A-GWASF-GA: the new version of GWASF-GA to solve many objective problems.

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A new version of the evolutionary algorithm based on GWASF-GA [1] is proposed in this work. GWASF-GA is an aggregation-based algorithm which uses the Tchebychev metric plus an augmentation term as fitness function and two reference points (the utopian and nadir points) to classify the individuals according to a set of widely-distributed weight vectors. Although this algorithm obtains a good approximation of the Pareto front (PF) for multi-objective optimization problems, this may be more difficult to obtain for many-objective optimization problems due to the fact that the weight vectors used are never updated along the search process. For this reason, we propose a new version of the algorithm, called A-GWASF-GA, in which a dynamic adjustment of the weight vectors is carried out. The main idea is to re-calculate some weight vectors in order to obtain solutions in parts of the PF with a lack of solutions. Firstly, a percentage (p) of the total number of evaluations is performed with the original GWASF-GA [1]. Secondly, during the rest of evaluations (1-p), we re-calculate n_a times the projection directions determined by a subset of N_a weight vectors. The re-calculation process is based on a scattering level, a measure based on the distance of each solution and the solutions around it. According to the scattering level of the generated solutions, we detect the N_a weight vectors projecting toward overcrowded areas of the PF and we re-calculate them so that their new projection directions point towards areas of the PF which are not so well approximated.

In order to show the effectiveness of A-GWASF-GA, we compare it with NSGA-III [2, 3], MOEA/D [4], MOEA/D-AWA [5] and the original GWASF-GA, considering ten problems with three, five, eight and ten objectives and with twenty and fifty decision variables. To evaluate their performance, we use the IGD metric [6]. The results of the computational experiment demonstrate the good performance of A-GWASF-GA in the novel many-objective optimization benchmark problems considered.

References

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