Exceptional service in the national interest

Sandia National Laboratories

Dakota: Algorithms for Design Exploration and Simulation Credibility
Data Analysis Capabilities

Dakota Goal: provide scientists and engineers (analysts, designers, decision makers) richer perspective on model predictions

➢ Software with suite of iterative mathematical and statistical methods that interface to computational models

➢ Makes sophisticated parametric exploration of black-box simulations practical for a computational design-analyze-test cycle
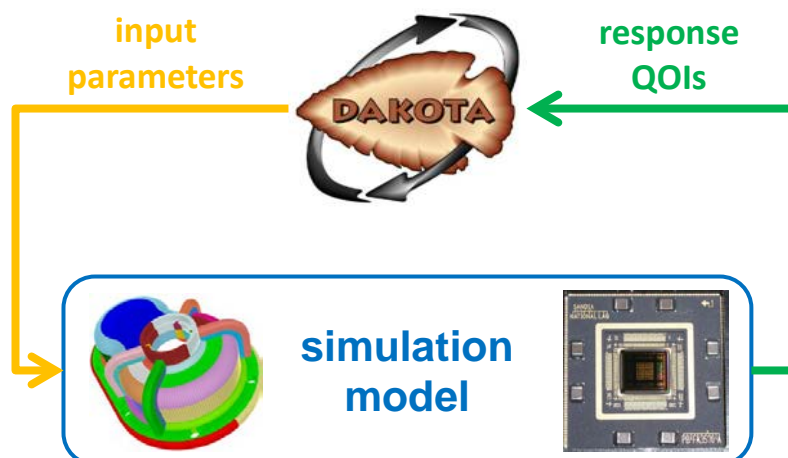
Sensitivity Analysis	Uncertainty Quantification
Design Optimization	Model Calibration

➢ Strategically selects input parameter values, runs simulations, and analyzes ensembles of resulting response quantities of interest (QOIs)

http://dakota.sandia.gov

CCR Center for Computing Research

Dakota Capabilities for Data Analysis

- **Sensitivity analysis** identifies most influential model parameters, components, or behaviors to help prioritize data gathering and model development

- **Deterministic model calibration,** with nonlinear least-squares optimization, finds point estimates of parameters that make the model most consistent with data

- **Statistical model calibration** (Bayesian or parametric) identifies statistical characterizations of parameters most consistent with data

- **Surrogate/response surface models** can be trained from data and serve as comparably inexpensive emulators of a computational model

- **Uncertainty quantification** yields statistics or intervals of simulation output due to input parameter uncertainty enabling uncertainty-aware validation assessments

✓ Free & open-source (LGPL)
✓ Scales from laptops to HPCs
✓ Portable (Windows, OS X, *NIX)
✓ Modern development practices
✓ Applications-driven research