Intelligent Automation and Soft Computing, Vol. 15, No. 3, pp. 361-384, 2009

A MULTI-OBJECTIVE EVOLUTIONARY ALGORITHM USING MIN-MAX STRATEGY AND SPHERE COORDINATE TRANSFORMATION

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ABSTRACT—Multi-objective evolutionary algorithms using the weighted sum of the objectives as the fitness functions feature simple execution and effectiveness in multi-objective optimization. However, they cannot find the Pareto solutions on the non-convex part of the Pareto frontier, and thus are difficult to find evenly distributed solutions. Under the circumstances, this paper proposes a new evolutionary algorithm using multiple fitness functions. Although the weights generated via the sphere coordinate transformation and uniform design are used to define the fitness, the fitness is not defined by the weighted sum of the objectives. Instead, it is defined by the maximum value of the weighted normalized objectives using a min-max strategy. In this manner, the proposed algorithm can overcome the drawbacks of the algorithms using the weighted sum of the objectives, and explore the objective space to find approximate uniformly distributed solutions on the Pareto front gradually. The numerical simulations show the proposed algorithm outperforms the existing ones.

Key Words: Evolutionary Algorithm, Multi-Objective Optimization, Min-Max Strategy, Sphere Coordinate Transformation, Uniform Design