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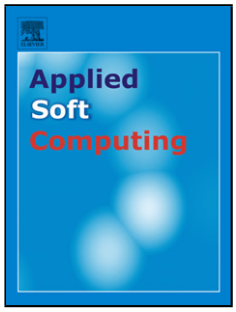

Title: Differential evolution mutation operators for constrained multi-objective optimization

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Differential evolution mutation operators for constrained multi-objective optimization

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Highlights

- Infeasible solutions are randomized, instead of undergoing DE mutation. Major mutation is to make individual search around the whole objective space. It emphasizes the global search. While minor mutation is to make individuals search around the local neighborhood. It focuses on local search. At the early stage of evolution, global search can be achieved by major mutation. At the middle and later stage of evolution, the local search is fortified by minor mutation.
- The DE mutation operator in feasible solutions is modified so that the solutions are re-ordered according to their Pareto rank and density. The novel mechanism can balance convergence and diversity.
- Systematic experiments have been conducted on a series of benchmark functions. The experimental results have indicated that the proposed DE algorithm is competitive compared with three constraint handling techniques and evolutionary algorithms.
- The proposed method is used to solve combined economic emission dispatch (CEED) problem. Compared with γ-iteration, recursive, simplified recursive, PSO, DE, GA similarity and gravitational search algorithm (GSA), the proposed method has achieved better results for two test systems. The finding has further validated the effectiveness of the method.

Abstract: Many real-world optimization problems belong to constrained multi-objective optimization problems (CMOPs). Handling constraints and optimizing objectives are two equally important goals. With effective and efficient population-based meta-heuristics in mind, how to generate the offspring with good convergence and diversity properties is a problem to be solved. Competitive algorithms based on different evolution (DE) metaphors have been proposed to solve CMOPs over years as the performance of the DE is attractive. The creative idea of the proposed algorithm is to design a novel mutation mechanism for handling infeasible solutions and feasible solutions respectively. The mechanism can produce well distributed Pareto optimal front while satisfying all concerning constraints. The performance of the algorithm is evaluated on nineteen benchmark functions. Compared with three representative constraint handling techniques and latest optimization algorithms, experimental results have indicated that the proposed algorithm is an effective candidate for real-world problems. At last, the proposed method is used to solve combined economic emission dispatch (CEED) problem. The experiment results have further