ABSTRACT OF PH.D. THESIS

Title of Ph.D. Thesis: "ABT Based Strategies for Automatic Generation Control in Interconnected Power Systems"
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This thesis presents the ABT-based strategies for Automatic generation control in interconnected power systems. Following an overview of load frequency control scheme in a deregulated power system in Chapter 1, a comprehensive review of literature reported in the area of LFC in a deregulated environment is presented in Chapter 2.

In Chapter 3, a decision-based governor control scheme to implement the primary frequency regulation norms of the Indian power system is developed. The designed scheme will aid the researcher in the offline study and help researchers to analyze the dynamics of primary frequency control in restricted governor mode operation (RGMO) scenario.

Even though the manual implementation of ABT-based scheme has improved the Indian grid frequency condition, It is very complex for the operators to infer and plan generation changes, load shedding or to draw/inject UI power in response to frequency fluctuation. An ABT-based automatic generation control scheme is designed for switching operation between AGC and non-AGC mode in chapter 4. The generators with different control schemes and marginal cost are considered in the system to compare the effectiveness of the proposed ABT-based AGC scheme. The

control scheme is found to be capable of restoring the power system frequency and tie-line flow to the nominal value.

It was observed from the study of the ABT regulation that there are unaddressed issues like fixed frequency dependent price and ceiling on payment to generators for remuneration of secondary regulation service. Fixed frequency dependent price de-motivates higher marginal cost generators to participate in secondary regulation. However, limit on payment for UI generation de-motivates lower marginal cost generator to generate more than this limit. To address these issues, a market based Automatic generation control mechanism is developed in Chapter 5.

The structure and operation of the deregulated power system have been greatly influenced by increased size, modified structure, and market dynamics. It is difficult to model highly complex and nonlinear system using the classical approach. On the other side, robust control has the issue like structural reshaping and states estimation. To overcome this, various control scheme using the computational efficiency of artificial intelligence (AI) and the evolutionary algorithm has been reported in the literature. Among the various types of such controllers, variants of swarm intelligence based controllers are widely popular. Therefore, a simulation study has been carried out in Chapter 6 for AGC of two areas interconnected power system under charged market structure using different PID controller gain tuning technique. The optimal gains of PID controllers are obtained by using Ziegler-Nichols (ZN) gain tuning technique, Particle Swarm Optimization (PSO) Algorithm and Quantum Particle Swarm Optimization (QPSO) Algorithm. Simulation results show that QPSO tuned PID controller outperforms PSO and ZN tuned PID controllers for AGC of two areas interconnected power system under deregulated environment.