ABSTRACT

In this thesis, design of power system stabilizer (PSS) and unified Power Flow Controller (UPFC) to improve power system stability and damp out all oscillation modes is presented. Despite PSS's aid to improve power system stability and increase damping ratio, but due to complexity of present day power systems, the number of modes of oscillation experienced by a particular generator has become large and the frequency of these modes has begun to vary over a wide range. So, UPFC controller is proposed, as a compromise solution over the traditional PSS. In order to damp all oscillation modes, a supplementary feedback signal from a power oscillation damper (POD) is applied to UPFC. Phase compensation and residue based-methods are implemented to design and compute the parameters of the controllers. Then, the suitable input signal of controller is selected according to the mode controllability and observability indices.

To avoid the interaction with other controller particularly PSS, the proposed UPFC damping controller (UPFC-POD) needs to be tuned to coordinate with other machines and devices. Genetic algorithm (GA) tuning technique is represented. The problem is then formulated as an optimization problem to tune UPFC damping controller parameters so that damping ratio increased above predetermined value.

To validate the performance and robustness of proposed controller, eigenvalues analysis and time domain simulation is carried out on a SMIB system under different loading conditions. Time domain-based design and eigenvalues analysis results show the effectiveness of the proposed UPFC damping controller to enhance stability and to damp different oscillation modes.