International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 01 | Jan-2018 www.irjet.net p-ISSN: 2395-0072

REVIEW ON OPTIMAL ALLOCATION OF CAPACITOR IN RADIAL DISTRIBUTION SYSTEM

Radhika G. Thakare[1], Kunal M. Raut[2], Seema M. Amune[3], Prof. A. B. Nagdewate[4]

[1,2,3] UG Students, Electrical Engineering, DES'sCOET, Dhamangaon Rly, Maharashtra (India)
[4]Assitant Professor, Electrical Engineering, DES'sCOET, Dhamangaon Rly, Maharashtra (India)

Abstract - *In recent years, optimal allocation and sizing of shunt capacitor in Radial Distribution Network (RDN) for minimizing the real power loss and total cost of the system. Loss Sensitivity Factor (LSF) approach is utilized to identify sensitive buses for capacitor placement and optimal size of shunt capacitor is determined by using Particle Swarm Optimization (PSO) and Genetic Algorithm (GA) and minimizes the total real power loss objective function. As a result it is observed that net saving is increased, enhance the voltage profile and improve power factor after capacitor placement. The proposed approaches have been demonstrated on 69 bus radial distribution systems. The obtained numerical results of the proposed approach have been compared to the other intelligent techniques.*

Key words: Capacitor Allocation, Capacitor Sizing, LSF, PSO, Power Loss, Voltage Profile.

1. INTRODUCTION

The major problem face by power system engineers is to match the increasing load demand with present generating capacities. Producing additional generation capacity includes large capital investments thus it is adequate to operate the existing power system network with optimal utilization. This needs systematic methods of planning and should install necessary control techniques to lower the energy losses and to increase the power quality (voltage profile) provided to the end users.

The radial distribution system is generally classified into Primary distribution network and Secondary distribution network. A primary distribution network provides power at larger than utilization voltages from the substation to the point where the voltages are further stepped down to the value at which the energy is utilized by the consumers. The secondary distribution network provides power to the consumer area at levels of utilization voltages. Based on the scheme of connection the primary distribution systems are classified as

1. Radial system
2. Ring main system
3. Interconnected system

Most of the distribution systems are radial, thus radial distribution system is selected for test case. In this system, separate feeders escape from a single substation and feed the distributors at one end only. capacitors are mostly used for reactive power compensation in distribution networks. They are also helpful for power loss reduction and increment of voltage profiles. The benefit of this kind of compensation depend on how and where to allocate the capacitors in the system. In recent years, according to proper results of optimal capacitor placement and optimal distribution network reconfiguration for power losses reduction, the concept of using these two methods simultaneously has been considered to maximize the amount of power loss reduction. The mix up of these approaches makes the optimization process more complex. Effective decisions optimization is required.

The modified distribution system is challenged by an ever increasing demand in load which causes the high stress and reduced voltage. The node voltage gets lower when the network in distribution gets far away from substation. This decrement of voltage is because of deficiency of reactive power, even it also results in collision of voltage. Hence compensation of reactive power is important to restrict the collision of voltage and improving voltage profile. Generally the losses in distribution system are greater than the losses in transmission system. Thus it's a need to work on distribution system losses respectively.

2. LITERATURE SURVEY

For this paper, literature survey has been studied from various sources like journal, books, article and others. Literature survey includes all important studies which have been done previously by other research work. It is importance to do the literature survey before doing the project. The review of the work as per the follows:

Benvindo R. Pereira work for the simultaneous allocation of capacitor banks and distributed generation, which takes into account the stochastic nature of distributed generation. To solve the model presented, it proposes an efficient hybrid method based on Tabu search and genetic algorithms. The hybrid method is applied to a well-known system in literature [1].

Chang in his paper 'Optimum Allocation of Shunt Capacitors and Voltage Regulation on Primary Feeders' assumes a

feeder with a uniform load and a concentrated end load. Accounting for both peak power losses and energy losses, he determines the optimal location of a fixed capacitors and results saving, given the capacitors size. The optimal solution is determined by considering each of the available capacitor sizes [2-3].

Cook in paper 'Analysis of Capacitors Application as Affected by load Cycle' also addresses application of fixed capacitors to a uniformly distributed load. However, instead of considering reduction of peak power losses, savings are based, on energy loos reduction considering a time-varying load [4]. This analysis is extended in Cook 'Optimizing the Application of Shunt Capacitors for Reactive-Volt-Ampere Control and Loss Reduction' to include switched capacitors. Savings are calculated on the basis of reduction of both peak losses and energy losses [5].

3. OBJECTIVE OF PAPER

The main problem in front of the power system engineer is to fulfill the increasing demand of power with the existing generating capacities. To become the optimal utilization of power it is required to lower the power loss and increase the voltage profile which is obtained by simultaneously applying optimal capacitor allocation and optimal distribution network reconfiguration. To make the better decisions optimization is mandatory. Recently created PSO algorithm is applied for optimization. Load flow technique for radial distribution using Newton- Raphson has been used.

This paper will held towards optimizing power loss and increasing bus voltage profile in distribution system. Since, an modifying method like Particle Swarm Optimization (PSO) has been used to meet at the results optimization is best to traditional methods.

The simultaneous solving of these two problems will lead to better results than their separated solution. It will also show PSO will give better results compared to other previous similar studies using other intelligent methods and simulations and comparison results show that optimal reconfiguration and capacitor placement simultaneously result in the most optimum condition of radial distribution system.

3. CONCLUSION

A simple method of minimizing the loss associated with the reactive component by placing capacitors in a radial distribution system has been proposed in this paper. The proposed method will be tested on 69 bus system which will use to develop a model for any artificial intelligence technique which can accurately predict the location and size of capacitor for any load conditions which gives a great promise for practical implementation of proposed technique.

REFERENCES

[1] Benvindo R. Pereira Jr., Geraldo R. Martins da Costa, "Optimal Distributed Generation and Reactive Power Allocation in Electrical Distribution Systems", IEEE Transactions on Sustainable Energy pp. 950, Vol. 7, No. 3, July 2016.

[2] Negale N.M. and Samson D. R., "Loss Reduction form capacitors Installed on Primary Feeders", AIEE Transactions, Vol.75, pt. III, 1956, pp. 950-959.

[3] Cook R. F., "Analysis of Capacitors Application as Affected by load Cycle", AIEE Transactions, Vol.78, pt. III, Oct. 1956, -957.

[4] Cook R. F., "Optimizing the Application of Shunt Capacitors for Reactive-Volt-Ampere Control and Loss Reduction", AIEE Transactions (Power Apparatus and Systems), Aug. 1961, pp. 430-444.

[5] Cook R. F., "calculating Loss Reduction Afforded by shunt capacitor Application", IEEE Tran. PAS, Dec. 1964, pp. 1227-1230.