Improving System Static Security Via Optimal Placement Of Static Var Compensator Using Multi Verse Optimizer (MVO)

Siti Nur Hazirah Asmadi[1], Nor Rul Hasma Abdullah[2], Ibrahim Haruna Shanono[1] , Mahfuzah Mustafa[2], Rosdiyana Samad[2]

[1] Kolej Kejuruteraan, Universiti Malaysia Pahang, 26600 Pekan, Malaysia
[2] Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik, Universiti Malaysia Pahang, 26600 Pekan, Malaysia
**Snhzrhasmdi@gmail.com*

Keywords: Multi Verse Optimizer (MVO), Static VAR Compensator (SVC), FACTS, Loss Minimization

Abstract

Numerous Flexible AC Transmission System (FACTS) devices have been installed in transmission networks in recent years. Due to energy demand rising, so does load consumption, resulting in increased power losses. This paper aims Multi Verse Optimizer (MVO) for transmission loss minimization and to optimize the location and sizing of Static VAR Compensator (SVC) to be installed. Multi Verse Optimizer (MVO) approach is suggested as a solution to improve system static security and optimize location sizing via optimal placement of SVC then validate it on standard IEEE 30-bus Reliability Test System (RTS) system. The objective function of this research is to minimize power loss using MVO by determining the location and sizing of SVC to be installed in the system. The obtained results demonstrate that installing SVCs in the system can aid in minimizing losses in weak and secure buses. The expected result shows that using MVO can determine the optimal parameters and reduce losses.

1 Introduction

In the last several years, many FACTS (Flexible AC Transmission System) devices have been deployed in transmission systems. Since the transmission system has a large percentage of renewable energy, this is a natural consequence. Transmission network controllability and stabilization, and power transfer capacity may be improved with the employment of FACTS devices in combination with other power system equipment[1]. The SVC is the most often used FACTS device and used to fine-tune and enhance voltage stability. The reactive resource, the Static VAR Compensator (SVC), employs power electronics to adjust its reactive power output in order to regulate bus voltage. It can deliver dynamically changeable reactive power between higher and lower limits and can be described by a changing shunt susceptance. The higher the expense of SVC installation, the greater the rise in susceptibility need. Thus, the best cost of size and placing SVC may be expressed by employing SVC with the lowest susceptibility. Voltage stability may be improved and fine-tuned by using the static VAR compensator (SVC). SVC is a critical FACTS device for optimising power flow. The main advantage of SVCs over compensatory schemes is their immediate reaction to system voltages. SVC is a more reliable and faster gadget. SVC does not have a moving or rotating component like synchronous compensators. Flexible AC transmission systems (FACTS) such as Unified Power Flow Controller (UPFC) and Static Synchronous Compensator (STATCOM) are more costly. A number of academic initiatives have used it for data analysis[2].

In various fields of study, optimization techniques are used to create solutions that maximize or reduce specific research parameters, such as minimizing expenses in the manufacture of a thing or service, maximizing earnings, minimizing raw materials in the creation of a good or maximizing productivity. Nature inspired the bulk of population-based stochastic optimization approaches. As the name suggests, such strategies optimise at random. The optimization method usually starts with the development of a collection of random solutions. These basic answers are then integrated, shifted, or developed over a certain number of iterations or generations. This is the fundamental building block of all population-based algorithms. An algorithm is distinguished from others in this area by its merging, shifting, or developing solutions during optimization. Genetic Algorithms (GA), for example, employ natural selection to identify the best solutions and then merge them based on chromosomal reproduction. Particle Swarm Optimization (PSO) was inspired by how birds think socially and individually while flying. As a result, candidate solutions must wander about a search space regarding their own individual best position gained thus far and the best place determined by the swarm thus far[3].

In this paper, a heuristic-based Multiverse Optimizer (MVO) approach is suggested as a solution to improve system static security and optimize location sizing via optimal placement of Static VAR Compensator (SVC). MVO, as the name suggests, is inspired by physicists' multiverse idea. The MVO is created by mathematically simulating three essential notions of the multiverse theory (white hole, black hole, and wormhole). So, the system static security can be improved via optimal placement of Static VAR Compensator using Multi Verse Optimizer (MVO). The efficiency of the MVO approach is

Authorized licensed use limited to: Universiti Malaysia Pahang Al Sultan Abdullah (UMPSA).. Downloaded on July 19,2024 at 08:13:26 UTC from IEEE Xplore. Restrictions apply.