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TITLE OF THESIS: **AGC OF MULTI-AREA INTERCONNECTED POWER SYSTEMS WITH PARALLEL AC/DC LINKS**

ABSTRACT

Operating an electrical power systems network involves on-line control to maintain economic operation while avoiding disruption of service and ensuring a good quality of power supply to the customers. One of the major concerns is to increase the market value of the services. They provide with adequate quality and reliability and to lower its costs for operations, maintenance and construction in order to provide lower rates for electrical customers.

Utilities have the mission to maintain the highest level of service reliability to the customers, and have the obligation to improve service reliability consistently by planning, operations, construction and maintenance with their limited resources. One of the prime objectives of the utility is to supply a good quality of electricity to the consumers connected to it at an affordable cost. The quality of electricity is however characterized by the constancy of voltage and frequency at the consumer end coupled with a fair degree of reliability and system security. A properly designed Automatic Generation Control (AGC) scheme is required to fulfill these objectives in a power system. The function of AGC is to control the allocation of generation so as to maintain the frequency and net interchange of power through transmission lines under sudden varying load conditions. To operate it, digital computer based telemeter data of loadings of generators, tie-line flows and frequency values are needed. Through the concern running technologies, it then sends raise or lower commands to the generating units under control.

Following the introduction of the problem of AGC in Chapter-1, the literature survey of the works carried out in the area of AGC is comprehensively presented in Chapter-2 of the thesis.

In Chapter-3, Simulink models for two power system models are achieved based on the types of area interconnections as (i) AC link is used as area interconnection and (ii) use of DC link in parallel with AC link as area interconnection with the help of Standard MATLAB software. The gains of the AGC regulators and biasing constants of the power system models under consideration are obtained using Ziegler Nichols (ZN) method and Genetic Algorithm (GA). To study the dynamic performance of power system models, the time response plots are plotted for various system states with the implementation of designed AGC regulators considering 1% load disturbance in one of the areas in the power systems.

To study Particle Swarm Optimization (PSO) based AGC schemes for power systems model under investigation are developed in Chapter-4. The optimal parameters of AGC regulators are tuned by PSO optimization technique using Integral Square Error cost function. Other types of investigated cost functions like Integral Absolute value of Error, Integral Time-multiplied Square Error and Integral Time-multiplied Absolute value of Error along with Integral Square Error and controlling parameters are also presented. Further, a comparison among the ZN, GA and PSO tuned regulators present that the systems performance can be improved with PSO.

In Chapter-5, Genetic Algorithm and Simulated Annealing (SA) based optimal AGC regulators are designed and implemented on a multi-area interconnected power system. The performance of proposed AGC regulators are compared with Linear Quadratic Regulator and GA based optimal AGC regulators.

A multi-area interconnected power system is considered for the investigation in Chapter-6. The power system model is simulated on MATLAB platform to carry out investigations with GASATF tuned AGC scheme. The dynamic responses of power system models under consideration are obtained using GASATF tuned AGC regulator by creating 1% load disturbance in area-3. The governor dead band non-linearity in system dynamic modeling is also considered for investigating the effect on system dynamics. It is also observed that the governor dead-band non-linearity produced oscillation in dynamic responses of power system model under investigation until AGC become effective after 1-4 seconds.