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Fragment Domination for Many-Objective Decision-Making Problems

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Abstract : This paper presents a number-based dominance method. The main idea is how to fragment the many attributes of the problem into subsets suitable for the well-established concept of Pareto dominance. Although other similar methods can be found in the literature, they focus on comparing the solutions one objective at a time, while the focus of this method is to compare entire subsets of the objective vector. Given the nature of the method, it is computationally costlier than other methods and thus, it is geared more towards selecting an option from a finite set of alternatives, where each solution is defined by multiple objectives. The need for this method was motivated by dynamic alternate airport selection (DAAS). In DAAS, pilots, while en route to their destination, can find themselves in a situation where they need to select a new landing airport. In such a predicament, they need to consider multiple alternatives with many different characteristics, such as wind conditions, available landing distance, the fuel needed to reach it, etc. Hence, this method is primarily aimed at human decision-makers. Many methods within the field of multi-objective and many-objective decision-making rely on the decision maker to initially provide the algorithm with preference points and weight vectors; however, this method aims to omit this very difficult step, especially when the number of objectives is so large. The proposed method will be compared to Favour (1 − k)-Dom and L-dominance (LD) methods. The test will be conducted using well-established test problems from the literature, such as the DTLZ problems. The proposed method is expected to outperform the currently available methods in the literature and hopefully provide future decision-makers and pilots with support when dealing with many-objective optimization problems.

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