

High-Rate Structural Dynamics under Mechanical Shock— Sensing, Characterizing, and Making Microsecond Decisions

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Abstract

Future functionality of high-speed Air Force systems depend on instrumentation in harsh environments and methods for characterization of nonlinear dynamics. This will enable microsecond monitoring and decision making in high-rate dynamic systems. Extreme mechanical environments have rapidly changing input forces on the nonlinear and time-varying structures that can change the system's configuration in a few microseconds. The characterization of instrumentation in these extreme high-g environments is required for the accurate measurement of the dynamic response. Methods that provide insight to the nonlinear response and novel testing methods are critical for the understanding of the nonlinear dynamics in these mechanical shock environments. With accurate sensors and some understanding of the nonlinear structural dynamics, this information can be used to a very challenging application — monitoring the functional integrity of systems on microsecond scales. There are many challenges with the new technical area: algorithm development, hardware implementation, methods for decision making, and system reaction. This presentation will discuss the technical challenges and recent interdisciplinary efforts in novel instrumentation for extreme environments, characterization and testing of time-varying nonlinear structures, and the growing area of microsecond structural health monitoring for high-rate impact environments.

Biography

Jacob Dodson earned a Ph.D. degree in Mechanical Engineering in 2012 from Virginia Tech. He the technical lead for the Fuzing for Functional Defeat of Hard Targets research group at the Munitions Directorate, Air Force Research Laboratory at Eglin Air Force Base, Florida. His technical publications cover the development and evaluation of shock sensors, microsecond structural health monitoring methods, and characterizing non-linear structures and materials for extreme environments. He is a member of the advisory committee for several technical groups including the Shock and Vibration Symposium, serves as a peer-reviewer for 15 journals and conferences, and is a registered Professional Engineer in Florida.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students. CCEE students are welcome to attend.

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