

Adaptive Energy Absorption Systems Using Magnetorheological Fluids

Norman M. Wereley

Minta Martin Professor and Chair, Dept. of Aerospace Engineering
University of Maryland

Thursday, January 24, 2013 -- 3:30pm -- Guggenheim 442

Abstract:

The ability to dissipate energy in vehicle systems, especially with the goal of protecting occupants and payloads from potentially injurious vibration, repetitive shock, crash and blast loads, is becoming a critical issue as the cumulative impact of these load spectra on chronic health and acute injury are becoming better understood. Energy is dissipated by utilizing a stroking element, such as a hydraulic damper or energy absorber. However, it is difficult to anticipate precisely what range of payload or occupant mass an isolation system might be expected to protect, or what vibration and shock spectra the system might encounter. Therefore, adaptation of stroking load is required to enable a system to have sufficient adjustability or control capability to effectively dissipate energy across a wide range of anticipated and even unanticipated disturbances. The goal of my research is threefold: (1) to develop field dependent or controllable energy absorbing materials, especially magnetorheological (MR) fluids, (2) to develop magnetorheological energy absorbers (MREAs) to enable adaptation of stroking load, and (3) to employ MREAs in systems to protect a payload or occupant from a wide range vibration and shock spectra, as well as accommodate a range of payload or occupant mass. Applications of MREAs to crew seating in rotorcraft and automobiles, as well as helicopter landing gear, will be discussed.

Bio:

Dr. Wereley's research interests are in dynamics and control of smart structures applied to helicopters and other aerospace and automotive systems, with emphasis on active and passive vibration isolation, shock mitigation (especially occupant protection systems), and actuation systems. Dr. Wereley has published over 150 journal articles, 11 book chapters, and over 250 conference articles. Dr. Wereley is an inventor on thirteen patents and over a dozen patents pending. Dr. Wereley is Editor of the *Journal of Intelligent Material Systems and Structures* and associate editor of *Smart Materials and Structures* and *AIAA Journal*. He is Chair (2012-2013) of the SPIE Symposium on Smart Structures/NDE. Dr. Wereley is the recipient of several awards including AIAA National Capital Section Engineer of the Year (2009), AIAA Sustained Service Award (2011), the AHS Harry T. Jensen Award (2011), and the ASME Adaptive Structures and Materials Systems Best Paper Award in Structural Dynamics and Control (2004, 2012). Dr. Wereley is also the recipient of the ASME Adaptive Structures and Material Systems Prize (2012) and the SPIE Smart Structures and Materials Lifetime Achievement Award (2012). Dr. Wereley is a Fellow of AIAA, ASME, and the Institute of Physics.

