14th World Congress on Computational Mechanics (WCCM XIV)
8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)
July 19–24, 2020, Paris, France

IMPROVING PREDICTIVE CAPABILITIES THROUGH MODEL ERROR QUANTIFICATION
TRACK NUMBER 800

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Key words: Model inadequacy, Model approximation, Model correction, Surrogate model error, Uncertainty quantification, Uncertainty propagation, Machine learning, Predictive modeling

ABSTRACT

Despite continuing advances in computational and data science, model inadequacy remains a concern in all areas of modeling and simulation for science and engineering applications. This inadequacy, or model form error, may be introduced by an incomplete understanding of the underlying physical phenomena and conditions and/or by the use of low-fidelity, reduced-order, or other approximate models, which are often necessitated by a limited computational budget.

Validation and calibration of a model correction, through the use of experimental data, higher-fidelity computational data, and machine learning, can improve the predictive capability of a given model and, arguably, increase the range of applicability of the computational model. However, these techniques are subject to the challenges of traditional model calibration, such as formulation and parameter estimation, and require careful consideration, as they are often problem specific. Quantifying the uncertainty and assessing the validity of these models in predictive and many-query settings is an active area of research.

Topics of particular interest include: Model correction techniques; Model discrepancy, model inadequacy, or model form error; Automated detection of model error; Surrogate model errors; Stochastic modeling; Uncertainty quantification and propagation; Machine learning.

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