



Smart Composites: Mechanics and Design (Composite Materials)

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Smart Composites: Mechanics and Design addresses the current progress in the mechanics and design of smart composites and multifunctional structures. Divided into three parts, it covers characterization of properties, analyses, and design of various advanced composite material systems with an emphasis on the coupled mechanical and non-mechanical behaviors.

Part one includes analyses of smart materials related to electrically conductive, magnetostrictive nanocomposites and design of active fiber composites. These discussions include several techniques and challenges in manufacturing smart composites and characterizing coupled properties, as well as the analyses of composite structures at various length and time scales undergoing coupled mechanical and non-mechanical stimuli considering elastic, viscoelastic (and/or viscoplastic), fatigue, and damage behaviors.

Part two is dedicated to a higher-scale analysis of smart structures with topics such as piezoelectrically actuated bistable composites, wing morphing design using macrofiber composites, and multifunctional layered composite beams. The analytical expressions for characterization of the smart structures are presented with an attention to practical application.

Finally, part three presents recent advances regarding sensing and structural health monitoring with a focus on how the sensing abilities can be integrated within the material and provide continuous sensing, recognizing that multifunctional materials can be designed to both improve and enhance the health-monitoring capabilities and also enable effective nondestructive evaluation.

Smart Composites: Mechanics and Design is an essential text for those interested in materials that not only possess the classical properties of stiffness and strength, but also act as actuators under a variety of external stimuli, provide passive and active response to enable structural health monitoring, facilitate advanced nondestructive testing strategies, and enable shape-changing and morphing structures.

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