Assessing the Impact of Sensitivity/Uncertainty-Based Selection Criteria on Computational Bias Prediction

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Goal and Role in DOE NCSP Mission

• Validation is an essential part of criticality safety
  – Sensitivity/Uncertainty (S/U) methods are used to form a validation suite of similar experiments to estimate computational bias
  – The S/U-based correlation coefficient, $c_k$, can be used to quantify similarity between an experiment and application
  – How similar is similar enough?

• Goal: Assess the relationship between the minimum $c_k$ threshold value and predicted computational bias
Method

- Develop a tool to calculate the predicted computational bias for a given application as a function of $c_k$ threshold.
- Apply this tool to critical experiment benchmarks with known computational biases:
  - Computational bias is defined by $\beta = C/E - 1$.
- Each application’s bias is predicted by averaging the computational biases of similar benchmark experiments.
- Then assess the bias misprediction:
  - The difference between the predicted and actual computational bias.
Results

Application: The 8 LEU-COMP-THERM-001 (LCT-001) benchmark cases in the SCALE Verified, Archived Library of Inputs and Data (VALID)

- Evaluation cases are excluded as minimum $c_k$ threshold increases
- Similar behavior for cases within the same evaluation
- What about LCT systems as a whole?
Results

Application: The 140 LEU-COMP-THERM (LCT) benchmark cases in VALID

- Larger variety of evaluations
- Noticeable differences in certain evaluations with respect to the mean
- What will this look like across multiple fissile system categories?
Conclusions and Future Work

- We have developed a tool that implements our proposed methodology and confirmed that it works correctly.
- The proposed method may be useful in performing the envisioned study to inform current guidance on $c_k$ thresholds.

**Future work:**
- Assess the impact of the $c_k$ threshold on different types of fissile systems.
- Analyze results across more categories of fissile systems in VALID and understand the impact of these findings.
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