PEMODELAN SISTEM KONTROL INTERLOCK CHEMICAL RAW WATER PUMP MENGGUNAKAN MATLAB UNTUK PERFORMA DCS PLTU BANTEN 3 LONTAR

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ABSTRAK

Distributed Control System (DCS) berperan penting dalam kontrol dan eksekusi logika proteksi pada pembangkit listrik tenaga uap. Penelitian ini bertujuan menganalisis karakteristik logika interlock Chemical Raw Water Pump (CRWP) serta performa DCS dalam mengeksekusi logika proteksi pada sistem Multiple Effect Distillation (MED) di PLTU Banten 3 Lontar. Metode penelitian menggunakan pemodelan dan simulasi sistem kontrol berbasis MATLAB/Simulink dengan Stateflow berdasarkan parameter operasi pompa dan logika interlock. Simulasi dilakukan pada lima skenario: normal, before interlock, after interlock, deadhead fast, dan interlock fail. Parameter performa DCS yang dianalisis meliputi Peak Pressure, Pressure Rise Rate, Flow Decay Rate, Alarm Response Time, Interlock Response Time, DCS Execution Time, Trip Success, Pressure Overshoot, dan Recovery Time. Hasil penelitian menunjukkan model mampu merepresentasikan karakteristik operasi CRWP dan respons interlock. DCS menunjukkan waktu eksekusi trip 5,0 detik sesuai delay dengan tingkat keberhasilan trip 100%, serta validasi model terhadap data aktual mencapai error 0,08%. Pada skenario deadhead fast, pressure rise rate mencapai 1,632 MPa/s dengan overshoot 0,820 MPa, mengindikasikan kelemahan delay untuk gangguan transien cepat. Proteksi berlapis efektif membatasi tekanan puncak pada 0,655 MPa saat interlock utama gagal. DCS terbukti andal, namun diperlukan optimasi delay dan penambahan logika rate-of-change untuk meningkatkan keandalan terhadap gangguan transien ekstrem..

Kata Kunci: CRWP, DCS, interlock, MATLAB/Simulink, performa sistem.

MODELING OF THE CRWP INTERLOCK CONTROL SYSTEM USING MATLAB FOR DCS PERFORMANCE RELIABILITY EVALUATION AT BANTEN 3 LONTAR STEAM POWER PLANT

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ABSTRACT

Distributed Control System (DCS) plays an important role in control and protection logic execution in steam power plants. This study aims to analyze the characteristics of Chemical Raw Water Pump (CRWP) interlock logic and DCS performance in executing protection logic in the Multiple Effect Distillation (MED) system at PLTU Banten 3 Lontar. The research method employs control system modeling and simulation using MATLAB/Simulink with Stateflow based on pump operating parameters and interlock logic. Simulations were conducted under five scenarios: normal, before interlock, after interlock, deadhead fast, and interlock fail. DCS performance parameters analyzed include Peak Pressure, Pressure Rise Rate, Flow Decay Rate, Alarm Response Time, Interlock Response Time, DCS Execution Time, Trip Success, Pressure Overshoot, and Recovery Time. The results show that the model can represent CRWP operational characteristics and interlock response. DCS demonstrated a trip execution time of 5.0 seconds according to the delay with a trip success rate of 100%, and model validation against actual data achieved an error of 0.08%. In the deadhead fast scenario, the pressure rise rate reached 1.632 MPa/s with an overshoot of 0.820 MPa, indicating weaknesses in the delay configuration for fast transient disturbances. Layered protection effectively limited peak pressure to 0.655 MPa when the primary interlock failed. DCS is proven reliable, although delay optimization and the addition of rate-of-change logic are needed to improve reliability against extreme transient disturbances.

Keywords: *CRWP, DCS, interlock, MATLAB/Simulink, system performance.*