ULTRALIGHT HYBRID-CORED SANDWICH CONSTRUCTIONS FOR SIMULTANEOUS LOAD BEARING, ENERGY ABSORPTION AND SOUND ABSORPTION

T. J. Lu

State Key Laboratory for Mechanics and Control of Mechanical Structures, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, P.R. China

ABSTRACT Sandwich constructions with either two-dimensional (2D) prismatic or three-dimensional (3D) lattice truss cores, such as honeycombs, folded panels (corrugations) and pyramidal trusses, are ultralight multifunctional structures: in addition to sustain structural loading, they can simultaneously absorb impact energy, dissipate heat, and attenuate sound. These properties can be significantly improved further by inserting different materials (e.g., open/close-celled foams, miniature honeycombs, ceramics, sand, liquid, and so on) into the interstices of the lattices to construct a multitude of novel hybrid lattice-cored sandwiches, as demonstrated in this lecture. Particular focus is placed upon two different types of hybrid lattice-core (i.e., metallic/polymeric foam-filled lattice core and metallic honeycomb-corrugation core) for simultaneous load bearing, energy absorption and broadband low-frequency sound absorption. Physical mechanisms underlying the remarkable performance enhancements and multi-functionalities of hybrid-cored sandwich structures are systematically explored using a combined approach of theoretical modeling, numerical simulation and experimental testing.