MS1L_12027

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

SMA Hybrid Composites: Self-healing, Self-Stiffening and Shape Control Simulations

Catherine L. Brinson, Deborah Burton, Xiujie Gao

Northwestern University, Evanston, USA

The usage of shape memory materials has extended rapidly to many fields, including medical devices, actuators, composites, structures and MEMS devices. For these various applications, shape memory alloys (SMAs) are available in various forms: bulk, wire, ribbon, thin film, and porous. In this paper, we consider the design and simulation of SMA Hybrid Composites with self-healing, self-stiffening and shape control functions. These composites are created by using SMA ribbons or wires inside a matrix material: SMA wires in a low melting point metallic matrix for self-healing materials or SMA wires/ribbons in a polymeric based composite panel/beam for adaptive stiffening or shape control via selective resistance heating. To study these materials, we develop an ABAQUS user element with an SMA constitutive law to simulate structural response of the SMA hybrid composites. Several examples are presented in which the critical design features and possibilities are highlighted.

View the extended summary