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Title : THE ASSESSMENT AND IMPROVEMENT OF ANGLE STABILITY CONDITION OF THE POWER SYSTEM USING PARTICLE SWARM OPTIMIZATION (PSO) TECHNIQUE

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This thesis presents the assessment and improvement of stability domains for the angle stability condition of the power system using particle swarm optimization (PSO) technique. An efficient optimization method using PSO for synchronizing torque coefficients K_s and damping torque coefficients K_d to solve angle stability problems was developed and used to identify the angle stability condition on single and multi machine system. In order to accelerate the determination of angle stability, particle swarm optimization (PSO) is proposed to be implemented in this study. The application of the proposed algorithm has been justified as the most accurate with lower computation time as compared to other optimization techniques such as evolutionary programming (EP) and artificial immune system (AIS). Subsequently, a newly control technique named as proportional-integral-derivative (PID) incorporated with flexible AC transmission (FACTS) device is proposed in this study to improve the damping capability of the system. The minimum damping ratio ξmin was applied as an indicator to precisely determine the angle stability condition based on PSO technique. The proposed optimization technique was compared with respect to EP and AIS. On the other hand, the installation of static var compensator (SVC) as the compensating device has been compared with respect to power system stabilizer (PSS) with lead-lag (LL) controller. PSS with LL controller (PSS-LL) system has been chosen due to well used by researchers of power system around the world and it can be selected as a benchmark model for research purposes. The study was implemented on single machine with infinite bus (SMIB) system. Results showed that the implementation of SVC as a compensating device managed to improve the angle stability condition. The application of SVC-PID was then extended with multi objective (MO) optimization process. The proposed approach was a combination of ξmin and maximum damping factor σmax as MO indicator in order to improve the damping capability of the system. The most suitable ratio of ξmin and σmax was investigated and applied into PSO based search algorithm. It was found that the proposed SVC-PID algorithm with MO as the objective function has been able to produce a better result as compared to the techniques developed in the literature.