EXECUTIVE SUMMARY

Automatic generation control (AGC) plays an imperative role in interconnected power system design and operation, with the increasing size changing structure and uncertain load demands the problem of AGC is becoming more significant today. For maintaining a proper generation-load balance AGC is required to necessitate augmented intelligence and flexibility.

The latest AGC mechanism should be capable of handling complex systems, changes in policies, and broad division in demand and supply sources. The controllers of such systems should be based on intelligent algorithms.

The presented work provides a methodical understanding of the power system AGC, and presents numerous new schemes using intelligent algorithms for reducing the deviation in frequency and tie-line power to counterpart total generation and load demand.

A study is performed on Automatic Generation Control (AGC) for a single area, where, a Genetic Algorithm (GA)-based design and optimization of Fuzzy Logic Controller (FLC) is carried out by automatically tuning (off-line) the parameters of the membership functions. Tuning is based on maximization of a comprehensive fitness function constructed as inverse of a weighted average of three performance indices, i.e., Integral Square Deviation (ISD), or the Integral of Square of the frequency deviation, Peak overshoot (Mp), & Settling time (ts). The GA-optimized FLC (in short, GAFLC) shows better performance as compared to a conventional Proportional Integral (PI) and a hand-designed Fuzzy Logic controller not only for a standard system (displaying frequency deviations) but also under parametric and load disturbances. Further the work is carried over by modeling of a two-area non-reheat thermal system. The design of the FLC is

carried out by automatically tuning the parameters of membership functions of the FLC using GA by minimizing the integral time absolute error (ITAE) based fitness function. The effectiveness of GAFLC is revealed over GA tuned PI controller (GAPI) for the same model.

Additionally in this work the main structures, configurations, and characteristics of AGC systems in a deregulated environment is presented. A Robust Fuzzy Logic controller is presented for the automatic generation control of 2-area interconnected system in market based Deregulated system with reheat turbine. The gains of the FLC's are optimized using GA by minimizing the fitness function based on Integral time absolute error criterion (IATE). System performance has been evaluated for different DISCO participation scenarios. The performance of the GA optimized FLC (GAFLC) is compared with the hand tuned FLC and conventional PI controller.

Sensitivity analysis is performed for both conventional and restructured AGC by varying the system parameters from their nominal values. Additionally the two area AGC model under restructured scenario is tested for dynamically changing generator model in Area-1. Furthermore the effectiveness of the GAFLC is verified by injecting a pattern of random step disturbance in Area-1.It is seen that the GAFLC arrests the parametric and load disturbances with the same set of optimal gains, thus testing the robustness of the controller.

All test systems are simulated using MATLAB/SIMULINK environment.

The physical and Engineering aspects are fully considered, and the proposed control strategies are examined by real-time simulations.