

Accepted Manuscript

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PII: S1568-4946(18)30192-3
DOI: <https://doi.org/10.1016/j.asoc.2018.04.006>
Reference: ASOC 4810

To appear in: *Applied Soft Computing*

Received date: 29-11-2017
Revised date: 27-3-2018
Accepted date: 3-4-2018

Please cite this article as: Gonggui Chen, Xingting Yi, Zhizhong Zhang, Huiming Wang, Applications of multi-objective dimension-based firefly algorithm to optimize the power losses, emission, and cost in power systems, *Applied Soft Computing Journal* <https://doi.org/10.1016/j.asoc.2018.04.006>

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Applications of multi-objective dimension-based firefly algorithm to optimize the power losses, emission, and cost in power systems

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Highlights

- A new multi-objective dimension-based firefly algorithm (MODFA) is proposed for MOOPF problem.
- A constrained Pareto-dominant approach is proposed for handling constraints.
- Three test systems with nine cases are tested to verify the proposed algorithm.
- Three performance metrics are employed to estimate approximation, distribution, and diversity.
- Compared results show MODFA outperforms the NSGA-III, NSGA-II, and MOPSO algorithm.

ABSTRACT

In this paper, a new multi-objective dimension-based firefly algorithm (MODFA) is proposed for solving the constrained multi-objective optimal power flow (MOOPF) problem with multiple and contradictory objectives in power systems. In our suggested MODFA algorithm, a constrained Pareto-dominant approach (CPA) is offered for guaranteeing zero violations of various inequality constraints on state variables in the constrained MOOPF problem. In addition to that, the CPA and the dimension-based technology (DT) are federated together to update the information of the non-dominant firefly to speed up the convergence of multiple target search. Crowding distance and non-dominated sorting based on the violation of constraints are also regarded as measures to sustain well-distributed Pareto optimal solution (POS) set. Furthermore, a fuzzy affiliation is utilized to pick the best compromise solution (BCS) from the obtained POS. The IEEE30-bus system, the IEEE57-bus system, and the IEEE118-bus system with nine cases are implemented to validate the performance of the proposed MODFA by considering the active power losses, the emission, and the total fuel cost. The

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