2.1 REPORTED WORKS ON NETWORK RECONFIGURATION

Ahmed and Abul’Wafa (2012) proposed a network-topology-based load flow for radial distribution networks with composite and exponential load. In this work, the technique is based on network graphical information that allows power flow equations formulation in a matrix form to satisfy the need of the distribution automation. It requires only tabulation of the input information for the line data in such a way that the receiving end node must be in an ascending order.

Chandramohan et al (2005) proposed that radial distributions are frequently reconfigured to maximize their operating performance and reliability. The key criteria for evaluating the optimal performance includes kW losses, reliability in terms of probable interruption costs, voltage profile and the radial system is reconfigured to optimize the objectives individually and collectively in a combination for a sample 33-bus radial distribution system chosen for analysis.

Chandramohan et al (2007) presented a radial system reconfiguration to minimize the operating costs in markets. The operating cost of a radial distribution system may be minimized by reducing the amount of real power and reactive power drawn from the transmission system. Reactive power is an ancillary service and its supply would be priced appropriately in
the near future through a clearing market structure. This work proposes a new method of reconfiguring radial systems considering costs of real and reactive power while maintaining an appropriate voltage profile and level of reliable power supply.

Chandramohan et al (2010) presented operating cost minimization of a radial distribution system in a deregulated electricity market through reconfiguration using NSGA method. A Distribution Corporation (Disco) would have to purchase reactive power along with real power from the connected transmission corporation. In this work, Non-Dominated Sorting Genetic Algorithm (NSGA) is used for reconfiguring a radial Disco to minimize its operating costs considering real and reactive power costs while maximizing its operating reliability and satisfying the regular operating constraints.

Civanlar et al (1988) presented a distribution feeder reconfiguration for loss reduction. Feeder reconfiguration is defined as altering the topological structures of the distribution feeders by changing the open/closed status of the sectionalizing and tie switches. In this work, a scheme is which utilizes feeder reconfiguration as a planning and/or real-time control tool to restructure the primary feeders has been presented.

Chin and Huang (2000) presented a simple distribution reconfiguration algorithm for loss minimization. Electrical distribution systems are planned as interconnected meshed networks. The network (feeder) configuration problem is to find a radial operating structure that optimizes network performance while satisfying the operating constraints. It reduces the system real power loss and balances the loading among the transformers and feeders.
Chun Wang et al (2008) proposed optimization of network reconfiguration in large distribution systems using plant growth simulation algorithm. It is based on the plant growth process, where a plant grows a trunk from its root, some branches will grow from the nodes on the trunk and some new branches will grow from the nodes on the branches. Based on an analogy with the plant growth process, an algorithm can be specified where the system to be optimized first “grows” beginning at the root of a plant and then “grows” branches continually until the optimal solution is found.

Dariush Shirmohanunadi and Wayne Hong (1989) presented a reconfiguration of electric distribution networks for reduction of resistive line losses. It describes an efficient and robust heuristic method for the reconfiguration of distribution networks to reduce their resistive line loss under normal operating conditions. Owing to its computational efficiency the approach is used in both the planning and operating environments.

Hernán Prieto Schmidt et al (2005) presented fast reconfiguration of the distribution systems considering loss minimization. Their work addresses the problem of finding the status of switching devices in the primary distribution networks so that the total loss is minimum. This optimization problem is a mixed-integer nonlinear optimization problem, in which the integer variables represent the state of the switches and the continuous variables represent the current flowing through the branches.

Juan Andres Martín and Antonio Jose Gil (2008) presented a new approach to solve the reconfiguration problem by a switching operation to reduce the power loss of the distribution systems. By using the proposed heuristic technique, a better network configuration that is based on the direction of the branch power flow is obtained. This reconfiguration algorithm starts with a radial topology by opening all the tie switches. At each step, after
a normally open switch is closed, the heuristic procedure establishes the switching-options thereby significantly reducing the number of candidate branches to be opened within a loop.

Kashem (2000) proposed the network reconfiguration for the enhancement of voltage stability in the distribution networks and an automatic selection method of optimal reconfiguration to minimize the losses. A meta-heuristic method is applied for power system optimization, particularly while dealing with combinatory optimization problem such as an optimal reconfiguration. The novel data structure load flow analysis and optimal placement of the capacitors for RDS using a fuzzy-GA method is reported by Venkatesh and Das (2003) and (2008) respectively.

Mesut et al (1989) presented a network reconfiguration in the distribution systems for loss reduction and load balancing. Network reconfiguration in the distribution systems is realized by changing the status of sectionalizing switches and is usually done for loss reduction or for load balancing in the system. In the network reconfiguration for loss reduction, the solution involves a search over relevant radial configurations. The methods are computationally attractive and in general give conservative estimates of loss reduction.

Saeed Jazebi and Behrooz Vahidi (2012) presented a reconfiguration of distribution networks to mitigate utilities power quality disturbances. The ability of network reconfiguration to enhance power quality issues such as harmonics and voltage sags while mitigating power losses. It belongs to a complicated combinatorial optimization problem, in which the best switching status could be determined via heuristic optimization techniques. Therefore, Differential Evolution Algorithm (DEA) has been implemented to solve the non-linear optimization problem.
Sahoo and Prasad (2006) presented a fuzzy genetic approach for network reconfiguration to enhance the voltage stability in RDS Energy Conversion and Management. The algorithms are enhancing the voltage stability of the distribution systems by network reconfiguration that alters the topological structure of the distribution feeders. However, there is still a need to device better techniques of capacitor placement to enhance the voltage stability in distribution systems.

Schmidt et al (2005) presented fast reconfiguration of distribution systems considering loss minimization. It formulated the problem as a mixed integer nonlinear optimization problem. The integer variables represent the status of the switches and continuous variables represent the current flowing through the branches. It considered the time varying load demand obtained through load estimation to reduce the loss. An exhaustive search algorithm obtains a minimum loss radial configuration of a distribution system.

Song et al (1997) presented a distribution network reconfiguration for loss reduction using fuzzy controlled evolutionary programming. The loss minimization in distribution systems has a greater significant trend towards distribution automation requiring the most efficient operating scenario for the economic viability variations. To reduce these losses, shunt capacitor banks are installed on the distribution primary feeders. The advantages with the addition of shunt capacitor banks are to improve the power factor, feeder voltage profile, Power loss reduction and increase in the available capacity of feeders.

Tao and Celso Cavellucci (1999) presented a parallel intelligent search for loss minimization in the distribution systems. The problem of obtaining a network re-configuration of minimum energy losses for electric power distribution system is addressed. It can be regarded as a generalization
of the minimum spanning tree problem, where edge cost varies as the configuration changes. Non-linear network flow optimization techniques team with search strategies from the field of artificial intelligence to cope with computation intractability.

An expert system using heuristic rules to shrink the search space for reducing the computation time is presented by Taylor and Lubkeman (1990). However, only a feasible solution can be obtained for knowledge based methods. The Distance Measurement Technique (DMT) that found a loop first and then a switching option was determined in that loop to improve the load balancing. The DMT can attain a near optimal configuration. In the network reconfiguration formulated as a multi-objective programming by considering power loss, system security and power quality is proposed by Kashem et al (1999).

Vahid Rashtchi and Saeed Pashai (2012) proposed a network reconfiguration in the distribution power system with distributed generators for power loss minimization. Here, they use an Ant Colony Search Algorithm (ACSA) to solve the optimal reconfiguration in RDS and without distributed resource for power loss reduction that determine the optimal location and size of DG according to the problem constraints. The ACSA applies local pheromone updating rule and global pheromone updating rule to promote the computation.

Venkatesh et al (2004) proposed an optimal reconfiguration of Radial distribution system to maximize loadability. It presents a new method for optimal reconfiguration of RDS. Optimal reconfiguration involves selection of the best set of branches to be opened, one each from each loop, such that the resulting RDS has the desired performance. Owing to the discrete nature of the solution space, a fuzzy adaptation of the Evolutionary
Programming Algorithm for optimal reconfiguration of RDS to maximize loadability is presented.

Venkatesh et al (2009) proposed an optimal reconfiguration of RDS using artificial intelligence methods. Reconfiguration of the radial distribution system is the significant way of altering the flow of power through lines. This altered flow changes the real power losses, reactive power losses and voltage profiles.Privatized RDS need to operate profitably with minimum operational losses and power quality. It focuses on the aspects of loss minimization and voltage enhancement of RDS by artificial intelligence methods.

Viswanadha Raju and Bijwe (2008) proposed efficient reconfiguration of balanced and unbalanced distribution systems for loss minimization. A simple and efficient two-stage reconfiguration algorithm for the minimization of active power loss in the balanced and unbalanced distribution systems is also presented. It begins with all candidate switches closed that uses current information obtained from a power flow, rather than from an optimal flow pattern used in other approaches to decide the switch to be opened, in a sequential manner.

Ying-Yi Hong (2003) presented a genetic algorithm based network reconfiguration for loss minimization in the distribution systems. Determination of the feeder configuration involving the switch status is essential for the operation in the distribution system. MW loss minimization is crucial if the system is normal. It presents a method based on Genetic Algorithm (GA) using a vertex encoding decoding to determine the network configuration. The Prufer number ensures that the system structure will be radial for the distribution system.
2.2 REPORTED WORKS ON CAPACITOR SWITCHING

Aravindhababu and Mohan (2009) presented an optimal capacitor placement for voltage stability enhancement in distribution systems. Voltage instability in the power systems is characterized by a monotonic voltage drop which is slow at first and becomes abrupt after some time and occurs when the system is unable to meet the increasing power demand. Capacitors are used in the distribution systems to minimize line losses and to improve the voltage profile.

Baghzouz and Ertem (1990) proposed shunt capacitor sizing for radial distribution feeders with distorted substation voltages. The selecting integer capacitor sizes closest to the optimal values found by the continuous variable approach may not guarantee an optimal solution. Therefore, the optimal capacitor placement should be viewed as an integer-programming problem and discrete capacitors are considered.

Bhattacharya and Goswami (2009) proposed a fuzzy based method for identification of the probable capacitor nodes of RDS. Simulated Annealing technique has been used for the final selection of the capacitor sizes. The new fuzzy functions are formulated where the active power membership is an exponential function of the nodal per unit active power and branch active power loss, the reactive membership function is a function of nodal reactive power and reactive branch loss.

Chen-Ching Liu et al (1989) presented loss minimization of distribution feeders, optimality and algorithms. It determines open switch positions for the minimum-loss configuration of a radial distribution system (RDS) is a discrete optimization problem. A global optimality condition of the problem has two algorithms (i) the uniformly distributed load model and (ii) the concentrated current (or power) demand model.
Chiang et al (1995) proposed optimal capacitor placement in large-scale unbalanced distribution system: system modeling and a new formulation. It used the method of Simulated Annealing to obtain the optimum values of shunt capacitors for radial distribution networks. It used Genetic Algorithm for obtaining the optimum values of shunt capacitor bank. They have treated the capacitors as constant reactive power loads. No method is used to reduce the CPU time as reported by Kim You (1999). GA based solution is capable of determining a near global solution with lesser computational burden than the Simulated Annealing method.

Chis et al (1997) proposed capacitor placement in distribution systems using heuristic search strategies. The capacitor placement problem investigates the decisions regarding the location, type, number and size of the capacitors installed in a RDS and the control scheme of the capacitor at different load levels. As the energy loss is critical to the placement performance, the load variations should be considered for a given period of time.

Damodar Reddy and Veera Reddy (2008) proposed optimal capacitor placement using Fuzzy and Real Coded Genetic Algorithm (RCGA) for maximum savings. A new methodology using Fuzzy and RCGA for the placement of capacitors on the primary feeders of the RDS to reduce the power losses and to improve the voltage profile has been developed. A two-stage methodology is used for the optimal capacitor placement problem, (i) fuzzy approach is used to find the optimal capacitor locations and (ii) RCGA is used to find the sizes of the capacitors corresponding to maximum savings.

Ellithy et al (2008) presented optimal shunt capacitors allocation in the distribution networks using Genetic Algorithm. The optimal shunt capacitor allocation problem is the determination of the location and sizes of
the capacitor to be placed in the distribution networks in an optimal manner to reduce the energy losses and peak power losses of the networks.

Fukuyama et al (1996) presented Parallel Genetic Algorithm for service restoration in the electric power distribution systems. A coarse-grain Parallel Genetic Algorithm is developed for solving a service restoration problem in electric power distribution systems. Service restoration is performed to restore electricity for out-of-service areas. The objective in service restoration procedures is to restore as much load as possible by transferring de-energized loads via network reconfigurations to other supporting distribution feeders without violating the operating and engineering constraints.

Haque (1999) presented the capacitor placement in radial distribution systems for loss reduction. Reduction of $I^2R$ loss in the distribution systems is very essential to improve the overall efficiency of power delivery that is separated into two parts based on the (i) active and (ii) reactive components of the branch currents. It presents a method of minimizing the loss associated with the reactive component of the branch currents by placing the shunt capacitors.

Marinko et al (2010) presented the Hybrid Evolutionary-Heuristic Algorithm for capacitor banks allocation. The issue of optimal allocation of the capacitor banks is concerning power losses minimization in the distribution networks. An evolutionary heuristic method has been proposed for optimal capacitor allocation in the radial distribution networks. A heuristic stage is used for improving the optimal solution given by the evolutionary stage. A new cost-voltage node index is used in the heuristic stage to improve the quality of solution.
Ng et al (2000) presented capacitor allocation by approximate reasoning, fuzzy capacitor placement. The problem of capacitor allocation in the electric distribution systems involve maximizing energy and peak power loss reductions by means of capacitor installations. A novel approach is using approximate reasoning to determine the suitable candidate nodes in a distribution system for capacitor placement. Voltages and power loss reduction indices of the distribution system nodes are modeled by fuzzy membership functions.

Prakash and Sydulu (2006) presented a novel approach for optimal locations and sizing of capacitors on radial distribution systems using loss sensitivity factors and $\alpha$ – coefficients. Capacitors are commonly used to provide reactive power support in the distribution systems. The amount of reactive compensation provided is very much related to the placement of the capacitors in the distribution feeders. The determination of the location, size and type of capacitors to be placed is of great significance, as it reduces power and energy losses, increases the available capacity of the feeders and improves the feeder voltage profile.

Rajendar and Basavaraja Banakara (2012) proposed a novel method for determining the optimum location and amount of reactive power to be injected to improve the voltage stability of entire power system or set of buses that are prone to voltage instability. A new sensitivity matrix named L-Index sensitivity matrix has been proposed and the same is considered for identifying the buses at which the reactive power is to be injected.

Ramesh et al (2008) presented voltage stability analysis and real power loss reduction in the distributed distribution system. A loss minimization for power distribution system by various techniques that have different approach like restructuring, DG implementation and capacitor
placement for loss minimization has been presented. The superiority of the system is validated by comparing the tested result with that of the existing system.

Robert Broadwater et al (1993) presented time varying load analysis to reduce the distribution losses through reconfiguration. A load estimation algorithm provides load information for each time point to be analyzed. The load estimation algorithm can incorporate any or all of the following, namely, spot loads, circuit measurement and customer time varying diversified load characteristics. Voltage dependency of the loads is considered at the circuit level that switching at the system peak can reduce losses, but may cause a marginal increase in the system peak.

Sharkawi and Huang (1994) presented an ancillary technique for Neural Network applications with the emergence of computational intelligence, the intelligence-oriented technologies to solve capacitor placement problems. By an appropriate design of network topologies and the improvement of training algorithms, Neural Networks have demonstrated their effectiveness in several power system applications. When utilizing this technique for capacitor placement, on-line measurements that include active and reactive line flows, voltage magnitudes and corresponding capacitor settings at certain buses are first collected for the neural networks training.

Shikha Gupta and Gursewak Singh Brar (2011) presented an efficient approach for capacitor sizing and location on a RDS using Artificial Intelligence technique. It determines the optimum size and location of the capacitors to be placed on RDS. The objective functions have maximization of saving due to the reduction of energy losses thereby considering the cost of the capacitor. The solution methodology used divides the problem into two parts, (i) load flow solution for the radial feeder is obtained and followed by a
loss sensitivity analysis to select the candidate capacitor installation locations. (ii) Genetic Algorithm is used as an optimization tool, which obtains the optimal value of capacitors to be installed.

Srinivasan Sundhararajan and Anil Pahwa (1994) presented an optimal selection of capacitors for radial distribution systems using a Genetic Algorithm. The objective is to minimize the peak power losses and the energy losses in the distribution system considering the capacitor cost. A sensitivity analysis based method is used to select the candidate locations for the capacitors. A new optimization method using a Genetic Algorithm is used to determine the optimal selection of capacitors.

Srinivasa Rao and Narasimham (2011) proposed optimal capacitor placement in a radial distribution system using Plant Growth Simulation Algorithm. A new and efficient approach for capacitor placement in the radial distribution systems that determine the optimal locations and size of the capacitor with an objective of improving the voltage profile and reduction of power loss is used. The solution methodology has two parts (i) loss sensitivity factors are used to select the candidate locations for the capacitor placement and (ii) a new algorithm that employs Plant growth Simulation Algorithm (PGSA) is used to estimate the optimal size of the capacitors at the optimal buses determined.

Subrahmanyam (2009) presented optimal capacitor placement in unbalanced radial distribution networks. It presents a novel method to determine the best locations for capacitor placement in unbalanced radial distribution networks and simple GA is used to find the optimal sizing of the capacitor bank. The objective function includes the energy cost, capacitor installation cost and purchase cost, so that the fitness functions are to be maximized for net saving.
Youman Deng and Xiaojuan Ren (2001) proposed a new approach with fuzzy variables for solving the capacitor-switching problem in RDS. This method incorporates the load uncertainty in optimizing capacitor on/off status to minimize real power losses and improve the bus voltages. Here, fuzzy distribution power flow is calculated and treated as the base of the capacitor switching calculation. The principles of fuzzy set theory are applied to form a methodology suitable for calculations of fuzzy complex numbers while maintaining the fast speed of calculations.

Yutian Liu et al (2000) proposed optimal reactive power and voltage control for radial distribution system. The optimal control problem is to find a proper dispatch schedule for shunt capacitor banks and on-load tap changer at substation and shunt capacitor banks on feeders such that the power loss is minimized and the voltage profile is improved. To reduce the computations, the whole problem is decomposed into two sub-problems, namely sub-problem on substation level and sub-problem on feeder level.

2.3 REPORTED WORKS ON OPTIMIZATION TECHNIQUES FOR POWER LOSS MINIMIZATION

Aoki (1987) presented a sub-problem related to distribution automation. It outlined an algorithm and presented computer results for minimizing the losses in a loop distribution system based on the remote operation of sectionalizing switches on feeders interconnecting different substations. The minimization was carried out subject to the voltage-drop, line-capacity and substation-capacity constraints.

Ashish Ahuja and Anil Pahwa (2005) proposed using Ant Colony Optimization for minimizing losses in the distribution networks. Distribution Systems have to bear different loading patterns at different times. This change in load causes distribution feeders to be overloaded sometimes and lightly
loaded at other times. With this load variation, operating conditions of the
distribution system also varies. If not compensated well, voltage at different
buses goes out of nominal range and real power loss on the feeders also
increase, leading to high operating cost of the system.

Chen-Ching et al (1988) proposed a new application of expert
system techniques for the restoration of the distribution systems. Primary
feeders are typically radial in structure. To increase the system reliability,
neighboring feeders are connected through a normally open tie switch. They
propose an expert system for the distribution system restoration. The
incorporated knowledge is acquired from the literature and discussions with
distribution engineers. A new application of expert system techniques for the
restoration of the distribution system has been presented.

Chen and Cho (1993) presented a systematic method to derive an
optimal switching plan to achieve energy loss minimization for the short and
long term operation of the distribution systems. The short term optimal
switching criterion is developed by Binary Integer Programming with branch
and bound technique. They have presented two combinatorial optimization
techniques, which use Simulated Annealing and Genetic Algorithm, to find an
inferior global solution for real power loss reduction. However, a lot of
computation efforts are required for these two methods to find the solution.

Das (2006) proposed an algorithm for network reconfiguration
based on fuzzy multi-objective approach. Multiple objectives are considered
for load balancing among the feeders. They are minimum deviation of the
nodes voltage, minimization of the power loss and branch current constraint
violation, and a radial network structure in which all loads must be energized.
These objectives are modeled with fuzzy sets to evaluate their imprecise
nature and one can provide his or her anticipated value of each objective and the distribution networks are configured radically.

Deng and Ren (2003) proposed an approach which uses fuzzy variables to solve the capacitor-switching (CS) problem in radial distribution systems. CS is an important measure for the minimization of losses in the distribution systems via an optimal capacitor dispatch schedule. Uncertainty of the forecasted load values are represented as trapezoidal fuzzy numbers via fuzzy sets. Iterative method is adopted to get the optimal result and integralisation is performed during each step of iteration to deal with the integer constraints.

Dong Zhang et al (2007) presented an improved Tabu Search (TS) algorithm for loss-minimum reconfiguration in large-scale distribution systems. TS algorithm is an efficient meta-heuristic searching algorithm that has advantages of both high local search efficiency of hill-climbing method and global search ability of the intelligent algorithm. However, tabu lengths and candidate neighborhood are two key parameters affecting the searching performance of TS algorithm and these two parameters are hard to be determined effectively in advance.

Enrico Carpaneto and Gianfranco Chicco (2004) presented a new application of the Ant Colony Search method to minimize losses in reconfiguration of the distribution systems. The optimization problem is formulated by considering the operational constraints of the distribution systems. The Ant Colony Search (ACS) has been compared to the other methods typically used for the minimum losses reconfiguration of the distribution systems, such as deterministic Iterative Improvement (IT), Simulated Annealing (SA) and Tabu Search (TS).
Batrinu et al (2005) proposed the optimal reconfiguration of a large distribution system which is a global optimization problem typically solved by using deterministic or heuristic methods. Comparing the effectiveness of the various methods can be assisted by formulating a unified framework to identify the common characteristics and the conceptual differences among the methods. Electricity distribution systems are typically structured as meshed networks, with the system nodes interconnected by a number of branches higher than the number of nodes, but are operated with radial configurations to simplify the protection schemes.

Garcia Santander et al (2006) proposed a method for minimal losses in the primary distribution systems by changing the topology. The loss minimization in the distribution systems is based on Simulated Annealing (SA) and Radial Power Flow. SA's major advantage over the other methods is an ability to avoid becoming trapped at local minima. The idea of Simulated Annealing comes from Thermodynamics and Metallurgy. When a melting metal is cooling lowly enough (annealing), it tends to solidify in a minimum energy structure. The same principle is used in Simulated Annealing at the beginning of the process almost every action is allowed.

Gomes and Das (2006) proposed the concept of distribution system reconfiguration for system loss reduction and several reconfiguration techniques for power loss reduction, which can be grouped into different categories: (i) blend optimization (ii) heuristic techniques (iii) purely heuristic techniques (iv) artificial intelligence based technique. A purely heuristic algorithm is based on a branch exchange using a simple formula to determine if a particular switching operation would increase or reduce the system losses. Different methods identify the branches to be exchanged using a heuristic approach, which searches systematically over the relevant spanning trees.
Goswami and Basu (1992) presented a new algorithm for the reconfiguration of distribution feeders for loss minimization. The modern techniques such as Constrained Decision Problems (CDPs) and Genetic Algorithms (GAs) have also been employed. Despite the fact that neither CDP nor GA guarantees optimal solution, they do provide high-quality suboptimal solutions. Both techniques suffer, to a certain extent, from scaling the problem size from a few switches up to 100 switches or more, typically found in realistic distribution systems.

Hongbin Wu and Liang Cai (2013) presented a new approach combing connection number and fuzzy simulation to calculate power flow of the distribution network considering uncertainty. The power flow calculation considering uncertainty is the most basic way for solving the security issue of the system under uncertain conditions. As the renewable energy such as wind and solar power is characterized by randomness and uncertainty, they have been applied to the distribution network. It is especially essential to study power flow of the distribution network considering uncertainty.

Huang (2002) proposed an Enhanced Genetic Algorithm (EGA) - based fuzzy multi-objective approach to solve a network reconfiguration problem in a radial distribution system. Maximizing the fuzzy satisfaction allows the operator to simultaneously consider the multiple objectives of the network reconfiguration to minimize power loss, violation of voltage and current constraints, as well as switching number, while subject to a radial network structure in which all loads must be energized.

Hoyong Kim et al (1993) proposed neural networks that include the capability to map the perplexed and extremely non-linear relationship between the load levels of the zone and the system topologies, which is required for the feeder reconfiguration in the distribution systems. This
system is radially structured, and closely connected so that widely distributed customers can be supplied.

Kashem et al (1998) proposed Artificial Neural Network approach to network reconfiguration for the loss minimization in distribution networks. Network reconfiguration of distribution systems is an operation in configuration management that determines the switching operations for a minimum loss condition. An artificial neural network (ANN)-based network reconfiguration method is developed to solve the network reconfiguration problem to reduce the real power loss in the distribution networks.

Leonardo et al (2009) proposed the Adaptive Hybrid Genetic Algorithm for technical loss reduction in distribution networks under variable demands. In power distribution networks, the load varies within any given time frame that reduce the losses would be the solving of a network reconfiguration problem to suit each of the significant load variations. However, frequent changes in configuration can trigger outages or cause transient problems which are avoided.

Lin et al (2003) proposed the application of an immune algorithm for the optimal switching search problem to achieve loss minimization and loading balance among the feeders and the main transformers. This algorithm prevents the possibility of stagnation in the iteration process and achieves fast convergence for global optimization.

Luan et al (2002) proposed Genetic Algorithm for supply restoration and optimal load shedding in the power system distribution networks. Genetic Algorithm has gained attention in optimization with both binary and continuous variables. It is also applied to solve the power engineering problems, e.g. optimal power flow, load shedding and unit commitment.
Mohammad Sharafi et al (2013) presented optimal conductor selection of radial distribution networks using PSO method. It optimizes an objective function to reduce the sum of the capital cost and power loss cost and voltage deviation of the radial distribution network of power simultaneously. It optimized the type of conductor by making use of Particle Swarm Optimization (PSO) method. It iteratively improves a potential type of the conductor with respect to a given measure of quality to reach to the optimized type of conductor.

Prakash and Sydulu (2007) presented Particle Swarm Optimization based capacitor placement on radial distribution systems. A novel approach determines the optimal location and size of the capacitors on the radial distribution systems to improve the voltage profile and reduce the active power loss. Capacitor placement & sizing are done by Loss Sensitivity Factors (LSF) and Particle Swarm Optimization respectively. LSF offers important information about the sequence of potential nodes for capacitor placement.

Ramesh et al (2009) presented minimization of power loss in distribution networks by different techniques. Accurate loss minimization is the critical component for efficient electrical distribution power flow. This work presents loss minimization in power distribution system through feeder restructuring, incorporating DG and placement of capacitor.

Rao et al (2013) proposed power loss minimization in the distribution system using network reconfiguration in the presence of Distributed Generation (DG). A Meta heuristic Harmony Search Algorithm (HSA) is used to simultaneously reconfigure and identify the optimal locations for the installation of DG units in a distribution network. Sensitivity analysis is used to identify optimal locations for the installation of the DG
units. Different scenarios of DG placement and reconfiguration of network are considered to study the performance of the proposed method.

Ravibabu et al (2010) presented implementation of improved Genetic Algorithm in the distribution system with feeder reconfiguration to minimize real power losses. The Bacterial Foraging Optimization (BFO) algorithms are well suited for combinatorial optimization problems.

Rider et al (2009) proposed a method for computing the minimum active power loss in competitive electric power markets. The active power loss minimization problem is formulated as an optimal power flow (OPF) with equality and inequality nonlinear constraints which considers the power system security. Active power loss minimization of electric power systems (EPS) may be considered a fundamental requirement in the current competitive electric markets to obtain economy and power quality.

Sathish Kumar and Jayabarathi (2012) presented power system reconfiguration and loss minimization for a distribution systems using Bacterial Foraging Optimization Algorithm (BFOA). The feeder reconfiguration problem is formulated as a non-linear optimization problem and BFOA is used to find the optimal solution. According to the characteristics of the distribution network, some modifications are done to retain the radial structure and reduce the searching requirement.

Shaik Mohammad Shakeer and Suresh Babu (2012) proposed an efficient method for the reconfiguration of the radial distribution systems for the minimization of real power loss using Adapted Ant Colony Optimization. The conventional Ant Colony Optimization is adapted by graph theory to always create feasible radial topologies during the whole evolutionary process. This avoids tedious mesh check and hence reduces the computational
burden. The initial population is created randomly and a heuristic spark is introduced to enhance the pace of the search process.

Shyh-Jier Huang (2000) presented an immune-based optimization method to capacitor placement in a radial distribution system. In the capacitor placement problem, those practical capacitor operating constraints, load profiles, feeder capacities and allowable voltage limits at different load levels are all considered while the investment cost and energy losses are minimized.

Tamer Mohamed Khalil et al (2006) presented a binary particle swarm optimization for optimal placement and sizing of capacitor banks in the radial distribution feeders with distorted substation voltages. It proposes a binary Particle Swarm Optimization (PSO) for optimal placement and sizing of fixed capacitor banks in radial distribution lines with non sinusoidal substation voltages. It includes the cost of power losses and capacitor banks with constraints which include limits on voltage, total harmonic distortion (THD) and sizes of installed capacitors.

Usha Reddy and Dinakara Prasad Reddy (2011) presented a differential evolution method for capacitor placement of the distribution systems. It presents a fuzzy and Differential Evolution (DE) method for the placement of capacitors on the primary feeders of the RDS to reduce the power losses and to improve the voltage profile. Fuzzy approach is used to find the optimal capacitor locations and DE method is used to find the sizes of the capacitors.

Tao et al (1999) presented the problem of uncovering a radial configuration with minimum energy losses for electric power distribution systems. The number of possible network configurations grows exponentially with the size of the network and the number of switches that must remain open to define a radial network. An optimal solution to this combinatorial
problem has been considered impractical. An enhanced backtracking search strategy guides the procedure to a feasible minimum-loss solution.

Venkatesh and Rakesh Ranjan (2003) proposed a method that uses fuzzy adaptation of Evolutionary Programming (FEP) as a solution technique. FEP technique has been chosen as it is particularly suitable for solving optimization problems with discontinuous solution space and when the global optimum is desired. Fuzzy adaptation of EP is necessitated while considering optimization of multiple objectives.

Wagner et al (1991) presented one of the features provided by Distribution Automation, which can result in substantial savings for the utility, is feeder reconfiguration for loss reduction. This work provides a comparison of the various methods applied to feeder reconfiguration for loss minimization. Here a comparison of the more promising methods of real-time reconfiguration for loss reduction is conducted. Linear Program methods using a Stepping Stone algorithm is applied to the feeder reconfiguration problem for the first time.

Young-Jae Jeon and Jae-Chul Kim (2004) presented an efficient algorithm for loss minimization by automatic sectionalizing switch operation in large-scale distribution systems. Simulated Annealing is particularly well suited for large combinational optimization problems, but the use of this algorithm also requires excessive time for computation.

Yu and Wilamowski (2010) presented second order algorithms, such as Levenberg Marquardt algorithm for Neural Network training. Being different from traditional computation in second order algorithms, the proposed method simplifies Hessian matrix computation, by removing Jacobian matrix computation and storage. Matrix multiplications are replaced
by vector operations. The proposed computation not only makes the training process faster, but also significantly reduces the memory cost.

2.4 INFEERENCE FROM LITERATURE SURVEY

Literature survey related to three major areas of study namely; power loss minimization, network reconfiguration with optimal capacitor placement and the remote closed loop monitoring in WAP enabled device has been done. The survey has revealed that in the area of power loss minimization, the use of multi-objective based optimization algorithms to achieve global optimum still remains largely unexplored. Similarly, improved second order training algorithms that can converge in minimum number of iterations has not been reported. In the previous work reported on network configuration, the focus has not been given on the metric reconfiguration time and the reported algorithms are considered suitable for offline.

The present research, a novel second order training algorithm that produces superior convergence results are demonstrated. It is more suited to perform real-time network reconfiguration. The hardware implementation of Neural Network has been done in the present research and this further provides a speed up to the network training, thereby reducing the time to reconfigure. Also, WAP based real-time monitoring of the network topology, its parameters, alarms to monitor and report limiting conditions have been provided in the present research. Thus, the integration of multi-objective power loss minimization algorithm, minimum convergence time neural network algorithm with hardware implementation and WAP enabled closed loop monitoring of the system makes the presented solution accurate, faster and reachable.