International Journal of Innovative
Computing, Information and Control
Volume **7**, Number **1**, January **2011**

 ISSN 1349-4198
pp. **189–202**

A NEW HYBRID FUZZY ADAPTIVE PARTICLE SWARM OPTIMIZATION FOR NON-CONVEX ECONOMIC DISPATCH

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Received July 2009; revised November 2009

Abstract. *In the electric power systems, there is a wide range of problems involving optimization processes. Among them, Economic Dispatch (ED) is one of the most important problems in the operation and management. Recently, modern meta-heuristic algorithms have been considered as effective tools for nonlinear optimization problems with applications to power systems scheduling. PSO is one of modern heuristic algorithms, in which particles change place to get close to the best position and find the global minimum point. The basic disadvantage of classic PSO is the fact that it may miss the optimum and provide a near-optimum solution in a limited runtime period. Moreover, the premature convergence of PSO degrades its performance and reduces its search capability that leads to a higher probability towards obtaining a local optimum. Therefore, this paper proposes a novel and efficient hybrid algorithm based on combing fuzzy adaptive PSO and Differential Evolution (DE), called FAPSO-DE, to solve ED problems. PSO is the main optimizer and the DE is used to maintain the population diversity and prevent leading to misleading local optima for every improvement in the solution of the PSO run. Also, a fuzzy system is used to tune its parameters such as inertia weight and learning factors. In order to validate of the proposed algorithm, it is applied to a system consisting of 13 and 40 thermal units whose fuel cost function is calculated by taking account of the effect of valve-point loading.*

Keywords: Economic dispatch, Fuzzy adaptive particle swarm optimization, Hybrid evolutionary algorithms

1. **Introduction.** Economic dispatch (ED) has been considered to be one of the key functions in electric power system operation. The ED problem is commonly formulated as an optimization problem, with the aim of minimizing the total generation cost of the power system but still satisfying specified constraints.

There are different algorithms to find rate of optimum product for each power generation unit. Conventional algorithms such as lambda iteration, gradient method, and Newton method can solve the ED problems [1-9].

Power plants usually have multiple valves that are used to control the power output of the unit. When steam admission valves in thermal units are first opened, a sudden increase in losses is observed. This leads to ripples in the cost function, which is known as the valve point loading. This paper focuses on ED with valve-point loading effects (EDVL), which is a non-convex problem. Conventional techniques offer good results, but when the search space is nonlinear and has discontinuities, they become very complicated with a slow convergence ratio and do not always seek the optimal solution.

Recently, as an alternative to the conventional mathematical approaches, the heuristic optimization techniques such as genetic algorithms (GA) [10,11], Tabu search (TS) [12],