

Total Transfer Capability Enhancement Using Hybrid Evolutionary Algorithm

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ABSTRACT

In this paper, a new hybrid evolutionary algorithm (HEA) based on evolutionary programming (EP), tabu search (TS) and simulated annealing (SA) is proposed to determine the total transfer capability (TTC) of power transfers between different control areas in deregulated power systems. The HEA simultaneously searches for real power generations except slack bus in a source area, real power loads in a sink area and generation bus voltages. Multi-objective optimal power flow (OPF) including TTC, system real power loss and penalty functions is used to evaluate the feasible maximum TTC value and minimal power loss within real and reactive power generation limits, thermal limits, voltage limits and stability limits. The proposed algorithm is tested on the modified IEEE 24-bus reliability test system (RTS) and compared to other heuristic optimization methods. Test results indicate that TTC calculation using the HEA algorithm could enhance TTC far more than the other methods, leading to an efficient utilization of the existing power systems.

Key words: Hybrid Evolutionary Algorithm, Optimal Power Flow, Total Transfer Capability

INTRODUCTION

Available transfer capability (ATC) is a measure of the transfer capability remaining in a physical transmission network for further commercial activity over and above already-committed uses (NERC, 1996). It is required to be calculated for each control area and posted on a public communication system to enhance the open-access of a transmission network by providing a market signal of the capability of transmission systems to deliver electric energy (FERC, 1996). Mathematically, ATC is defined as the total transfer capability (TTC) less the transmission reliability margin (TRM), and less the sum of the capacity benefit margin (CBM) and the existing transmission commitments (ETC).

Total transfer capability (TTC) is the main component for the ATC computation. TTC is defined as the amount of electric power that can be transferred over the interconnected transmission network in a reliable manner while meeting all of a