

SEMINAR



SERIES

北京大学工学院

航空航天工程系

Accelerating Uncertainty Analysis for Complex Systems: Leveraging Physics-Informed Surrogate Models and Engineering Empirical Relationships



报告人: 李勇副教授

University of Alberta

时 间: 4月24日 周四 15:30-17:00

地 点: 北京大学工学院1号楼210会议室

Abstract: Uncertainty analysis is crucial for evaluating the reliability and performance of complex engineering systems, but traditional stochastic simulation methods can be computationally prohibitive when evaluating a single deterministic system response is computationally expensive. This talk explores two strategies for accelerating uncertainty analysis: physics-informed surrogate models and engineering empirical relationships. The first approach solves governing differential equations, representing the high-rigor extreme of modeling, using physics-informed neural networks to develop a surrogate model for Monte Carlo simulations. The second approach integrates empirical data-derived equations, at the other end of the rigor spectrum of modeling, with detailed mechanics-based finite element simulations to create a bi-fidelity model for uncertainty analysis. Two case studies are presented to illustrate these methodologies, demonstrating their effectiveness in balancing computational efficiency and accuracy. The findings highlight the potential of these approaches to enhance probability-based engineering design and risk assessment in uncertain environments.

Bio: Yong Li is currently an Associate Professor at University of Alberta, in Canada. He earned his Ph.D. degree in Structural Engineering from the University of California, San Diego, where he also completed his Master's degree in Applied Mathematics. Before that, he studied Civil Engineering at Tsinghua University and Beihang University in China, for his Master's degree and Bachelor's degree in Civil Engineering. Since joining the University of Alberta in 2017, Dr. Li has been actively conducting research on structural dynamics & earthquake engineering, computational mechanics, reliability & risk analysis, Bayesian parameter estimation, probabilistic performance-based engineering & risk-based maintenance planning, aiming to bridge theoretical innovations and practical engineering applications in bridges, buildings, and oil/gas pipelines. Dr. Li has helped secure \$5.8+ million in research funding as a principal investigator (PI) or co-principal investigator (Co-PI) at University of Alberta. In the past 8 years of his career as a Professor, Dr. Li has mentored over 40 trainees, including 4 postdoctoral fellows, 31 graduate students (12 Ph.D., 14 M.Sc., and 5 M.Eng.), and 5 undergraduates, many of whom now hold prominent roles as university professors, practicing engineers, and entrepreneurs. Along with his collaborators, he published 80+ peer-reviewed journal articles and numerous conference papers. Additionally, Dr. Li serves as an active member on various committees, both internally within the U of A and externally at the national level in Canada.

欢迎广大师生光临!