FEB 26, 2015

Advances in Aerospace Morphing Structures with Shape Memory Alloy Actuators

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ABSTRACT:

Advances in actuation materials development over the past two decades have led into the availability of solid state actuators undergoing reversible phase transformations with stable performance over a large span of actuation ranges. Various compositions of intermetallic Shape Memory Alloys (SMA) have emerged as actuator materials capable of providing large deformations at high actuation loads with reasonable reliability and performance. This presentation will provide an overview of recent advances in the development of SMA, including high temperature and magnetic SMA. Different research areas will be outlined including thermomechanical and actuation characterization, constitutive modeling and numerical implementation using finite element analysis. The influence of cyclic reversible phase transformation on fracture and actuation fatigue will be discussed. Examples from SMA integration into morphing structures will be given, emphasizing design optimization approaches for maximum actuation performance. Finally, current challenges will be outlined and future directions for the use and integration of shape memory materials in smart structures will be proposed.

BIOGRAPHY:

Dimitris C. Lagoudas is the holder of the John and Bea Slattery Chair in the Department of Aerospace Engineering with a joint appointment in the Materials Science and Engineering Department and is the Senior Associate Dean for Research at Texas A&M College of Engineering and a University Distinguished Professor. He serves the Texas A&M University System as the Associate Vice Chancellor for Engineering Research and Deputy Director of the Texas Engineering Experiment Station (TEES). His research team is recognized internationally in the area of modeling and characterization of shape memory materials. The models that his research group developed have been implemented into finite element analysis frameworks and utilized by industrial and governmental entities as well as academic institutions worldwide.