Model Refinement and Validation in Simulation-based Design Optimization
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The optimal design of complex systems in engineering requires the availability of mathematical models of system behavior as a function of a set of design variables; such models allow the designer to find the best solution to the design problem. However, system models (e.g. CFD analysis, physical prototypes) are usually time-consuming and expensive to evaluate, and thus unsuited for systematic use during design. Approximate models of system behavior based on a limited set of data allow significant savings by reducing the resources devoted to modeling during the design process.

This project is part of our research into methods to support engineering design based on computer simulation models, in which we use model approximation and optimization techniques to assist decision making during the design process. The goal of this specific project is to develop strategies for the sequential exploration of multi-dimensional design spaces with approximation models (a.k.a. metamodels). These strategies have the potential to reduce the number of model analysis that are required to reach an optimal solution to the design problem, thus resulting in significant savings in both time and cost.

Pre-requisites: (a) previous courses on numerical methods, statistics/design of experiments, optimization (optional); (b) Proficiency in computer programming (Matlab or C/C++).

If you are interested in this project, consider taking the course MIE1299H “Special Topics in Fluid Mechanics – Methodological Tools for Simulation-based Design Optimization”.