

Abstract

Frequency Control of large interconnected power systems is governed by means of Automatic Generation Control (AGC), which regulates the system frequency and tie line power interchange at its nominal parameter set points. Conventional approaches to AGC controller design is centered around the Proportional, Integral and Derivative (PID) controller structures, which have found widespread application within industry.

However, the dynamic changes experienced throughout the life cycle of power systems have many contributing factors, in part attributed to unknown knowledge of system behavior, neglected process dynamics and a limited knowledge of system interactions, which makes modeling for AGC systems particularly trying for conventional AGC controller design approaches.

Therefore, in this study, Genetic - Fuzzy controllers (GA - Fuzzy) are applied as plausible candidates for Automatic Generation Controller design and application. In GA - Fuzzy controllers, genetic algorithms which are based on the foundation of evolutionary heuristics are used as a global search method for FLC design. This is particularly motivated by the fact that Fuzzy controllers, especially where there are large data sets, unknown process knowledge and insufficient expert data available, FLC controller design proves to be a daunting task.

Therefore, this thesis explores the automatic design of FLC controllers through evolutionary heuristics and applies the designed controller to the AGC problem of large interconnected power systems. The design methodology followed is to understand power system interactions through power plant modeling and the simulation power plant models for the basis for AGC controller design.

It is shown in this study that the performance of the GA - Fuzzy controller have favourable characteristics in terms of robust performance, robustness properties and compares favorably with conventional AGC controller techniques. The analysis of the GA - Fuzzy controller shows that problem formulation and chromosome encoding of the problem search space forms an important prerequisite for controller design by evolutionary methods.

Therefore the study concludes by stating that GA - Fuzzy controllers are plausible for application within the power industry because of its desirable attributes and that future work would include extending this research into areas of renewable energy for study and application.