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2004-2005 Monthly Seminar Series on Space Research

21 October, 18 November, 20 January, 17 February, 21 April, 19 May
3rd Thursday 4:00-5:00 pm

Force Limited Vibration Testing

Dennis Kern
Jet Propulsion Laboratory

Date: **21 October 2004_Thursday** Time: **4:10-5:00 pm** Location: **1062 Bainer**
Refreshments will be provided at 4:00 p.m.

ABSTRACT

The primary goal of vibration tests of aerospace hardware is to identify problems that, if not remedied, would result in flight failures. This goal can only be met by implementing a realistic (flight-like) test with a specified positive margin. However, it has been known for over 30 years that the major cause of overtesting in aerospace vibration tests is associated with the infinite mechanical impedance of the shaker and the standard practice of controlling the input acceleration to the frequency envelope of the flight data. This approach results in artificially high shaker forces and responses at the resonance frequencies of the test item. The advent of piezoelectric triaxial force gages has made possible an alternative, improved vibration-testing approach based on measuring and limiting the reaction force between the shaker and test item. Also vibration test controllers now provide the capability to limit the measured forces and thereby notch the input acceleration in real time. To take advantage of this new capability to measure and control shaker force, Scharton of the Jet Propulsion Laboratory (JPL) developed a rationale for predicting the flight-limit forces. He and his colleagues at JPL have applied force limiting to many flight project vibration tests during the past fifteen years. Force limited vibration tests are now conducted routinely at several NASA Centers, Government laboratories, and many aerospace contractors. Force limited vibration testing theory, implementation methodology, and several application examples will be presented.

ABOUT THE SPEAKER

Dennis Kern has managed the Dynamics Environments Group at the Jet Propulsion Laboratory (JPL) since 1978. In that time he has supported all of JPL's flight projects, including Galileo, Mars Pathfinder, Cassini, Genesis, Spitzer, Mars Exploration Rover, Deep Impact, Cloudsat, DAWN, and Mars Reconnaissance Orbiter. He has also managed numerous vibroacoustics and shock research tasks at JPL, such as improved transient vibration test methodologies, force limited vibration test methodology, direct field acoustic test methodology, multi-axis vibration shaker criteria development, combined dynamic tests methodology, improved_pyroshock testing methodologies, and improved Statistical Energy Analysis (SEA) methodologies. He has co-authored several NASA Handbooks and Standards concerning dynamics environments and has organized the annual NASA/USAF/Industry *Spacecraft & Launch Vehicle Dynamics Environments* Workshops since 1988. Prior to joining JPL, he was vibroacoustics lead engineer for the B-1 Bomber project at Rockwell International. He received his BSME and MSME degrees from CSULB.

For more information about
SpaceED (Space Engineering Research and Graduate Program) or the seminars please contact
Professor Nesrin Sarigul-Klijn at (530)-752-0682 or nsarigulklijn@ucdavis.edu
Members of the campus community and visitors from the region are welcome to attend the seminar series.
Sign-in is required at the event. SpaceED seminar will replace MAE297 seminar on 3rd Thursdays.

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