# Application of Group Based Sorting Method to Multiple-Constrained Optimization Problems

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The purpose of this study is to develop a new method for multiple-constrained optimization problems. In real-world optimization problems, it is necessary to consider multiple constraint conditions. In the past researches, various constraint satisfaction methods have been proposed. In penalty function methods, an objective function is transformed to an unconstrained function by merging constraints with objective function. Furthermore, hybrid methods like multi-phased optimizations have been proposed in order to optimize the objective function and satisfy constraint conditions separately. In the former, the complexity of optimization depends on the formulation of transformed function like weighting or ranking of constraint conditions. However, it is difficult to determine an appropriate function in multiple-constrained optimization problems. Moreover, probabilistic search methods like Genetic Algorithm (GA) or Particle Swarm Optimization (PSO) have more difficulty in solving multiple-constrained optimization problems with penalty methods, because they require a lot of evaluation process of objective function. In addition, these methods have possibility not to obtain useful solutions because it is difficult to treat solution candidates which violate constraint conditions.

In this study, an attempt is made to propose Group Based Sorting (GBS) method for probabilistic searches as a useful method for the multiple-constrained optimization problems. In the GBS method, solution candidates are grouped and ranked based on a criterion for objective function or constraint satisfaction in each group respectively. In this way, the proposed method can consider the priority among constraints and evaluate violated solution candidates easily. Unlike the conventional methods, the proposed method does not need complicated formulation for the constraint satisfaction. In this study, the proposed GBS method is applied to GA and PSO. Numerical examples are presented to demonstrate the effectiveness of the proposed method to multiple-constrained optimization problems.