# CHAPTER 6
# CONCLUSION AND FUTURE SCOPE

The presented research work is mainly on the load frequency problem in power system and detailed modeling of an AGC system. A rigorous review of literature available under conventional and restructured scenario is presented. The Conventional PI and Fuzzy logic controllers are designed for AGC in an isolated system and in multi-area power systems. However the scope of fine-tuning several levers/parameters of the FLC is identified to yield better performance which paves the path for using evolutionary computational techniques in the design and implementation of AGC.

The GAs because of its inherent adaptability and ability to converge to optimal solutions has become an alternative to optimization methods used in many applications to solve many complex problems over the years. Here GAs are effectively applied in tuning the FLC parameters of AGC, thus making the controllers intelligent. The efficiency of the proposed intelligent algorithms has been verified through simulations by using the GA programs interfaced with AGC models in MATLAB Simulink.

## 6.1 FINDINGS WITH REGARDS TO AN ISOLATED SYSTEM

GA tuned FLC produced some good solutions. The load frequency control model of an isolated power system under different testing conditions are novel in that in the hitherto published papers on AGC, such parametric and load disturbances had not been injected while the same have been applied here. Also during this work, a comprehensive fitness function has been accustomed to assess three different performance indices of the response. The results show that the projected GAFLC is extremely powerful in reducing the frequency deviations even underneath parametric and load disturbances in distinction

to a hand designed FLC. Figure 6.1 shows the pictographic performance comparison of various controllers for an isolated Power System with respect to settling time and overshoots. The figure clearly shows that the performance of intelligent GAFLC is far better than other controllers.

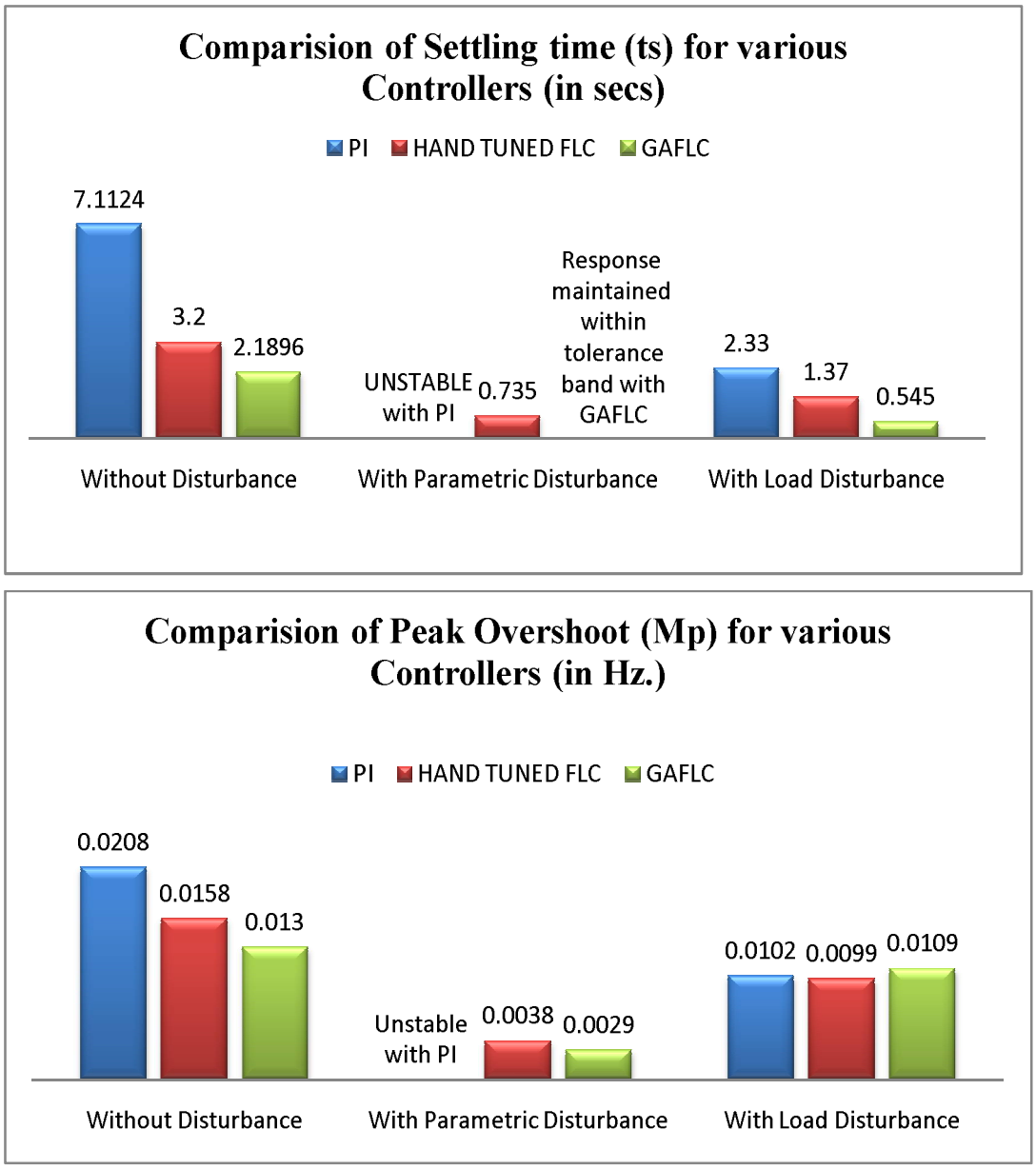
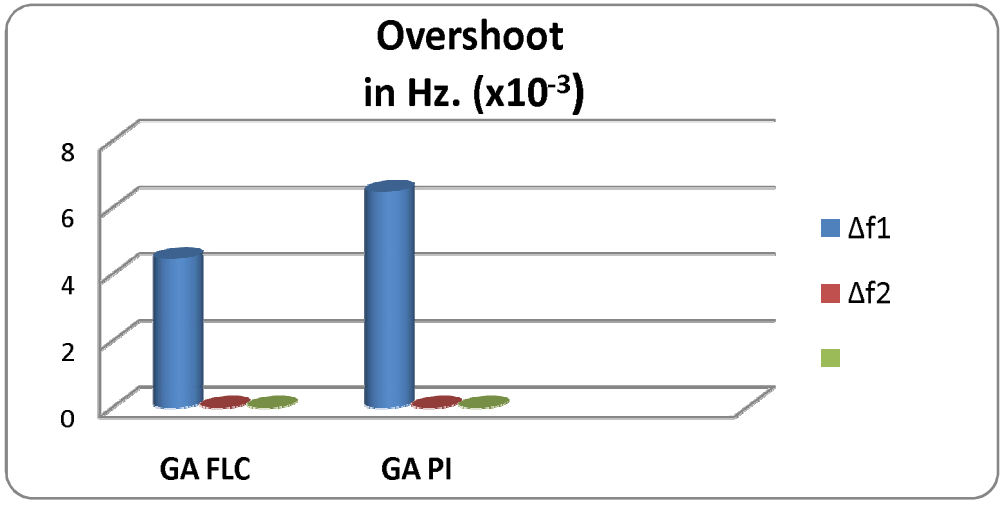
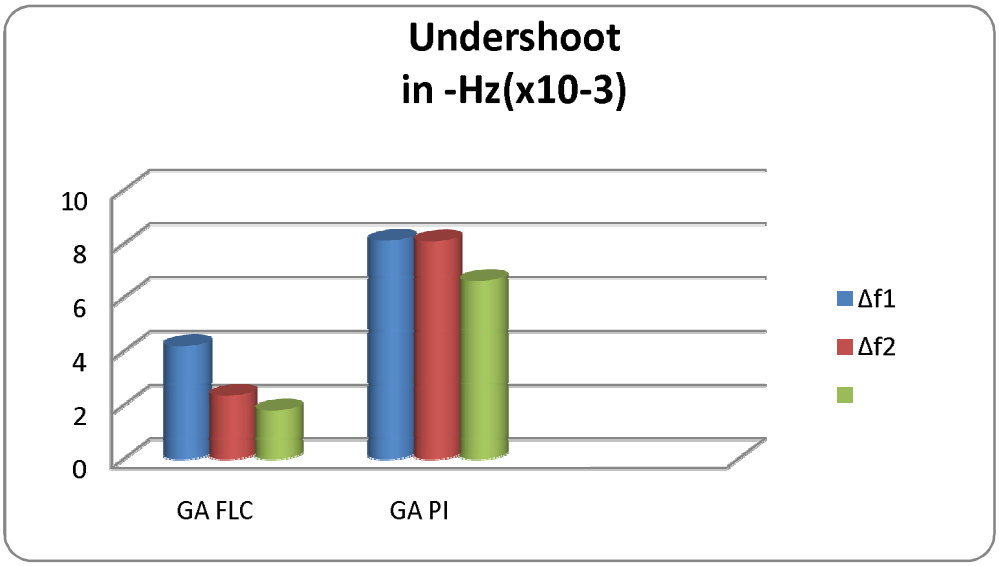



Figure 6.1 Pictorial representation of performance indices of various controllers under different testing conditions for an Isolated Power system

## 6.2 FINDINGS WITH REGARDS TO MULTI-AREA AGC SYSTEM

A standard two-area model of an AGC has been proposed where the FLC in each area is tuned automatically by Genetic Algorithm. IATE-based fitness function is minimized for the sake of optimization. Various performance indices such as undershoot, overshoot, Settling time and IATE are evaluated to compare the proposed GAFLC and GAPI controller implemented on the same model. The performance comparison in Fig. 6.2 shows the ascendance of



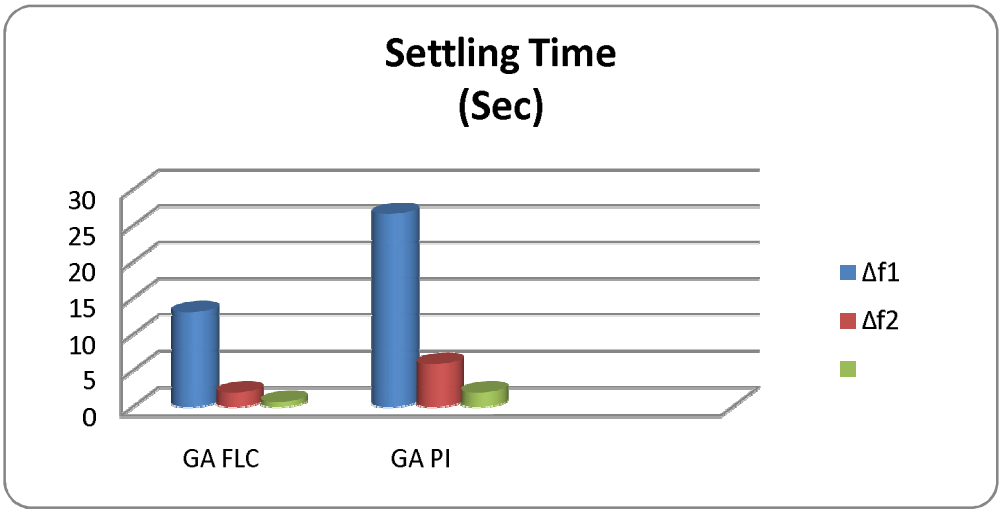
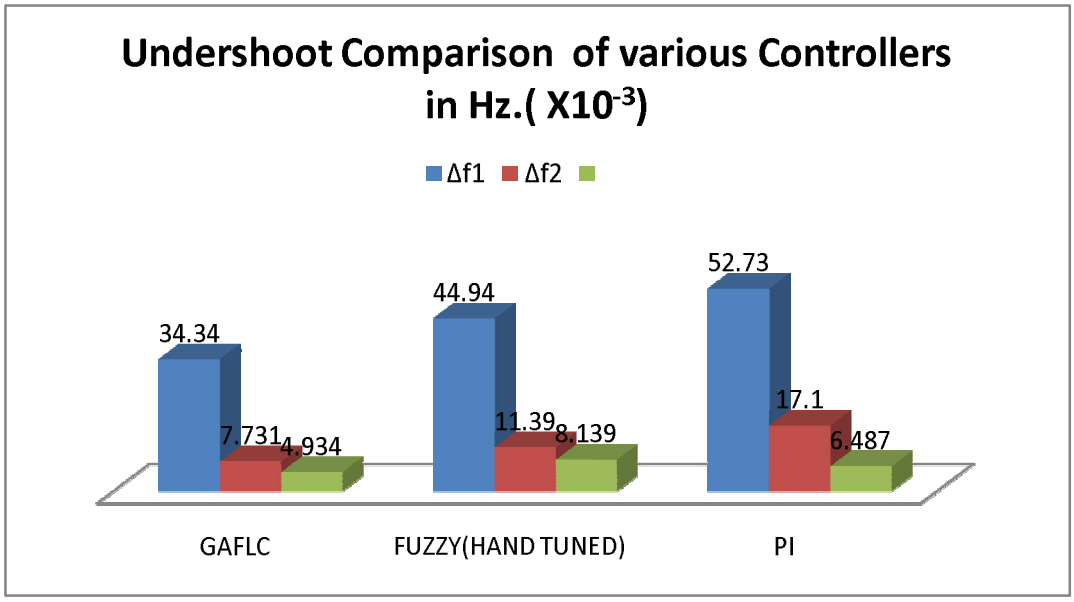
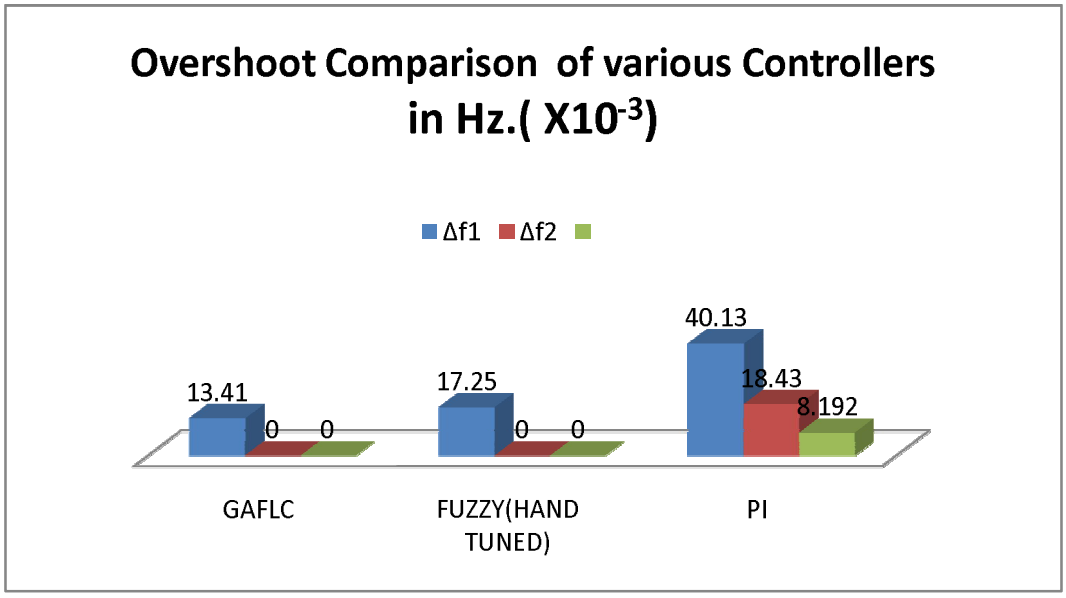



Figure 6.2 Pictorial representation of performance comparison of GAFLC & GAPI controllers in terms of Overshoot, Undershoot and Settling time.

## 6.3 FINDINGS WITH REGARDS TO AGC SYSTEM UNDER RESTRUCTURED SCENARIO

Furthermore the study is carried forward to an AGC of power system under Deregulation, where, the gains of the Fuzzy logic controllers in both areas are optimized using GA. Simulation results are compared with a standard PI controller. The result shows that the planned intelligent controller has improved dynamic response quicker than typical PI controller. Additionally, sensitivity analysis is performed by varying the nominal parameters of the system over a large range portraying the robustness of the proposed controller.


Undershoot Comparison of various Controllers in Hz.( X10-3)
Δf1
Δf2
34.34
7.731
4.934
44.94
11.39
8.139
52.73
17.1
6.487
GAFLC
FUZZY(HAND TUNED)
PI


Overshoot Comparison of various Controllers in Hz.( X10-3)
Δf1
Δf2
13.41
0
0
17.25
0
0
40.13
18.43
8.192
GAFLC
FUZZY(HAND TUNED)
PI

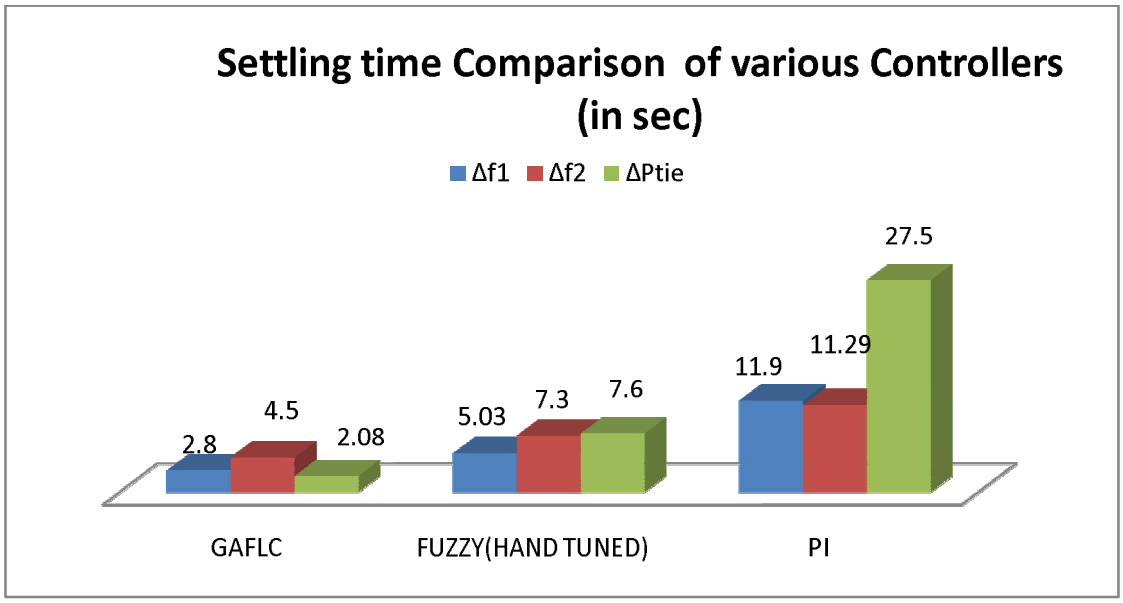



Figure 6.3 Response comparisons of various controllers under Deregulation

It is demonstrated within the planned work that the problem of AGC design can be easily transferred into a performance optimization problem that is appropriate for application of artificial intelligent techniques. Intelligent AGC design using Fuzzy logic and Genetic Algorithm provides an adaptive and self tuning scheme to tackle the uncertainly issues in AGC arising due to parametric and load perturbations.

## 6.4 SUGGESTIONS & FUTURE SCOPE

During this thesis work, a broad investigation on Intelligent controllers for AGC is carried out. Suggestions for follow-up work that may come after this work are listed below:

a. The current work used Mamdani Fuzzy Controllers, however, TSK Fuzzy Controllers can be used.
b. Optimization of the controller can be carried out with various upcoming Intelligent Algorithms.
c. Compliance of the AGC controllers with NERC standards can be carried out.

d. A Price-based Availibility based tarrif (ABT) mechanism can be implemented for AGC sytem under deregulation.
e. On-line tuning of AGC system can be carried out.