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Design and Mechanical Behaviors of Lightweight Composite Lattice Truss Sandwich Structures

Speaker: Jian Xiong*

Center for Composite Materials and Structures, Harbin Institute of Technology

*jx@hit.edu.cn

Abstract

Fiber-reinforced composites are a major class of lightweight structural materials used in a wide range of engineering fields, including the aerospace, automotive and marine structures field, due to their attractive mechanical properties, such as high specific stiffness and high strength. Constructing lattice truss sandwich materials from fiber-reinforced composites is an efficient approach for developing ultra-lightweight structural systems with superior mechanical properties and multifunctional benefits. In contrast to corrugated, foam and honeycomb core materials, composite lattice truss sandwich materials can be manufactured with various architectural designs, such as woven cores, grid cores and truss cores. Moreover, lattice materials with open cell topology provide multifunctional advantages over conventional closed cell honeycomb and foam structures, and are thus, highly desirable for developing aerospace systems, hypersonic vehicles, long-range rockets and missiles, ship and naval structures, and protective systems. The primary objective of this presentation is to review and analyze representative studies performed by Prof. Xiong's group in the area of composite lattice materials, and to highlight topics for future research.