K_y \frac{\partial h}{\partial y}\right] + \frac{\partial}{\partial z}\left[K_z \frac{\partial h}{\partial z}\right] = S_s \frac{dh}{dt} \qquad (2.3.24)$$

Pada akuifer tidak terkekang terdapat sebuah koefisien yang dikenal dengan *Specific yield* (S_y). *Specific yield* dapat didefinisikan sebagai volume air yang dilepaskan dari tampungan akuifer tidak terkekang untuk menurunkan sat unit muka air tanah.
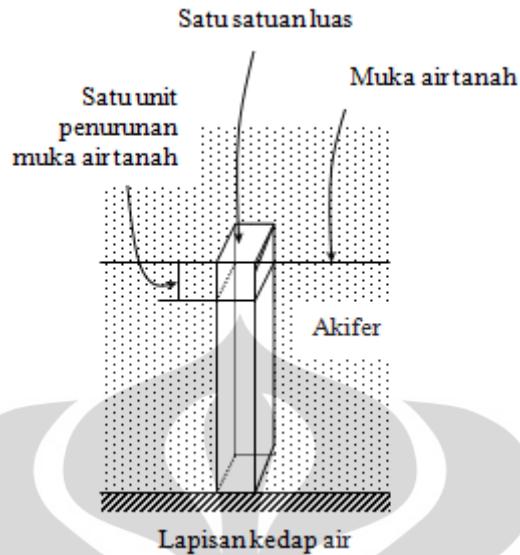
Gambar 2.5   Skematik dari *specific yield (Sy)* pada *unconfined aquifer*.

Sumber: (Freeze & Cherry, 1979)

Sehingga untuk kasus dua dimensi pada akuifer tidak terkekang, *Ss* dirubah menjadi *Sy* maka persamaan (2.3.24) di atas menjadi:

$$\frac{\partial}{\partial x}\left[K_x \frac{\partial h}{\partial x}\right] + \frac{\partial}{\partial y}\left[K_y \frac{\partial h}{\partial y}\right] = S_y \frac{dh}{dt}$$

$$K_x \frac{\partial^2 h}{\partial x^2} + K_y \frac{\partial^2 h}{\partial y^2} = S_y \frac{dh}{dt} \tag{2.3.25}$$

2.4   Metode Elemen Beda Hingga (*Finite Difference*)

2.4.1 Diskretisasi Model

Pada penyelesaian persamaan diferensial menggunakan metode elemen beda hingga dilakukan diskretisasi ruang dan waktu yang dinyatakan dengan *Δx* dan *Δt*. Diskretisasi ruang dilakukan dengan melakukan pembagian wilayah menjadi grid-grid berbentuk persegi atau persegi panjang dengan jarak antar nodal atau sel dalam arah *x* dan *y* konstan yang disebut sebagai *Δx = h* dan *Δy = k*. Sama halnya dengan diskretisasi ruang, diskretisasi waktu dilakukan dengan membagi waktu dalam nilai kenaikan konstan yaitu *Δt*.
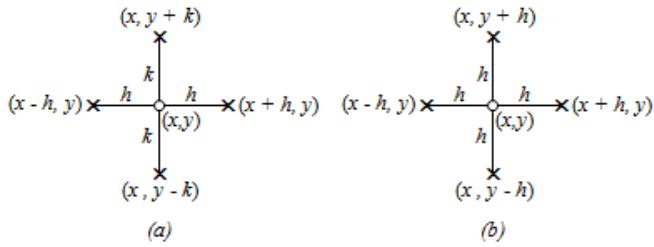
Gambar 2.6   Skema diskretisasi ruang (a) $h \neq k$, (b) $h = k$.

Dikretisasi diturunkan menggunakan Deret Taylor seperti berikut:

Persamaan Deret Taylor (pada arah x):

$$FD \quad u(x + h, y) = u(x, y) + h u_x(x, y) + \frac{1}{2} h^2 u_{xx}(x, y) + \frac{1}{6} h^3 u_{xxx}(x, y) + \cdots$$

$$BD \quad u(x - h, y) = u(x, y) - h u_x(x, y) + \frac{1}{2} h^2 u_{xx}(x, y) - \frac{1}{6} h^3 u_{xxx}(x, y) + \cdots$$

$$u(x + h, y) + u(x - h, y) = 2u(x, y) + h^2 u_{xx}(x, y) + \cdots$$

dengan mengabaikan unsur yang mengandung h^4, h^6, ..., maka didapatkan

$$u(x + h, y) + u(x - h, y) = 2u(x, y) + h^2 u_{xx}(x, y)$$
$$u_{xx}(x, y) \approx \frac{1}{h^2}[u(x + h, y) - 2u(x, y) + u(x - h, y)] \tag{2.4.1}$$

Persamaan Deret Taylor (pada arah y):

$$FD \quad u(x, y + k) = u(x, y) + k u_y(x, y) + \frac{1}{2} k^2 u_{yy}(x, y) + \frac{1}{6} k^3 u_{yyy}(x, y) + \cdots$$

$$BD \quad u(x, y - k) = u(x, y) - k u_y(x, y) + \frac{1}{2} k^2 u_{yy}(x, y) - \frac{1}{6} k^3 u_{yyy}(x, y) + \cdots$$

$$u(x, y + k) + u(x, y - k) = 2u(x, y) + k^2 u_{yy}(x, y) + \cdots$$

dengan mengabaikan unsur yang mengandung k^4, k^6, ..., maka didapatkan

$$u(x, y + k) + u(x, y - k) = 2u(x, y) + k^2 u_{yy}(x, y)$$
$$u_{yy}(x, y) \approx \frac{1}{k^2}[u(x, y + k) - 2u(x, y) + u(x, y - k)] \tag{2.4.2}$$

2.4.2 Iterative Alternating Direction Implicit Scheme

Iterative Alternating Direction Implicit atau IADI merupakan skema yang dapat menyelesaikan persamaan diferensial parsial dua dimensi menggunakan matrik tridiagional. Dalam skema ini di setiap perubahan dieksekusi menggunakan dua langkah.

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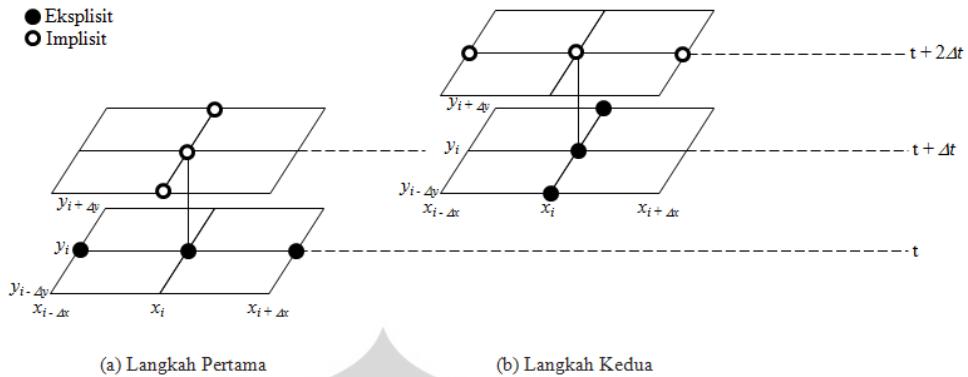
Gambar 2.7   Skema IADI pada persamaan parabolik dua dimensi.

Sumber: (Chapra & Canale, 1998)

Persamaan turunan kedua yang didapatkan dari Deret Taylor, persamaan (2.4.1) dan (2.4.2) disubtitusikan kedalam persamaan Laplace dengan kondisi $h = k$ sehingga menjadi seperti berikut:

$$\nabla^2 u = u_{xx} + u_{yy} = 0$$

$$u(x + h, y) + u(x, y + h) + u(x - h, y) + u(x, y - h) - 4u(x, y) = 0$$

Jika besar nilai $h = k = 1$ dan $u_{xy} = u(x, y)$ maka persamaan di atas dapat ditulis menjadi:

$$u_{x+1,y} + u_{x,y+1} + u_{x-1,y} + u_{x,y-1} - 4u_{x,y} = 0 \qquad (2.4.3)$$

persamaan (2.4.3) merupakan aproksimasi 5-titik dengan skema atau pola

$$\begin{bmatrix} & 1 & \\ 1 & -4 & 1 \\ & 1 & \end{bmatrix}$$

Pola di atas menunjukkan bahwa sebuah matrik tridiagonal dapat dibentuk jika terdapat tiga titik pada satu baris atau terdapat tiga titik pada satu kolom, sehingga bila disusun pada sisi kiri persamaan merupakan u baris-y dan sisi kanan persamaan merupakan u kolom-x maka persamaan (2.4.3) menjadi:

$$u_{x-1,y} - 4u_{x,y} + u_{x+1,y} = -u_{x,y-1} - u_{x,y+1} \qquad (2.4.3a)$$

dapat pula disusun pada sisi kiri persamaan merupakan u kolom-x dan sisi kanan persamaan merupakan u baris-y maka persamaan (2.4.3) menjadi:

$$u_{x,y-1} - 4u_{x,y} + u_{x,y+1} = -u_{x-1,y} - u_{x+1,y} \qquad (2.4.3b)$$

Pada skema IADI dilakukan proses iterasi dengan mengambil sebuah nilai awal $u_{x,y}^{(0)}$, pada saat melakukan iterasi dilakukan dua tahapan. Tahapan

pertama dilakukan iterasi menggunakan persamaan (2.4.3a) dan dilangkah kedua dilakukan iterasi mengunakan persamaan (2.4.3b), dilakukan tahapan yang sama untuk iterasi berikutnya.

Lebih detilnya, jika pendekatan hasil untuk $u_{x,y}^{(m)}$ telah didapatkan maka selanjutnya dilakukan perhitungan pendekatan hasil untuk $u_{x,y}^{(m+1)}$ dengan melakukan subtitusi $u_{x,y}^{(m)}$ pada sisi kanan persamaan (2..4.3a) dan $u_{x,y}^{(m+1)}$ di sisi kiri. Persamaan (2.4.3a) menjadi berikut:

$$u_{x-1,y}^{(m+1)} - 4u_{x,y}^{(m+1)} + u_{x+1,y}^{(m+1)} = -u_{x,y-1}^{(m)} - u_{x,y+1}^{(m)} \qquad (2.4.4a)$$

selanjutnya pendekatan hasil untuk $u_{x,y}^{(m+1)}$ telah didapatkan maka dilakukan perhitungan pendekatan hasil untuk $u_{x,y}^{(m+2)}$ dengan melakukan subtitusi $u_{x,y}^{(m+1)}$ pada sisi kanan persamaan (2.4.3b) dan $u_{x,y}^{(m+2)}$ di sisi kiri. Persamaan (2.4.3b) menjadi berikut:

$$u_{x,y-1}^{(m+2)} - 4u_{x,y}^{(m+2)} + u_{x,y+1}^{(m+2)} = -u_{x-1,y}^{(m+1)} - u_{x+1,y}^{(m+1)} \qquad (2.4.4b)$$

iterasi ini dilakukan hingga mendapatkan nilai yang tetap dengan bantuan penyelesaian matrik menggunakan cara eliminasi Gauss.

2.5 Metode Numerik *Runge-Kutta* orde 4

Metode numerik *Runge-Kutta* (*RK*) merupakan sebuah metode numerik yang digunakan untuk menyelesaikan persamaan diferensial. Metode ini memiliki keunggulan dari metode-metode numerik lainnya karena memiliki laju pertumbuhan *truncation error* yang kecil. Secara umum metode ini dapat ditulis:

$$y_{i+1} = y_i + \emptyset(x_i, y_i, h)h \qquad (2.5.1)$$

Dari persamaan di atas $\emptyset(x_i, y_i, h)$ disebut sebagai fungsi peningkatan yang dapat diinterpretasikan sebagai kemiringan pada setiap interval. Fungsi peningkatan ini dapat ditulis dalam bentuk umum sebagai berikut:

$$\emptyset = a_1 k_1 + a_2 k_2 + \cdots + a_2 k_2 \qquad (2.5.2)$$

dimana nilai a adalah selalu konstan dan nilai k adalah sebagai berikut:

$$k_1 = f(x_i, y_i) \qquad (2.5.2a)$$

$$k_2 = f(x_i + p_1 h, y_i + q_{11} k_1 h) \qquad (2.5.2b)$$

$$k_3 = f(x_i + p_2 h, y_i + q_{21} k_1 h + q_{22} k_2 h) \qquad (2.5.2c)$$

.

.

$$k_n = f(x_i + p_{n-1}h, y_i + q_{n-1,1}k_1h + q_{n-1,2}k_2h + \cdots + q_{n-1,n-1}k_{n-1}h) \qquad (2.5.2d)$$

Perlu diperhatikan bahwa nilai k merupakan sebuah hubungan yang saling berkaitan, nilai k_1 muncul pada persamaan k_2 kemudian pada persamaan k_3 dan begitu seterusnya. Karena setiap nilai k merupakan sebuah fungsi evaluasi, keterkaitan ini membuat metode numerik RK ini efisien untuk perhitungan menggunakan komputer. Selanjutnya ketika nilai orde (n) telah ditetapkan, nilai dari a, p dan q dievaluasi dengan cara mengatur persamaan dasar sesuai dengan ekspansi deret Taylor.

Metode numerik RK yang paling sering digunakan adalah metode numerik RK orde 4, karena semakin besar nilai orde (n) maka akurasi dari penyelesainnya semakin baik. Berikut merupakan bentuk umum yang sering digunakan dan biasa disebut sebagai *Metode klasik RK orde 4:*

$$y_{i+1} = y_i + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)h \qquad (2.5.3)$$

dimana

$$k_1 = f(x_i, y_i) \qquad (2.5.3a)$$

$$k_2 = f\left(x_i + \frac{1}{2}h, y_i + \frac{1}{2}k_1h\right) \qquad (2.5.3b)$$

$$k_3 = f\left(x_i + \frac{1}{2}h, y_i + \frac{1}{2}k_2h\right) \qquad (2.5.3c)$$

$$k_4 = f(x_i + h, y_i + k_3h) \qquad (2.5.3d)$$

MODEL MATEMATIK

3.1 Penyelesaian Sistem Persamaan Aliran Air Tanah dengan Metode *IterativeAlternating Direction Implicit*

Berdasarkan persamaan (2.4.1) dan (2.4.2), persamaan gerak aliran air tanah dapat diturunkan menggunakan metode IADI seperti berikut:

$$K_x \frac{\partial^2 h}{\partial x^2} + K_y \frac{\partial^2 h}{\partial y^2} = S_y \frac{dh}{dt}$$

$$S_y \frac{h_{x,y}^{(t+\Delta t)} - h_{x,y}^{(t)}}{\Delta t} =$$

$$K_x \left(\frac{h_{x+1,y}^{(t)} - 2h_{x,y}^{(t)} + h_{x-1,y}^{(t)}}{\Delta x^2} \right) + K_y \left(\frac{h_{x,y+1}^{(t)} - 2h_{x,y}^{(t)} + h_{x,y-1}^{(t)}}{\Delta y^2} \right)$$

$$S_y \frac{h_{x,y}^{(t+\Delta t)}}{\Delta t} - S_y \frac{h_{x,y}^{(t)}}{\Delta t} = K_x \frac{h_{x+1,y}^{(t)}}{\Delta x^2} - 2K_x \frac{h_{x,y}^{(t)}}{\Delta x^2} + K_x \frac{h_{x-1,y}^{(t)}}{\Delta x^2} +$$

$$K_y \frac{h_{x,y+1}^{(t)}}{\Delta y^2} - 2K_y \frac{h_{x,y}^{(t)}}{\Delta y^2} + K_y \frac{h_{x,y-1}^{(t)}}{\Delta y^2} \tag{3.1.1}$$

Pada iterasi pertama dari persamaan (2.6.1) $h(t + \Delta t)$ pada arah x didapat berdasarkan $h(t)$ pada arah y

$$S_y \frac{h_{x,y}^{(t+\Delta t)}}{\Delta t} - S_y \frac{h_{x,y}^{(t)}}{\Delta t} = K_x \frac{h_{x+1,y}^{(t+\Delta t)}}{\Delta x^2} - 2K_x \frac{h_{x,y}^{(t+\Delta t)}}{\Delta x^2} + K_x \frac{h_{x-1,y}^{(t+\Delta t)}}{\Delta x^2} +$$

$$K_y \frac{h_{x,y+1}^{(t)}}{\Delta y^2} - 2K_y \frac{h_{x,y}^{(t+\Delta t)}}{\Delta y^2} + K_y \frac{h_{x,y-1}^{(t)}}{\Delta y^2}$$

$$h_{x+1,y}^{(t+\Delta t)} \frac{K_x}{\Delta x^2} - h_{x,y}^{(t+\Delta t)} \left(\frac{S_y}{\Delta t} + \frac{2K_x}{\Delta x^2} + \frac{2K_y}{\Delta y^2} \right) + h_{x-1,y}^{(t+\Delta t)} \frac{K_x}{\Delta x^2} =$$

$$-h_{x,y+1}^{(t)} \frac{K_y}{\Delta y^2} + h_{x,y}^{(t)} \frac{S_y}{\Delta t} - h_{x,y-1}^{(t)} \frac{K_y}{\Delta y^2} \tag{3.1.1a}$$

Pada iterasi kedua, dari persamaan (2.6.1) $h(t + \Delta t)$ pada arah y didapat berdasarkan $h(t)$ pada arah x

$$S_y \frac{h_{x,y}^{(t+\Delta t)}}{\Delta t} - S_y \frac{h_{x,y}^{(t)}}{\Delta t} = K_x \frac{h_{x+1,y}^{(t)}}{\Delta x^2} - 2K_x \frac{h_{x,y}^{(t+\Delta t)}}{\Delta x^2} + K_x \frac{h_{x-1,y}^{(t)}}{\Delta x^2} +$$

$$K_y \frac{h_{x,y+1}^{(t+\Delta t)}}{\Delta y^2} - 2K_y \frac{h_{x,y}^{(t+\Delta t)}}{\Delta y^2} + K_y \frac{h_{x,y-1}^{(t+\Delta t)}}{\Delta y^2}$$

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$$h_{x,y+1}{}^{(t+\Delta t)} \frac{K_y}{\Delta y^2} - h_{x,y}{}^{(t+\Delta t)} \left(\frac{S_y}{\Delta t} + \frac{2K_x}{\Delta x^2} + \frac{2K_y}{\Delta y^2} \right) + h_{x,y-1}{}^{(t)} \frac{K_y}{\Delta y^2} =$$

$$-h_{x+1,y}{}^{(t)} \frac{K_x}{\Delta x^2} + h_{x,y}{}^{(t)} \frac{S_y}{\Delta t} - h_{x-1,y}{}^{(t)} \frac{K_x}{\Delta x^2} \qquad (3.1.1b)$$

3.2 Penyelesaian Sistem Persamaan Aliran Air Tanah dengan Metode Numerik *Runge-Kutta Orde 4*

Berdasarkan persamaan (2.4.1), (2.4.2) dan (2.5.3), persamaan gerak aliran air tanah dapat diturunkan menggunakan metode numerik *Runge-Kutta* orde 4 seperti berikut:

$$K_x \frac{\partial^2 h}{\partial x^2} + K_y \frac{\partial^2 h}{\partial y^2} = S_y \frac{dh}{dt}$$

$$S_y \frac{h_{x,y}{}^{(t+\Delta t)} - h_{x,y}{}^{(t)}}{\Delta t} =$$

$$K_x \left(\frac{h_{x+1,y}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right) + K_y \left(\frac{h_{x,y+1}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right)$$

$$\frac{h_{x,y}{}^{(t+\Delta t)} - h_{x,y}{}^{(t)}}{\Delta t} = \frac{K_x}{S_y} \left(\frac{h_{x+1,y}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right) + \frac{K_y}{S_y} \left(\frac{h_{x,y+1}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right)$$

Dari persamaan di atas didapatkan untuk arah x sebagai berikut:

$$f(t, h_{x,y}) = \frac{K_x}{S_y} \left(\frac{h_{x+1,y}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right) \qquad (3.2.1)$$

$$k_{1x} = f(t, h_{x,y})$$

$$k_{1x} = \frac{K_x}{S_y} \left(\frac{h_{x+1,y}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right) \qquad (3.2.1a)$$

$$k_{2x} = f\left(t, h_{x,y} + \frac{1}{2}k_1\Delta t\right)$$

$$k_{2x} = \frac{K_x}{S_y} \left[\frac{h_{x+1,y}{}^{(t)} - 2\left(h_{x,y}{}^{(t)} + \frac{1}{2}k_1\Delta t\right) + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right] \qquad (3.2.1b)$$

$$k_{3x} = f\left(t, h_{x,y} + \frac{1}{2}k_2\Delta t\right)$$

$$k_{3x} = \frac{K_x}{S_y} \left[\frac{h_{x+1,y}{}^{(t)} - 2\left(h_{x,y}{}^{(t)} + \frac{1}{2}k_2\Delta t\right) + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right] \qquad (3.2.1c)$$

$$k_{4x} = f(t, h_{x,y} + k_3\Delta t)$$

$$k_{4x} = \frac{K_x}{S_y} \left[\frac{h_{x+1,y}{}^{(t)} - 2\left(h_{x,y}{}^{(t)} + k_3 \Delta t\right) + h_{x-1,y}{}^{(t)}}{\Delta x^2} \right] \tag{3.2.1d}$$

Dari persamaan di atas didapatkan untuk arah *y* sebagai berikut:

$$f\left(t, h_{x,y}\right) = \frac{K_y}{S_y} \left(\frac{h_{x,y+1}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right) \tag{3.2.2}$$

$$k_{1y} = f\left(t, h_{x,y}\right)$$

$$k_{1y} = \frac{K_y}{S_y} \left(\frac{h_{x,y+1}{}^{(t)} - 2h_{x,y}{}^{(t)} + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right) \tag{3.2.2a}$$

$$k_{2y} = f\left(t, h_{x,y} + \frac{1}{2} k_1 \Delta t\right)$$

$$k_{2y} = \frac{K_y}{S_y} \left[\frac{h_{x,y+1}{}^{(t)} - 2\left(h_{x,y}{}^{(t)} + \frac{1}{2} k_1 \Delta t\right) + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right] \tag{3.2.2b}$$

$$k_{3y} = f\left(t, h_{x,y} + \frac{1}{2} k_2 \Delta t\right)$$

$$k_{3y} = \frac{K_y}{S_y} \left[\frac{h_{x,y+1}{}^{(t)} - 2\left(h_{x,y}{}^{(t)} + \frac{1}{2} k_2 \Delta t\right) + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right] \tag{3.2.2c}$$

$$k_{4y} = f\left(t, h_{x,y} + k_3 \Delta t\right)$$

$$k_{4y} = \frac{K_y}{S_y} \left[\frac{h_{x,y+1}{}^{(t)} - 2\left(h_{x,y}{}^{(t)} + k_3 \Delta t\right) + h_{x,y-1}{}^{(t)}}{\Delta y^2} \right] \tag{3.2.2d}$$

Berdasarkan uraian persamaan gerak aliran air tanah menggunakan metode numerik *Runge-Kutta* orde 4 di atas maka persamaan tersebut dapat disederhanakan menjadi persamaan berikut:

$$h_{x,y}{}^{(t+\Delta t)} = h_{x,y}{}^{(t)} + \left[\frac{(k_1 + 2k_2 + 2k_3 + k_4)_x + (k_1 + 2k_2 + 2k_3 + k_4)_y}{6} \right] \Delta t \tag{3.2.3}$$

3.3   Penerapan pada Model Gerak Aliran Air Tanah

Dalam mengembangkan model matematika yang dapat mensimulasikan gerak aliran air tanah dengan mencatat perubahan tinggi *hydraulic head* di setiap titik terhadap waktu, sesuai dengan maksud dari penulisan karya tulis ini,

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diperlukan batas, kondisi batas, kondisi awal, variabel dan parameter aliran untuk dapat menyelesaikan persamaan gerak aliran air tanah.

3.3.1 Batas Akuifer

Batas kifer yang dimaksud disini adalah luas daerah akuifer yang akan dimodelkan dimana hal ini akan menentukan pilihan parameter diskretisasi seperti jarak antar grid pada arah sumbu x (Δx) dan y (Δy) kemudian juga jumlah nodal pada arah sumbu x (nx) dan y (ny).

3.3.2 Parameter Diskretisasi Model Gerak Aliran Air Tanah

Terdapat 3 jenis parameter untama yang digunakan pada model ini. Kedua parameter tersebut adalah:

- Parameter diskretisasi ruang
  - Jarak antar grid pada arah sumbu x : Δx
  - Jarak antar grid pada arah sumbu y : Δy
  - Jumlah nodal pada arah sumbu x : nx
  - Jumlah nodal pada arah sumbu y : ny
- Parameter diskretisasi waktu
  - Pertambahan waktu : Δt
- Parameter maksimum
  - Waktu maksimum pada model : *tm*
  - Iterasi maksimum dalam satu pertambahan waktu : *im*

3.3.3 Kondisi Batas Akuifer (*Boundary Condition)*

Terdapat 2 jenis kondisi batas yang dapat ditentukan sebagai batas dari akuifer yang dimodelkan.

- Kondisi tinggi *hydraulic head* tetap terhadap waktu (*constant head*)

Persamaan matematika dari kondisi batas ini adalah $\frac{dh}{dt} = 0$. Kondisi ini merupakan penerapan dari kondisi lapangan ketika akuifer bertemu atau dikelilingi oleh tinggi muka air tetap seperti sungai, danau, atau laut. Pada pemodelan ini untuk menjada nilai tinggi *hydraulic head* pada persamaan nodal akan diberikan nilai *Specific Yield* (*Sy*) yang besar.

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- Kondisi batas kedap air

Persamaan matematika dari kondisi batas ini adalah $K\frac{dh}{dx} = 0$. Kondisi ini merupakan penerapan dari kondisi lapangan ketika akuifer bertemu dengan wilayah yang tidak dapat dialiri air.

3.3.4 Kondisi Awal Akuifer (*Initial Condition*)

Untuk dapat mensimulasikan perubahan tinggi *hidraulic head* (*h*) menurut ruang dan waktu diperlukan kondisi awal dari *h* sebagai variabel utama (*primary variable*) model aliran air tanah pada setiap nodal. Kondisi awal ini dapat berupa nilai *h* praduga karena tidak diketahui kondisi awal yang sebenarnya untuk menjalankan simulasi pertama kali.

3.3.5 Variabel Persamaan Gerak Aliran Air Tanah

Seperti yang telah dijelaskan sebelumnya pada sub bab 2.2, variabel penentu persamaan aliran air tanah untuk akuifer tidak terkekang adalah *Specific yield* (*Sy*) dan *Hydraulic Conductivity* (*K*) pada masing-masing akuifer.

3.3.6 Algoritma dan Analisa Simulator IADI dan *Runge-Kutta* Orde 4
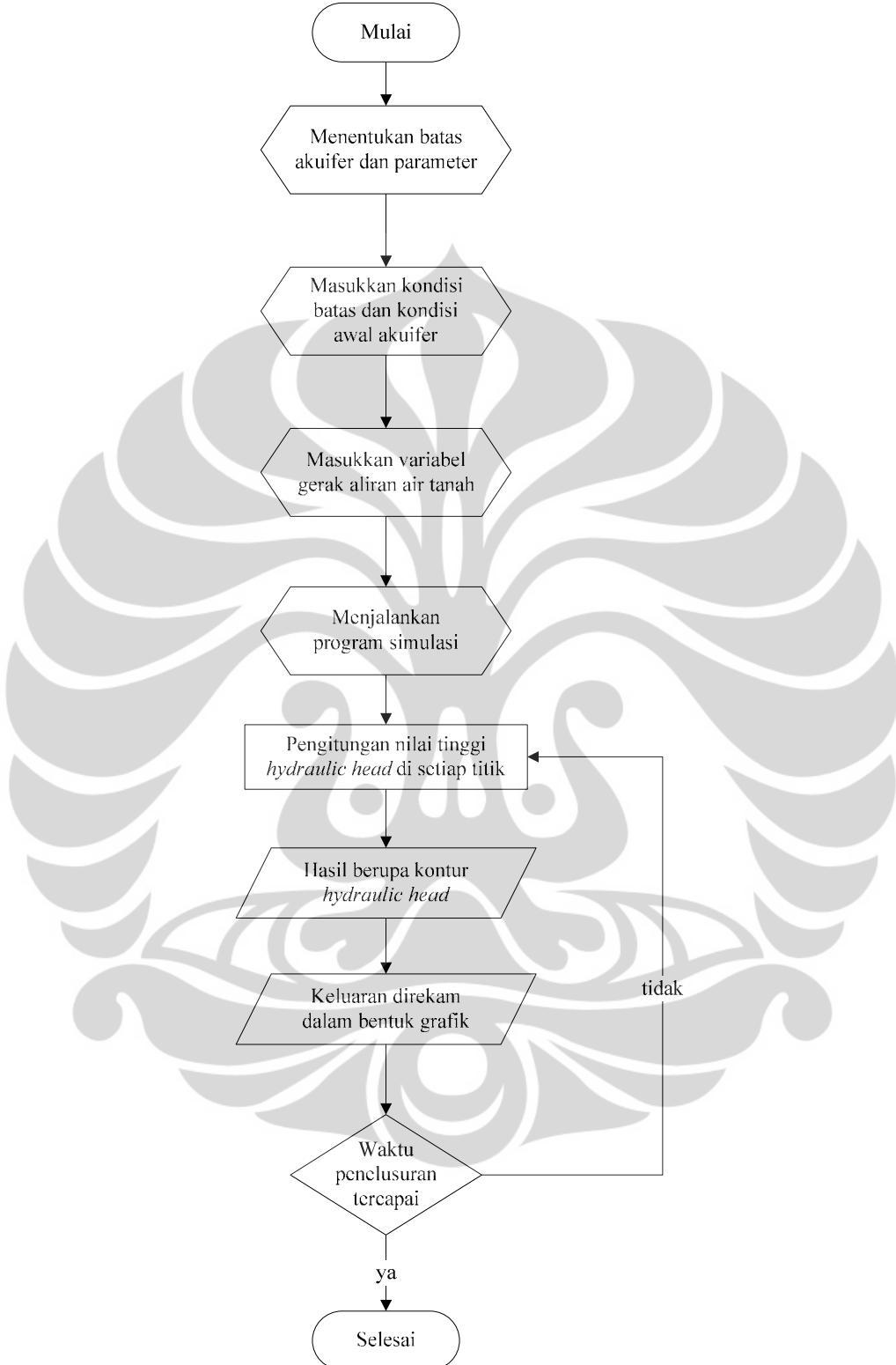
Gambar 3.1   Algoritma simulator IADI dan *Runge-Kutta* orde 4

Sumber: Olahan sendiri

Setelah masing-masing model memberikan data keluaran dari skenario yang ditentukan maka dilakukan perbandingan dan analisa sehingga dapat diketahui kemampuan dari setiap model dan dapat ditentukan model yang lebih baik.

3.4 Rancangan Aplikasi

Model matematika gerak aliran air tanah ini dibuat menggunakan *spreadsheet* yang dirancang menggunakan bahasa program *Visual Basic* pada aplikasi *MS. Excel*. Penggunaan bahasa program *Visual Basic* dipilih karena lebih sederhana dan dapat dengan mudah dipelajari dan dijalankan oleh penggunanya. Bahasa *Visual Basic* ini digunakan pada modul yang terdapat pada aplikasi *MS. Excel* baik untuk simulator IADI maupun untuk *Runge-Kutta* orde 4.

Seluruh data yang diperlukan pada model ini nantinya akan dimasukkan pada *userform* dan pada *sheet* sama diperoleh keluaran berupa data kontur dan grafik kontur dari gerak aliran air tanah setiap waktu.

Berikut merupakan *layout* beserta penjelasan penggunaan dari aplikasi model matekmatka gerak aliran tanah yang diberi nama GWFM 2012.

- Halaman Muka
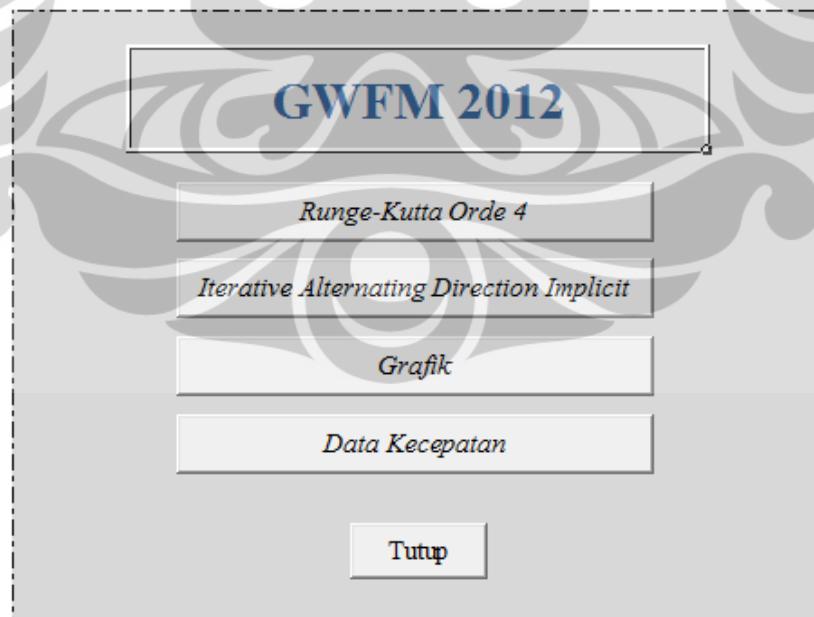
Gambar 3.2   Halaman muka aplikasi program GWFM 2012

Sumber: Olahan sendiri

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Halaman muka ini merupakan tampilan ketika aplikasi ini dibuka, menampilkan nama program yaitu GWFM 2012. Pada halaman ini terdapat empat tombol yang apabila ditekan akan menuju pada halaman berikutnya sesuai dengan nama tombol tersebut dan satu tombol Tutup untuk menutup aplikasi ini. Tombol *Runge-Kutta Orde 4* menuju ke halaman yang berisikan model menggunakan penyelesaian *Runge-Kutta Orde 4,* tombol *Iterative Alternating Direction Implicit* menuju ke halaman berisikan model menggunakan penyelesaian IADI, tombol *Grafik* menuju ke halaman yang berisikan perbandingan grafik antara grafik hasil dari model *Runge-Kutta Orde 4* dan grafik dari hasil model IADI. Tombol *Data Kecepatan* menuju ke halaman yang berisikan data kecepatan dari setiap titik pada model *Runge-Kutta Orde 4*.

- Halaman model *Runge-Kutta Orde* 4 & *Iterative Alternating Direction Implicit*
    Setelah tombol *Runge-Kutta Orde* 4 atau *Iterative Alternating Direction Implicit* ditekan maka akan muncul halaman selanjutnya seperti pada tampilan Gambar 3.3.

Gambar 3.3   Halaman model *Runge-Kutta Orde* 4 dan *Iterative Alternating Direction Implicit*

Sumber: Olahan sendiri

Pada kedua halaman ini terdapat beberapa tombol yang sengaja di buat tipikal agar pengguna dapat dengan dengan mudah memahami penggunaan di dua model penyelesaian yang berbeda ini. Pada kedua halaman ini terdapat tombol *Parameter, Variabel* yang apabila ditekan nantinya akan memunculkan *userform*

sebagai tempat input data parameter yang akan menjadi parameter pada model gerak aliran air tanah untuk kedua metode penyelesaian.

Pada *userform* input parameter & variabel ini terdapat beberapa parameter dan variabel yang dibutuhkan agar model dapat berjalan sesuai dengan kondisi yang atur oleh pengguna. Seperti yang telah dijelasakan pada bab sebelumnya parameter yang digukanan pada model ini adalah parameter diskretisasi spasial seperti panjang akuifer, lebar aquifer, jarak grid arah x dan arah y, diskretisasi waktu seperti perubahan waktu tinjau, serta parameter maksimum seperti iterasi maksimum dan waktu tinjau maksimum.
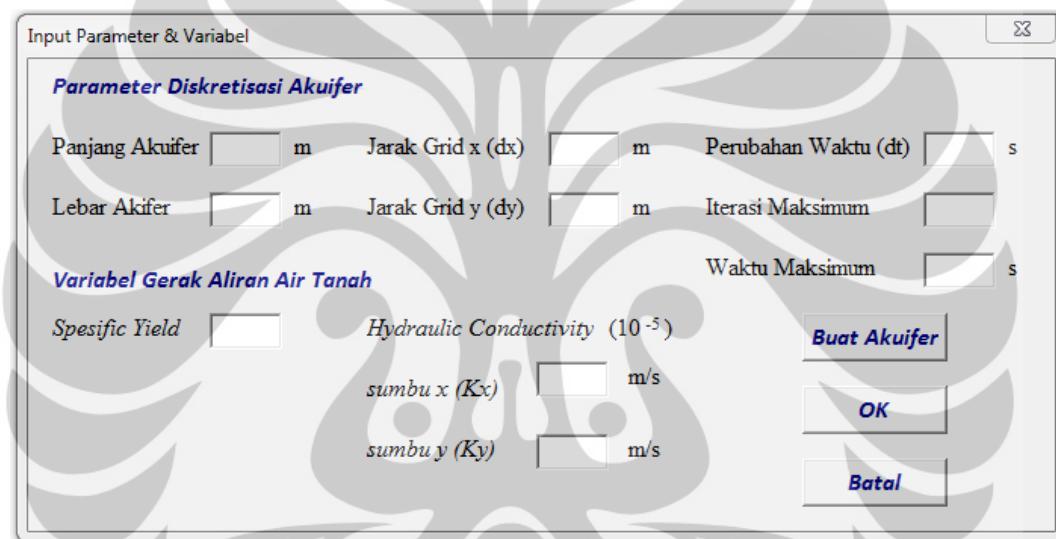
Gambar 3.4   *Userform* Input Parameter & Variabel

Sumber: Olahan sendiri

Variabel yang digunakan pada model ini adalah parameter gerak aliran air tanah berupa *Spesific Yield,* dan *Hidraulic Conductivity* pada arah x dan arah y. Untuk *Hidraulic Conductivity* data yang dimasukkan dibuat dalam skala 10^{-5}, sebagai contoh jika nilai *Hidraulic Conductivity* adalah 10^{-2} m/s maka pada isian diisi dengan nilai 1000, hal ini dilakukan supaya tidak terlalu sulit apabila nilai mencapai nilai lebih kecil dari pada 10^{-5} m/s.

Pada *userform* ini juga terdapat tiga tombol yaitu tombol *Buat Akuifer, OK,* dan *Batal*. Tombol *Buat Akuifer* berfungsi untuk membuat baru atau merubah bidang akuifer model sesuai dengan parameter diskretisasi spasial yang telah ditentukan, tombol *OK* ditekan ketika terjadi perubahan pada input data selain

parameter diskretisasi spasial, tombol *Batal* untuk membatalkan input parameter dan variabel yang telah ditentukan.

Pada halaman model *Runge-Kutta Orde* 4 & *Iterative Alternating Direction Implicit* ini juga terdapat tombol *Kondisi Batas, Kondisi Awal* yang apabila ditekan nantinya akan memunculkan *userform* sebagai tempat untuk menentukan kondisi dari model akuifer.
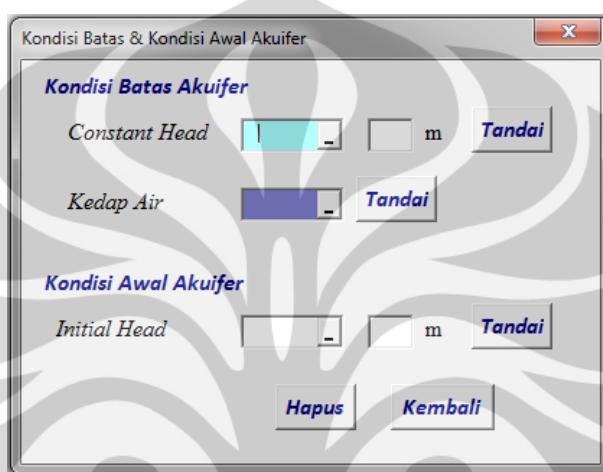
Gambar 3.5   *Userform* Kondisi Batas & Kondisi Awal Akuifer
Sumber: Olahan sendiri

Pada *userform* ini terdapat dua jenis kondisi yang bisa ditentukan pada akuifer yaitu kondisi batas dan kondisi awal seperti yang telah dijelaskan pada bab sebelumnya. Untuk menentukan kondisi batas pada akuifer ini digunakan tombol *Refedit* supaya pengguna dapat menentukan sediri seseuai keinginan sel mana yang berupa *constant head* atau kedap air, setelah sel dipilih maka perlu ditekan tombol *Tandai* agar sel tersebut berwarna sesuai dengan warna yang ada pada tombol *Refedit,* untuk *constant head* perlu dimasukkan besarnya nilai head pada sel yang akan ditentukan. Selanjutnya untuk kondisi awal akuifer digunakan untuk menentukan besarnya nilai head di semua sel tanpa merubah warna dari sel tersebut.

Selanjutnya tombol *Jalankan Model* yang apabila ditekan akan memunculkan *userform* untuk menjalankan model sesuai dengan penyelesaian masing-masing. Pada *userform* ini terdapat dua pilihan kondisi aliran yang dapat disimulasikan yaitu kondisi *menuju steady* dimana tidak terjadi perubahan *head*

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terhadap waktu dan kondisi *menuju waktu maksmum* dimana terjadi perubahan *head* terhadap waktu. Cara kerja model saat kondisi *menuju steady* adalah melakukan iterasi dari nilai *initial condition* sampai kondisi *steady* sampai batas iterasi maksimum tercapai*,* sedangkan cara kerja model saat kondisi *menuju waktu maksimum* adalah melakukan iterasi dari nilai *initial condition* sampai mencapai kondisi *steady* kemudian berubah menjadi kondisi *unsteady* kemudian diiterasi kembali sampai menuju kondisi *steady* hingga batas waktu maksimum yang ditentukan.

(a)   (b)

Gambar 3.6   *Userform* Jalankan Model (a) *Runge-Kutta orde 4,* (b) IADI
Sumber: Olahan sendiri

Tombol *Grafik* pada kedua halaman ini memiliki fungsi yang berbeda dengan tombol *Grafik* yang ada pada halaman muka. Pada halaman ini tidak dilakukan perbandingan grafik melainkan hanya menampilkan grafik kontur dari masing-masing pengolahan.
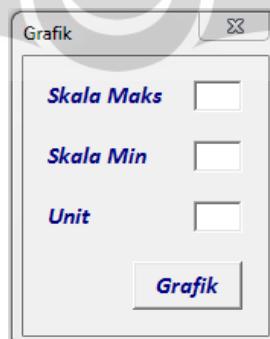
Gambar 3.7   *Userform* Grafik
Sumber: Olahan sendiri

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Pada *userform* grafik ini pengguna nantinya dapat menentukan sendiri skala maksimum, skala minimum, dan unit dari grafik yang ingin dimunculkan.

- Halaman Perbandingan Grafik

Setelah tombol *Grafik* pada halaman muka ditekan maka akan menuju halaman grafik. Seperti yang telah dijelaskan sebelumnya bahwa pada halaman ini akan dikeluarkan perbandingan grafik antara garfik pada model *Runge-Kutta Orde 4* dan model IADI.

Gambar 3.8　Halaman perbandingan grafik

Sumber: Olahan sendiri

Sebelum membandingkan grafik pengguna harus memastikan terlebih dahulu bahwa grafik di masing-masing halaman model dalam keadaan aktif. Apabila belum, maka disediakan tombol untuk menuju ke masing-masing halaman model.

- Data Kecepatan

Ketika tombol *Data Kecapatan* di halaman muka ditekan makan pengguna akan menuju halaman data kecepatan. Pada halaman ini pengguna nantinya dapat mengetahui kecepatan pada setiap sel akuifer. Data kecepatan yang dibedakan menjadi data kecepatan arah x dan data kecepatan k arah y.

Gambar 3.9　Halaman data kecepatan

Sumber: Olahan sendiri

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3.5 Skenario Model Matematika Aliran Air Tanah

Masalah yang ingin disimulasikan pada model ini adalah tinggi *hydraulic head* di masing-masing titik pada lapisan akuifer setiap waktu secara angka dan visual dua dimensi. Sehingga dibuatlah skenario simulasi untuk menguji konvergensi dari program ini.

- Kasus *General Flow Menuju Steady*
    - Kondisi aliran diatur menuju keadaan *steady*
    - Menetapkan $K_x = K_y = 3 \times 10^{-4}$ m/s, $Sy = 10^4$ dan *constant head h* = 80m pada daerah hulu dan $h = 75$ m pada bagian hilir model
    - Menetapkan $h = 77.5$ m untuk semua titik pada seluruh luasan akuifer
    - Menjalankan simulasi

- Kasus *Seepage Tank Menuju Steady*
    - Kondisi aliran diatur menuju keadaan *steady*
    - Menetapkan $K_x = K_y = 10^{-2}$ m/s, $Sy = 0.05$ dan *constant head h* = 49.5 cm pada bagian hulu dan $h = 34$ cm pada bagian hilir model
    - Menetapkan $h = 42$ cm untuk semua titik pada seluruh luasan akuifer
    - Menjalankan simulasi

- Kasus *Seepage Tank Menuju Waktu Maksimum*
    - Menggunakan hasil pada kasus *seepage tank menuju steady* kemudian kondisi aliran diatur menuju waktu maksimum
    - *dt* = 100s dengan waktu maksimum 40000 s
    - Menjalankan simulasi

BAB 4
EXPERIMENTAL MODEL MATEMATIKA

4.1 Verifikasi Model Matematik

Sebelum model matematik GWFM 2012 ini dapat digunakan, model ini terlebih dahulu harus diverifikasi menggunakan model yang telah teruji sebelumnya atau menggunakan hasil perhitungan analitik untuk memastikan bahwa prosedur pengolahan yang dilakukan model telah sesuai dan mengetahui besarnya *error* yang dihasilkan.

4.1.1 Verifikasi Model Matematik dengan Model Numerik Teruji

Model yang telah teruji yang digunakan untuk melakukan verifikasi merupakan model numerik dangan kasus *pumping well* yang telah dibuat dan dipublikasikan oleh Wolfgang Kinzelbach pada buku *Groundwater Modelling*, selanjutnya model numerik ini akan disebut dengan model teruji.

Model gerak aliran air tanah dengan kasus *pumping well* merupakan salah satu model yan penyelesaiannya menggunakan metode *Iterative Alternating Direction Implicit*, model ini memiliki parameter dan variabel sebagai berikut:

- Parameter Diskretisasi Akuifer
  - Jarak Grid arah x dan arah y = 100 m, Luas Grid = 7 × 7
- Variabel Gerak Aliran Air Tanah
  - *Storativity* = 0.001, *Homogeneous Transimisivity* = 0.1 m²/s
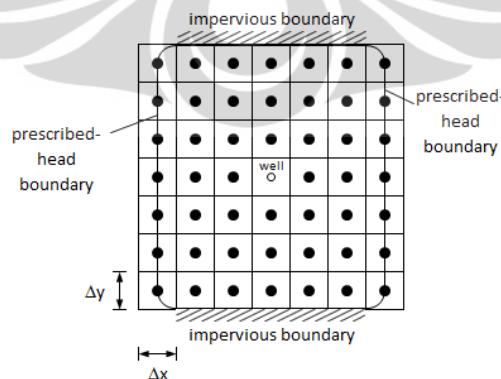
Gambar 4.1   Akuifer dan grid yang digunakan dalam kasus *pumping well*

Sumber: (Kinzelbach, 1986)

30

Keluaran model numerik teruji ditampilkan pada Gambar 4.2 yang memperlihatkan nilai *head* di setiap titik.

```
PIEZOMETER HEADS (M)
TIME (SEC) : 1000
50  49.6  49.2  49.1  49.2  49.6  50
50  49.5  49    48.7  49    49.5  50
50  49.3  48.5  47.8  48.5  49.3  50
50  49.1  47.9  45.3  47.9  49.1  50
50  49.3  48.5  47.8  48.5  49.3  50
50  49.5  49    48.7  49    49.5  50
50  49.6  49.2  49.1  49.2  49.6  50
```

Gambar 4.2   Hasil perhitungan model teruji

Sumber: (Kinzelbach, 1986)

Langkah pertama yang dilakukan adalah melakukan verifikasi model IADI dengan membuka halaman model *Iterative Alternating Direction Implicit* dalam model GWFM 2012, kemudian melakukan input nilai parameter diskretisasi akuifer dan variabel gerak aliran air tanah kedalam *userform* input parameter dan variabel. Kriteria input variabel yang diketahui pada model teruji berbeda dengan kriteria input variabel yang terdapat pada model GWFM 2012 sehingga harus dihitung terlebih dahulu.

Pada input variabel model teruji, data yang diketahui adalah *transimisivity* (T) dan *storativity* (S) sementara pada input variabel model GWFM 2012 data yang harus dimasukkan adalah *hydraulic conductivity* (K) dan *spesific yield* (Sy). Pada *unconfined aquifer* atau akuifer tak terkekang nilai tersebut dapat dihitung sebagai berikut:

$$K_x = K_y = \frac{T}{h} = \frac{0.1}{50} = 0.002 = 200 \times 10^{-5} m/s$$

$$S_y = S \times h = 0.001 \times 50 = 0.05$$
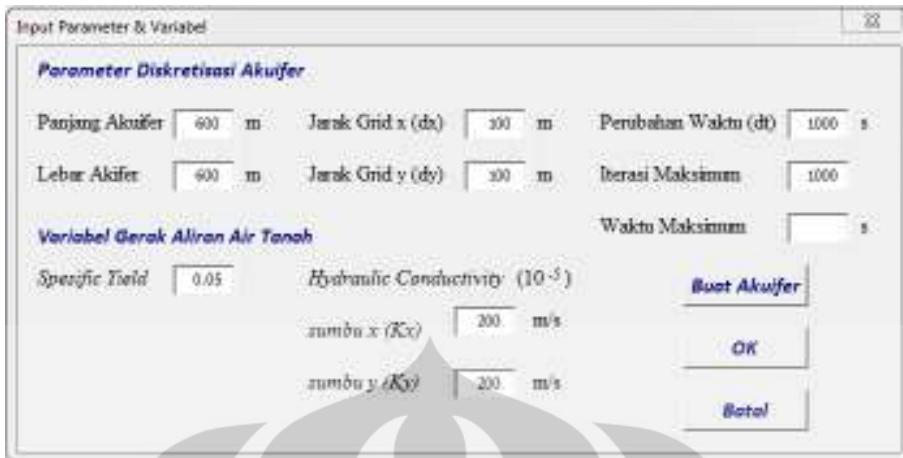
Gambar 4.3   Input parameter dan variabel model kasus *pumping well*

Sumber: Olahan sendiri

Setelah nilai input parameter dan variabel telah dimasukkan selanjutnya membuat grid akuifer dengan menekan tombol *Buat Akuifer* sehingga pada halaman model muncul tampilan seperti Gambar 4.4.
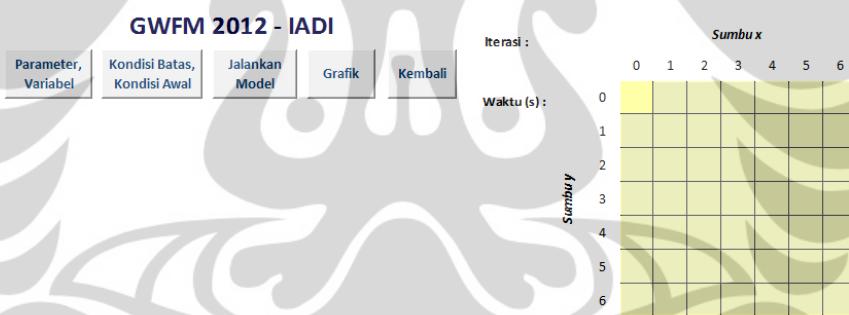
Gambar 4.4   Halaman model IADI dengan grid model kasus *pumping well*

Sumber: Olahan Sendiri

Grid pada halaman model ini diberikan kondisi batas dan kondisi awal terlebih dahlu sebelum dapat dijalankan. Kondisi batas dan kondisi awal ditentukan sesuai dengan kondisi pada model teruji:

• Sel bagian paling kanan dan paling kiri merupakan *constant head* sehingga dapat digunakan tombol *Refedit* dibagian *constant head* untuk memilih sel-sel tersebut.
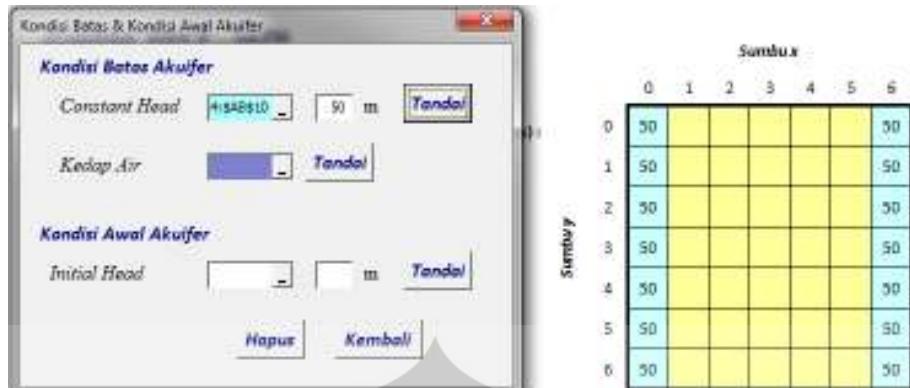
Gambar 4.5   Menentukan kondisi *constant head* kasus *pumping well*

Sumber: Olahan sendiri

- Dikarenakan model GWFM 2012 tidak dirancang untuk kasus *pumping well* sehingga dilakukan pendekatan kondisi, head pada dasar sumur dianggap sebagai *constant head*.
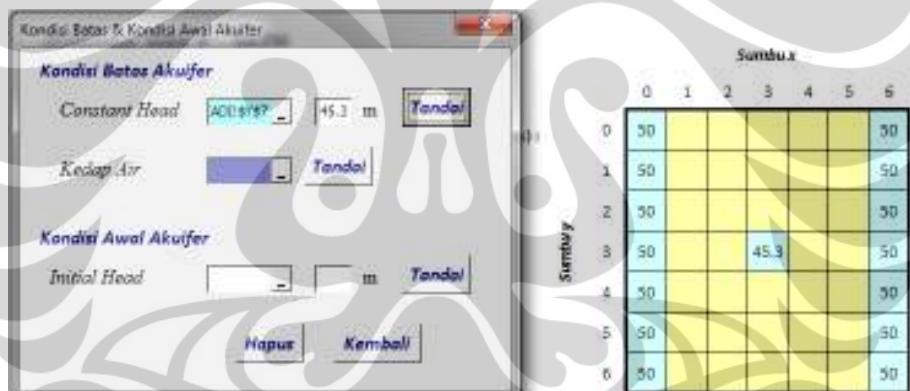
Gambar 4.6   Menentukan *head* dasar sumur sebagai *constant head* kasus *pumping well*

Sumber: Olahan sendiri

- Pada model teruji nilai *head* di sel-sel yang tersisa diisi dengan nilai 50m. Oleh karena itu digunakan tombol *Refedit* di bagian *initial head* untuk memasukkan nilai tersebut.
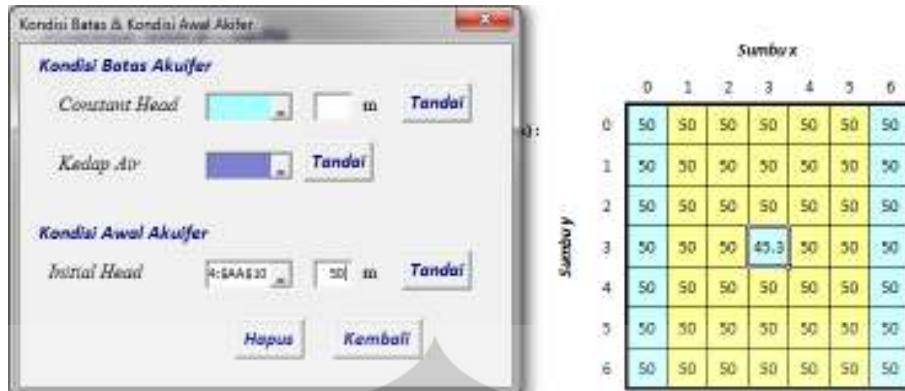
Gambar 4.7   Menentukan nilai *initial head* kasus *pumping well*

Sumber: Olahan sendiri

Setelah parameter, variabel, kondisi batas, dan kondisi awal dimasukkan maka program telah dapat dijalankan dengan menekan tombol *Jalankan Model* kemudian pilih kondisi *menuju steady*. Model akan berjalan sampai muncul *message box* bertuliskan "Selesai" jika konvergensi telah tercapai sebelum iterasi maksimum tercapai.
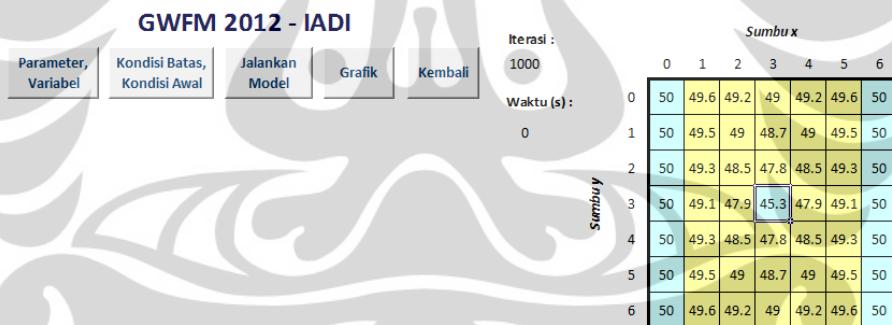
Gambar 4.8   Hasil *running* model IADI kasus *pumping well*

Sumber: Olahan sendiri

Langkah yang sama dilakukan pada model *Runge-Kutta Orde 4*, sehingga didapatkan hasil sebagai Gambar 4.9.

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Gambar 4.9   Hasil *running* model *Runge-Kutta Orde 4* kasus *pumping well*

Sumber: Olahan sendiri

Menggunakan keluaran yang didapatkan dari model IADI dan *Runge-Kutta Orde 4* maka sudah dapat dibandingkan hasil keluaran tersebut dengan hasil keluaran pada model teruji. Perbandingan tersebut disajiksan dalam bentuk grafik keluaran dengan melakukan plot data pada arah x dan arah y yang melewati *pumping well*.

Tabel 4.1 Perbandingan *head* numerik kasus *pumping well* arah x

Model	Jarak (m)						
	0	100	200	300	400	500	600
WK	50	49.1	47.9	45.3	47.9	49.1	50
RKo4	50	49.1	47.9	45.3	47.9	49.1	50
IADI	50	49.1	47.9	45.3	47.9	49.1	50

Sumber: Olahan sendiri
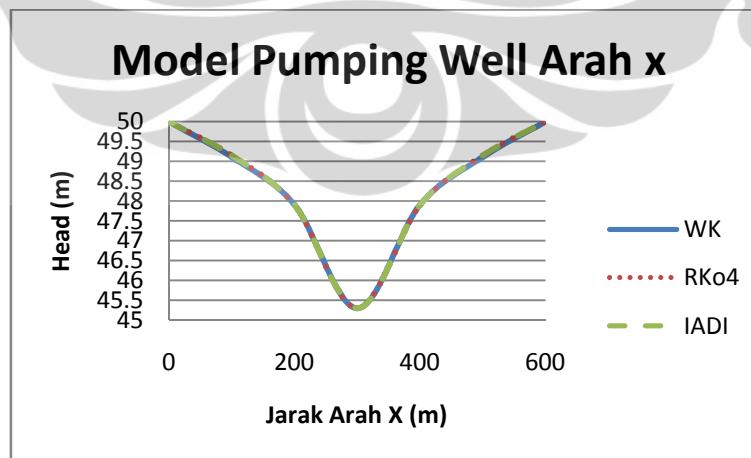
Gambar 4.10   Perbandingan keluaran numerik kasus *pumping well* arah x

Sumber: Olahan sendiri

Perbandingan antara keluaran model GWFM 2012 arah x dapat lebih terlihat pada nilai *error* yang dihasilkan.

Tabel 4.2 Nilai *error* numerik model GWFM 2012 kasus *pumping well* arah x

Model	Error						
RKo4	0.0000	0.0008	0.0001	0.0000	0.0001	0.0008	0.0000
IADI	0.0000	0.0009	0.0001	0.0000	0.0001	0.0009	0.0000

Sumber: Olahan sendiri
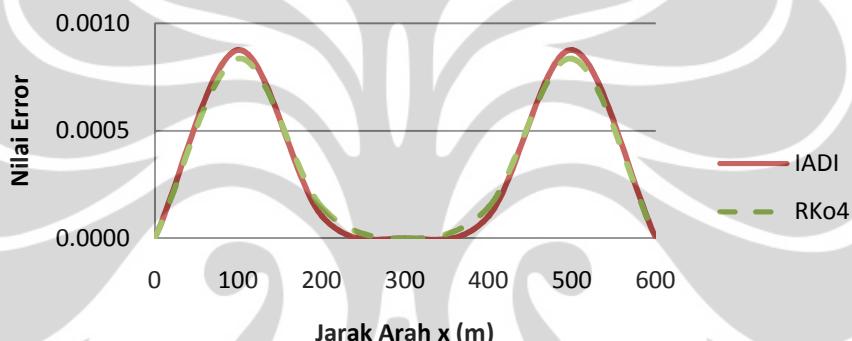
Gambar 4.11   Nilai *error* numerik kasus *pumping well* arah x

Sumber: Olahan sendiri

Dari hasil perhitungan nilai *error* numerik pada arah x didapatkan nilai *error* terbesar bernilai 0.0009 atau 0.09%.

Tabel 4.3 Perbandingan *head* numerik kasus *pumping well* arah y

Model	Jarak (m)						
	0	100	200	300	400	500	600
WK	49.1	48.7	47.8	45.3	47.8	48.7	49.1
RKo4	49	48.7	47.8	45.3	47.8	48.7	49
IADI	49	48.7	47.8	45.3	47.8	48.7	49

Sumber: Olahan sendiri

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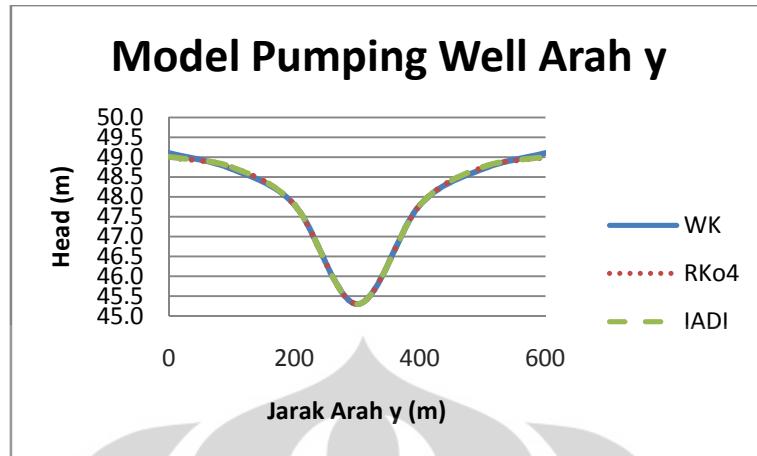
Gambar 4.12   Perbandingan keluaran numerik kasus *pumping well* arah *y*

Sumber: Olahan sendiri

Perbandingan antara keluaran model GWFM 2012 arah *y* dapat lebih terlihat pada nilai *error* yang dihasilkan.

Tabel 4.4 Nilai *error* numerik kasus *pumping well* arah *y*

Model	Error						
RKo4	0.0020	0.0009	0.0000	0.0000	0.0000	0.0009	0.0020
IADI	0.0019	0.0010	0.0000	0.0000	0.0000	0.0010	0.0019

Sumber: Olahan sendiri
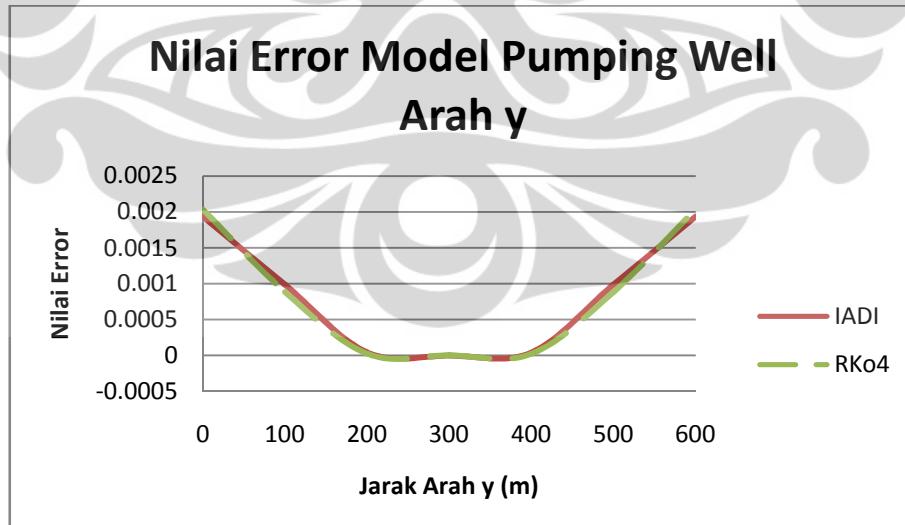
Gambar 4.13   Nilai *error* numerik kasus *pumping well* arah *y*

Sumber: Olahan sendiri

Dari hasil perhitungan nilai *error* pada arah *y* didapatkan nilai *error* terbesar bernilai 0.002 atau 0.2%.

4.1.2 Verifikasi Model Matematik dengan Hasil Perhitungan Analitik

Menggunakan kasus yang sama dilakukan perhitungan analitik untuk mendapatkan nilai *head* di setiap titik pada sumbu arah x dan arah y. Untuk mengetahui perubahan tinggi *head* atau *dh* digunakan persamaan:

$$h_0 - h = \frac{Q}{4\pi T} W(u), \text{dengan } u = \frac{r^2 S}{4\pi Tt}$$

Pada kasus ini perhitungan tidak bisa menggunakan persamaan di atas begitu saja karena terdapat *boundary* seperti *constant head* dan kedap air, untuk kedua kondisi tersebut persamaan menjadi:

- *constant head*

$$h_0 - h = \frac{Q}{4\pi T} (W(u_r) + W(u_t)), \text{dengan } u = \frac{r^2 S}{4\pi Tt}$$

- kedap air

$$h_0 - h = \frac{Q}{4\pi T} (W(u_r) - W(u_t)), \text{dengan } u = \frac{r^2 S}{4\pi Tt}$$

Tabel 4.5 Hasil perhitungan analitik

r	t	u_r	$W(u_r)$	u_t	$W(u_t)$	dh_{kedap}	h_{kedap}	dh_{ch}	h_h
100	500	0.025	3.14	0.625	0.43	2.50	47.50	2.15	47.85
200	400	0.100	1.82	0.400	0.70	1.45	48.55	0.89	49.11
300	300	0.225	1.13	0.225	1.13	0.90	49.10	0.00	50.00

Sumber: Olahan sendiri

Berdasarkan hasil perhitungan di atas maka nilai *head* disetiap titik pada sumbu arah x dan arah y dapat dilihat pada Gambar 4.14.

Gambar 4.14   Hasil perhitungan analitik kasus *pumping well*

Sumber: Olahan sendiri]

Menggunakan keluaran yang didapatkan dari model IADI dan *Runge-Kutta Orde 4* maka sudah dapat dibandingkan hasil keluaran tersebut dengan hasil keluaran pada perhitungan analitik. Perbandingan tersebut disajiksan dalam bentuk grafik keluaran dengan melakukan plot data pada arah x dan arah y yang melewati *pumping well*.

Tabel 4.6 Perbandingan *head* analitik arah x

Model	Jarak (m)						
	0	100	200	300	400	500	600
Analitik	50	49.1	47.8	45.3	47.8	49.1	50
RKo4	50	49.1	47.9	45.3	47.9	49.1	50
IADI	50	49.1	47.9	45.3	47.9	49.1	50

Sumber: Olahan sendiri

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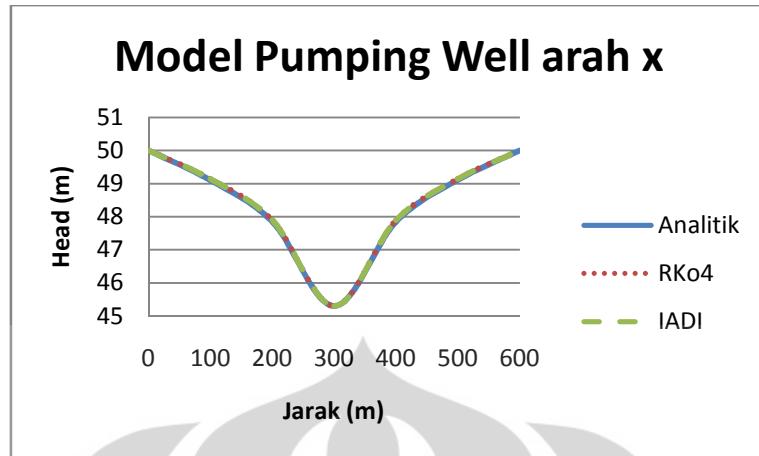
Gambar 4.15 Perbandingan *head* dengan analitik kasus *pumping well* arah x

Sumber: Olahan sendiri

Perbandingan antara keluaran model GWFM 2012 arah *x* dapat lebih terlihat pada nilai *error* yang dihasilkan.

Tabel 4.7 Nilai *error* analitik kasus *pumping well* arah *x*

Model	Error						
RKo4	0.0000	0.0008	0.0009	0.0004	0.0009	0.0007	0.0000
IADI	0.0000	0.0008	0.0010	0.0004	0.0010	0.0007	0.0000

Sumber: Olahan Sendiri
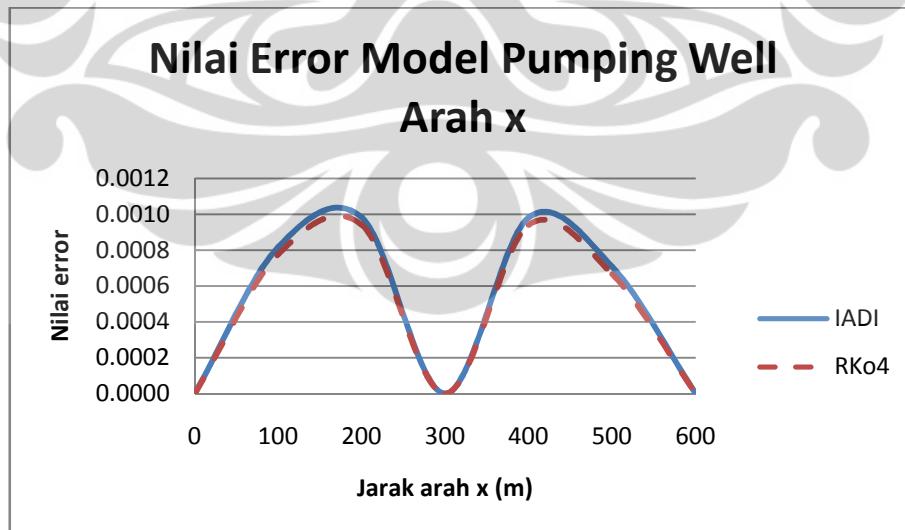
Gambar 4.16 Nilai *error* analitik kasus *pumping well* arah *x*

Sumber: Olahan sendiri

Dari hasil perhitungan nilai *error* numerik pada arah *x* didapatkan nilai *error* terbesar bernilai 0.001 atau 0.1%.

Tabel 4.8 Perbandingan *head* dengan perhitungan analitik arah y

Model	Jarak (m)						
	0	100	200	300	400	500	600
Analitik	49.1	48.5	47.5	45.3	47.5	48.5	49.1
RKo4	49	48.7	47.8	45.3	47.8	48.7	49
IADI	49	48.7	47.8	45.3	47.8	48.7	49

Sumber: Olahan sendiri
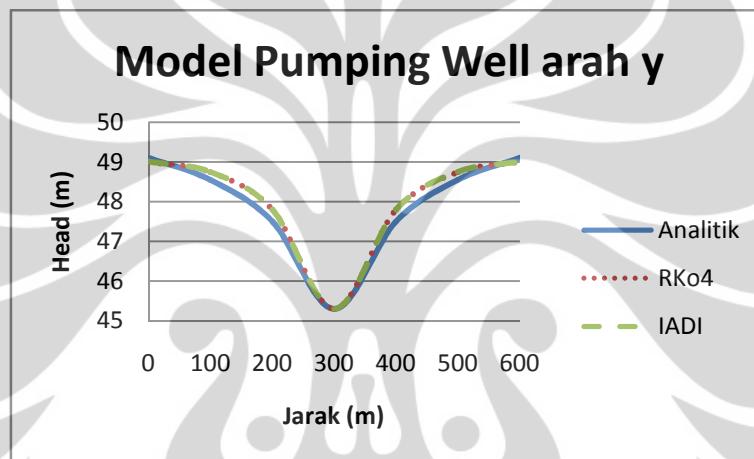
Gambar 4.17   Perbandingan *head* dengan analitik kasus *pumping well* arah y

Sumber: Olahan Sendiri

Perbandingan antara keluaran model GWFM 2012 arah *y* dapat lebih terlihat pada nilai *error* yang dihasilkan.

Tabel 4.9 Nilai *error* analitik kasus *pumping well* arah *y*

Model	*Error*						
RKo4	0.0021	0.0040	0.0062	0.0004	0.0062	0.0040	0.0021
IADI	0.0020	0.0041	0.0063	0.0004	0.0063	0.0041	0.0020

Sumber: Olahan sendiri
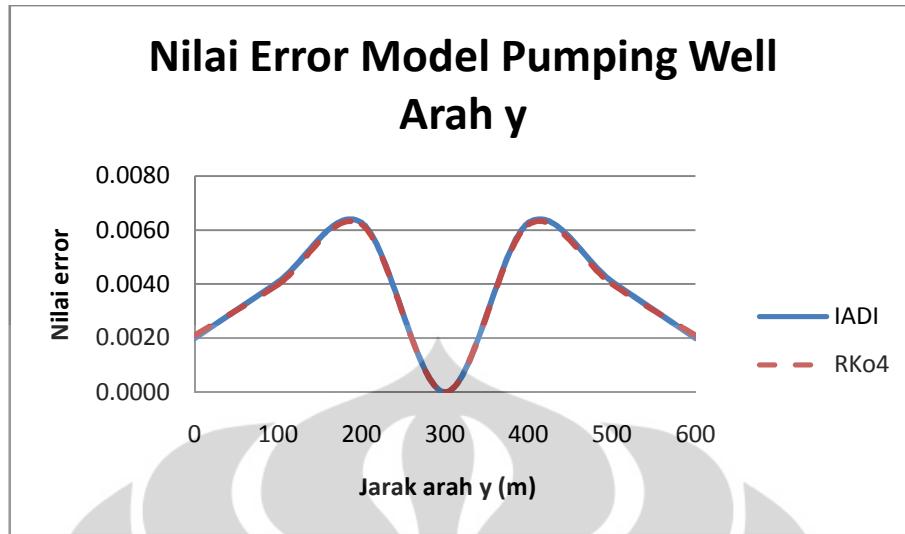
Gambar 4.18   Nilai *error* analitik kasus *pumping well* arah *y*

Sumber: Olahan Sendiri

Dari hasil perhitungan nilai *error* numerik pada arah *x* didapatkan nilai *error* terbesar bernilai 0.0063 atau 0.63%.

4.2   Eksperimen Model Matematik

4.2.1 Eksperimen model matematik kasus *general flow* menuju *steady*

Model ini merupakan model gerak aliran air tanah biasa. Pada bagian hulu (bagian paling kiri) *head* memiliki nilai sebesar 80 m dan pada bagian hilir (bagian paling kanan) *head* bernilai sebesar 75 m, untuk kondisi awal setiap sel diberi *head* dengan besar nilai adalah 77.5 m.
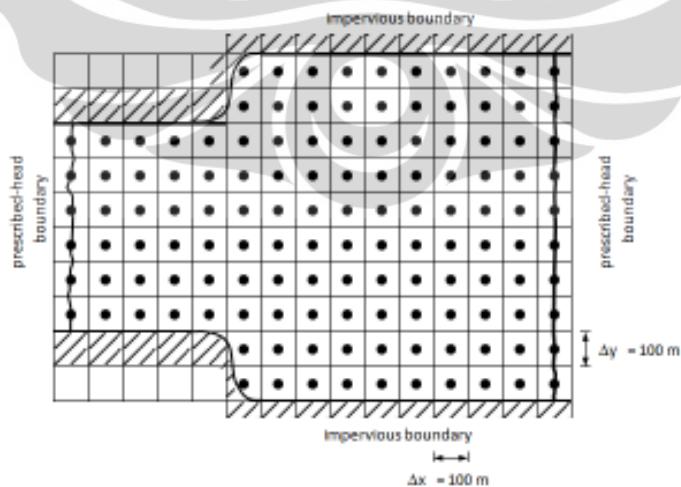
Gambar 4.19   Akuifer dan grid yang digunakan dalam kasus *general flow*

Sumber: (Kinzelbach, 1986)

- Variabel Gerak Aliran Air Tanah
  - *Spesific yield* = 0.0001
  - $Kx = Ky = 30 \times 10^{-5}$ m^2/s

Langkah pertama yang dilakukan adalah membuka halaman model *Iterative Alternating Direction Implicit* dalam model GWFM 2012, kemudian melakukan input nilai parameter diskretisasi akuifer dan variabel gerak aliran air tanah kedalam *userform* input parameter dan variabel.

Gambar 4.20   Input parameter dan variabel model kasus *general flow*
Sumber: Olahan sendiri

Setelah nilai input parameter dan variabel telah dimasukkan selanjutnya membuat grid akuifer dengan menekan tombol *Buat Akuifer* sehingga pada halaman model muncul tampilan seperti Gambar 4.21.
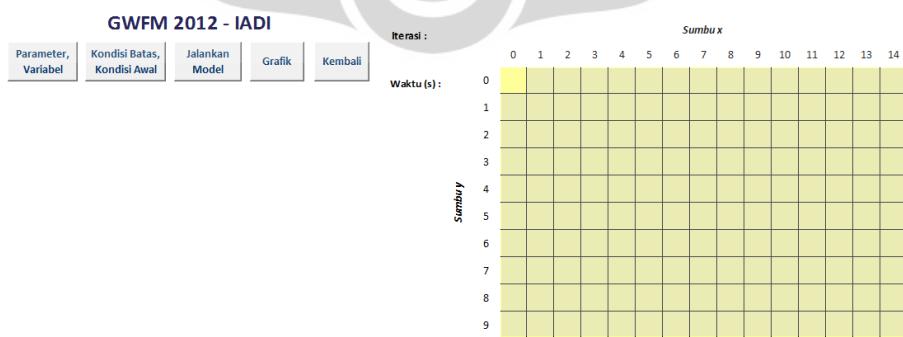
Gambar 4.21   Halaman model IADI dengan grid kasus *general flow*
Sumber: Olahan Sendiri

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Sesuai dengan bentuk akuifer pada model teruji kasus *general* flow ini maka dilakukan modifikasi terhadap grid terlebih dahulu. Modifikasi tersebut berupa menghapus beberapa sel secara manual dengan memberikan warna putih pada sel tersebut.
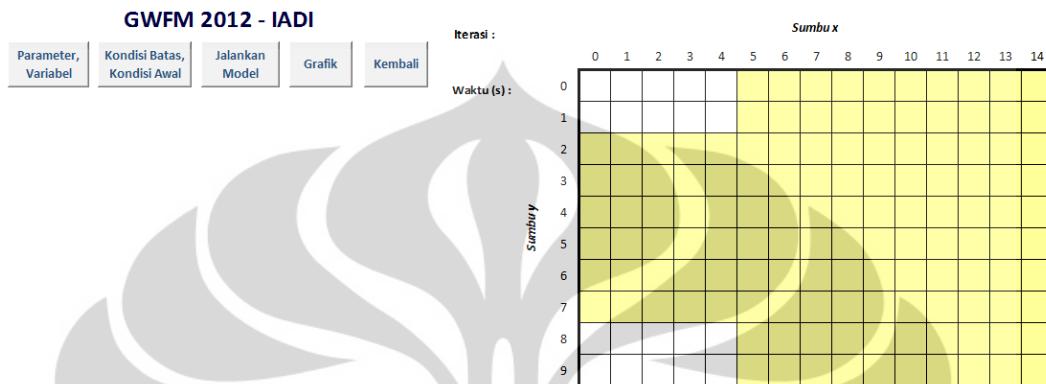
Gambar 4.22   Modifikasi grid pada kasus *general flow*
Sumber: Olahan sendiri

Setelah grid dimodifikasi selanjutnya menentukan kondisi batas dan kondisi awal model sesuai dengan model teruji.

- Sel bagian paling kanan dan paling kiri merupakan *constant head* sehingga dapat digunakan tombol *Refedit* dibagian *constant head* untuk memilih sel-sel tersebut.
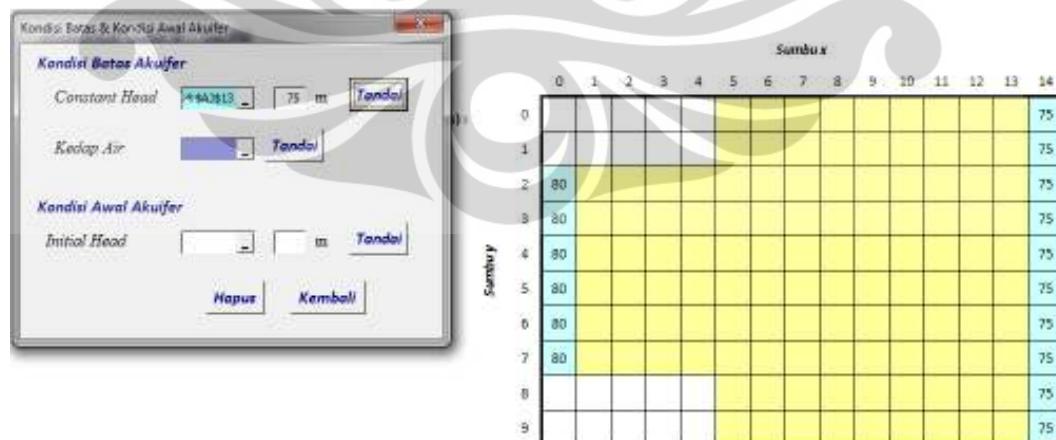
Gambar 4.23   Menentukan kondisi *constant head* kasus *general flow*
Sumber: Olahan sendiri

- Selanjutnya menentukan nilai *head* pada sel yang tersisa, sesuai dengan model teruji sel tersebut diisi dengan nilai *head* sebesar 77.5 m tetapi untuk sel yang berwarna putih diisikan nilai *head* sebesar 0 m.
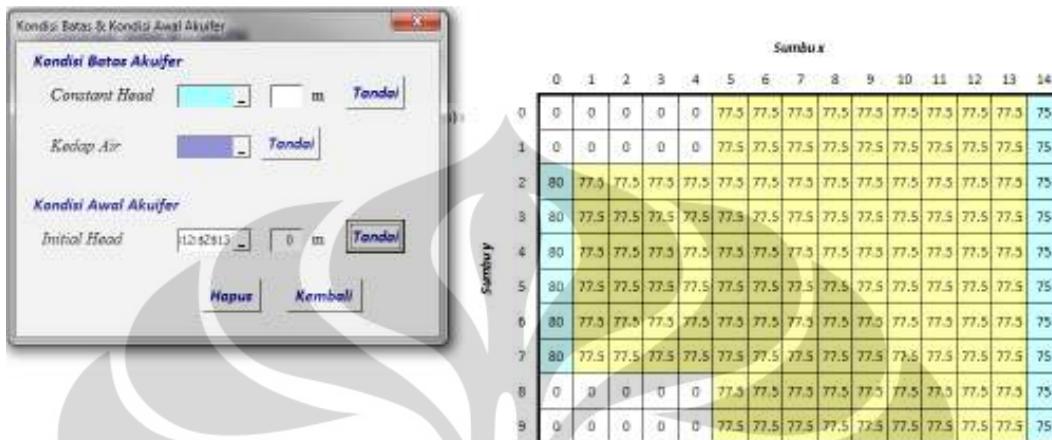
Gambar 4.24   Menentukan *initial head* kasus *general flow*

Sumber: Olahan sendiri

Setelah parameter, variabel, kondisi batas, dan kondisi awal dimasukkan maka program telah dapat dijalankan dengan menekan tombol *Jalankan Model* kemudian pilih kondisi *menuju steady*. Sama seperti sebelumnya model akan berjalan sampai muncul *message box* bertuliskan *Selesai* apabila konvergensi telah tercapai sebelum iterasi maksimum tercapai atau *Iterasi Maksimum Tercapai*.
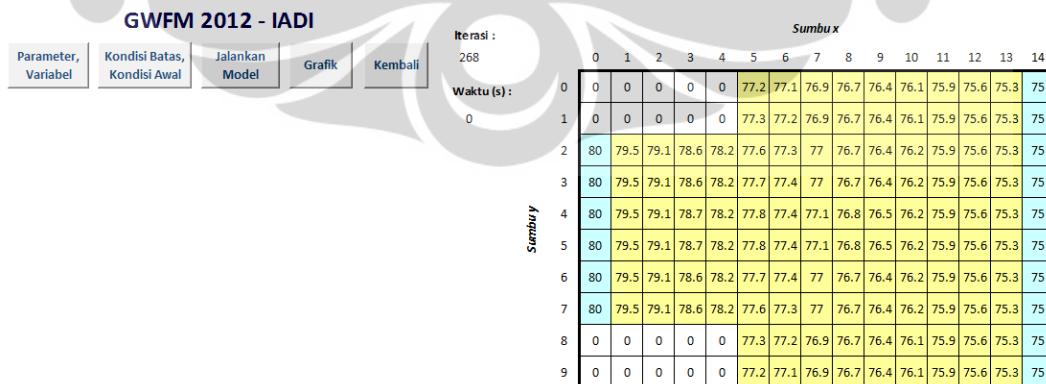
Gambar 4.25   Hasil *running* model IADI kasus *general flow*

Sumber: Olahan sendiri

Langkah yang sama dilakukan pada model *Runge-Kutta Orde 4*, sehingga didapatkan hasil sebagai Gambar 4.26.

Gambar 4.26   Hasil *running* model *Runge-Kutta Orde 4* kasus *general flow*

Sumber: Olahan sendiri

Kemudian ditampilkan grafik *equipotential line* dari kedua model untuk melihat perbedaan diantara keduanya.
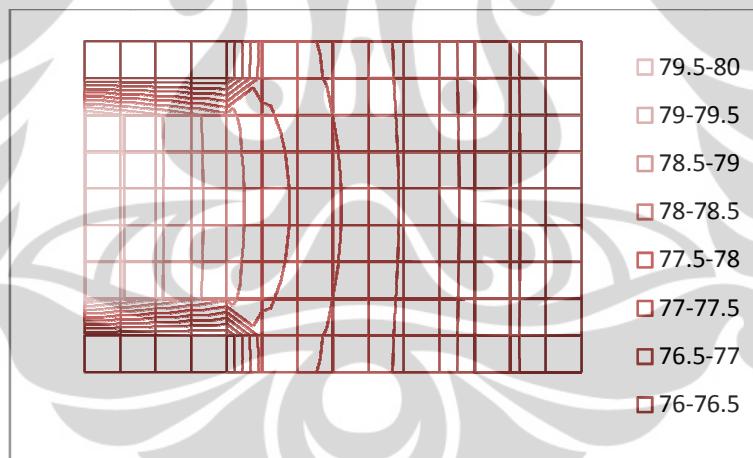
Gambar 4.27   Grafik *equipotential line* model IADI kasus *general* flow

Sumber: Olahan sendiri
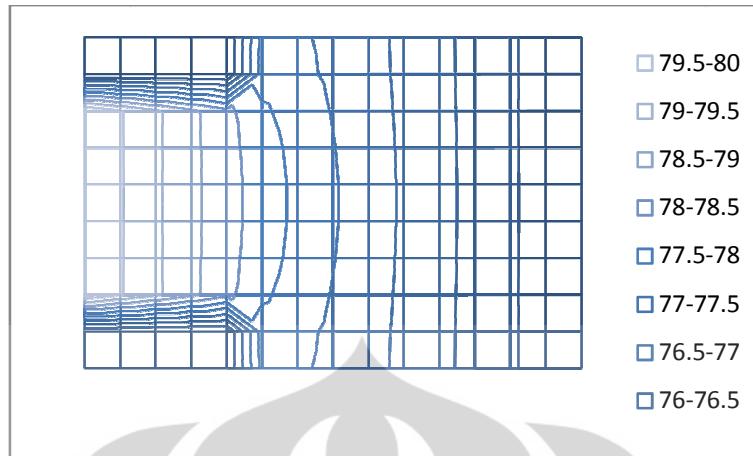
Gambar 4.28 Grafik *equipotential line* model *RKo4* kasus *general flow*
Sumber: Olahan sendiri
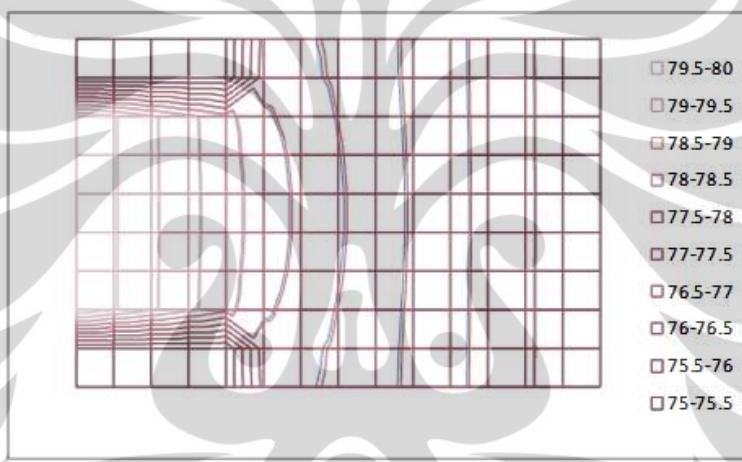
Gambar 4.29 *Overlay* kedua grafik *equipotential line* kasus *general flow*
Sumber: Olahan sendiri

Berdasarkan dua grafik keluaran model GWFM 2012 dapat dilihat bahwa garis-garis *equipotential* yang dihasilkan sudah sesuai dengan logika kondisi lapangan dimana ketika luas penampang aliran mengecil membuat aliran akan menjadi curam sehingga membuat garis *equipotential* akan semakin rapat, sementara ketika penampang aliran melebar membuat aliran akan menjadi landai sehingga membuat garia *equipotential* akan semakin jarang.

4.2.2 Eksperimen model matematik kasus *seepage tank*

Kasus *seepage tank* merupakan salah satu kasus yang umum digunakan sebagai contoh untuk memahami gerak aliran tanah, oleh karena itu kasus ini diangkat sebagai salah satu eksperimen.
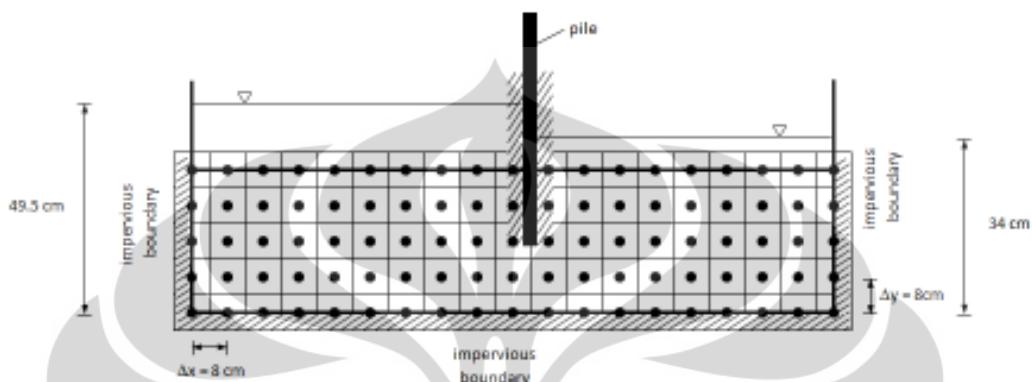
Gambar 4.30   Akuifer dan grid yang digunakan dalam kasus *seepage tank*

Sumber: Olahan sendiri

- Variabel Gerak Aliran Air Tanah
  - *Spesific yield* = 0.05
  - $Kx = Ky = 10^{-2} = 1000 \times 10^{-5}$ m²/s

Langkah pertama melakukan input nilai parameter diskretisasi akuifer dan variabel gerak aliran air tanah.

Gambar 4.31   Input parameter dan variabel model kasus *seepage tank*

Sumber: Olahan sendiri

Perlu diperhatikan bahwa input parameter dan variabel model GWFM 2012 tidak bisa terlalu kecil, untuk menyelesaikan hal tersebut input dapat ke dalam skala 10 sampai 100 kali lebih besar.
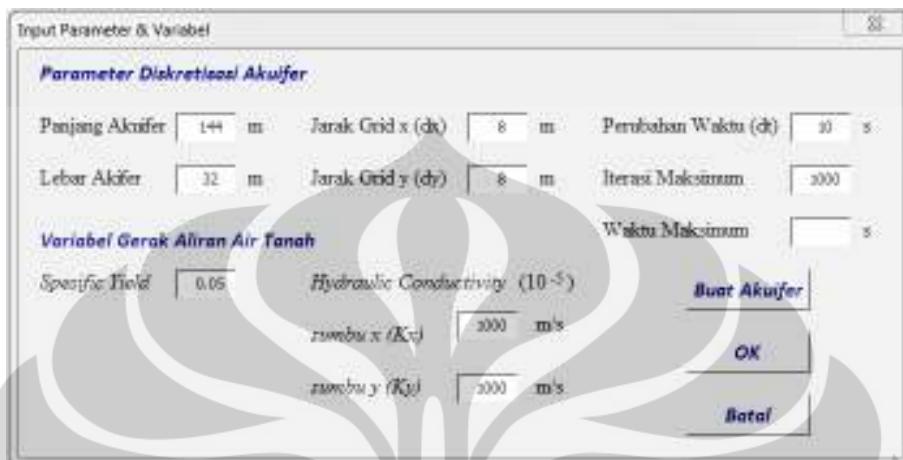
Gambar 4.32   Input parameter dan variabel model kasus *seepage tank* (skala)
Sumber: Olahan sendiri

Setelah nilai input parameter dan variabel telah dimasukkan selanjutnya membuat grid akuifer dengan menekan tombol *Buat Akuifer* sehingga pada halaman model muncul tampilan seperti Gambar 4.33.
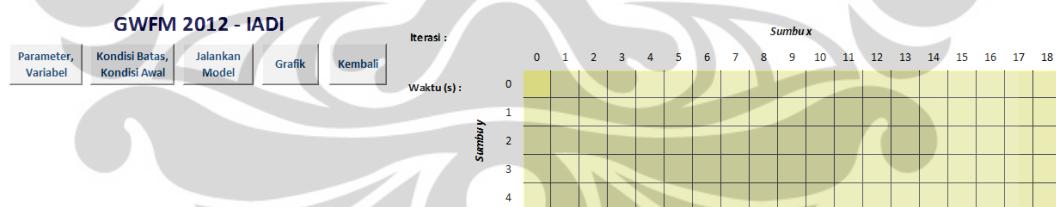
Gambar 4.33   Halaman model IADI dengan grid kasus *seepage tank*
Sumber: Olahan sendiri

Grid pada halaman model ini diberikan kondisi batas dan kondisi awal terlebih dahlu sebelum dapat dijalankan. Kondisi batas dan kondisi awal ditentukan sesuai dengan kondisi *seepage tank*

- Sel bagian paling atas merupakan *constant head* sehingga dapat digunakan tombol *Refedit* dibagian *constant head* untuk memilih sel-sel tersebut.

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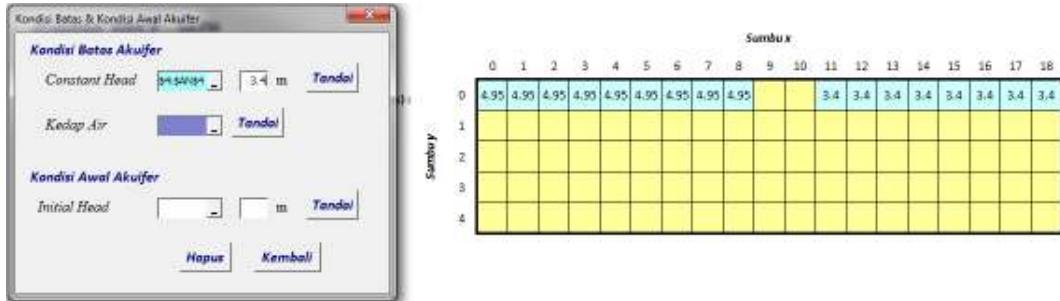
Gambar 4.34   Menentukan kondisi *constant head* kasus *seepage tank*
Sumber: Olahan sendiri

- Selanjutnya menentukan sel kondisi kedap air sehingga dapat digunakan tombol *Refedit* dibagian kedap air untuk memilih sel-sel tersebut. Tombol ini digunakan apabila kondisi kedap air berada didalam grid.
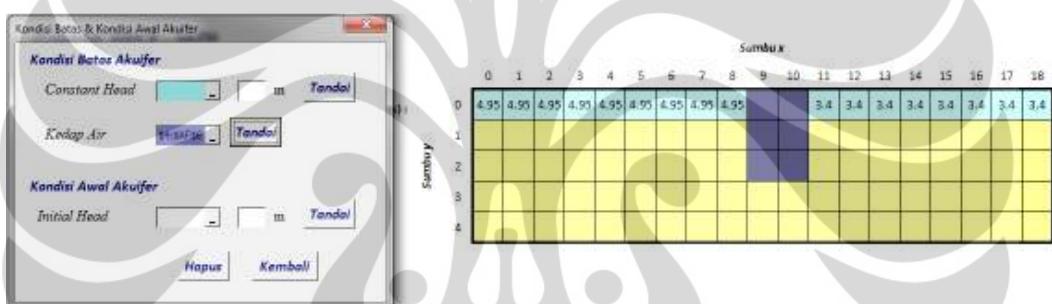
Gambar 4.35   Menentukan kondisi kedap air kasus *seepage tank*
Sumber: Olahan sendiri

- Selanjutnya menentukan nilai *head* pada sel yang tersisa, sebagai kondisi awal maka sel diisi dengan nilai rata-rata sebesar 0.42 m
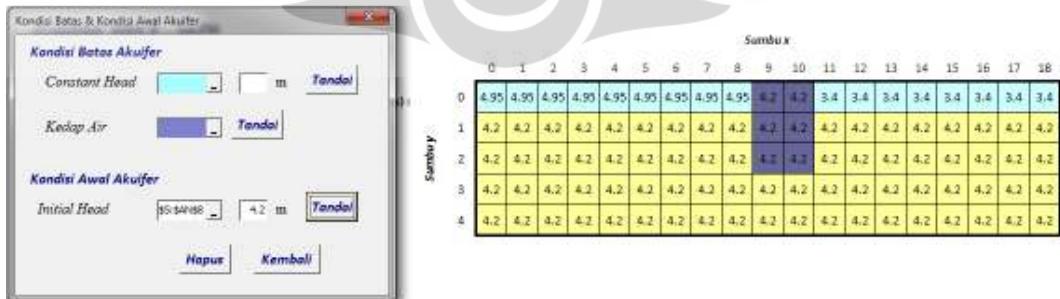
Gambar 4.36   Menentukan *initial head* kasus *seepage tank*
Sumber: Olahan sendiri

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Setelah parameter, variabel, kondisi batas, dan kondisi awal dimasukkan maka program telah dapat dijalankan dengan menekan tombol *Jalankan Model* kemudian pilih kondisi *menuju steady*. Sama seperti sebelumnya model akan berjalan sampai muncul *message box* bertuliskan "selesai" apabila konvergensi telah tercapai sebelum iterasi maksimum tercapai atau *Iterasi Maksimum Tercapai*.

Gambar 4.37   Hasil *running* model IADI kasus *seepage tank*

Sumber: Olahan sendiri

Langkah yang sama dilakukan pada model *Runge-Kutta Orde 4*, sehingga didapatkan hasil seperti pada Gambar 4.38.

Gambar 4.38   Hasil *running* model *runge-Kutta Orde 4* kasus *seepage tank*

Sumber: Olahan sendiri
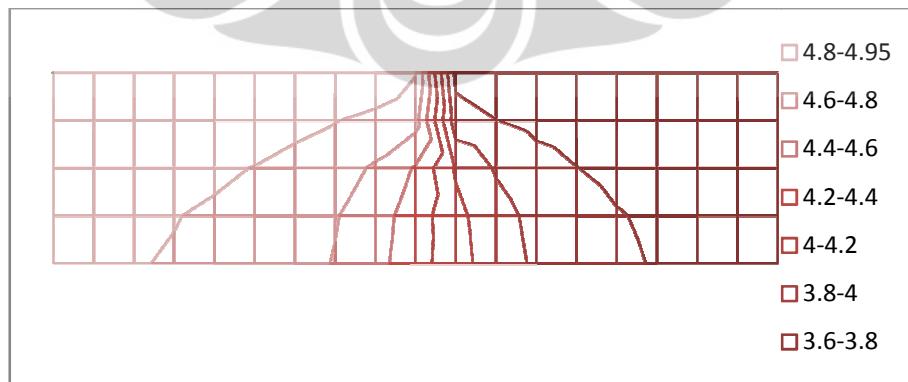
Gambar 4.39   Grafik *equipotential line* model IADI kasus *seepage tank*

Sumber: Olahan sendiri
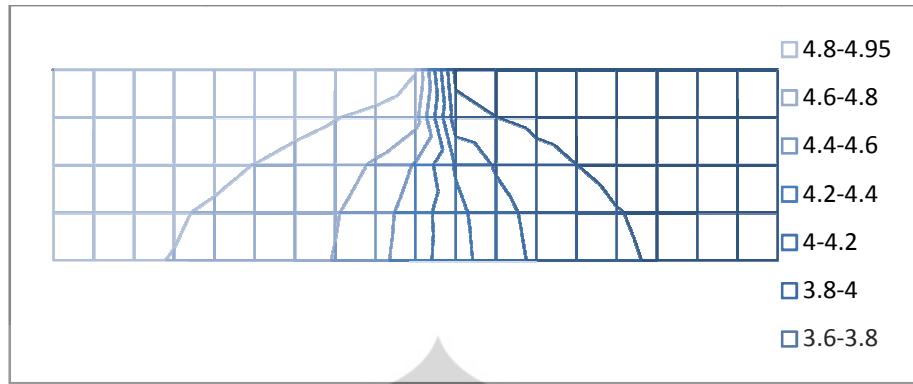
Gambar 4.40   Grafik *equipotential line* model *RKo4* kasus *seepage tank*
Sumber: Olahan sendiri
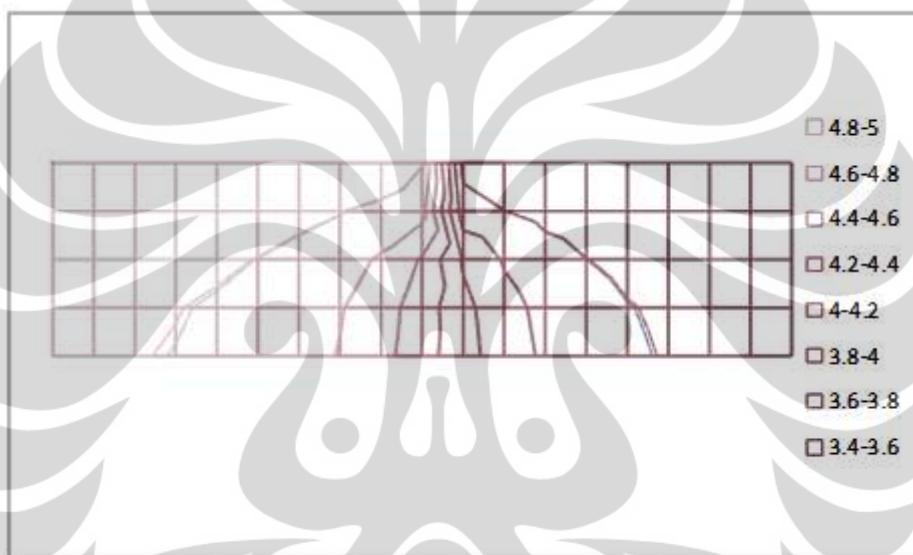
Gambar 4.41   *Overlay* kedua grafik *equipotential line* kasus *seepage tank*
Sumber: Olahan sendiri

Berdasarkan dua grafik keluaran model GWFM 2012 dapat dilihat bahwa garis-garis *equipotential* yang dihasilkan sudah sesuai dengan logika kondisi lapangan namun masih terdapat kekurangan dimana garis *equipotential* belum tegak lurus dengan sisi kedap air. Hal ini dikarenakan grafik *equipotential line* dibuat menggunakan fitur pada *MS. Excel* sehingga hanya membaca nilai *h* pada setiap titik kemudian menghubungkannya padahal seharunya harus dilakukan interpolasi pada setiap data *h* yang terbaca.

4.2.3 Eskperimen model matematik kasus *seepage tank menuju waktu maksimum*

Setelah model dengan kasus *seepage tank menuju steady* dijalankan selanjutnya akan diuji konvergensi model *Runge-Kutta* orde 4 apabila dijalankan pada kondisi *unteady*. Kondisi ini dijalan dengan parameter dt = 100s menuju waktu maksimum 40000s. Sebelum model dijalankan ditentukan terlebih dahulu tiga titik yang akan diamati, titik tersebut adalah titik di bagian hulu, tengah dan hilir. Titik yang diberi warna merah pada model merupakan titik yang ditinjau.

Gambar 4.42   Titik tinjau kasus *seepage tank* kondisi *menuju waktu maksimum*
Sumber: Olahan sendiri

Gambar 4.43   Titik tinjau kasus *seepage tank* kondisi telah *steady*
Sumber: Olahan sendiri

Waktu yang dibutuh untuk mencapai kondisi benar-benar *steady* adalah 40000s atau 11.11 jam. Rekaman data mulai dari t = 0s sampai dengan t = 40000s terlihat pada Gambar 4.44.
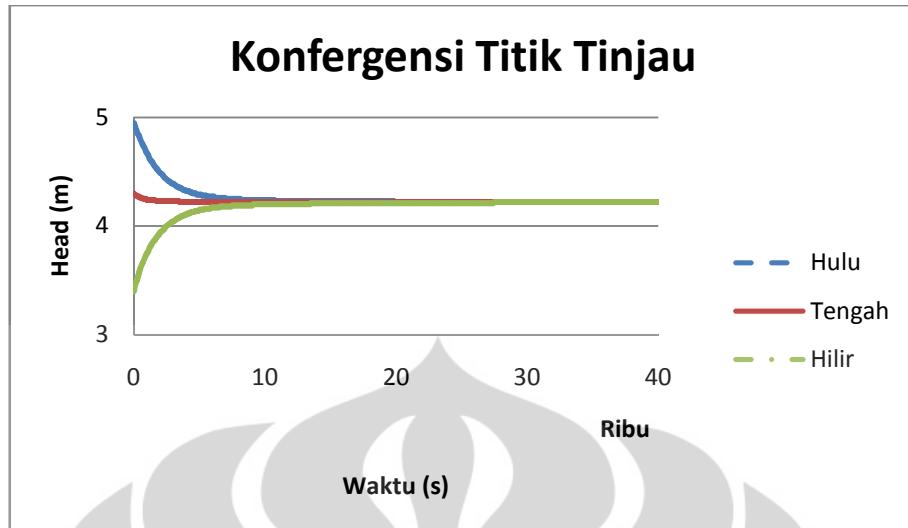
Gambar 4.44   Konvergensi titik tinjau dari kondisi awal menuju kondisi *steady*

Sumber: Olahan sendiri

Dari Gambar 4.44 dapat dilihat bahwa keluaran model *menuju waktu maksimum* sudah konvergen menuju kondisi *steady*.

4.3   Sensitivitas Parameter Dan Variabel Model Matematik

Parameter diskretisasi dan variabel gerak aliran air tanah keduanya merupakan besaran yang dapat mempengaruhi hasil perhitungan pada model GWFM 2012 sehingga perlu diketahui bagaimana pengaruh perubahan parameter dan variabel terhadap hasil perhitungan atau lebih dikenal dengan sensitivitas parameter dan variabel model.

Untuk menguji sensitivitas parameter dan variabel dari model GWFM 2012 digunakan model dengan kasus *pumping well*, data lapangan variabel gerak aliran air tanah yang didapatkan sebagai berikut:

4.3.1 Sensitivitas Parameter *dx/dy*

Untuk mengetahui sensitivitas parameter *dx/dy* pada model GWFM 2012, model dijalankan dalam keadaan *menuju steady* dengan nilai parameter *dx/dy* adalah 150m, 100m, dan 50m. Sensitivitas parameter *dx/dy* ini akan ditinjau pada sumbu *x* dan sumbu *y* yang melewati sumur pada model *Runge-Kutta* orde 4.

(a)   (b)

Gambar 4.45 Data keluaran model *Runge-Kutta* orde 4 kasus *pumping well*; (a)
dx=150m; (b) dx=50m

Sumber: Olahan sendiri

Dari hasil keluaran di atas dihitung nilai standar deviasi dari nilai *head*.
Didapatkan bahwa besar nilai standar deviasi *head* dari masing-masing *dx/dy*
dibandingkan dengan perhitungan analitik seperti pada Tabel 4.10. Standar
deviasi paling kecil didapat dengan menggunakan *dx/dy* dengan nilai 100 m
sehingga untuk model ini nilai *dx/dy* tersebut menjadi nilai yang paling baik.

Tabel 4.10 Standar deviasi perubahan dx/dy

dx/dy (m)	150	100	50
σ	0.174	0.133	0.279

Sumber: Olahan sendiri

4.3.2 Sensitivitas Parameter *dt*

Untuk mengetahui sensitivitas parameter *dt* pada model GWFM 2012,
model dijalankan dalam keadaan *menuju steady* dengan nilai parameter *dt* adalah
500s, 1000s, 1500s. Sensitivitas parameter *dt* ini akan ditinjau pada sumbu *x* dan
sumbu *y* yang melewati sumur pada model *Runge-Kutta* orde 4.
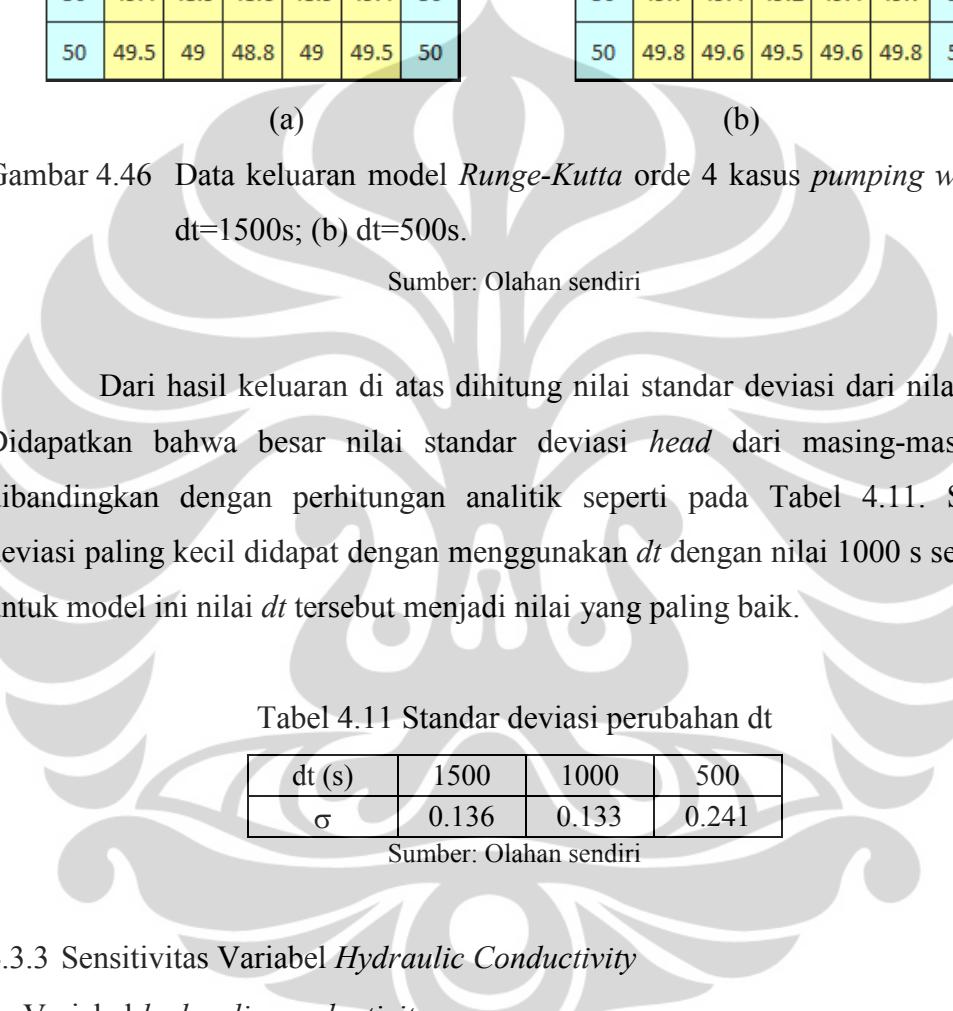
50	49.5	49	48.8	49	49.5	50
50	49.4	48.9	48.6	48.9	49.4	50
50	49.2	48.4	47.7	48.4	49.2	50
50	49.1	47.8	45.3	47.8	49.1	50
50	49.2	48.4	47.7	48.4	49.2	50
50	49.4	48.9	48.6	48.9	49.4	50
50	49.5	49	48.8	49	49.5	50

50	49.8	49.6	49.5	49.6	49.8	50
50	49.7	49.4	49.2	49.4	49.7	50
50	49.5	48.9	48.1	48.9	49.5	50
50	49.3	48.2	45.3	48.2	49.3	50
50	49.5	48.9	48.1	48.9	49.5	50
50	49.7	49.4	49.2	49.4	49.7	50
50	49.8	49.6	49.5	49.6	49.8	50

(a)   (b)

Gambar 4.46 Data keluaran model *Runge-Kutta* orde 4 kasus *pumping well*; (a) dt=1500s; (b) dt=500s.

Sumber: Olahan sendiri

Dari hasil keluaran di atas dihitung nilai standar deviasi dari nilai *head*. Didapatkan bahwa besar nilai standar deviasi *head* dari masing-masing *dt* dibandingkan dengan perhitungan analitik seperti pada Tabel 4.11. Standar deviasi paling kecil didapat dengan menggunakan *dt* dengan nilai 1000 s sehingga untuk model ini nilai *dt* tersebut menjadi nilai yang paling baik.

Tabel 4.11 Standar deviasi perubahan dt

dt (s)	1500	1000	500
σ	0.136	0.133	0.241

Sumber: Olahan sendiri

4.3.3 Sensitivitas Variabel *Hydraulic Conductivity*

• Variabel *hydraulic conductivity*

Tabel 4.12 Hasil pengukuran *hydraulic conductivity* hipotetik

No	Pengukuran *Hydraulic Conductivity* Lapangan
1	1.18×10^{-3} m/s
2	2.18×10^{-3} m/s
3	2.23×10^{-3} m/s
4	2.00×10^{-3} m/s
5	2.21×10^{-3} m/s

Sumber: Olahan sendiri

Data pengukuran di atas harus diolah terlebih dahulu untuk mendapat nilai variabel *hydraulic conductivity* yang akan digunakan dalam model. Hasil pengolahan data variabel *hydraulic conductivity* seperti pada Tabel 4.13.

Tabel 4.13 Perhitungan nilai *hydraulic conductivity*

No	Pengukuran Lapangan (10^{-3} m/s)	Nilai Rata-rata	Standar Deviasi
1	1.18		
2	2.18		
3	2.23	1.96	0.445
4	2		
5	2.21		

Sumber: Olahan sendiri

Didapatkan dari hasil perhitungan bahwa nilai variabel *hydraulic conductivity* adalah $(1.96 \pm 0.445) \times 10^{-3}$ m/s. Menggunakan nilai tersebut dapat ditentukan batas atas, batas tengah dan batas bawah nilai variabel *hydraulic conductivity* berturut-turut adalah 2.405×10^{-3} m/s, 1.96×10^{-3} m/s dan 1.515×10^{-3} m/s.

Untuk mengetahui sensitivitas variabel *hydraulic conductivity* pada model GWFM 2012, model dijalankan dalam keadaan *menuju steady* dengan nilai variabel *hydraulic conductivity* adalah batas atas dan batas bawah yaitu 2.405×10^{-3} m/s dan 1.515×10^{-3} m/s. Untuk nilai variabel *spesific yied* digunakan nilai batas tengah yaitu 0.05. Sensitivitas variabel *hydraulic conductivity* ini akan ditinjau pada sumbu *x* dan sumbu *y* yang melewati sumur pada model *Runge-Kutta* orde 4.

(a)   (b)

Gambar 4.47   Data keluaran model *Runge-Kutta* orde 4 kasus *pumping well*; (a) batas atas; (b) batas bawah nilai *hydraulic conductivity*.

Sumber: Olahan sendiri

Dari Gambar 4.47 dihitung selisih antara batas atas dengan batas bawah di setiap titik, kemudian dihitung nilai standar deviasi dari nilai *head*. Didapatkan besar nilai *head* di setiap titik berada di antara $h \pm 0.099$ m.
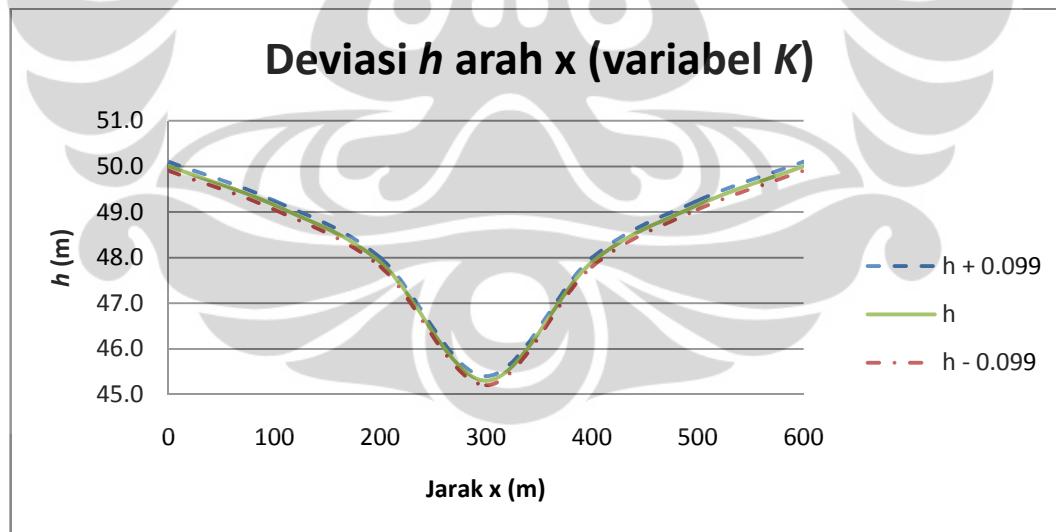
Gambar 4.48   Grafik deviasi h arah x akibat variabel *hydraulic conductivity*

Sumber: Olahan sendiri
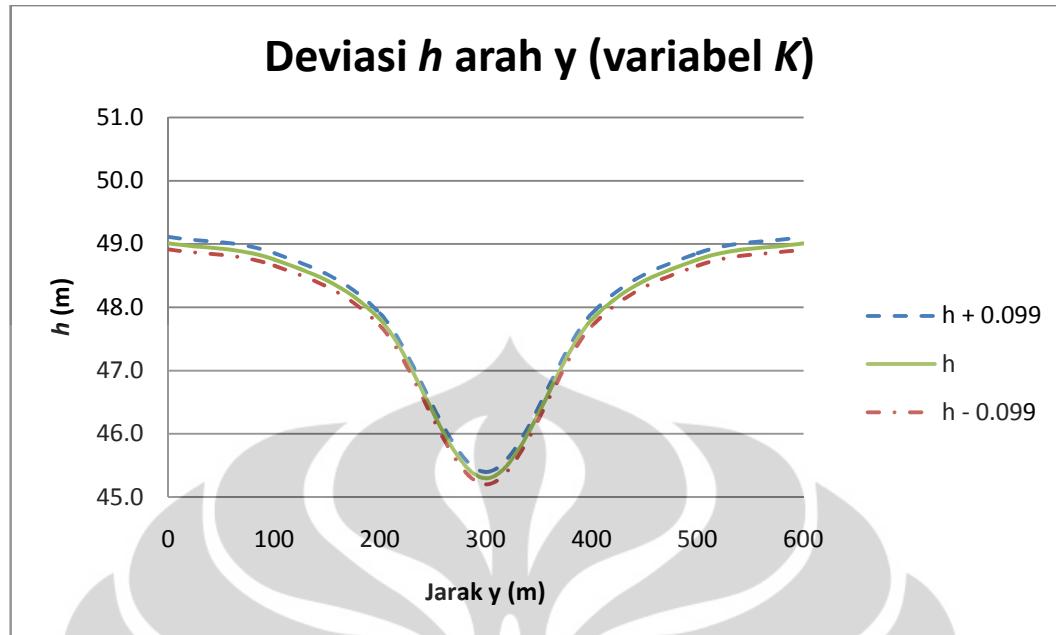
Gambar 4.49 Grafik deviasi *h* arah y akibat variabel *hydraulic conductivity*

Sumber: Olahan sendiri

4.3.4 Sensitivitas Variabel *Spesific Yield*

- Variabel *spesific yield*

Tabel 4.14 Hasil pengukuran *spesific yield* hipotetik

No	Pengukuran *Spesific Yield* Lapangan
1	0.052
2	0.049
3	0.053
4	0.052
5	0.050

Sumber: Olahan sendiri

Data pengukuran di atas harus diolah terlebih dahulu untuk mendapat nilai variabel *spesific yield* yang akan digunakan dalam model. Hasil pengolahan data variabel *spesific yield* seperti pada Tabel 4.15.

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Tabel 4.15 Perhitungan nilai *spesific yield*

No	Pengukuran Lapangan	Nilai Rata-rata	Standar Deviasi
1	0.049		
2	0.048		
3	0.053	0.05	0.002
4	0.052		
5	0.050		

Sumber: Olahan sendiri

Didapatkan dari hasil perhitungan bahwa nilai variabel *spesific yield* adalah 0.05 ± 0.002. Menggunakan nilai tersebut dapat ditentukan batas atas, batas tengah dan batas bawah nilai variabel *spesific yield* berturut-turut adalah 0.052, 0.05 dan 0.048.

Untuk mengetahui sensitivitas variabel *spesific yield* pada model GWFM 2012, model dijalankan dalam keadaan *menuju steady* dengan nilai variabel *spesific yield* adalah batas atas dan batas bawah yaitu 0.052 dan 0.048. Untuk nilai variabel *hydraulic conductivity* digunakan nilai batas tengah yaitu 1.96×10^{-3} m/s. Sensitivitas variabel *spesific yield* ini akan ditinjau pada sumbu x dan sumbu y yang melewati sumur pada model *Runge-Kutta* orde 4.
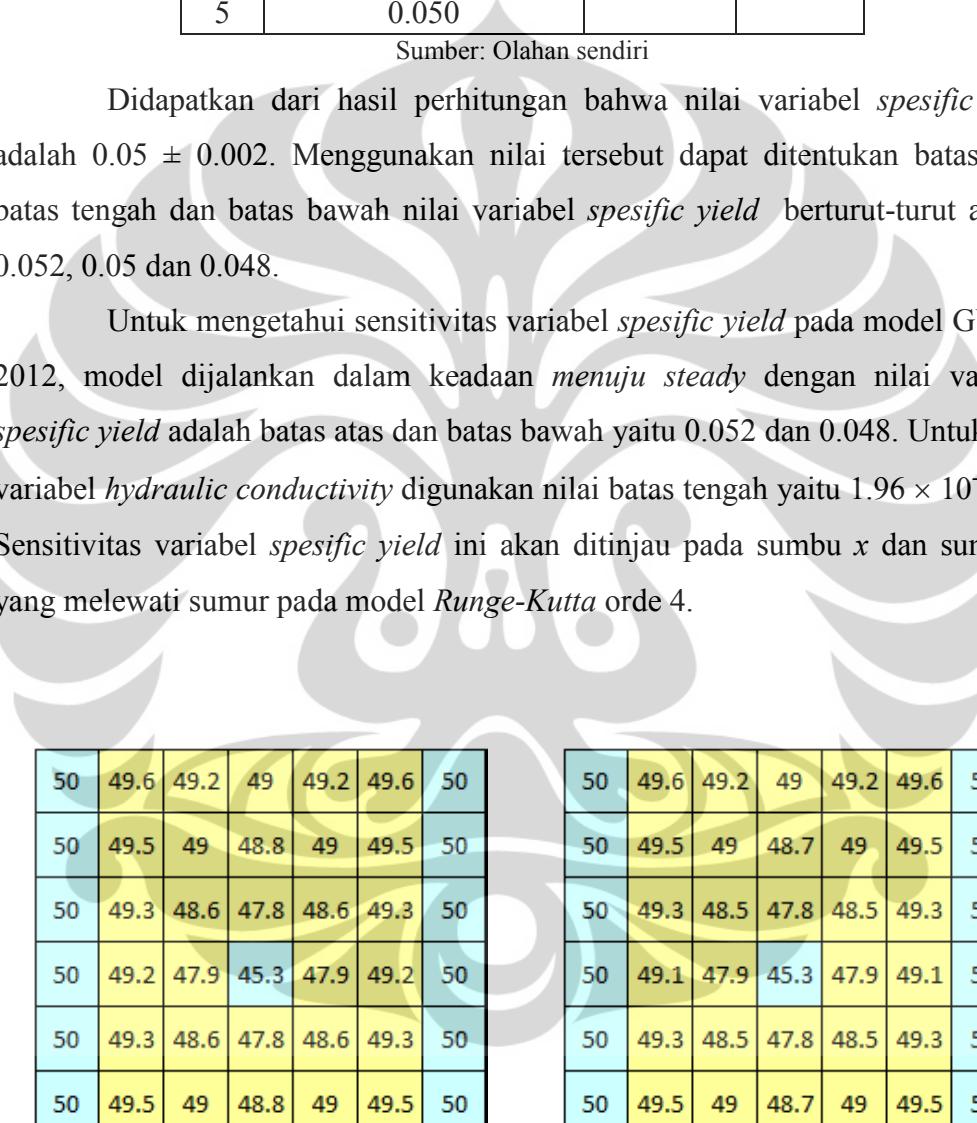
(a)　　　　　　　　　　　　　(b)

Gambar 4.50 Data keluaran model *Runge-Kutta* orde 4 kasus *pumping well*; (a) batas atas; (b) batas bawah nilai *spesific yield.*

Sumber: Olahan sendiri

Dari Gambar 4.50 dihitung selisih antara batas atas dengan batas bawah di setiap titik, kemudian dihitung nilai standar deviasi dari nilai *head*. Didapatkan besar nilai *head* di setiap titik berada di antara $h \pm 0.017$ m.
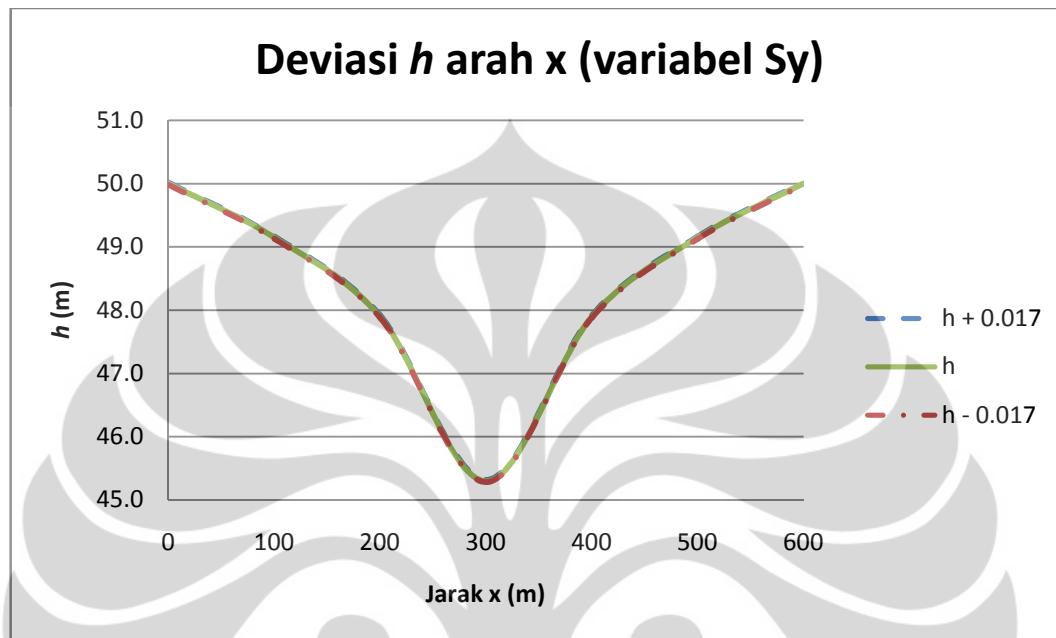
Gambar 4.51   Grafik deviasi *h* arah x akibat variabel *spesific yield*

Sumber: Olahan sendiri
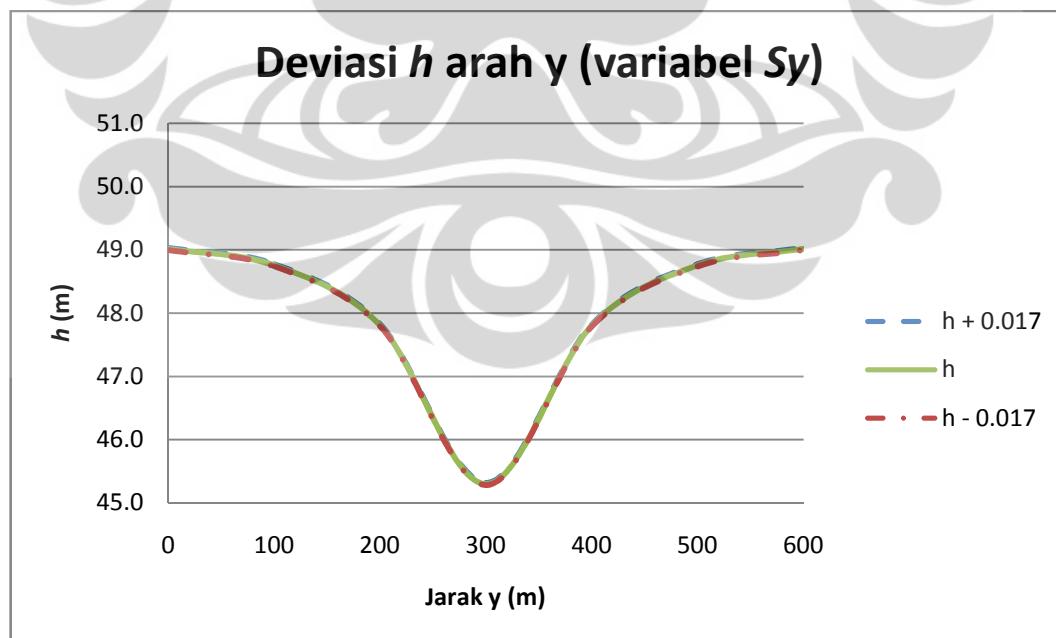
Gambar 4.52   Grafik deviasi *h* arah y akibat variabel *spesific yield*

Sumber: Olahan sendiri

4.3.5 *Confidence Belt* Model GWFM 2012

    Confidence belt nilai *head* merupakan interval nilai *head* pada keluaran model yang dipengaruhi oleh nilai standar deviasi input variabel gerak aliran air tanah.

$$\sigma h_{cb} = \sqrt{\sigma h_K{}^2 + \sigma h_{Sy}{}^2}$$

σh_K = standar deviasi *head* akibat perubahan nilai *hydraulic conductivity*

σh_{Sy} = standar deviasi *head* akibat perubahan nilai *spesific yield*

    Berdasarkan perhintungan sensitivitas variabel sebelumnya maka interval nilai *head* pada model dengan kasus *pumping well* adalah sebagai berikut:

$$\sigma h_{cb} = \sqrt{(0.099)^2 + (0.017)^2}$$
$$\sigma h_{cb} = 0.1$$
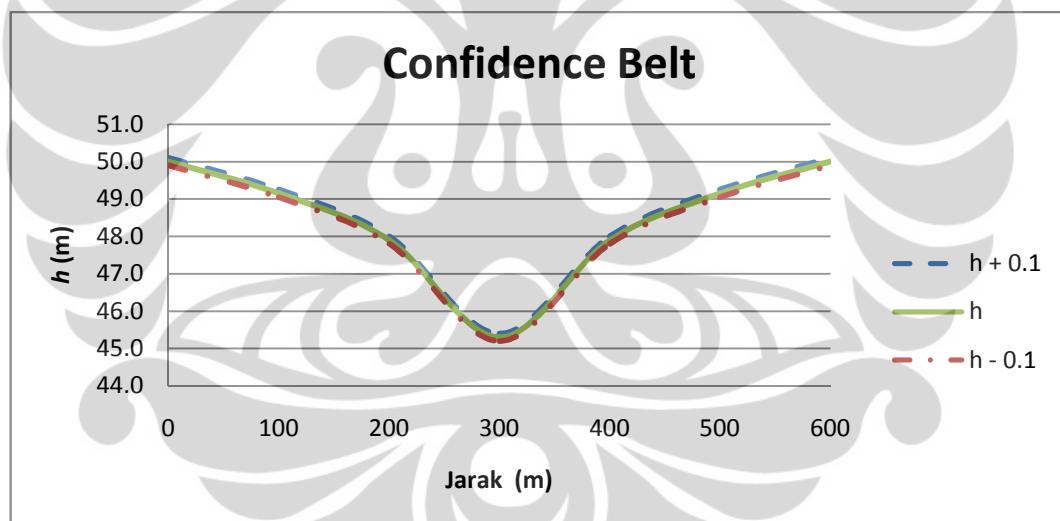
Gambar 4.53 *Confidence Belt* keluaran model GWFM 2012

Sumber: Olahan sendiri

BAB 5

KESIMPULAN DAN SARAN

5.1   Kesimpulan

Hasil verifikasi model menggunakan model numerik teruji menunjukkan nilai *error* yang berkisar antara 0.09% sampai dengan 0.2%, sementara verifikasi model menggunakan hasil perhitungan analitik menunjukkan nilai *error* yang berkisar antara 0.1% sampai dengan 0.63%. Berdasarkan hasil verifikasi tersebut dapat dikatakan bahwa model GWFM 2012 ini sudah menjalankan prosedur perhitungan dengan benar dan menghasilkan nilai *error* di bawah 1%.

Model GWFM dijalankan dengan beberapa skenario atau kasus untuk menguji konvergensi keluaran model. Menggunakan kasus *general flow* sebagai kasus yang paling sederhana keluaran model sudah menunjukkan hasil yang sesuai dengan aturan-aturan gerak aliran air tanah, hal itu terlihat dari grafik *equipotential* yang dihasilkan. Menggunakan kasus *seepage tank* kondisi *steady* sebagai kasus yang paling banyak diangkat untuk memahami gerak aliran air tanah, keluaran model juga sudah menunjukkan hasil yang sesuai dengan atura-aturan gerak aliran air tanah. Selanjutnya menggunakan kasus *seepage tank* kondisi *menuju waktu maksimum* sabagai kasus terakhir untuk menguji konvergensi model, keluaran meunjukan kekovergensian dari kondisi *unsteady* menujui kondisi *steady,* namun ketika keluaran model berupa grafik *equipotential line* ditampilkan masih terdapat kekurangan yaitu *equipotential line* tidak tegak lurus dengan permukaan kedap air.

Pada saat digunakan nanti model memiliki suatu interval yang disebut dengan *confidence belt* yang merupakan interval perkiraan nilai *head* di lapangan. *Confidence belt* dihitung berdasarkan paramater diskretisasi dan variabel gerak aliran tanah yang menjadi input pada model. Dari hasil perhitungan *confidence belt* menggunakan hipotetikal data diketahui bahwa parameter dx/dy dan parameter dt memiliki psngaruh yang besar dibandingkan dengan variabel gerak aliran air tanah.

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Hasil verifikasi dan eksperimen model dengan penyelesain temporal metode numerik *Runge-Kutta Orde* 4 memiliki hasil yang sama dengan metode *Iterative Alternating Direction Implicit* sehingga model dengan penyelesaian ini dapat digunakan sebagai salah satu alat hitung gerak aliran air tanah dengan *platform* yang sederhana dan dapat dipakai oleh semua orang atau *public domain*.

5.2   Saran

Berdasarkan kekurangan yang muncul pada keluaran model maka disarankan keluaran model berupa grafik *equipotential line* dibuat menggunakan bahasa program sendiri tidak menggunakan fitur *MS. Excel* supaya dapat menampilkan grafik yang lebih akurat.

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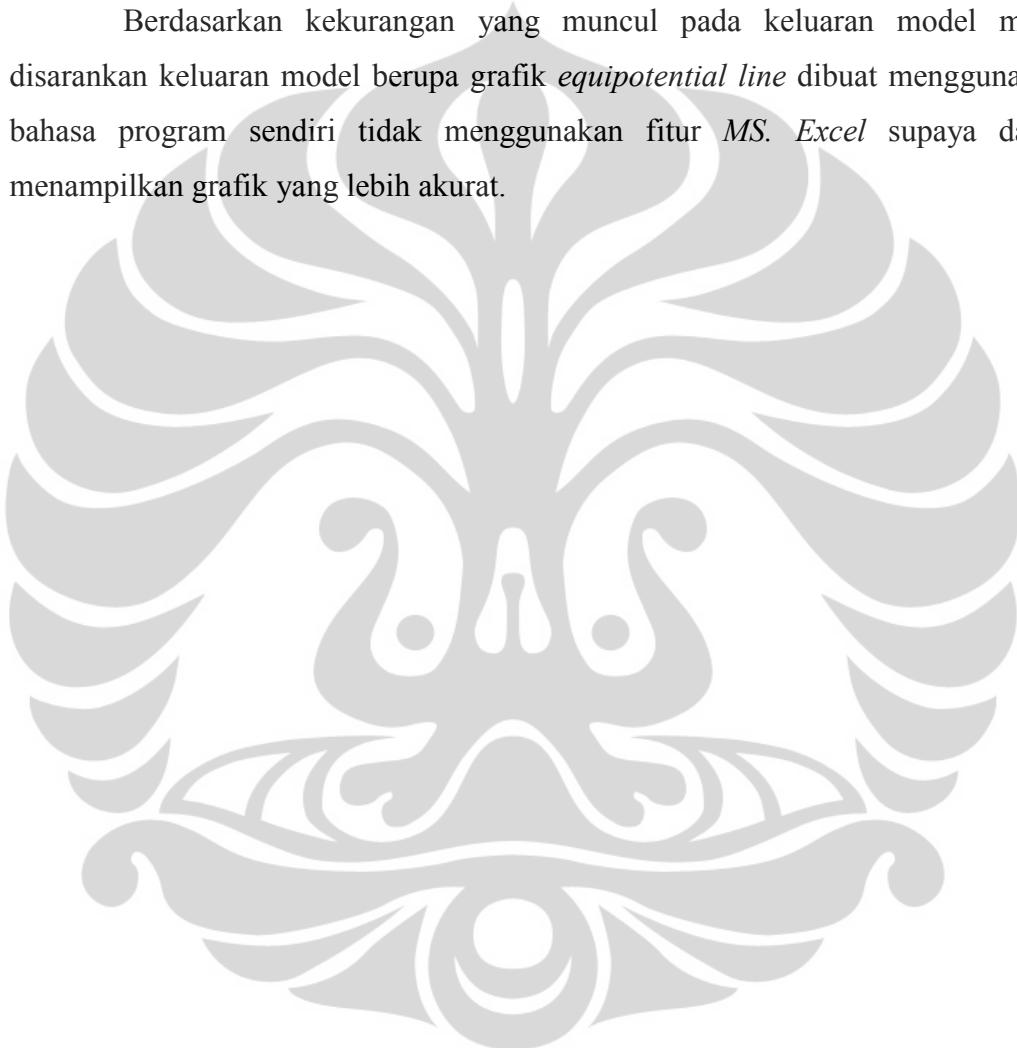
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Potter, M. C., & Wiggert, D. C. (1997). *Mechanics of Fluids.* New Jersey: Prentice-Hall.

Manual Penggunaan Program GWFM 2012

- Membuka Program GWFM 2012.xlsm

- Klik *Read Only*

- *Security Warning → Options → Enable this content → OK*

'Menjalankan model IADI/*Runge-Kutta Orde* 4

- Klik *Runge-Kutta Orde* 4 atau Klik *Iterative Alternating Direction Implicit*

- Klik *Prameter, Variabel* → Isi setiap kolom parameter dan variabel → *Buat Akuifer*

- Klik *Kondisi Batas, Kondisi Awal*

- Untuk menentukan titik-titik *constant head,* Klik *Refedit Constant Head* → Isi kolom *head* → *Tandai*

- Untuk menentukan titik-titik kedap air, Klik *Refedit Kedap Air* → *Tandai*

- Untuk menentukan titik-titik *initial head*, Klik *Refedit Initial Head* → isi kolom *head* → *Tandai*

- Untuk menjalankan model *menuju steady*, Klik *Jalankan Model → Menuju Steady*

- Untuk menjalankan model *menuju waktu maksimum,* Klik *Jalankan Model → Menuju Waktu Maksimum*

- Untuk menampilkan grafik, Klik *Grafik* → isi kolom *Skala Maks*, *Skala Min*, dan *Unit → Grafik*

'Menjalankan perbandingan grafik

- Klik *Grafik*

- Klik *Runge-Kutta Orde* 4 → Pastikan grafik telah aktif → *Kembali → Grafik*

- Klik *IADI* → Pastikan grafik telah aktif → *Kembali → Grafik*

- Klik *Bandingkan Grafik*

Menjalankan data kecepatan

- Klik *Data Kecepatan* → Klik *Vx (m/s)*

- Klik *Data Kecepatan* → Klik *Vy (m/s)*

'Menyimpan data

- *Ctrl+S → OK→* ketik judul kasus dibelakang *Copy of GWFM 2012 .... → OK*

Form Parameter, Variabel

```
Private Sub B_Click()
Unload Me
End Sub


Private Sub OK_Click()
Worksheets("HIDE").Range("E5").Value = PA.Value
Worksheets("HIDE").Range("E7").Value = LA.Value
Worksheets("HIDE").Range("J5").Value = JGX.Value
Worksheets("HIDE").Range("J7").Value = JGY.Value
Worksheets("HIDE").Range("O5").Value = PW.Value
Worksheets("HIDE").Range("e14").Value = SY.Value
Worksheets("HIDE").Range("J15").Value = KX.Value
Worksheets("HIDE").Range("J17").Value = KY.Value
Worksheets("HIDE").Range("O7").Value = IM.Value
Worksheets("HIDE").Range("O9").Value = WM.Value
Unload Me
End Sub


Private Sub UserForm_Initialize()
Me.StartUpPosition = 0
Me.Top = 135
Me.Left = 25
PA.Value = Worksheets("HIDE").Range("E5").Value
LA.Value = Worksheets("HIDE").Range("E7").Value
JGX.Value = Worksheets("HIDE").Range("J5").Value
JGY.Value = Worksheets("HIDE").Range("J7").Value
PW.Value = Worksheets("HIDE").Range("O5").Value
SY.Value = Worksheets("HIDE").Range("e14").Value
KX.Value = Worksheets("HIDE").Range("J15").Value
KY.Value = Worksheets("HIDE").Range("J17").Value
IM.Value = Worksheets("HIDE").Range("O7").Value
WM.Value = Worksheets("HIDE").Range("O9").Value
PA.SetFocus
End Sub


Private Sub PA_Change()
PA.Value = Me.PA.Value
End Sub


Private Sub LA_Change()
LA.Value = Me.LA.Value
End Sub


Private Sub JGX_Change()
JGX.Value = Me.JGX.Value
End Sub


Private Sub JGY_Change()
JGY.Value = Me.JGY.Value
End Sub


Private Sub BA_Click()
Worksheets("HIDE").Range("E5").Value = PA.Value
Worksheets("HIDE").Range("E7").Value = LA.Value
Worksheets("HIDE").Range("J5").Value = JGX.Value
Worksheets("HIDE").Range("J7").Value = JGY.Value
```

```
Worksheets("HIDE").Range("o5").Value = PW.Value
Worksheets("HIDE").Range("e14").Value = SY.Value
Worksheets("HIDE").Range("J15").Value = KX.Value
Worksheets("HIDE").Range("J17").Value = KY.Value
Worksheets("HIDE").Range("O7").Value = IM.Value
Worksheets("HIDE").Range("O9").Value = WM.Value
Worksheets("HIDERK").Cells.Clear
Worksheets("HIDEIADI").Cells.Clear
Worksheets("Kecepatan").Cells.Clear
ActiveSheet.Cells.Clear
ActiveSheet.Cells.HorizontalAlignment = xlCenter
ActiveSheet.Cells.VerticalAlignment = xlCenter
If JGX.Value = "" Then
    nx = 0
Else
    nx = PA.Value / JGX.Value
End If
If JGY.Value = "" Then
    ny = 0
Else
    ny = LA.Value / JGY.Value
End If
Range(Cells(2, 22), Cells(2, 22 + nx)).Select
    With Selection
    .Merge
    .Font.Italic = True
    .Font.Bold = True
    .Value = "Sumbu x"
    End With
Range(Cells(4, 20), Cells(4 + ny, 20)).Select
    With Selection
    .Merge
    .Font.Italic = True
    .Font.Bold = True
    .Orientation = xlUpward
    .Value = "Sumbu y"
    End With
Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Select
Selection.Interior.ColorIndex = 36
    Selection.Borders(xlDiagonalDown).LineStyle = xlNone
    Selection.Borders(xlDiagonalUp).LineStyle = xlNone
    With Selection
    .Borders(xlEdgeLeft).LineStyle = xlContinuous
    .Borders(xlEdgeLeft).Weight = xlThick
    .Borders(xlEdgeTop).LineStyle = xlContinuous
    .Borders(xlEdgeTop).Weight = xlThick
    .Borders(xlEdgeBottom).LineStyle = xlContinuous
    .Borders(xlEdgeBottom).Weight = xlThick
    .Borders(xlEdgeRight).LineStyle = xlContinuous
    .Borders(xlEdgeRight).Weight = xlThick
    End With
    With Selection
    .Borders(xlInsideVertical).LineStyle = xlContinuous
    .Borders(xlInsideHorizontal).LineStyle = xlContinuous
    End With
For i = 0 To nx Step 1
Cells(3, 22 + i) = i
Cells(3, 22 + i).Interior.ColorIndex = 2
```

```
Cells(5 + ny, 22 + i).Interior.ColorIndex = 2
Next i
For i = 0 To ny Step 1
Cells(4 + i, 21) = i
Cells(4 + i, 21).Interior.ColorIndex = 2
Cells(4 + i, 23 + nx).Interior.ColorIndex = 2
Next i
Unload Me
End Sub
```

Form Kondisi Batas, Kondisi Awal

```
Private Sub UserForm_Initialize()
Me.StartUpPosition = 0
Me.Top = 135
Me.Left = 95
End Sub
Private Sub H_Change()
H.Value = Me.H.Value
End Sub


Private Sub H2_Change()
H2.Value = Me.H2.Value
End Sub


Private Sub TCH_Click()
Dim SelRange As Range
Dim AddrCH As String
AddrCH = CH.Value
If AddrCH = "" Then
   MsgBox "cells belum ditentukan"
Else
   Set SelRange = Range(AddrCH)
   SelRange.Interior.ColorIndex = 34
   SelRange.Value = H.Value
End If
End Sub

Private Sub TKA_Click()
Dim SelRange As Range
Dim AddrKA As String
AddrKA = KA.Value
If AddrKA = "" Then
   MsgBox "cells belum ditentukan"
Else
   Set SelRange = Range(AddrKA)
   SelRange.Interior.ColorIndex = 47
End If
End Sub

Private Sub TCF_Click()
Dim SelRange As Range
Dim AddrCF As String
AddrCF = CF.Value
If AddrCF = "" Then
   MsgBox "cells belum ditentukan"
Else
```

```
    Set SelRange = Range(AddrCF)
    SelRange.Interior.ColorIndex = 46
End If
End Sub
Private Sub TIH_Click()
Dim SelRange As Range
Dim AddrIH As String
AddrIH = IH.Value
If AddrIH = "" Then
    MsgBox "cells belum ditentukan"
Else
    Set SelRange = Range(AddrIH)
    SelRange.Value = H2.Value
End If
End Sub
Private Sub Hapus_Click()
PA = Worksheets("HIDE").Range("E5").Value
LA = Worksheets("HIDE").Range("E7").Value
JGX = Worksheets("HIDE").Range("J5").Value
JGY = Worksheets("HIDE").Range("J7").Value
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If
Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Select
Selection.Interior.ColorIndex = 36
Selection.Value = ""
End Sub


Private Sub Kembali_Click()
Unload Me
End Sub
```

Form Jalankan Model

```
Private Sub UserForm_Initialize()
Me.StartUpPosition = 0
Me.Top = 135
Me.Left = 185
End Sub


Private Sub CommandButton1_Click()
Unload Me
Range("R3").Value = 0
Range("R5").Value = 0
Start = Timer
Rungekutta
Finish = Timer
MsgBox Format(Finish - Start, "0.000""  detik"), vbOKOnly, "Running Time"
End Sub


Private Sub CommandButton2_Click()
```

```
Unload Me
Range("R3").Value = 0
Range("R5").Value = 0
Start = Timer
Rungekuttaust
Finish = Timer
MsgBox Format(Finish - Start, "0.000""  detik"), vbOKOnly, "Running Time"
End Sub


Private Sub CommandButton3_Click()
Unload Me
End Sub
```

Form Grafik

```
Private Sub UserForm_Initialize()
Me.StartUpPosition = 0
Me.Top = 135
Me.Left = 255
Smaks.Value = Worksheets("Hide").Range("E20").Value
Smin.Value = Worksheets("Hide").Range("E21").Value
unit.Value = Worksheets("Hide").Range("E22").Value
End Sub
Private Sub Smaks_Change()
Smaks.Value = Me.Smaks.Value
End Sub


Private Sub Smin_Change()
Smin.Value = Me.Smin.Value
End Sub


Private Sub unit_Change()
unit.Value = Me.unit.Value
End Sub


Private Sub CommandButton1_Click()
Worksheets("Hide").Range("E20").Value = Smaks.Value
Worksheets("Hide").Range("E21").Value = Smin.Value
Worksheets("Hide").Range("E22").Value = unit.Value
ActiveSheet.Shapes.AddChart.Select
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
```

```
End If
ActiveChart.SetSourceData Source:=Range(Cells(4, 22), Cells(4 + ny, 22 + nx))
ActiveChart.ChartType = xlSurfaceTopViewWireframe
ActiveChart.Elevation = -90
ActiveChart.Parent.Left = 25
ActiveChart.Parent.Top = 100
ActiveChart.Axes(xlValue).MinimumScale = Smin.Value
If Smin.Value = "" Then
MsgBox "skala belum ditentukan"
End If
ActiveChart.Axes(xlValue).MaximumScale = Smaks.Value
If Smaks.Value = "" Then
MsgBox "skala belum ditentukan"
End If
ActiveChart.Axes(xlValue).MajorUnit = unit.Value
If unit.Value = "" Then
MsgBox "unit belum ditentukan"
End If
ActiveChart.ChartStyle = 3
ActiveChart.ChartArea.Format.Fill.Visible = False
ActiveChart.Axes(xlValue).HasMajorGridlines = False
ActiveChart.Legend.IncludeInLayout = False
Unload Me
End Sub
```

Modul 1 Perhitungan IADI *menuju steady*

```
'Perhitungan IADI arah horizontal ke kanan
Sub IADIx()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If


A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATX").Cells.Clear
Worksheets("MATX").Cells.HorizontalAlignment = xlCenter
Worksheets("MATX").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0
```

```vba
For j = 0 To ny Step 1
   For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Or Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATX").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = 1
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
         Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
         Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
         Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
         Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
         Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
```

```
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
```

```
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
```

```
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
End If
    Next i
Next j

For j = 0 To ny Step 1
Range(Worksheets("MATX").Cells(j * (nx + 1) + 1, 4 + nx), Worksheets("MATX").Cells((1 + j)
*       nx      +      (1      +      j),       4       +       nx)).Value       =
Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(1      +      j,      1),
Worksheets("MATX").Cells(1 + j, 1 + nx)).Value)
Next j
```

```
Range(Worksheets("MATX").Cells(1, 5 + nx), Worksheets("MATX").Cells((1 + nx) * (1 + ny), 5
+                                              nx)).Value                                            =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)   *   (1   +   ny))).Value),   Range(Worksheets("MATX").Cells(1,   4   +   nx),
Worksheets("MATX").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)

For j = 0 To ny Step 1
Range(Worksheets("MATX").Cells(3 + ny + j, 1), Worksheets("MATX").Cells(3 + ny + j, 1 +
nx)).Value = Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(j *
(nx + 1) + 1, 5 + nx), Worksheets("MATX").Cells((1 + j) * nx + (1 + j), 5 + nx)).Value)
Next j


Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATX").Cells(3 + ny,
1), Worksheets("MATX").Cells(3 + ny + ny, 1 + nx)).Value

End Sub

'Perhitungan IADI arah vertikal ke bawah
Sub IADIy()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If

A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATY").Cells.Clear
Worksheets("MATY").Cells.HorizontalAlignment = xlCenter
Worksheets("MATY").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0

 For i = 0 To nx Step 1
    For j = 0 To ny Step 1
    x = 22 + i
    y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Or Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATY").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = 1
```

```vba
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
```

```
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
      End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
      End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
```

```
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
      End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
```

```
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    End If
End If
    Next j
Next i

For i = 0 To nx Step 1
Range(Worksheets("MATY").Cells(i * (ny + 1) + 1, 4 + nx), Worksheets("MATY").Cells((1 + i)
* ny + (1 + i), 4 + nx)).Value = Range(Worksheets("MATY").Cells(1, 1 + i),
Worksheets("MATY").Cells(1 + ny, 1 + i)).Value
Next i

Range(Worksheets("MATY").Cells(1, 5 + nx), Worksheets("MATY").Cells((1 + nx) * (1 + ny), 5
+                                    nx)).Value                                    =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)   *   (1   +   ny))).Value),   Range(Worksheets("MATY").Cells(1,   4   +   nx),
Worksheets("MATY").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)

For i = 0 To nx Step 1
Range(Worksheets("MATY").Cells(3 + ny, 1 + i), Worksheets("MATY").Cells(3 + ny + ny, 1 +
i)).Value   =   Range(Worksheets("MATY").Cells(i   *   (ny   +   1)   +   1,   5   +   nx),
Worksheets("MATY").Cells((1 + i) * ny + (1 + i), 5 + nx)).Value
```

```
Next i


Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATY").Cells(3 + ny,
1), Worksheets("MATY").Cells(3 + ny + ny, 1 + nx)).Value

End Sub

'Perhitungan IADI arah horizontal ke kiri
Sub IADIx1()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If


A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATX").Cells.Clear
Worksheets("MATX").Cells.HorizontalAlignment = xlCenter
Worksheets("MATX").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0

For j = ny To 0 Step -1
    For i = nx To 0 Step -1
    x = 22 + i
    y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Or Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATX").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = 1
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
```

```
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
```

```
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
  If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
```

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    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
```

```
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
    Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
  End If
End If
  Next i
Next j

For j = ny To 0 Step -1
Range(Worksheets("MATX").Cells(j * (nx + 1) + 1, 4 + nx), Worksheets("MATX").Cells((1 + j)
*       nx      +      (1      +      j),      4      +      nx)).Value      =
Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(1      +     j,     1),
Worksheets("MATX").Cells(1 + j, 1 + nx)).Value)
Next j

Range(Worksheets("MATX").Cells(1, 5 + nx), Worksheets("MATX").Cells((1 + nx) * (1 + ny), 5
+                       nx)).Value                       =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)   *   (1   +   ny))).Value),   Range(Worksheets("MATX").Cells(1,   4   +   nx),
Worksheets("MATX").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)

For j = ny To 0 Step -1
Range(Worksheets("MATX").Cells(3 + ny + j, 1), Worksheets("MATX").Cells(3 + ny + j, 1 +
nx)).Value = Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(j *
(nx + 1) + 1, 5 + nx), Worksheets("MATX").Cells((1 + j) * nx + (1 + j), 5 + nx)).Value)
Next j

Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATX").Cells(3 + ny,
1), Worksheets("MATX").Cells(3 + ny + ny, 1 + nx)).Value

End Sub

'Perhitungan IADI arah vertikal ke atas
Sub IADIy1()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
```

```
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If


A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATY").Cells.Clear
Worksheets("MATY").Cells.HorizontalAlignment = xlCenter
Worksheets("MATY").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0


 For i = nx To 0 Step -1
   For j = ny To 0 Step -1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Or Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATY").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = 1
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
     Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
     Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
     Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
     Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
```

```
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        End If
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
```

```
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
  If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
```

```
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
     ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
     ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
     ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
     ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
     ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
     ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
       Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
       Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
```

```
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    End If
End If
    Next j
Next i


For i = nx To 0 Step -1
Range(Worksheets("MATY").Cells(i * (ny + 1) + 1, 4 + nx), Worksheets("MATY").Cells((1 + i)
* ny + (1 + i), 4 + nx)).Value = Range(Worksheets("MATY").Cells(1, 1 + i),
Worksheets("MATY").Cells(1 + ny, 1 + i)).Value
Next i

Range(Worksheets("MATY").Cells(1, 5 + nx), Worksheets("MATY").Cells((1 + nx) * (1 + ny), 5
+                                              nx)).Value                                      =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)   *   (1   +   ny))).Value),   Range(Worksheets("MATY").Cells(1,   4   +   nx),
Worksheets("MATY").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)


For i = nx To 0 Step -1
Range(Worksheets("MATY").Cells(3 + ny, 1 + i), Worksheets("MATY").Cells(3 + ny + ny, 1 +
i)).Value   =   Range(Worksheets("MATY").Cells(i   *   (ny   +   1)   +   1,   5   +   nx),
Worksheets("MATY").Cells((1 + i) * ny + (1 + i), 5 + nx)).Value
Next i

Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATY").Cells(3 + ny,
1), Worksheets("MATY").Cells(3 + ny + ny, 1 + nx)).Value

End Sub
'Prosedur Iterasi
Sub iadi()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
```

```
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If

Count = Range("R3").Value
Do
'iterasi 1
IADIx
IADIy
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5  +  ny  +  ny  +  j,  1  +  i).Value  =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7  +  ny  +  ny  +  ny,  1).Value  =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
'iterasi 2
IADIy
IADIx
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
```

```
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5  +  ny  +  ny  +  j,  1  +  i).Value  =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
'iterasi 3
IADIx1
IADIy1
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5  +  ny  +  ny  +  j,  1  +  i).Value  =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
```

```
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
'iterasi 4
IADIy1
IADIx1
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5   +   ny   +   ny   +   j,   1   +   i).Value   =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
Loop
End Sub
```

Modul 2 Perhitungan *Runge-Kutta Orde* 4 *menuju steady*

```vba
'Perhitungan Runge-Kutta Orde 4 arah horizontal ke kanan
Sub rungekutta1()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If
For j = 0 To ny Step 1
    For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
Cells(y, x) = Cells(y, x)
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
```

```
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
     k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
     k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
     k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
     k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
     k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
     If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
       k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
       k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
       k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
       k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
       k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
       k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
       k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
       k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
       k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
```

```
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
  If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
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        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      End If
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
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   k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
   k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
   k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
   k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
   k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
   k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
   k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
   k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
   k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
   k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
  End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
  If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
   k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
   k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
   k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
   k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
   k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
   k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
   k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
   k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
   k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
   k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
   k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
   k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
   k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
   k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
   k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
   k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
   k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
   k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
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    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
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      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
End If
   Next i
Next j
End Sub
'Perhitungan Runge-Kutta Orde 4 arah vertikal ke bawah
Sub rungekutta2()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
```

```
      ny = LA / JGY
End If
For i = 0 To nx Step 1
   For j = 0 To ny Step 1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
Cells(y, x) = Cells(y, x)
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
```

```
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
```

```
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
```

```
    k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
```

```
   k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
   k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
   k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1y + 2 * k2y + 2 * k3y + k4y) / 6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
```

```
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
```

```vba
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
    End If
End If
    Next j
Next i
End Sub
'Perhitungan Runge-Kutta Orde 4 arah horizontal ke kiri
Sub rungekutta3()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
```

```
   ny = LA / JGY
End If
For j = ny To 0 Step -1
   For i = nx To 0 Step -1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
Cells(y, x) = Cells(y, x)
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
```

```
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
```

```
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
        End If
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
        End If
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
```

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      k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
     k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
     k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
```

```
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
```

```
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
     k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
     k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
     k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
     k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
     k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
     k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
     k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
     k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
     k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
     k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
     k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
     k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
     k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
     k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
```

```
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
     k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
     k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
     k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
     k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
End If
   Next i
Next j
End Sub
'Perhitungan Runge-Kutta Orde 4 arah vertikal ke atas
Sub rungekutta4()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If
For i = nx To 0 Step -1
   For j = ny To 0 Step -1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
Cells(y, x) = Cells(y, x)
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
     k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
     k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
```

```
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
```

```
     k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
     If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
       k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
       k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
       k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
       k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
       k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
       k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
       k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
       k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
       k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
       k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
       k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
       k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
       k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
       k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
       k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
       k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
       k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
       k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
       k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
       k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
       k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
       k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
       k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
       k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
     End If
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
     If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
       k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
       k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
       k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
       k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
       k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
       k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
       k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
       k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
```

```
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
        End If
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
```

```
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
  k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
  k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
  k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
  k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
  k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
  k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
  k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
  k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
  Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
  End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
  If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
```

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      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
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      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
   k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
   k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
   k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
   k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
End If
```

```
   Next j
Next i
End Sub
'Prosedur Iterasi
Sub Rungekutta()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If

Count = Range("R3").Value
Do
'iterasi 1
rungekutta1
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5   +   ny   +   ny   +   j,   1   +   i).Value   =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
```

```
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
'iterasi 2
rungekutta2
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5    +    ny    +    ny    +    j,    1    +    i).Value    =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7    +    ny    +    ny    +    ny,    1).Value    =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
'iterasi 3
rungekutta3
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5    +    ny    +    ny    +    j,    1    +    i).Value    =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
```

```
Next i
Next j
Worksheets("HIDERK").Cells(7    +    ny    +    ny    +    ny,    1).Value    =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
'iterasi 4
rungekutta4
Count = Count + 1
ActiveSheet.Range("R3") = Count
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5    +    ny    +    ny    +    j,    1    +    i).Value    =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7    +    ny    +    ny    +    ny,    1).Value    =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Count = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
```

```
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Selesai"
Exit Do
End If
Loop
End Sub
```

Modul 3 *Control*

```
Sub PV()
parametervariabel.Show
End Sub

Sub PVIADI()
parametervariabeliadi.Show
End Sub

Sub KBA()
KBKA.Show
End Sub

Sub mdl()
Model.Show
End Sub

Sub mdliadi()
ModelIADI.Show
End Sub

Sub grafikRK()
Grafik.Show
End Sub

Sub grafikdi()
GrafikIADI.Show
End Sub

Sub RK()
Worksheets("Runge-Kutta Orde 4").Select
End Sub

Sub iad()
Worksheets("IADI").Select
End Sub

Sub Kembali()
    Worksheets("HOME").Select
End Sub
```

Modul 4 Perhitungan *Runge-Kutta Orde* 4 *menuju waktu maksimum*

```vba
'Perhitungan Runge-Kutta Orde 4 arah horizontal ke kanan
Sub rungekutta1ust()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If
For j = 0 To ny Step 1
    For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j

If Cells(y, x).Interior.ColorIndex = 34 Then
    If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
        Cells(y, x) = Cells(y, x)
    ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
    GoTo Line1
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
```

```
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
```

```
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
```

```
        k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
```

```vba
    k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
     k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
     k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
     k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
     k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
     k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
     k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
     k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
     k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
     k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
     k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
     k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
     k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
     k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
     k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
```

```
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
```

```
    k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
   k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
   k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
   k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
   k2y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
End If
   Next i
Next j
End Sub
'Perhitungan Runge-Kutta Orde 4 arah vertikal ke bawah
Sub rungekutta2ust()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
```

```vba
        JGY = Worksheets("HIDE").Range("J7")
    If JGX = "" Then
        nx = 0
    Else
        nx = PA / JGX
    End If
    If JGY = "" Then
        ny = 0
    Else
        ny = LA / JGY
    End If
    For i = 0 To nx Step 1
        For j = 0 To ny Step 1
        x = 22 + i
        y = 4 + j
    If Cells(y, x).Interior.ColorIndex = 34 Then
        If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
            Cells(y, x) = Cells(y, x)
        ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
        GoTo Line1
        End If
    ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
        If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
            k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
            k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
            k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
            k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
            k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
            k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
            k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
            k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
            Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
        ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
            k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
            k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
            k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
            k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
            k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
            k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
            k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
            k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
            Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
        ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
            k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
            k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
            k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
            k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
            k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
            k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
            k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
            k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
            Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
            k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
            k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
```

```
          k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
          k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
          k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
          k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
          k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
          k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
       k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
       k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
       k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
       k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
       k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
       k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
       k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
       k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
       k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
       k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
       k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
       k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
       k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
       k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
       k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
       k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
       If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
          k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
          k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
          k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
          k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
          k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
          k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
          k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
          k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
          Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
       ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
          k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
          k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
          k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
          k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
          k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
          k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
          k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
          k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
```

```
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    End If
```

```
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
```

```
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
  If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1y + 2 * k2y + 2 * k3y + k4y) / 6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
```

```
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
      k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
      k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
```

```
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
    End If
End If
    Next j
Next i
End Sub
'Perhitungan Runge-Kutta Orde 4 arah horizontal ke kiri
Sub rungekutta3ust()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
```

```
      PW = Worksheets("HIDE").Range("O5")
      PA = Worksheets("HIDE").Range("E5")
      LA = Worksheets("HIDE").Range("E7")
      JGX = Worksheets("HIDE").Range("J5")
      JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
      nx = 0
Else
      nx = PA / JGX
End If
If JGY = "" Then
      ny = 0
Else
      ny = LA / JGY
End If
For j = ny To 0 Step -1
   For i = nx To 0 Step -1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
   If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
      Cells(y, x) = Cells(y, x)
   ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   GoTo Line1
   End If
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
```

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    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
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```
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    End If
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * ((Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
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        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      End If
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
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        k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
```

```
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
       Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
     ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
```

```
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
      k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
      k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
   k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
   k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
   k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
   k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
   k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
   k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
   Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
   End If
End If
   Next i
Next j
End Sub
'Perhitungan Runge-Kutta Orde 4 arah vertikal ke atas
Sub rungekutta4ust()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
```

```
      ny = LA / JGY
End If
For i = nx To 0 Step -1
   For j = ny To 0 Step -1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
   If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
      Cells(y, x) = Cells(y, x)
   ElseIf Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   GoTo Line1
   End If
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
      k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
      k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
      k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
      k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
      k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
      k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
      k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
```

```
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
      Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
```

```
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      End If
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1)))
/ (JGX ^ 2))
        k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y +
k4y) / 6) * PW
      End If
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
```

```
        k2y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
        k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
        k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
        k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
        k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
        k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
        k2y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k3y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
        k4y = KY / SY * ((((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
        k2x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k3x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
        k4x = KX / SY * ((((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
        k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
        k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
        k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
        k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
        Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
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  k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
  k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
  k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
  k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
  k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
  k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
  k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
  k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
  Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
  End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
  If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
```

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    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x + 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x + 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
    k1x = KX / SY * (2 * (Cells(y, x - 1) - Cells(y, x)) / (JGX ^ 2))
    k2x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k1x * PW)) / (JGX ^ 2))
    k3x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + 0.5 * k2x * PW)) / (JGX ^ 2))
    k4x = KX / SY * (2 * ((Cells(y, x - 1)) - (Cells(y, x) + k3x * PW)) / (JGX ^ 2))
    k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
    k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
    k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY
^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y + 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
    k4y = KY / SY * (2 * ((Cells(y + 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
    Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
    k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
    k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
    k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX
^ 2))
    k1y = KY / SY * (2 * (Cells(y - 1, x) - Cells(y, x)) / (JGY ^ 2))
    k2y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k1y * PW)) / (JGY ^ 2))
    k3y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + 0.5 * k2y * PW)) / (JGY ^ 2))
```

```
      k4y = KY / SY * (2 * ((Cells(y - 1, x)) - (Cells(y, x) + k3y * PW)) / (JGY ^ 2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) /
6) * PW
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
     k1x = KX / SY * ((Cells(y, x + 1) - 2 * Cells(y, x) + Cells(y, x - 1)) / (JGX ^ 2))
     k2x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k1x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k3x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + 0.5 * k2x * PW) + (Cells(y, x - 1))) /
(JGX ^ 2))
     k4x = KX / SY * (((Cells(y, x + 1)) - 2 * (Cells(y, x) + k3x * PW) + (Cells(y, x - 1))) / (JGX ^
2))
     k1y = KY / SY * ((Cells(y + 1, x) - 2 * Cells(y, x) + Cells(y - 1, x)) / (JGY ^ 2))
     k2y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k1y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k3y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + 0.5 * k2y * PW) + (Cells(y - 1, x))) /
(JGY ^ 2))
     k4y = KY / SY * (((Cells(y + 1, x)) - 2 * (Cells(y, x) + k3y * PW) + (Cells(y - 1, x))) / (JGY ^
2))
     Cells(y, x) = Cells(y, x) + ((k1x + 2 * k2x + 2 * k3x + k4x + k1y + 2 * k2y + 2 * k3y + k4y) / 6)
* PW
    End If
End If
   Next j
Next i
End Sub
'Prosedur Iterasi
Sub Rungekuttaust()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If

Do
'iterasi 1
If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
     For j = 0 To ny Step 1
     For i = 0 To nx Step 1
        x = 22 + i
        y = 4 + j
     Cells(y, x) = Round(Cells(y, x), 3)
     Next i
     Next j
```

```vba
        MsgBox "Selesai"
        Exit Do
    Else
    Range("R3").Value = 0
    Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
    End If
End If
rungekutta1ust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5 + ny + ny + j, 1 + i).Value =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
'iterasi 2
If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
    If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
        For j = 0 To ny Step 1
        For i = 0 To nx Step 1
            x = 22 + i
            y = 4 + j
        Cells(y, x) = Round(Cells(y, x), 3)
        Next i
        Next j
        MsgBox "Selesai"
        Exit Do
    Else
    Range("R3").Value = 0
    Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
    End If
End If
rungekutta2ust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
```

```vba
Worksheets("HIDERK").Cells(5 + ny + ny + j, 1 + i).Value =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
'iterasi 3
If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
      For j = 0 To ny Step 1
      For i = 0 To nx Step 1
         x = 22 + i
         y = 4 + j
      Cells(y, x) = Round(Cells(y, x), 3)
      Next i
      Next j
      MsgBox "Selesai"
      Exit Do
   Else
   Range("R3").Value = 0
   Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
   End If
End If
rungekutta3ust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5 + ny + ny + j, 1 + i).Value =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
```

```
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
'iterasi 4
If Worksheets("HIDERK").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
    If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
        For j = 0 To ny Step 1
        For i = 0 To nx Step 1
            x = 22 + i
            y = 4 + j
        Cells(y, x) = Round(Cells(y, x), 3)
        Next i
        Next j
        MsgBox "Selesai"
        Exit Do
    Else
    Range("R3").Value = 0
    Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
    End If
End If
rungekutta4ust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDERK").Cells(1 + j, 1 +
i).Value
Worksheets("HIDERK").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDERK").Cells(5   +   ny   +   ny   +   j,   1   +   i).Value   =
Abs(Worksheets("HIDERK").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDERK").Cells(1 + j,
1 + i).Value)
Next i
Next j
Worksheets("HIDERK").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDERK").Cells(5 + ny + ny, 1),
Worksheets("HIDERK").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
Loop
End Sub
```

Modul 5 Perhitungan IADI *menuju waktu maksimum*

```
'Perhitungan IADI arah horizontal ke kanan
Sub IADIxust()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If

A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATX").Cells.Clear
Worksheets("MATX").Cells.HorizontalAlignment = xlCenter
Worksheets("MATX").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0

For j = 0 To ny Step 1
    For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j

If Cells(y, x).Interior.ColorIndex = 34 Then
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
Worksheets("MATX").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = 1
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
GoTo Line1
End If
ElseIf Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATX").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = 1
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
```

```
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
        End If
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
```

```
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
```

```
Line1:
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
```

```
     ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
       Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
     ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
       Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
     ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
       Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
     ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
       Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
       Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
     End If
End If
   Next i
Next j


For j = 0 To ny Step 1
Range(Worksheets("MATX").Cells(j * (nx + 1) + 1, 4 + nx), Worksheets("MATX").Cells((1 + j)
*      nx      +      (1 +      j),      4      +      nx)).Value      =
Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(1 +      j,      1),
Worksheets("MATX").Cells(1 + j, 1 + nx)).Value)
Next j


Range(Worksheets("MATX").Cells(1, 5 + nx), Worksheets("MATX").Cells((1 + nx) * (1 + ny), 5
+                                      nx)).Value                                      =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)    *    (1    +    ny))).Value),    Range(Worksheets("MATX").Cells(1,    4    +    nx),
Worksheets("MATX").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)


For j = 0 To ny Step 1
Range(Worksheets("MATX").Cells(3 + ny + j, 1), Worksheets("MATX").Cells(3 + ny + j, 1 +
nx)).Value = Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(j *
(nx + 1) + 1, 5 + nx), Worksheets("MATX").Cells((1 + j) * nx + (1 + j), 5 + nx)).Value)
Next j
```

```vba
Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATX").Cells(3 + ny,
1), Worksheets("MATX").Cells(3 + ny + ny, 1 + nx)).Value

End Sub
'Perhitungan IADI arah vertikal ke bawah
Sub IADIyust()
    KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
    KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
    SY = Worksheets("HIDE").Range("E14")
    PW = Worksheets("HIDE").Range("O5")
    PA = Worksheets("HIDE").Range("E5")
    LA = Worksheets("HIDE").Range("E7")
    JGX = Worksheets("HIDE").Range("J5")
    JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
    nx = 0
Else
    nx = PA / JGX
End If
If JGY = "" Then
    ny = 0
Else
    ny = LA / JGY
End If

A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATY").Cells.Clear
Worksheets("MATY").Cells.HorizontalAlignment = xlCenter
Worksheets("MATY").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0

 For i = 0 To nx Step 1
    For j = 0 To ny Step 1
    x = 22 + i
    y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
Worksheets("MATY").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = 1
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
GoTo Line1
End If
ElseIf Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATY").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = 1
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
```

```
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        End If
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
```

```
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    End If
```

```
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
   ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
   ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
   ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
   ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
```

```
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    End If
End If
  Next j
Next i

For i = 0 To nx Step 1
Range(Worksheets("MATY").Cells(i * (ny + 1) + 1, 4 + nx), Worksheets("MATY").Cells((1 + i)
* ny + (1 + i), 4 + nx)).Value = Range(Worksheets("MATY").Cells(1, 1 + i),
Worksheets("MATY").Cells(1 + ny, 1 + i)).Value
Next i

Range(Worksheets("MATY").Cells(1, 5 + nx), Worksheets("MATY").Cells((1 + nx) * (1 + ny), 5
+                                   nx)).Value                                 =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)    *    (1    +    ny))).Value),    Range(Worksheets("MATY").Cells(1,    4    +    nx),
Worksheets("MATY").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)

For i = 0 To nx Step 1
Range(Worksheets("MATY").Cells(3 + ny, 1 + i), Worksheets("MATY").Cells(3 + ny + ny, 1 +
i)).Value   =   Range(Worksheets("MATY").Cells(i   *   (ny   +   1)   +   1,   5   +   nx),
Worksheets("MATY").Cells((1 + i) * ny + (1 + i), 5 + nx)).Value
Next i


Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATY").Cells(3 + ny,
1), Worksheets("MATY").Cells(3 + ny + ny, 1 + nx)).Value
```

```
End Sub
'Perhitungan IADI arah horizontal ke kiri
Sub IADIx1ust()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If

A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATX").Cells.Clear
Worksheets("MATX").Cells.HorizontalAlignment = xlCenter
Worksheets("MATX").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0

For j = ny To 0 Step -1
   For i = nx To 0 Step -1
   x = 22 + i
   y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
Worksheets("MATX").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = 1
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
GoTo Line1
End If
ElseIf Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATX").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = 1
Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
      Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
```

```
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
        End If
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
```

```
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
            Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
            Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
        End If
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
```

```
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) *
C * 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = 0
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A * 2
```

```
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A * 2
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y + 1, x) * C *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATX").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y - 1, x) * C +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y + 1, x) * C
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j).Value = A
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 1).Value = D
        Worksheets("MATX").Cells(nx * j + i + j + 1, (8 + nx) + nx * j + i + j + 2).Value = A
    End If
End If
    Next i
Next j

For j = ny To 0 Step -1
Range(Worksheets("MATX").Cells(j * (nx + 1) + 1, 4 + nx), Worksheets("MATX").Cells((1 + j)
*      nx      +      (1      +      j),      4      +      nx)).Value      =
Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(1      +      j,      1),
Worksheets("MATX").Cells(1 + j, 1 + nx)).Value)
Next j

Range(Worksheets("MATX").Cells(1, 5 + nx), Worksheets("MATX").Cells((1 + nx) * (1 + ny), 5
+                                        nx)).Value                                        =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATX").Cells(1, (9 + nx)), Worksheets("MATX").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)      *      (1      +      ny))).Value),      Range(Worksheets("MATX").Cells(1,      4      +      nx),
Worksheets("MATX").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)

For j = ny To 0 Step -1
Range(Worksheets("MATX").Cells(3 + ny + j, 1), Worksheets("MATX").Cells(3 + ny + j, 1 +
nx)).Value = Application.WorksheetFunction.Transpose(Range(Worksheets("MATX").Cells(j *
(nx + 1) + 1, 5 + nx), Worksheets("MATX").Cells((1 + j) * nx + (1 + j), 5 + nx)).Value)
Next j

Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATX").Cells(3 + ny,
1), Worksheets("MATX").Cells(3 + ny + ny, 1 + nx)).Value
```

```vba
End Sub
'Perhitungan IADI arah vertikal ke atas
Sub IADIy1ust()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If

A = KX / (JGX ^ 2)
C = KY / (JGY ^ 2)
B = -(SY / (0.5 * PW))
D = -(SY / (0.5 * PW) + 2 * A + 2 * C)
Worksheets("MATY").Cells.Clear
Worksheets("MATY").Cells.HorizontalAlignment = xlCenter
Worksheets("MATY").Cells.VerticalAlignment = xlCenter
Range(Worksheets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny),
(8 + nx) + (1 + nx) * (1 + ny))).Value = 0

 For i = nx To 0 Step -1
    For j = ny To 0 Step -1
    x = 22 + i
    y = 4 + j
If Cells(y, x).Interior.ColorIndex = 34 Then
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value <> (1 + nx) * (1 + ny) Then
Worksheets("MATY").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = 1
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
ElseIf Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
GoTo Line1
End If
ElseIf Cells(y, x).Interior.ColorIndex = 2 Then
Worksheets("MATY").Cells(y - 3, x - 21).Value = Worksheets("IADI").Cells(y, x)
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = 1
Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
ElseIf Cells(y, x).Interior.ColorIndex = 47 Then
   If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
      Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
```

```
        ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
        ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
        ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
        ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
            Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
            Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
        ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
            If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
                Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
            ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
                Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
            ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
                Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
            End If
        ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
            If Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y, x + 1).Interior.ColorIndex <> 47 Then
                Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A * 2 + Worksheets("IADI").Cells(y, x) * B
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
                Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
```

```
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex <> 47
Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A
* 2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y, x - 1).Interior.ColorIndex = 47
Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    End If
  ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
  ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
  ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
  End If
ElseIf Cells(y, x).Interior.ColorIndex = 36 Then
Line1:
```

```
    If Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 And Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 And Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) *
A + Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x - 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47
And Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x + 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
```

```
    ElseIf Cells(y, x - 1).Interior.ColorIndex = 47 And Cells(y + 1, x - 1).Interior.ColorIndex = 47
And Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C * 2
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = 0
    ElseIf Cells(y + 1, x).Interior.ColorIndex = 47 And Cells(y + 1, x + 1).Interior.ColorIndex = 47
And Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A *
2 + Worksheets("IADI").Cells(y, x) * B
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    ElseIf Cells(y, x + 1).Interior.ColorIndex = 47 And Cells(y - 1, x + 1).Interior.ColorIndex = 47
And Cells(y - 1, x).Interior.ColorIndex = 47 And Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = 0
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C * 2
    ElseIf Cells(y, x - 1).Interior.ColorIndex <> 2 And Cells(y + 1, x).Interior.ColorIndex <> 2 And
Cells(y, x + 1).Interior.ColorIndex <> 2 And Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Worksheets("MATY").Cells(y - 3, x - 21).Value = -Worksheets("IADI").Cells(y, x - 1) * A +
Worksheets("IADI").Cells(y, x) * B - Worksheets("IADI").Cells(y, x + 1) * A
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i).Value = C
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 1).Value = D
        Worksheets("MATY").Cells(ny * i + j + i + 1, (8 + nx) + ny * i + j + i + 2).Value = C
    End If
End If
    Next j
Next i

For i = nx To 0 Step -1
Range(Worksheets("MATY").Cells(i * (ny + 1) + 1, 4 + nx), Worksheets("MATY").Cells((1 + i)
* ny + (1 + i), 4 + nx)).Value = Range(Worksheets("MATY").Cells(1, 1 + i),
Worksheets("MATY").Cells(1 + ny, 1 + i)).Value
Next i

Range(Worksheets("MATY").Cells(1, 5 + nx), Worksheets("MATY").Cells((1 + nx) * (1 + ny), 5
+                                    nx)).Value                                    =
Application.WorksheetFunction.MMult(Application.WorksheetFunction.MInverse(Range(Worksh
eets("MATY").Cells(1, (9 + nx)), Worksheets("MATY").Cells((1 + nx) * (1 + ny), (8 + nx) + (1 +
nx)   *   (1   +   ny))).Value),   Range(Worksheets("MATY").Cells(1,   4   +   nx),
Worksheets("MATY").Cells((1 + nx) * (1 + ny), 4 + nx)).Value)

For i = nx To 0 Step -1
Range(Worksheets("MATY").Cells(3 + ny, 1 + i), Worksheets("MATY").Cells(3 + ny + ny, 1 +
i)).Value   =   Range(Worksheets("MATY").Cells(i   *   (ny   +   1)   +   1,   5   +   nx),
Worksheets("MATY").Cells((1 + i) * ny + (1 + i), 5 + nx)).Value
Next i

Range(Cells(4, 22), Cells(4 + ny, 22 + nx)).Value = Range(Worksheets("MATY").Cells(3 + ny,
1), Worksheets("MATY").Cells(3 + ny + ny, 1 + nx)).Value
```

```
End Sub
'Prosedur Iterasi
Sub iadiust()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If

Do
'iterasi 1
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
      For j = 0 To ny Step 1
      For i = 0 To nx Step 1
         x = 22 + i
         y = 4 + j
      Cells(y, x) = Round(Cells(y, x), 3)
      Next i
      Next j
      MsgBox "Selesai"
      Exit Do
   Else
   Range("R3").Value = 0
   Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
   End If
End If
IADIxust
IADIyust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5   +   ny   +   ny   +   j,   1   +   i).Value   =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
```

```
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
'iterasi 2
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
      For j = 0 To ny Step 1
      For i = 0 To nx Step 1
         x = 22 + i
         y = 4 + j
      Cells(y, x) = Round(Cells(y, x), 3)
      Next i
      Next j
      MsgBox "Selesai"
      Exit Do
   Else
   Range("R3").Value = 0
   Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
   End If
End If
IADIyust
IADIxust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5  +  ny  +  ny  +  j,  1  +  i).Value  =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7   +   ny   +   ny   +   ny,   1).Value   =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
'iterasi 3
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
```

```
      For j = 0 To ny Step 1
      For i = 0 To nx Step 1
         x = 22 + i
         y = 4 + j
      Cells(y, x) = Round(Cells(y, x), 3)
      Next i
      Next j
      MsgBox "Selesai"
      Exit Do
   Else
   Range("R3").Value = 0
   Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
   End If
End If
IADIx1ust
IADIy1ust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5  +  ny  +  ny  +  j,  1  +  i).Value  =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7  +  ny  +  ny  +  ny,  1).Value  =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
'iterasi 4
If Worksheets("HIDEIADI").Cells(7 + ny + ny + ny, 1).Value = (1 + nx) * (1 + ny) Then
   If Range("R5").Value = Worksheets("HIDE").Range("O9").Value Then
      For j = 0 To ny Step 1
      For i = 0 To nx Step 1
         x = 22 + i
         y = 4 + j
      Cells(y, x) = Round(Cells(y, x), 3)
      Next i
      Next j
      MsgBox "Selesai"
      Exit Do
   Else
   Range("R3").Value = 0
   Range("R5").Value = Range("R5").Value + Worksheets("HIDE").Range("O5").Value
   End If
```

```
End If
IADIy1ust
IADIx1ust
Range("R3").Value = Range("R3").Value + 1
For j = 0 To ny Step 1
For i = 0 To nx Step 1
Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value = Worksheets("HIDEIADI").Cells(1 + j,
1 + i).Value
Worksheets("HIDEIADI").Cells(1 + j, 1 + i).Value = Cells(4 + j, 22 + i)
Worksheets("HIDEIADI").Cells(5  +  ny  +  ny  +  j,  1  +  i).Value  =
Abs(Worksheets("HIDEIADI").Cells(3 + ny + j, 1 + i).Value - Worksheets("HIDEIADI").Cells(1
+ j, 1 + i).Value)
Next i
Next j
Worksheets("HIDEIADI").Cells(7  +  ny  +  ny  +  ny,  1).Value  =
Application.WorksheetFunction.CountIf(Range(Worksheets("HIDEIADI").Cells(5 + ny + ny, 1),
Worksheets("HIDEIADI").Cells(5 + ny + ny + ny, 1 + nx)), "<0.0005")

If Range("R3").Value = Worksheets("HIDE").Range("O7").Value Then
For j = 0 To ny Step 1
For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
Cells(y, x) = Round(Cells(y, x), 3)
Next i
Next j
MsgBox "Iterasi Maksimum Tercapai"
Exit Do
End If
Loop
End Sub
```

Modul 6 Perhitungan Data Kecepatan

```
'Perhitungan kecepatan arah x
Sub Vx()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If
ActiveSheet.Cells.Clear
Range(Cells(5, 3), Cells(5, 3 + nx)).Select
   With Selection
   .Merge
```

```
      .Font.Italic = True
      .Font.Bold = True
      .Value = "Kecepatan Arah x (Vx)"
      .HorizontalAlignment = xlCenter
      .VerticalAlignment = xlCenter
      End With
For j = 0 To ny Step 1
    For i = 0 To nx Step 1
    x = 22 + i
    y = 4 + j
If Worksheets("Runge-Kutta Orde 4").Cells(y, x).Interior.ColorIndex = 34 Then
    If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
    End If
ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x).Interior.ColorIndex = 47 Then
    If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
```

```
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
    If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 47 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 47 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 Then
      Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
    End If
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
    If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 47 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 47 Then
      Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 Then
      Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
    End If
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 47 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 Then
    Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
```

```
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 47 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 Then
    Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
  End If
ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x).Interior.ColorIndex = 36 Then
  If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * (Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGX)
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
    Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
  ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex <> 2 Then
    Cells(6 + j, 3 + i) = KX * ((Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1)) / (JGX * 2))
  End If
End If
  Next i
Next j
End Sub
```

```vba
'Perhitungan kekecepatan arah y
Sub Vy()
   KX = Worksheets("HIDE").Range("J15") * (10 ^ (-5))
   KY = Worksheets("HIDE").Range("J17") * (10 ^ (-5))
   SY = Worksheets("HIDE").Range("E14")
   PW = Worksheets("HIDE").Range("O5")
   PA = Worksheets("HIDE").Range("E5")
   LA = Worksheets("HIDE").Range("E7")
   JGX = Worksheets("HIDE").Range("J5")
   JGY = Worksheets("HIDE").Range("J7")
If JGX = "" Then
   nx = 0
Else
   nx = PA / JGX
End If
If JGY = "" Then
   ny = 0
Else
   ny = LA / JGY
End If
ActiveSheet.Cells.Clear
Range(Cells(5, 3), Cells(5, 3 + nx)).Select
   With Selection
   .Merge
   .Font.Italic = True
   .Font.Bold = True
   .Value = "Kecepatan Arah y (Vy)"
   .HorizontalAlignment = xlCenter
   .VerticalAlignment = xlCenter
   End With
For j = 0 To ny Step 1
   For i = 0 To nx Step 1
   x = 22 + i
   y = 4 + j
If Worksheets("Runge-Kutta Orde 4").Cells(y, x).Interior.ColorIndex = 34 Then
   If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
     Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
     Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
     Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
     Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 Then
     Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
     Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
```

```
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
    End If
ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x).Interior.ColorIndex = 47 Then
    If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
      ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
      ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
      End If
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
      ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
```

```vba
        ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 Then
            Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
        End If
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 47 Then
        Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 47 Then
        Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x + 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x - 1).Interior.ColorIndex = 47 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 47 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex <> 2 Then
        Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
    End If
ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x).Interior.ColorIndex = 36 Then
    If Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
        Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
    ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex = 2 Then
```

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      Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x + 1).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x).Interior.ColorIndex = 2 Then
      Cells(6 + j, 3 + i) = KY * (Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y, x)) / (JGY)
   ElseIf Worksheets("Runge-Kutta Orde 4").Cells(y, x - 1).Interior.ColorIndex <> 2 And
Worksheets("Runge-Kutta  Orde  4").Cells(y  +  1,  x).Interior.ColorIndex  <>  2  And
Worksheets("Runge-Kutta  Orde  4").Cells(y,  x  +  1).Interior.ColorIndex  <>  2  And
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x).Interior.ColorIndex <> 2 Then
      Cells(6 + j, 3 + i) = KY * ((Worksheets("Runge-Kutta Orde 4").Cells(y + 1, x) -
Worksheets("Runge-Kutta Orde 4").Cells(y - 1, x)) / (JGY * 2))
   End If
End If
   Next i
Next j
End Sub
```