SORS: Scalable Uncertainty Quantification for Progressive Damage Models in Composite Structures

AI4S registration link

Abstract

We present a scalable methodology for uncertainty quantification (UQ) in high-dimensional problems involving advanced progressive damage models for composite materials. The approach combines bootstrapping and Bayesian UQ to robustly characterize the distribution of structural Quantities of Interest (QoIs), such as load-displacement curves and failure loads. Applied to a realistic 40-dimensional case study—Open Hole Tension and Compression specimens with variability in material properties, geometry, and ply orientations—the method delivers consistent and efficient predictions of QoI distributions. This approach is highly suited for industrial applications, and its computational scalability makes it ideal for leveraging supercomputing resources to handle complex models and large ensembles, ultimately accelerating the design and certification of next-generation composite structures.

Short Bio

Giuseppe Catalanotti holds an MSc in Mechanical Engineering from the University of Palermo (2007) and a PhD in Mechanical Engineering from the University of Porto (2011). He began his career as an Early Research Scientist in the MOMENTUM project (Marie Curie Action) and worked at Alstom Transport as a composites expert before transitioning to academia.

His research focuses on the structural integrity of advanced polymer composites, including fracture mechanics, computational modeling, and innovative testing methods. Dr. Catalanotti has supervised a number of PhD students and participated in several European Commission and industry-funded projects.

He has held visiting positions at the University of Girona and NASA Langley Research Center and has contributed to teaching and research initiatives at institutions such as the University of Porto, INEGI, and Queen's University Belfast. In 2021, he joined the University of Évora as an Associate Professor, earning his Habilitation in 2022. Currently, Dr. Catalanotti is an Associate Professor at the University of Enna "Kore".

Speakers

Speaker: Giuseppe Catalanotti, MSc in Mechanical Engineering from the University of Palermo and PhD in Mechanical Engineering from the University of Porto.
Host: Gerard Guillamet, researcher in CASE department in Dual Technologies, BSC
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