

ABSTRAK

Indra S Siburian: Perancangan Dan Analisis Kendali Motor Tiga Fasa Dengan Metode Proportional, Integral Dan Derivative (PID) di UPT SPAM Paranginan. Skripsi. Fakultas Teknik. Universitas Negeri Medan, 2025

Abstrak: Pemerintah Kabupaten Humbang Hasundutan melalui Unit Pelaksana Teknis Sistem Penyediaan Air Minum (UPT SPAM) Paranginan mengelola sumber mata air untuk mendistribusikan air bersih kepada masyarakat. Sistem distribusi menggunakan pompa sentrifugal yang digerakkan oleh motor induksi tiga fasa dengan spesifikasi 11,0 kW, 2 kutub, dan frekuensi 50 Hz. Tantangan utama sistem ini adalah fluktuasi permintaan air dan perubahan beban yang mempengaruhi efisiensi distribusi. Untuk mengatasi hal ini, digunakan sistem kendali berbasis PID (Proportional, Integral, Derivative) guna menstabilkan kecepatan motor, sehingga debit air dapat dipertahankan pada nilai optimal 20,1 liter/detik. Pengujian menunjukkan bahwa dengan PID, sistem mencapai efisiensi maksimum 91,2% pada total head 68,3 m dan menghasilkan kecepatan motor stabil dalam rentang 2620–2865 rpm dengan fluktuasi kecepatan hanya sekitar 1,9%. Sistem juga menunjukkan karakteristik respons dinamis yang baik, dengan rise time 0,787 detik, fall time dan settling time < 1 ms, serta overshoot dan undershoot masing-masing hanya 0,501% dan 1,999%. Hasil ini membuktikan bahwa pengendalian PID mampu meningkatkan stabilitas dan efisiensi sistem distribusi air.

Kata kunci: Motor induksi tiga fasa, Sistem kendali PID, Kecepatan motor, Debit air.

ABSTRACT

Indra S Siburian: Indra S Siburian: Design and Analysis of a Three-Phase Motor Drive Using the Proportional, Integral, and Derivative (PID) Method at UPT SPAM Paranginan. Undergraduate Thesis. Faculty of Engineering. State University of Medan, 2025

Abstract: The Government of Humbang Hasundutan Regency, through the Technical Implementation Unit of the Drinking Water Supply System (UPT SPAM) Paranginan, manages a water spring to distribute clean water to the community. The distribution system uses a centrifugal pump driven by a three-phase induction motor with specifications of 11.0 kW, 2 poles, and a frequency of 50 Hz. The main challenge of this system lies in fluctuating water demand and variable load conditions that affect distribution efficiency. To address this, a control system based on PID (Proportional, Integral, Derivative) is used to stabilize the motor speed, allowing the water flow rate to be maintained at an optimal value of 20.1 liters/second. Tests show that with PID control, the system achieves a maximum efficiency of 91.2% at a total head of 68.3 meters and maintains a stable motor speed within the range of 2620–2865 rpm, with speed fluctuations of only about 1.9%. The system also demonstrates good dynamic response characteristics, with a rise time of 0.787 seconds, fall time and settling time of less than 1 ms, and overshoot and undershoot values of only 0.501% and 1.999%, respectively. These results prove that PID control enhances the stability and efficiency of the water distribution system.

Keywords: *Three-phase induction motor, PID control system, Motor speed, Water discharge.*