DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING
WILLIAM MAXWELL REED SEMINAR SERIES

"How to model uncertainty in complex systems: application to hypersonic flows."

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Abstract:

In many fields of engineering research, it is still common practice to resort to deterministic approaches when it comes to posing and solving inverse problems for the calibration of theoretical models. It is important to stress that this issue not only concerns active parameter fitting procedures but also the resulting comparisons between model predictions and experiments which drive model validation. This formulation fails at dealing with the uncertainties present in experimental data as well as epistemic uncertainties that stem from our limited knowledge about some model parameters. Furthermore, our limitations to produce unequivocal experiments to inform and validate our models lead to a crucial question, what can we really learn about a complex system if we need to make assumptions to fulfill the models' need for data? The role of uncertainties, and how they impact our capabilities to build predictive models and understanding of these systems, is still very poorly understood. As one of the key challenges in engineering today, modeling uncertainty becomes central to advancing our understanding of complex systems. In this talk, I will first introduce the Bayesian formalism to solving stochastic inverse problems by going through its constitutive steps. I will then show a practical example from my research on hypersonic flows about learning stochastic models for gas-phase chemical reaction rates from experiments in air plasmas.

Speaker Bio:

Dr. Anabel del Val is currently a postdoctoral researcher at the von Karman Institute for Fluid Dynamics (VKI), working on applying uncertainty quantification methods to hypersonic flow problems. She received her Ph.D. jointly from l'École Polytechnique (France) and VKI in 2021. During her Ph.D., she developed computational methodologies to solve Bayesian inference problems for high temperature gas-surface interaction models. For this work, she was awarded the prestigious Amelia Earhart Fellowship that recognizes female doctoral students in aerospace engineering who show promise for distinguished careers in research. Her research interests are in the development and application of novel stochastic methods to further the understanding of high-speed flows.

Date: Monday, February 20, 2023
Time: 3:00 PM EST
Place: Whitehall Classroom Building 118
Contact: Dr. Jesse Hoagg

Attendance open to all interested persons

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