THESIS ABSTRACT

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Title DESIGN OF ROBUST PSS AND FACTS-BASED CONTROLLERS FOR STABILITY ENHANCEMENT OF POWER SYSTEMS

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The objective of this thesis is to investigate the effectiveness of the coordinated design of power system stabilizers and FACTS-based stabilizers to improve power system transient stability. Three power systems are studied: a single-machine-infinite-bus system with First Generation (G1) FACTS devices, a single-machine infinite-bus system with a UPFC, and a multimachine power system. To estimate the controllability of each stabilizer control signal on the electromechanical modes, singular value decomposition is employed. In each system, the problem of designing all the stabilizers, PSSs and FACTS-based stabilizers, individually is formulated as an optimization problem. Particle swarm optimizer is utilized to search for the optimum stabilizer parameter settings that optimize a given eigenvalue-based objective function. Coordinated design of the different stabilizers is also carried out by finding the best parameter settings for more than one stabilizer at a given operating condition simultaneously. To ensure the robustness of the proposed control schemes, the design procedure is repeated considering a wide range of operating conditions. To assess the effectiveness of the proposed designs, damping torque coefficient analysis, eigenvalue analysis, as well as nonlinear time-domain simulations are carried out.

Keywords: Power system stability, PSS, FACTS, SVC, TCSC, TCPS, UPFC, singular value, damping torque, robust control, particle swarm, optimization.

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