ABSTRAK

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Optimasi Penempatan *Unified Power Flow Control* Pada Sistem Transmisi Jawa-Bali 500 kV Menggunakan Metode *Particle Swarm Optimization*

Perangkat *Unified Power Flow Control* (UPFC) dapat mengendalikan aliran daya melalui penyerapan daya aktif dan penginjeksian daya reaktif pada saluran transmisi. Model injeksi daya UPFC dibuat dalam suatu persamaan aliran daya dan digabungkan ke dalam solusi aliran daya metode *Newton-Raphson*. Agar menghasilkan injeksi daya yang dapat meminimalisir rugi daya saluran transmisi tanpa melampaui batas *rating* saluran, lokasi penempatan dan *rating* perangkat UPFC diperlukan suatu metode optimasi. Metode yang digunakan adalah *Particle Swarm Optimization* Penelitian dilakukan melalui studi kasus pada sistem transmisi Jawa-Bali 500 kV. Hasil penelitian menunjukkan dengan memenpatkan 5 buah UPFC dapat meminimalisir rugi daya. Dengan hasil penurunan rugi-rugi daya aktif sebesar 5,942 MW (3,327%) dan penurunan rugi-rugi daya rekatif sebesar 57,178 MVAR (3,133%) pada siang hari, serta menurunkan rugi-rugi daya aktif sebesar 9,327 MW (3,45%) dan penurunan rugi-rugi daya rekatif sebesar 86,838 MVAR (2,113%) padam malam hari.

Kata Kunci: UPFC, *Newton-Raphson*, Jaringan Transmisi, *Particle Swarm Optimization*

ABSTRACT

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Unified Power Flow Control Placement Optimation on Jawa-Bali 500 kV Transmission System Using Particle Swarm Optimization

Unified Power Flow Control (UPFC) devices could control power flow through absorption of active power and injection of reactive power on the transmission line. The UPFC power injection model is made into power flow equation and combine into the Newton-Raphson method power flow solution. In order to produce power injection that could minimilize power *losses* an transmission line without exceeding ratung line limits, location placement and UPFC rating devices need an optimation method. The method used is Particle Swarm Optimization. This study was conducted through a case study on Jawa-Bali 500 kV transmission system. The results of this study show that by putting 5 unit UPFCs could minimalize power *losses*. With power *losses* degradation of active power 5,942 MW (3,327%) and reactive power 57,178 MVAR (3,133%) during day and power *losses* degradstion of active power 9,327 MW (3,45%) and reactive power 86,838 MVAR (3,11%) at night.

Key words**:** UPFC, Newton-Raphson, Transmission network, Particle Swarm Optimization