

SELF ORGANIZING MULTI-OBJECTIVE OPTIMIZATION PROBLEM

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ABSTRACT. *Weighted-sum approach genetic algorithm (GA) is one of the popular methods applied to solve multi-objectives optimization problems because it is a straight forward formulation and computationally efficient. However, this approach has some limitations because of the difficulty in selecting an appropriate weight for each objective and the need of some knowledge about the problems. The weight selection is a subjective decision which is usually based on trial and error, and is impractical for complex engineering problems. In order to overcome these problems, this paper proposes a new self organizing genetic algorithm (SOGA) for multi-objective optimization problems. The SOGA involves GA within GA evaluation process which optimally tunes the weight of each objective function and applies weighted-sum approach for fitness evaluation process. This algorithm has been tested for optimization of components placement on printed circuit boards. The results show that SOGA is able to obtain a better minimum value as compared to other methods such as fix weight GA, random weight GA and formulated weight based GA methods.*

Keywords: Genetic algorithm, Weighted-sum approach, Multi-objective optimization problems, Printed circuit board, Resistance thermal network

1. Introduction. Most real world problems are generally based on multi-objective functions which are usually conflicting in nature. In order to optimize these functions, we need to adjust the design variables while satisfying design constraints simultaneously. The process may pose some difficulty, which may need some compromise in the design criteria.

One of the earliest methods used to solve these types of problems is the weighted-sum approach [1]. This approach is popular because it is computationally efficient and requires straightforward implementation of combining the individual objective functions into a single composite scalar function. However, in practice, it can be very difficult to precisely and accurately select the appropriate weights for each objective function even by someone who is familiar with the problem domain. The best optimal solution which satisfies all objective functions is difficult to obtain and often results in unacceptable solution with respect to the other objective functions.

During the 1990's many approaches have been developed using optimization technique such as genetic algorithm (GA) in combination with the weighted sum approach for solving multi-objective problems [2-6]. GA is a population-based evolutionary approach, which searches for a possible solution in different regions of solution space simultaneously. This makes it possible to find a diverse set of solutions for non-linear, non-convex, discontinuous and complex problems.