Dear Emma Hart,

We are pleased to present an original research work entitled “VSD-MOEA: A Dominance-Based Multi-Objective Evolutionary Algorithm with Explicit Variable Space Diversity Management” by Joel Chacón Castillo, Carlos Segura and Carlos A. Coello Coello. In this work, an innovative technique for the multi-objective optimization field - called VSD-MOEA - is proposed. The first part of the paper highlights the important differences that have appeared between the more successful single-objective and multi-objective evolutionary optimizers. Then, these differences are used to guide the design of VSD-MOEA. The main novelty of VSD-MOEA dwell in the way of controlling the diversity. Particularly, it is the first Multi-objective Evolutionary Algorithm (MOEA) that explicitly considers the diversity of the decision variable and objective space in a simultaneous way by taking into account a dynamic approach to balance the importance of each kind of diversity. This is done by reducing the importance granted to the diversity of decision variable space as the generations progress. This principle of design is incorporated in the replacement phase. Additionally, a novel objective space density estimator is designed. Note that the principle of design studied in this paper might be incorporated in MOEAs of different kinds. In this case, it is incorporated into a dominance-based approach. The main contribution of the paper is showing that controlling explicitly the amount of diversity maintained in the decision variable space is useful to increase the quality of MOEAs when taking into account metrics of the objective space.

Experimental validation is carried out with some of the most popular and widely used benchmarks. These problems are the WFG, DTLZ, and UF. In addition to our proposal, the well-known NSGA-II, MOEA/D and R2-EMOA are considered to perform a full validation. This comparison shows the clear advantages of the novel proposal put forth in this paper. In addition to comparing against the state of the art, some additional experiments are attached with the aim of gaining a clearer understanding of the specifics of VSD-MOEA. They include an analysis of scalability in the decision variables, parameterization analyses and some studies regarding the stopping criterion. The analyses are performed both in terms of hyper-volume and IGD+. Proper statistical tests are used to ensure the validity of the attained conclusions. Overall, the benefits of the proposal are quite clear with the most important benefits appearing in the most complex test functions. The paper consist of 21 pages and, in addition, a supplementary material is attached. It includes an explanatory video that allows to clearly visualize the differences between our methodology and the ones used by the state of the art. In order to facilitate the replicability and future comparisons and with the aim of increasing the impact of this research, we have also attached the source code and it is available at github.

The proposal is robust and quite innovate in the field. Moreover it fulfills the aims and scope of the journal so we consider it to be a good paper for the Evolutionary Computation Journal. This manuscript has no been published and is not under consideration for publication elsewhere.

Thank you for your consideration.