

SORS/WomenInBSC: Machine Learning-Accelerated Predictions of Design Allowable of Composite Laminates

Abstract

The generation of design allowables for composite laminates is crucial for aerospace composite structure design and certification. Typically, determining these design allowables involves costly and time-intensive experimental tests. With advances in computational power and high-fidelity numerical models that accurately simulate composite materials' responses, finite element simulations have emerged as alternatives to reduce certification costs, though they remain computationally demanding. Recent advancements in machine learning offer new possibilities for rapidly predicting materials' structural responses via surrogate models that describe the design space analytically and continuously.

A database of open-hole high-fidelity simulations was used to train machine learning algorithms, creating surrogate models capable of predicting the notched strength of various materials, layups, and notched geometries. These trained algorithms can predict the strength of open-hole multidirectional composite coupons with high-fidelity simulation precision in milliseconds, achieving a prediction speed-up of over 10,000 times.



Short Bio

Carolina Furtado has served as an Assistant Professor at the Faculty of Engineering – University of Porto (FEUP) since 2022. Earning her PhD from the FEUP in 2020, she further developed her expertise during a 2-year Postdoctoral research position at the Massachusetts Institute of Technology, USA. Her dedication to scientific excellence has been recognized with 8 merit-based awards, including a Fulbright Grant, an Amelia Earhart award, and the European-level ECCOMAS award for the best Ph.D. Thesis in Computational Methods in Applied Sciences and Engineering.

Carolina Furtado has made significant contributions to the scientific community through impactful scientific work on the virtual certification of composite materials and the determination of design allowables through machine learning-powered simulations.

Speakers

Speaker: Carolina Furtado, Assistant Professor at the Faculty of Engineering – University of Porto (FEUP)

Host: Gerard Guillamet, Dual Technologies Stablished Researcher, CASE, BSC

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