Active subspaces: emerging ideas for dimension reduction in computational science and engineering models

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ABSTRACT

Scientists and engineers use computer simulations to study relationships between a physical model's input parameters and its output predictions. However, thorough parameter studies—e.g., constructing response surfaces, optimizing, or averaging—are challenging, if not impossible, when the simulation is expensive and the model has several inputs. To enable parameter studies in these cases, the engineer may attempt to reduce the dimension of the model's input parameter space. Active subspaces are part of an emerging set of subspace-based dimension reduction tools that identify important directions in the input parameter space. I will (i) describe computational methods for discovering a model's active subspaces, (ii) propose strategies for exploiting the reduced dimension to enable otherwise infeasible parameter studies, and (iii) review results from several science and engineering applications. For more information, visit `activesubspaces.org`.