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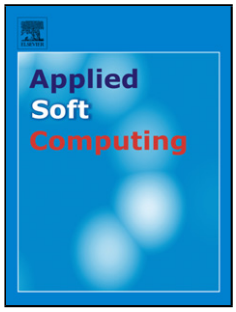

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Hybrid Multi-objective Evolutionary Algorithms based on Decomposition for Wireless Sensor Network Coverage Optimization

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Highlights

- This paper models the coverage control optimization problem in WSN as a multi-objective optimization problem with three objectives, including the energy consumption, the coverage rate and the equilibrium of energy consumption.
- In order to diversify the search, two reproduction operators based on Genetic Algorithm (GA) and Differential Evolution (DE) have been hybridized in Hybrid-MOEA/D-I to obtain a better Pareto solution set.
- To further enhance the search ability of Hybrid-MOEA/D-I and preserve high quality individuals in each generation, a new Hybrid-MOEA/D-II algorithm is devised to integrate an improved discrete binary particle swarm optimization algorithm as the enhancement strategy to obtain a better Pareto solution set.
- Large amount of experiments have been carried out to test our proposed algorithms which demonstrate the effectiveness of the proposed algorithms.

Abstract—In Wireless Sensor Networks (WSN), maintaining a high coverage and extending the network lifetime are two conflicting crucial issues considered by real world service providers. In this paper, we consider the coverage optimization problem in WSN with three objectives to strike the balance between network lifetime and coverage. These include minimizing the energy consumption, maximizing the coverage rate and maximizing the equilibrium of energy consumption. Two improved hybrid multi-objective evolutionary algorithms, namely Hybrid-MOEA/D-I and Hybrid-MOEA/D-II, have been proposed. Based on the well-known multi-objective evolutionary algorithm based on decomposition (MOEA/D), Hybrid-MOEA/D-I hybrids a genetic algorithm and a differential evolutionary algorithm to effectively optimize sub-problems of the multi-objective optimization problem in WSN. By integrating a discrete particle swarm algorithm, we further enhance solutions generated by Hybrid-MOEA/D-I in a new Hybrid-MOEA/D-II algorithm. Simulation results show that the proposed Hybrid-MOEA/D-I and Hybrid-MOEA/D-II algorithms have a significant better performance compared with existing algorithms in the literature in terms of all the objectives concerned.