Analisis Efek Analog Filter Terhadap Sinyal Photoplethysmography (PPG) Menggunakan Open Source Software LTspice = Analysis of the Analog Filter Effect on Photoplethysmography (PPG) Signals using Open Source Software LTspice

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Abstrak

Pengolahan sinyal fisiologis, seperti Photoplethysmography (PPG), memerlukan penguatan dan filter dalam rentang 0,4 hingga 5 Hz. Derau dapat berasal dari berbagai sumber, termasuk gerakan otot, pernapasan, powerline interference, atau bahkan internal noise dari perangkat itu sendiri. Metodologi penelitian ini menggunakan perbandingan filter analog Butterworth 2nd-order, 4th-order dan 8th-order. Sinyal uji input berasal dari simulator SPO2 tipe MS100 Contect yaitu dengan parameter SPO2 diatur pada 96% 60 Beats Per Minute. Data dari simulator dibaca oleh sensor PPG standar, dan dirubah oleh internal Analog Digital Converter (ADC) pada Nucleo-F429ZI dan data ADC dikirim ke komputer menggunakan protokol UART. Data tersebut disimpan dalam format comma-separated values untuk berikutnya disimulasikan pada model desain filter dengan LTspice (Linear Technology Simulation Program with Integrated Circuit Emphasis). Hasil penelitian menunjukkan Signal-to-Noise-Ratio Butterworth 8th-order yang paling rendah yaitu -0,077 dB sedangkan 4th-Order dan 2nd-Order secara berurutan -0,085 dB dan -0,089 dB

.....The processing of physiological signals, such as Photoplethysmography (PPG), necessitates amplification and filtering within the range of 0,4 to 5 Hz. Noise can stem from various sources, including muscle movements, respiration, interference from electrical grids, or even internal noise from the device itself. The methodology employed in this research utilizes analog Butterworth filters of 2nd-order, 4th-order, and 8th-order for comparison. The input test signal originates from an MS100 Contect SPO2 simulator with SPO2 parameters set at 96% and 60 Beats Per Minute. Data from the simulator is acquired by a standard PPG sensor and converted by the internal Analog-Digital Converter (ADC) on the Nucleo-F429ZI. The ADC data is then transmitted to the computer using UART protocol. The data is stored in comma-separated values format for subsequent simulation in the filter design model using LTspice (Linear Technology Simulation Program with Integrated Circuit Emphasis).The research results indicate that the Signal-to-Noise Ratio of Butterworth 8th-order is the lowest at -0.077 dB, while the 4th Order and 2nd Order have values of -0.085 dB and -0.089 dB, respectively.