

Solving the Economic Load Dispatch Problem Using Differential Evolution

Authors : Alaa Sheta

Abstract : Economic Load Dispatch (ELD) is one of the vital optimization problems in power system planning. Solving the ELD problems mean finding the best mixture of power unit outputs of all members of the power system network such that the total fuel cost is minimized while sustaining operation requirements limits satisfied across the entire dispatch phases. Many optimization techniques were proposed to solve this problem. A famous one is the Quadratic Programming (QP). QP is a very simple and fast method but it still suffer many problem as gradient methods that might trapped at local minimum solutions and cannot handle complex nonlinear functions. Numbers of metaheuristic algorithms were used to solve this problem such as Genetic Algorithms (GAs) and Particle Swarm Optimization (PSO). In this paper, another meta-heuristic search algorithm named Differential Evolution (DE) is used to solve the ELD problem in power systems planning. The practicality of the proposed DE based algorithm is verified for three and six power generator system test cases. The gained results are compared to existing results based on QP, GAs and PSO. The developed results show that differential evolution is superior in obtaining a combination of power loads that fulfill the problem constraints and minimize the total fuel cost. DE found to be fast in converging to the optimal power generation loads and capable of handling the non-linearity of ELD problem. The proposed DE solution is able to minimize the cost of generated power, minimize the total power loss in the transmission and maximize the reliability of the power provided to the customers.

Keywords : economic load dispatch, power systems, optimization, differential evolution

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