Methods for Computationally Expensive Large Scale Black Box Simulation Optimization

Scientific Achievement
Integration of sensitivity analysis methods in adaptive surrogate model algorithm for solving high-dimensional simulation optimization problems

Significance and Impact
Methodology will enable us to solve large scale optimization problems efficiently and effectively; applicability to a wide range of science problems, e.g. physics event generator tuning, smart building design

Research Details
– Iterative, adaptive method (see Fig. 1)
– Use sensitivity analysis to determine parameter importance
– Use a stepwise radial basis function (RBF) method to select only the most important parameters for the low-dimensional model fit
– Use the low-dimensional model to select a new sample point

Fig. 1: Flowchart of the algorithm

Fig. 2: Convergence plot for 20-d problem: lower graphs are better. “saiso”’= new method; “old”’= off-the-shelf surrogate optimizer; “2stage”’= first sensitivity analysis, then optimization on low-dim space

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