Economic Emission Load Dispatch using , Interval Differential Evolution algorithm

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Keywords: *Interval arithmetic; Branch and bound algorithm; Differential Evolution; Shrinking box; Fuel cost; Emission.*

Abstract

Differential Evolution (DE) algorithm is a heuristic approach for minimizing nonlinear and non-differentiable continuous space functions; see Storn (1997). However, the implementation of DE requires some estimate of the global minimum to be provided, which is difficult for any arbitrary function. Also, the termination with maximum number of iterations does not assure the global minima. Moreover, as the region of global minimum approaches, the convergence of the algorithm is very slow.

In order to overcome these drawbacks, we propose here a Modified Differential Evolution algorithm (MDE) which uses interval analysis; see Moore (1966) in three phases. In the first phase of MDE, global minimum is roughly estimated with the application of interval arithmetic, which provides the upper and lower bounds of the objective function. In the second phase of MDE an interval branch and bound algorithm is used, to initialize a potential population. In the third phase, MDE constructs a mechanism using interval arithmetic; see Sotiropoulos et al. (1997) which updates the bounds in each generation, and is able to define an efficient termination criterion. When the criterion is fulfilled, the algorithm converges to the global minimum with certainty with a lesser computational effort.

The proposed algorithm is applied to Economic Emission Load Dispatch (EELD)problem; see Dhillon et al. (1993). The purpose of EELD is to obtain the optimal amount of generated power for the fossil based generating unit in the system by simultaneously minimizing the fuel and emission costs. We choose IEEE 30 bus, six generator system as a test system and obtain lesser fuel and emission costs in lesser computational time as compared to conventional Differential Evolution algorithm.

References

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