CHAPTER 3

3.1 Literature Survey

In recent years, numerous algorithms have been successfully introduced such as genetic algorithms (GAs),[19] differential algorithm (DE), simulated annealing (SA), particle swarm optimization (PSO), harmony search algorithm (HSA), artificial bee colony algorithm (ABC) [14], gravitational search algorithm (GSA)[17] and Grey wolf optimizer (GWO) [13]. Cuckoo search method Extensive competitions between researchers have been done in last decade, in an effort to seek for a more suitable/reliable approach for handling different power system optimization problems.

Chung and Shaoyun [3] presented a **recursive linear programming** based approach for minimizing line losses and finding the optimal capacitor allocation in a distribution system.

Bouri et al. in [4] presented an **ant colony optimization** approach to shunt capacitor placement in distribution systems under certain constraints. These constraints were voltage constraints and capacitor switching constraints. The voltage constraints were taken into account by specifying upper and lower limits of voltage variations at the nodes of the distribution system. The capacitor switching constraints prevented high in-rush currents caused by the interaction between the capacitors on the distribution system.

Prakash and Sydulu in [6] presented a novel approach that determines the optimal location and size of capacitors on radial distribution systems to improve voltage profile and reduce the active power loss. Capacitor placement and sizing were done using loss sensitivity factors and PSO, respectively. The concept of loss sensitivity factors was considered as the contribution in the area of distribution systems. Loss sensitivity factors determined the candidate nodes for the placement of capacitors. The estimation of these candidate nodes basically helps in reduction of the search space for the optimization procedure. These factors are determined using a base case load flow; that is, without any compensation. **PSO**[32][33][37]was used for estimation of required level of shunt capacitive compensation to improve the voltage profile of the system. The method was tested on 10, 15, 34, 69 and 85 bus distribution systems. The main advantage of that method was that it systematically decided the locations and size of capacitors to realize the optimum sizable reduction in active power loss and significant improvement in voltage profile. The method placed capacitors

at a fewer number of locations with optimum sizes and offered much saving in initial investment and regular maintenance. The disadvantage of that algorithm was that the capacitor sizes were considered as continuous variables, then the capacitor sizes were rounded off to the nearest available capacitor value. In this paper, an enhancement to that algorithm is proposed.

Azim and Swarup in [5] presented a GA-based approach to determine the optimum locations and sizes of capacitors for a distribution system. The capacitor sizes were assumed as discrete known variables, which were to be placed on the buses such that they reduced the losses of the distribution system to a minimum. A **genetic algorithm** [35][36] was used as an optimization tool, which obtained the optimal values and location of capacitors and minimized the objective function, which was the power loss in the distribution network under study. An initial base case load flow was used to calculate power loss and voltage profile of the distribution system. The problem was formulated as a constrained optimization problem. In this constrained problem, the constraint was the voltage limit; i.e. if the voltage magnitude exceeded a specified limit, this increased the value power loss function as a penalty term. Since the addition of a capacitor at any bus in the distribution system resulted in voltage magnitude increase, therefore it became imperative to model voltage magnitude as a constraint in the mathematical equation, which was to be optimized. The line flow limits were taken care of by the load flow program that calculated the losses.

Tabatabaei, S.M. et ai.[7] has planned a novel method for optimal location and size of the shunt capacitors . It is based on fuzzy decision making that uses new evolutionary method. The capacitor placement optimization problem involves : decreasing cost of peak power, reduces energy loss and improve the voltage profile. The initialization node has been opted by fuzzy reasoning which is supported by fuzzy[39][47] set theory in step by step procedure. An evolutionary algorithm called as bacteria foraging algorithm is used to solve multivariable optimization problem and optimal node for the capacitor placement is described.

In November 2005, Gozel, Hocaoglu, Eminoglu and Balikci [42] presented and evaluated an analytical method based on the effects of the load modeling for optimum size and location of DG in a radial system to minimize total power losses for the uniformly, centrally and increasingly distributed load profile. The optimal DG size and location which is determined by the analytical approach is validated against the results obtained by the classical grid search algorithm for each type of loads.