Matthew Riley

Assistant Professor

Department of Mechanical Engineering

Computational Design and Optimization of Composite Structures under Uncertainty

Abstract

The structural design of many traditional aerospace structures has focused upon the use of metallic materials due to the wide availability of experimental data and the maturity of the computational models used to develop performance predictions. However, increasing material demands place upon aerostructures has given rise to the opinion that traditional metallic materials are no longer the optimal choice for structural design. Instead, modern composite materials—integrating multiple types of ceramic materials with different material properties in a specified manner—have risen to the forefront as a successor to metals for aerostructure design. However, a significant limitation to the use of these composite materials is the large number of parameters that are associated with the development of a material. As such, it is often excessively expensive to experimentally evaluate all possible configurations of different composite materials. This research proposes the development and validation of accurate and efficient computational models to predict the performance of these composite materials. This development will allow for cheap and inexpensive evaluation of different composite material configurations as well as allow for a rigorous approach to optimize the performance of these materials in an uncertain environment.