

## ANALISA ALIRAN BERKEMBANG PENUH DALAM PIPA

*Turunan formula Navier-Stokes dipakai untuk menghitung kerugian tekanan aliran dalam pipa. Panjang pipa, diameter pipa, kecepatan fluida, kekasaran permukaan dan koefisien gesek yang mempengaruhi nilai kerugian tekanan. Formula tersebut tidak berlaku pada belokan/cabang pipa, setelah katup, adanya perubahan diameter (unsteady flow), adanya getaran, dll. Tujuan penelitian adalah melihat pengaruh panjang aliran hidrodinamik pada pipa masuk (inlet) terhadap nilai kerugian tekanan aliran dalam pipa dan membuktikan keterbatasan penggunaan formula Navier-Stokes. Eksperimen ini menggunakan pipa acrylic berdiameter 12 mm. Variasi panjang pipa masuk terhadap titik pengukur tekanan (pressure tap) yaitu dengan menggeser pipa kecil masuk kedalam pipa uji hingga keadaan fluida mencapai kondisi berkembang penuh. Pada pipa uji dipasang 4 buah pressure tap dengan jarak masing-masing tap 250 mm. Air murni sebagai fluida uji. Debit yang keluar diukur dengan gelas ukur pada periode waktu untuk mendapatkan nilai bilangan Reynolds. Hasil menunjukkan bahwa karakteristik panjang aliran berkembang penuh untuk aliran laminar adalah rasio  $L/D = \pm 0,05*Re$  dan pada aliran turbulen yaitu  $L/D = \pm 4,4*Re^{1/6}$ .*

**Kata kunci:** rasio panjang per diameter, fully Developed flow, aliran hidrodinamik, turbulen.

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## FULLY DEVELOPED FLOW ANALYSIS IN PIPE

### ABSTRACT

*Differential Navier-stokes formula is used to calculate a pressure loss in a pipe. Pressure loss in pipe influenced by the pipe length, the pipe diameter, the fluid velocity, surface roughness of pipe and friction coefficient. This formula could not be applied to the turning or branch of the pipe, after the valve, pipe in which its diameter has changed (unsteady flow), shock or vibration occurs, etc. The goal of this study is to measure the influence of inlet pipe length to the value of pressure loss in pipe and to proved the limitation in order to use the Navier-Stokes formula. This experiment used acrylic pipe with 12 mm diameter. Variation of inlet pipe length to first pressure tap are 50D, 70D, 100D and 130D. Variation the length of inlet pipe is arranged by put the inlet pipe into the test pipe. On the test pipe are used four pressure taps with 25 cm distance. Displacement the inlet pipe into first pressure tap will be effected to the value of pressure in the manometer. Water as a test fluid. Debit or rate of the flow is measured in period of time to get Reynolds number. The results had showed that the characteristic of fully developed flow lenght for the laminar flow is shown by  $L/D$  ratio =  $0.05 \cdot Re$  and in turbulent flow  $L/D$  ratio =  $4.4 \cdot Re^{1/6}$*

**Keywords : Lenght / Diameter ratio, Fully developed flow, hidrodinamic flow, turbulent.**