CHAPTER 7

CONCLUSIONS AND FUTURE SCOPE

7.1 Introduction

The economic operation and planning of power generation by the units is very important problem in power industries. The electric power utilities have to maintain sufficient committed capacity of generation to maintain the varying all through the operating hours. The unit commitment is an optimization problem used to determine the optimum scheduling of generators at every time interval with varying load demand under different operating constraints and environmental aspects. Many algorithms have been developed over past few decades and still researchers are working on it to make the problem more realistic.

In order to overcome the general difficulties in various approaches to solve UC problem and to increase profits to electrical industries, the following new approaches are proposed in the thesis. There is an incentive to explore hybrid methods to get over the difficulties. These methods combine the strength of one approach with weakness of other approach.

The primary objectives of this thesis are outlined below:

- To develop new techniques for Unit Commitment Problem.
- Applying this technique along with AI Methods to solve UCP.
- To develop new technique based hybrid models to solve UCP.

This thesis focuses on clustering based AI techniques to the solution of Unit Commitment Problem. The following four techniques have been proposed in the thesis to Unit Commitment problem.

- A novel method based on clustering technique is proposed. Following load pattern, two individual algorithms based on Additive and Divisive cluster algorithms are proposed for increasing and decreasing load patterns. The Euclidian cost of generation of units is obtained and based on these costs the units are segregated in to clusters.
A new methodology employing the concept of cluster algorithm called as additive and divisive hierarchical clustering has been employed along with Genetic Algorithm (GA).

A method based on combined GASA clustering technique is proposed. The operating cost of each unit is calculated and the units are clustered based on their fitness values.

A new approach employing Particle Swarm Optimization (PSO) based clustering technique is proposed.

7.2 Objectives and Contributions

The following four techniques have been proposed in the thesis to Unit Commitment problem.

1. A novel method with the application of cluster algorithms has been proposed. The proposed method is more realistic and less heuristic. Following load pattern, two individual algorithms based on Additive and Divisive cluster algorithms are proposed for increasing and decreasing load patterns. The Euclidian cost of generation of units is obtained and based on these costs the units are segregated into clusters. Two separate priorities lists one for increasing and another for decreasing load conditions are prepared based on generation costs. The proposed technique is tested on a 10 unit system and the simulation results show the performance of the proposed technique.

2. A new approach to the problem of large scale unit commitment has been presented using genetic Algorithm. The units are classified into various clusters based on genetic algorithm in order to reduce the overall operating cost and also to satisfy the minimum up/down constraints easily. Unit commitment problem is an important optimizing task in daily operational planning of power systems which can be mathematically formulated as a large scale nonlinear mixed-integer minimization problem. A new methodology employing the concept of cluster algorithm called as additive and divisive hierarchical clustering has been employed along with genetic algorithm in order to carry out the technique of unit commitment; proposed methodology.
involve two individual algorithms. While the load is increasing, additive
cluster algorithm has been employed while divisive cluster algorithm is used
when the load is decreasing. Mat lab code is developed for the proposed
technique and tested on a 10 unit test system. There is a saving of $21669 per
day when compared with GA based technique without unit clustering [38].

3. A novel method based on combined GA-SA based clustering technique is
proposed to solve the problem of Unit Commitment. The proposed method is
more advantageous and less heuristic. Following load pattern, two individual
algorithms based on Additive and Divisive cluster algorithms are proposed for
increasing and decreasing load patterns. The operating cost of generation of
units is obtained and based on these costs the units are segregated in to
clusters. Two separate priorities lists one for increasing and another for
decreasing load conditions are prepared based on generation costs. A 10-
thermal unit system is considered for simulation study. Mat lab code is
developed for the proposed technique and tested on a 10 unit test system.
There is a saving of $24511 per day when compared with GA based technique
without unit clustering [38]. The simulation results show that the operating
cost greatly reduces with this technique and the obtained results are also
compared with those of previous techniques. The strategy employed proved to
be quite effective and satisfactory as evident through simulation results.

4. Inspired by the results of PSO method and to overcome the general difficulties
in GA approach, a novel method with the application of cluster algorithms has
been proposed in this paper. The method uses Additive and Divisive Cluster
Algorithms. The proposed methodology can be unfolded in to three stages. In
the first stage, four clusters are formed namely base load, intermittent load,
semi-peak load and peak load clusters. All the generating units of the unit are
segregated into corresponding clusters based on operating costs. The operating
costs are obtained by PSO, based on the operating costs of units clusters are
formed and also useful for preparing the priority list. In the second stage, UC
solution is obtained by developing Additive Cluster algorithm for increasing
load pattern. A 10-thermal unit system is considered for simulation study. Mat
lab code is developed for the proposed technique and tested on a 10 unit test
system. There is a saving of $29166 per day when compared with GA based
technique without unit clustering [38]. The simulation results show that the operating cost greatly reduces with this technique. The strategy employed proved to be quite effective and results in great savings when compared with all other methods proposed.

Mat lab code is developed for all the techniques proposed and tested on a 10 unit thermal system. The simulation results are compared with Genetic Algorithm based Unit commitment without clustering [38]. PSO based clustering technique showed good performance when compared to other techniques as the saving is more in this technique.

7.3 Future Scope

Unit Commitment is the most significant optimization task in the operation of the power systems. An optimal unit commitment is an essential factor in planning and operation of power systems to enable the maximum profit to be generated in the electric industry. This work can be extended using Clustering based Technique on Fuzzy, Fire fly algorithm, Bat algorithm, Ant bee Colony algorithms and on Hybrid models Like PSO-SA etc. to Unit Commitment problem to save more money.