Cuckoo Search Algorithm as an Optimizer for Optimal Reactive Power Dispatch Problems

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Abstract—This paper presents the application of Cuckoo Search Algorithm (CSA) in optimizing the control variables of power system operation in solving the optimal reactive power dispatch (ORPD) problem. CSA is inspired by the parasitic behavior of Cuckoo birds in reproduction process based on the probability for a host bird in discovering an alien egg in its nest. The implementation of CSA in determining the optimal value of control variables such as generator bus voltages, transformer tap setting and shunt reactive elements in order to obtain the minimize loss in the system. In this paper, IEEE-30 bus system is utilized to show the effectiveness of CSA and then the comparison with other nature inspired algorithms will be presented.

Keywords-cuckoo search algorithm, loss minimization, nature inspired algorithms, optimal reactive power dispatch

I. INTRODUCTION

Optimal Reactive Power Dispatch (ORPD) is one of the complex problems in power system planning and operation which can be treated as a sub-problem of optimal power flow (OPF) problems. One of the main objectives of ORPD is to obtain a minimum power loss in the system by configuring the control variables while fulfilling all the system's constraints. The control variables that need to be optimized are voltage magnitude of generator buses, transformer tap setting as well as shunt reactive elements.

Recently, there are various nature inspired algorithms that have been applied to solve the ORPD problems such as Artificial Bee Colony (ABC), Grey Wolf Optimizer (GWO) [2], Gravitational Search Algorithm (GSA) [3], Chaotic Krill Herd Algorithm (CKHA) [4] and many more.

This paper intends to propose a nature inspired based algorithm namely Cuckoo Search Algorithm (CSA) in order to obtain an optimal solution of ORPD problem especially in loss minimization problem. Even though there is a work has been done in similar field such as discussed in [5], the different approach has been taken in this study which is the integration between CSA with MATPOWER software package [6] so that the accurate and precise loss calculation can be obtained. CSA on the other hand is a nature inspired algorithm proposed by Yang and Deb [7] in 2009 that mimic the brood parasitism behavior of Cuckoo birds.