

# Multiobjective Design of Complex Systems Using Surrogates <sup>1</sup>

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As an application of a Toolbox for Optimal Design that it is being developed, we consider the design of a full aircraft. By this we mean the combination of aerodynamics, structural and control analysis, within a full mission specification, that can include take-off, different cruising regimes, landing, and economical goals.

The key to the solution of this complex multiobjective optimization and modeling problem is to use a combination of multi-fidelity, surrogates, and parallelism. Surrogates replace costly full analysis by first creating a data base of input/outputs and then using that information to generate an analytic approximation that is comparatively inexpensive to evaluate. This surrogate functional is then used to generate "good" approximations to the Pareto front by using evolutionary algorithms.

The multi-fidelity approach helps in reducing even farther the cost of generating the data base for the surrogates by performing inexpensive analysis first and then refining that analysis only on those regions of parameter space where a more accurate treatment is required.

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