OPTIMIZATION TECHNIQUE BASED ON OPTIMAL LOCATION OF FACTS BY USING HYBRID METHOD

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***Abstract*:** *This is very difficult task to find out the optimal location of FACTS devices in de-regulated power system the optimizations are made on three parameters: the location of the devices, their types and their sizes. The FACTS devices are located in order to enhance the system security. In this paper the Novel method is use, in which combination of two methods are use particle swarm optimization and genetic algorithm the problem of ameliorating the voltage and mitigating power loss in electrical networks is a task that ought to be solved optimally. In this paper a novel way for locating FACTS devices optimally in a multi machine power system. By assessing the proposed method, the location of FACTS controllers, different type and rated values can be optimized simultaneously. Also, the proposed approach goals to evaluate the number of devices and their ratings in optimal way with the help of the optimization technique with the thermal and voltage limits taken into consideration. Various conditions of loading in the power system are taken into account during this method. The exploration of the proposed approach is accomplished on the IEEE 40-bus system.*

***Index Terms*- FACTS devices, TCR, SVR, PSO, GA, TSR, TSC, etc.**

I. INTRODUCTION

The FACTS devices (Flexible AC Transmission Systems) bring up contemporary opportunities for regulating power and thus improving the utilizable capacity of transmission lines existing. In a meshed network, an optimal location of Flexible AC Transmission Systems devices permits to regulate its power flows and therefore to increase the load ability of the system. Generally it is observed that a fixed number of devices, which beyond this load ability can't be ameliorated. There exist three distinct classes of devices, along with specific characteristics, which have been adopted and modeled for steady-state analysis. These devices are applied in maximizing the power transmitted by the network by regulating the power flows. In the combinatorial analysis, for the given number of FACTS devices, finding optimal locations is becoming a problem. To resolve this kind of problems, Genetic Algorithms and PSO have chosen.

Most of the investigations over optimal FACTS device installation are intended towards technical, economic or covering both. The technical concerns involve the proposed method in practically installing different FACTS devices on different locations to recognize the increase of load ability. The genetic algorithm has been employed to pick up the suitable locations for the installation of FACTS to paramount the method security with improved load ability.

1.1 STATIC VAR COMPENSATOR

The SVC can be operated as both inductive and capacitive compensation. It is modeled as an ideal reactive power injection at bus i. The value is between - 100 MVAR to 100 MVAR. The typical Static VAR Compensator is classified as Thyristor-Controlled Reactor, Thyristor-Switched Reactor or Thyristor-switched capacitors. Figure 1 represents a Thyristor-Controlled Reactor single-phase equivalent circuit

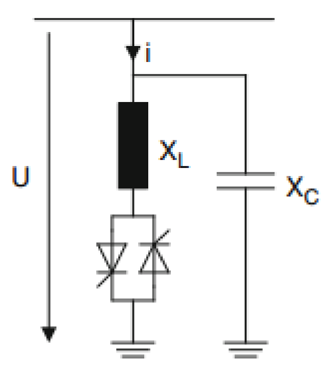


Fig. 1 Single-phase equivalent circuit of the shunt SVC (TCR)

II. GENETIC ALGORITHM

The GA is a search algorithm based on the mechanism of natural selection and natural genetics *Planning* the variables of the problem. The strength of an individual is the objective function that must be optimized. The population of candidates evolves by the genetic operators of mutation, crossover, and selection. The characteristics of good candidates have more chances to be inherited, because good candidates live longer. So the average strength of the population rises through the generations. Finally, the population stabilizes, because no better individual can be found. At that stage, the algorithm has converged, and most of the individuals in the population are generally identical, and represent a suboptimal solution to the problem. A GA is governed by three factors: the mutation rate, the crossover rate, and the population size. The GA are one of the effective methods for optimization problems especially in non-differential objective functions with discrete or continuous decision variables . A brief description of the components is as below:

1. Initialize a population of chromosomes.
2. Evaluate each chromosome in the population.
3. Create new chromosomes by mating current chromosomes.
4 Apply mutation and recombination as the parent chromosomes mate.
5. Delete a member of the population to accommodate room for new chromosomes.
6. Evaluate the new chromosomes and insert them into the population.
7. If time is up, stop and return the best chromosomes; if not, go to 3.

. The speed of the iterations is determined by the length of the chromosome and the size of the populations. There are two main methods for the GA to generate itself, namely generational or steady state. In the case of generational, an entire population is replaced after iteration (generation), whereas in steady state, only a few members of the population are discarded at each generation and the population size remains constant . Another drawback of this algorithm is it's high sensitivity to the initial population

There are a few main limitations of a GA when being applied to problems

8. The fitness function must be well-written.
9. It is a blind and undirected search.
10. It is a stochastic search.
11. It is sensitive to initial parameters.
12. It is computationally expensive.
13. What is the stopping criterion?

The important parameters of GA are:

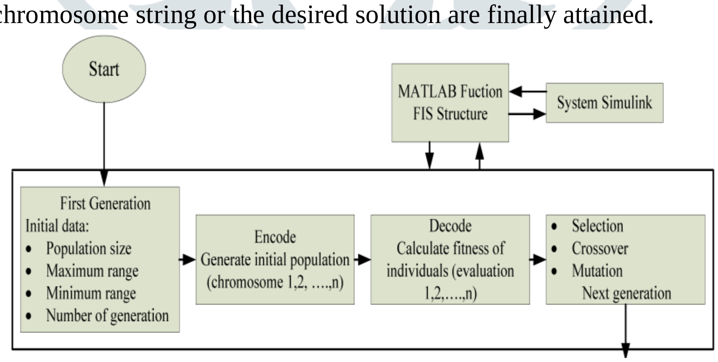
Selection – Based upon the fitness criterion to pick the chromosome from a population to reproduce.

Reproduction – Propagation of individuals from one generation to the next.

Crossover – Operator transforms genetic material which is the features of an optimization problem. Single point cross over is used here.

Mutation – The reconstruction of chromosomes for single individuals. Mutation does not permit the algorithm to get stuck at local minimum.

Stopping criteria – When the number of cycles is reached to maximum, the iteration stops. The minimum Cost function and regarding chromosome string or the desired solution are finally attained.



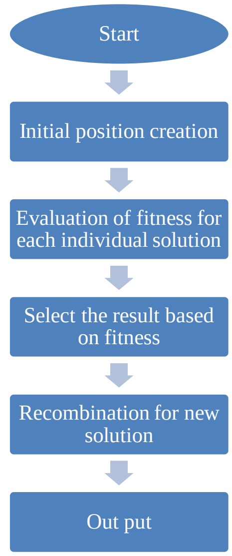
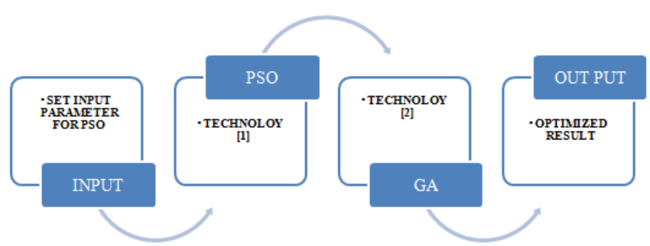


Fig: 2 Flowchart of Genetic Algorithm

III. OPTIMIZATION

The idea behind this paper is the combination of the PSO and GA algorithm in such a way that the performance of the newly established algorithm is better than the PSO or GA algorithm. This new algorithm could be used for many optimization problems. In the fist stage of solving the problem of optimization the PSO algorithm will create an initial population near the global optima. After that the algorithm switches to the GA and the GA takes this initial population and continues to solve the optimization problem. The step by step algorithm for the proposed optimal
placement of SVC devices using PSO-GA is given below :placement of SVC devices using PSO-GA is given below:

Step 1. The number of devices to be placed is declared and the load flow is performed.
Step 2. The initial population of individuals is created satisfying the SVC device's constraints given by (4) and (5) and also it is verified that only one device is placed in each line.
Step 3. For each individual in the population, the fitness function given by (3) is evaluated after running load flow.
Step 4. The velocity and new population is updated by (8).
Step 5. If maximum iteration number is reached, then go to the next step or else go to step 3.
Step 6. Get the last population as the initial population and using the GA update the population.
Step 7. For each individual in the population, the fitness function given by (3) is evaluated after running load flow.
Step 8. If the stop criterion is met, go to step 9 or else go to step 6.
Step 9. Output the results



IV. RESULTS

In this paper, the FACTS device location considered Economic saving function, which obtained by power loss reduction. In order to verify the effectiveness of the proposed method IEEE 40 bus system is used. Different operating conditions are considered for finding the optimal choice and location of FACTS controllers.

Table: 1 Optimum Location

S.N	PSO-GA Results (Bus No.)
1	1
2	2
3	11
4	20
5	29

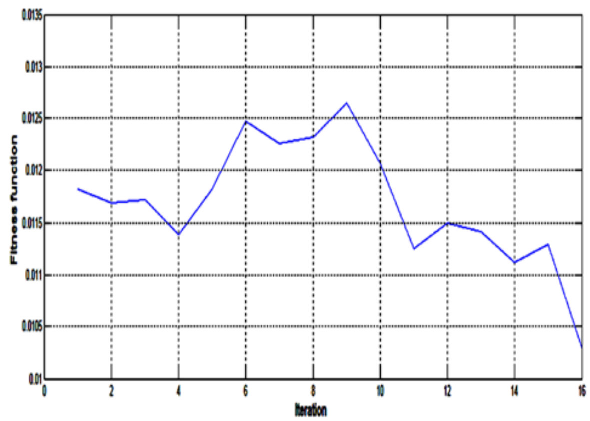


Fig: 3 Performance of Iteration Vs Fitness Function

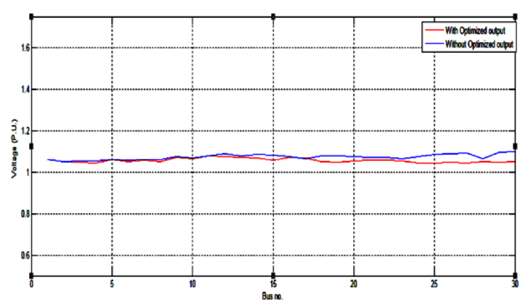


Fig: 4 Performance of Graph with and Without Optimization

In this figure show in 5, power transmission loss with optimization method and without optimization, increase power loss problem batter then normal condition.

V. CONCLUSION

In this approach Optimization algorithm based optimal placement of FACTS devices in a transmission network is done for the increased load ability of the power system as well as to minimize the transmission loss. It is clearly evident from the result that effective placement of FACTS devices in proper locations can significantly improve. This approach could be a new technique for the installation of FACTS devices in the transmission scheme.

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