

# Multi-concept Optimization vs. Multimodal Optimization

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## Abstract

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A major goal of multimodal optimization is to find alternative solutions by searching for multiple peaks in the landscape. Recently, in [1], we have suggested that the notion of multi-modal optimization, as related to that goal, is problematic on a fundamental level. This suggestion has been substantiated by demonstrating a paradox that is inherent to the common way multi-modal optimization is viewed. In addition to presenting the paradox, it is argued in [1] there that multi-concept optimization can be employed as an alternative to multimodal optimization to produce meaningful solution alternatives in both single and multi-objective problems.

The proposed presentation aims to substantiate the conclusions in [1] by way of a demonstration. It considers a real-life problem of finding alternative solutions for the design of a propulsion system. Two conflicting objectives dictate the search including maximization of the propulsion efficiency and minimization of the noise. The multi-concept optimization was conducted using the evolutionary algorithm of [2]. This constitutes a parallel search at different subsets of the entire set of solutions. It results not only with Pareto-optimal alternative solutions, but also with sub-optimal alternatives, which are meaningful for the designers. Based on the obtained alternatives, it is argued that under certain conditions the designers may prefer the alternatives, which are suboptimal.

## REFERENCES

- [1] Moshaiov, A. (2016) The Paradox of Multimodal Optimization: Concepts vs. Species in Single and Multi-objective Problems. To appear in the Proceedings of the 2016 IEEE Congress on Evolutionary Computation. Currently available at <http://www.eng.tau.ac.il/~moshaiov/Moshaiov%202016.pdf>
- [2] Moshaiov, A., Snir, A. and Samina, B. (2015) Concept-based evolutionary exploration of design spaces by a resolution-relaxation-Pareto approach. In the Proc. of the 2015 IEEE Congress on Evolutionary Computations.