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Abstract for an Invited Paper
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Calibration, Validation and Uncertainty Quantification for Hypersonic Reentry Vehicles[1]

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At the Center for Predictive Engineering and Computational Sciences at the University of Texas, we are engaged in an effort to characterize the uncertainties encountered in simulations of hypersonic reentry vehicles. Uncertainties arise from the modeling of several complex phenomena such as aerochemistry, thermal radiation, turbulence and ablation, and their interactions. Our approach to characterizing uncertainty is intimately connected to the process of determining uncertain model parameters through calibration and the assessment of model veracity through validation. The outlines of this approach will be described, including the use of Bayesian inference, treatment of uncertainty arising from modeling errors and validation criteria. As examples, application of this uncertainty quantification framework to several component problems will be described, including turbulence and chemical reaction mechanisms. Also discussed will be the sensitivities of simulations of a full-scale reentry vehicle to the various sources of uncertainties discussed above.

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