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# DISCOVERING THE APPLICATIONS OF THE NEGLECTED CLASSIFICATION SURROGATE FOR ROCKET DESIGN OPTIMIZATION

**Abstract**

This paper aims to discover the useful applications of the neglected classification surrogate in design optimization. A review of design optimization algorithms reveals that classification-based approaches, despite their maturity, remain largely unexplored. To address this gap, a Surrogate Based Optimization (SBO) architecture is modified to support classifiers and benchmarked against comparable schemes. It is found through experimentation that classification surrogates enable fast estimations of feasible modes. This advantage is exploited to speed up convergence on existing optimizers by constraining the problem to the smaller feasible set. Synergies are found that enable the existing function evaluations to be reused to provide good regression surrogates of the feasible modes giving insight to performance impacts for a design point that is forcibly moved due to real life project uncertainties. This framework is particularly advantageous for applications where computational or experimental resources are limited, such as early-stage aerospace startups and low-budget RD teams. We introduce a novel classification-based SBO framework that efficiently identifies feasible design modes, significantly reducing the search space and improving convergence speed. The proposed method is benchmarked against conventional SBO approaches and applied to the multidisciplinary challenge of maximizing sounding rocket flight altitude.