Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 92 (2016) 42 – 47

Procedia Computer Science

2nd International Conference on Intelligent Computing, Communication & Convergence

(ICCC-2016)

Srikanta Patnaik, Editor in Chief

Conference Organized by Interscience Institute of Management and Technology

Bhubaneswar, Odisha, India

Optimal Power Flow with Static VAR Compensator Using Galaxy based Search Algorithm to minimize Real Power Losses

B.Sravan Kumar[a], M.Suryakalavathi[b] and G.V.Nagesh Kumar[a]*

[a]*Department of EEE, GITAM University, Visakhapatnam-530045,INDIA*
[b]*Department of EEE, JNT University, Hyderabad, INDIA*

Abstract

In this paper, Galaxy based search algorithm (GbSA) is used to solve multi-objective problem of optimization in power systems. The proposed GbSA resembles the spiral arms of some galaxies to search for the optimal solutions. The GbSA also uses a modified Hill Climbing algorithm as a local search. Simulation results show that the GbSA finds the optimal or very near optimal values in all runs of the algorithm. The weighted sum technique with equal weights has been chosen to solve the multi-objective function. The functions considered are to minimize the power losses in transmission line, cost of the real power generation and voltage deviation. Static VAR Compensator (SVC) is used for the purpose of optimal power flow. L-index is used to identify the optimal location to place SVC. The results have been compared with Genetic algorithm (GA) for IEEE-14 System.

Peer-review under responsibility of the Organizing Committee of ICCC 2016

* Corresponding author. Tel.: +91-9000573759
*E-mail address:*gundavarapu_kumar@yahoo.com

Peer-review under responsibility of the Organizing Committee of ICCC 2016
doi:10.1016/j.procs.2016.07.321

Keywords: Flexible AC Transmission System, Galaxy based Search algorithm , Optimal Power Flow, Static VAR Compensator, L-index.

1. INTRODUCTION

Modern electric power systems have to face many difficulties due to their complex structure and operation. Power system instability is one of the major problems faced by power engineers [1]. Power system instability is majorly due to deficiency of new transmission lines and over usage of the existing lines. Mechanical control is used in conventional power systems. However control using mechanical procedures is not as reliable as the devices tend to wear out fast in comparison to their static counterparts. This necessitates power flow control to shift from mechanical devices to static devices. The power electronic based FACTS introduced in 1980's, provided a highly efficient and economical means in solving various problems related to power systems. Improved utilization of the existing electrical network with the employment of FACTS devices has become mandatory [2-5].

Out of all FACTS devices, static VAR compensator (SVC) has been the most extensively used in power systems. This device can deliver a very quick control of the susceptance and thus the reactive power supplied to transmission lines, which maintains the node voltage at or near a constant value thereby enhancing the power system performance [6, 7]. SVC offers many prospects for improvement of performance of the power system.

This paper offers Galaxy based Search Algorithm for Generation Reallocation of generator buses in the power system, with SVC and without SVC device to reduce real power losses and cost of real power generation and its performance is compared with Genetic Algorithm (GA). GbSA is a recent metaheuristic method with many advantages in comparison the existing methods [8, 9]. The obtained results show that SVC is a very efficient shunt compensation device and it can minimize the system real power losses very efficiently. Simulation is carried out in MATLAB for IEEE14 test bus system.

2. GALAXY BASED SEARCH ALGORITHM

In 2011, Hamed Shah-Hosseini introduced the concept of Galaxy based Search Algorithm(GbSA).It is a nature inspired metaheuristic algorithm which is positioned on a variable neighborhood search algorithm. GbSA is based on two main components. Spiral chaotic move: by using spiral movement, the Spiral chaotic moves searches around the current best solution This movement uses some chaotic variables around the current best solution. If it obtains a better solution than the current solution, it immediately updates and goes for the local search to obtain more suitable solution around the newly updated solution [3,7]. Local search: This component is activated to search locally around the newly updated solution. The local search ensures the exploitation of search space and spiral chaotic move provides exploration of the search space ensuring towards the global optimum solution.

2.1. Parameters of GbSA:

L = the number of components for candidate solution.
S = the current solution with L components.
SNext = the output of the local search.
ΔS= the step size which is set by the function Next Chaos.
Kmax = the maximum iteration that the local search has to search around a component to find a better solution.
Max Rep = is the maximum iteration that the spiral chaotic move searches.
$\Delta\theta$ = is an initial parameter.
Δr=function Next Chaos in each call.

2.2. Algorithm of GbSA

Implementation of Galaxy based Search Algorithm in Generation reallocation
STEP 1: Generate the initial solution.

$$F1 = [0.25 * abs(TL) + 0.25 * SM + 0.25 * VD + 0.25 * PQ12]$$