Composites Manufacturing & Simulation Center

MICHAEL J. BOGDANOR

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Originally from Columbia, MD, Mike received his B.S. Civil Engineering from Villanova University in 2009, where he also earned a Business minor and was a member of the Men's Lacrosse team. Upon graduation, he was employed at Bechtel Power Corporation performing structural steel design for the Ivanpah Solar Electric Generating System. After completion of Ivanpah's design, Mike left to pursue his PhD in Civil Engineering, which he received from Vanderbilt University in 2015. At Vanderbilt, he studied under Dr. Caglar Oskay in the Multiscale Computation Mechanics Laboratory where his primary research focus was the failure prediction of laminated composites using reduced order multiscale homogenization. He joined the CMSC at Purdue in January 2016 and lives in West Lafayette, IN with his wife, Merissa and daughter, Mikayla. He enjoys woodworking, lacrosse, and playing drums in the band at his church.

Research Interests

Multiscale modeling – Using reduced order computational homogenization techniques to accurately and efficiently predict the structural response of large systems from the local behavior of their constituents.

Failure prediction of composite materials – Utilizing multiscale modeling techniques to predict the failure of composite materials under static, dynamic, and cyclic loading. Predicting the accumulation in the heterogeneous microstructure to understand the growth and interaction of structural scale failure mechanisms.

Uncertainty quantification – Calibrating the behavior of complex systems in the presence of sparse and incomplete data. Utilizing statistical analysis methods and high performance computing to design robust and reliable systems that account for uncertainty from multiple sources.

Design and optimization automation – Formalizing end-to-end simulation approaches from manufacturing to performance to facility rapid design iteration and achieve optimal designs while significantly reducing the need for physical iteration of prototype designs.

Publications

M. J. Bogdanor, and C. Oskay. "Prediction of progressive fatigue damage and failure behavior of IM7/977-3 composites using the reduced-order multiple space-time homogenization approach." Journal of Composite Materials, Aug 26, 2016.

M. J. Bogdanor, and C. Oskay. "Prediction of Progressive Damage and Strength of IM7/977-3 Composites using the Eigendeformation Based Homogenization Approach: Static Loading." Journal of Composite Materials, May 25, 2016.

M. J. Bogdanor, C. Oskay, and S. B. Clay, "Multiscale Modeling of Failure in Composites under Model Parameter Uncertainty," Computational Mechanics, 56:389-404, 2015.

M. J. Bogdanor, S. Mahadevan and C. Oskay, "Uncertainty Quantification in Damage Model-ing of Heterogeneous Materials," International Journal for Multiscale Computational Engineering, 11(3):289-307, 2013

Figures

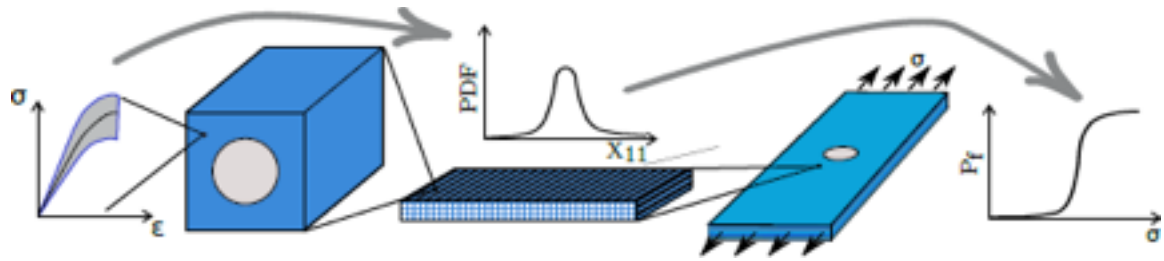

Figure 1. Multiple scales of uncertainty in a laminated composites structure from natural variability in constituent materials to laminate strength distributions

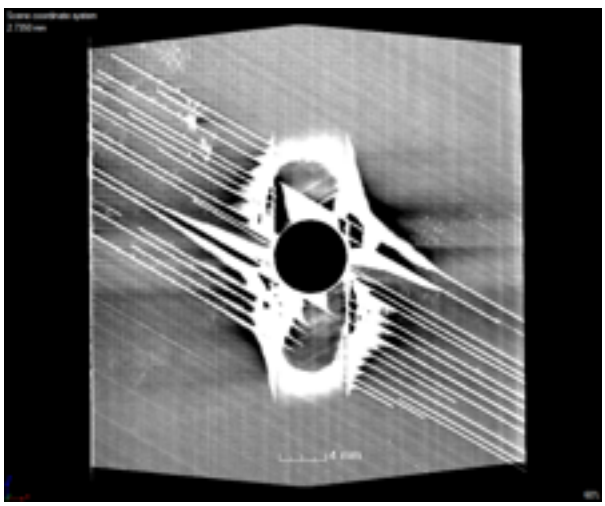

Figure 2. Interacting failure mechanisms in a [60,0,-60]3s coupon still able to carry significant load in the vertical direction

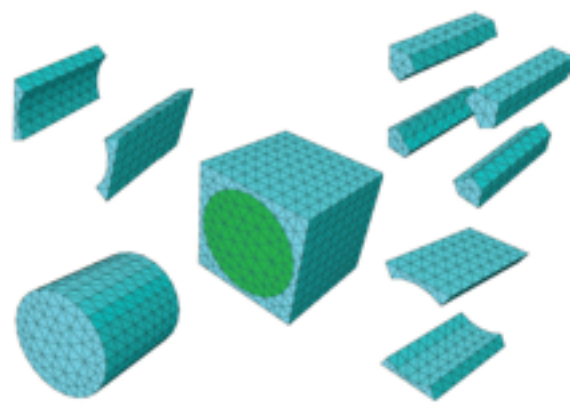

Figure 3. Graphical representation of a reduced order multiscale model used to predict the failure evolution of multiple local failure mechanisms in laminated composites

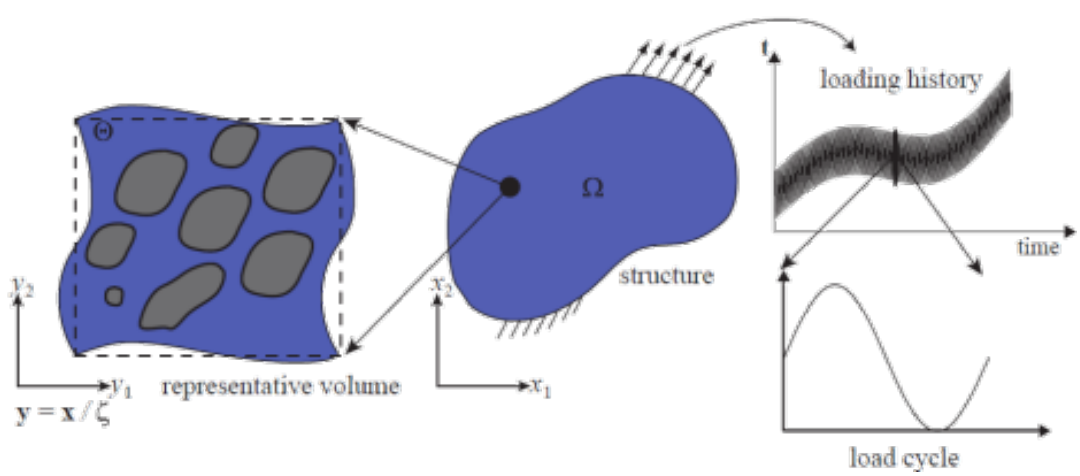

Figure 4. Multi-spatial/multi-temporal modeling framework.