Optimal Placement of Multi-Type Facts Devices by the Hybrid Tabu Search / Simulated Annealing Approach

Pornrapeepat Bhasaputra

Abstract

In this dissertation, hybrid tabu search and simulated annealing (TS/SA) approach is proposed to find the optimal placement of multi-type FACTS devices to simultaneously minimize the total generator fuel cost and violation function. The problem is decomposed into the multi-objective optimal placement (MOOP) of multi-type FACTS devices subproblem that is searched by the hybrid TS/SA approach and the multi-objective optimal power flow (MOOPF) with multi-type FACTS devices subproblem that is also solved by the hybrid TS/SA approach and quadratic programming (QP). Four types of FACTS devices are used: thyristor-controlled series capacitor (TCSC), thyristor-controlled phase shifter (TCPS), unified power flow controller (UPFC), and static var compensator (SVC). The solution includes multi-location and multi-type of FACTS devices. Test results on the modified IEEE 30 bus indicate that the proposed hybrid TS/SA approach obtains less combined total generator fuel cost and violation function and requires less computing times than genetic algorithm (GA), SA, or TS alone. The loadability of the MOOPF with multi-type FACTS devices placed by hybrid TS/SA on the modified IEEE 30 bus, IEEE 57 bus, IEEE 118 bus, and EGAT 160 bus systems are higher than those placed by the sensitivity method. Furthermore, six multi-type FACTS devices can increase the maximum load factor by 10% without overloaded line and voltage violation on the modified Electricity Generating Authority of Thailand (EGAT) 160 bus system.