Bring to class

Steve suggests that you write down a list of questions. Ask your co-workers for their questions. Ask these (and other) questions during the course. Steve uses just a little math and you'll find a simple calculator helpful. The usual four functions, square roots and base 10 logarithms for deciBel calculations. Before class, verify that all six functions work.

Lab demonstration

Most courses meet at testing laboratories. At these, at least one physical demonstration will utilize the host's shaker and data acquisition equipment.

Driving Instructions

For directions, please visit http://www.angelantoni.it/pagine-comuni/gb/dove-siamo.htm.

Fee and Registration

Fee is US$ 2,095. For registration and payment received at ERI a month in advance, deduct US$100. For three or more participants from an organization and payment received a month in advance, deduct US$200 each.

To register, go to *http://www.equipment-reliability.com/regist_form.htm*, complete the form and send it to us by fax or postal mail. Alternately, call us to provide the needed information.

Contacting ERI

1520 Santa Rosa Ave - Santa Barbara - California - 93109 - USA
Telephone: (805) 564-1260 and FAX: (805) 966-7875
email: *tustin@equipment-reliability.com / tustin@vibrationandshock.com*
http://www.equipment-reliability.com / http://www.vibrationandshock.com

Other training from ERI

This brochure describes what we call "open" vibration and shock training. Alternately, we can bring training to your facility. Another alternative: distance learning via CD-ROM and 31 back-and-forth lessons via e-mail. Visit our websites *http://www.equipment-reliability.com and http://www.vibrationandshock.com* for other subjects such as Climatics, EMC, Data Acquisition, etc.

Testimonials

"Having worked with Steve Brenner for the last 11 years, I have seen first hand the depth of his expertise in environmental test and evaluation. His knowledge first becomes apparent with an interpretation of test requirements and a unique ability to synthesize test plans and procedures. But more than theoretical knowledge, Steve has performed almost every environmental test I can think of. His communications both written and oral are clear and concise. I can't think of a better expert to teach a course on Climatic Testing."
Lawrence M. Cuprys, Director of Engineering, Visual Products Group, Kopin Corporation, Los Gatos, California

"I was a student of Mr. Brenner's HALT class. The class included a good overview of theory infused with well thougt out practical application. Mr. Brenner effectively addressed areas of concern, presented the material skillfully and made good use of time. I highly recommend Mr. Brenner."
Dennis Schmalz, Environmental Test/Reliability Engineer, Pemstar Inc.

Fundamentals of Random Vibration and Shock Testing, HALT, ESS, HASS Measurements, Analysis and Calibration

taught by Steve Brenner

March 22-24, 2006
8am to 4pm

Angelantoni Industrie SpA
Località Cimacolle 464
06056 Massa Martana (PG) - Italy

To register
go to *http://www.equipment-reliability.com/regist_form.htm*
or call us at (805) 564-1260.

Course Outline

- Overview
- Purpose of environmental testing, particularly vibration and shock
- Purpose of environmental stress screening (ESS), HALT and HASS
- Test types: resonance search/dwell, fatigue, specification, modal
- Quiz so instructor knows where to start
- Classical sinusoidal vibration never observed in service; useful concept
- Introduction: terminology, structural resonant behavior, isolation
- Sinusoidal vibration measurements: units, sensors, readouts, errors
- Calibration of sensors and systems; traceability to national standards
- Most machinery vibration is complex; introduction to random vibration
- Sinusoidal vibration testing
- Electrohydraulic and electrodynamic shakers; theory, tradeoffs, limits
- Power amplifier theory, operation, limitations, distortion effects
- Test standards; *e.g.* MIL-STD-810, IEC Series 68, etc.
- Controls for sinusoidal vibration testing; test practice
- Controversial test methodology: tracking filters, switching and averaging among sensors
- Introduction to random vibration
- Sources of random vibration in commerce and in transportation
- No possible equivalence to sinusoidal vibration
- Terminology and definitions
- Spectral density measurement and analysis - the frequency domain
- Probability density - the time domain
- Random vibration test practices
- Test standards; *e.g.* MIL-STD-810, IEC Series 68, etc.
- Equalization before testing; methods and limits, controls
- Combined environment (CERT) testing; reliability tests, *e.g.* MIL-STD-781
- Acoustical environment (intense noise) testing
- Environmental stress screening (ESS) of electronics hardware production
- Accelerated testing; HALT and HASS
- Sequential vs. multi-axis vibration
- Pneumatic repetitive-shock (RS) machines
- Vibration and shock test fixtures; fixtures for stress screening
- Recommended designs, materials, fabrication methods
- Experimental evaluation before use
- Practical limits: transverse motion; specimen size and weight
- Instrumentation for measuring shock in service and during tests
- Sensors, readouts, errors, calibration
- Shock spectrum analysis; shock response spectrum (SRS)
- Shock testing standards and methods
- Shock testing machines; limitations
- Shock testing on shakers
- Witnessing of tests
- Course summary
- Award of certificates

Course Overview

Equipment Reliability Institute offers three concentrated days on vibration and shock technology (fundamentals, measurement, analysis, calibration and testing, as well as HALT, ESS and HASS), taught by Steve Brenner. Steve's presentation is divided into 32 units that include drawings, photographs, animations and video clips. He conducts sine and random vibration demonstrations. Each participant receives a copy of Wayne Tustin's 2005 text 'A minimal-mathematics Introduction to the Fundamentals of Random Vibration and Shock Testing, HALT, ESS & HASS, also Measurements, Analysis & Calibration', including a CD containing a number of video clips. A simple certificate is awarded.

For whom intended

I need practical knowledge about mechanical vibration and mechanical shock test, measurement, analysis, designing for dynamics, also calibration and/or control, because my work requires me to:

- instrument land, sea and air vehicles as well as fixed-based equipment, in order to measure mechanical vibration and/or shock in service and during transport.
- analyze dynamic responses to mechanical vibration and shock inputs recorded during normal and abnormal transport.
- design (ruggedize) products that must withstand factory handling + transport + normal and abnormal usage. I design products to dynamic requirements, which I don't fully understand. Then I send a prototype to our lab for testing. I really don't understand what our lab does. I'd better find out.
- work in an environmental test lab. We perform vibration and shock tests on prototype hardware. These tests may be part of developing a new product, of determining vibration levels for future production screens or tests, or of investigating in-service or transport failures.
- calibrate various vibration and shock sensors (including accelerometers) and analyze vibration and/or shock.
- control (reduce) the intensity of vibration and/or shock, which otherwise may damage equipment (i.e. COTS) that cannot be made sufficiently rugged.
- maintain machinery whose vibration signature can warn of approaching failure.
- analyze machinery vibration spectra, as a step in predicting and preventing failure.

Steve Brenner

Steve has been working in the field of environmental simulation and reliability testing for over 30 years, beginning in the late sixties with reliability and design verification testing on the Lunar Module, the Space Shuttle in the eighties and semiconductor manufacturing equipment in the nineties. Steve began his career as an Environmental test engineer with Grumman Aerospace Corporation in New York, then worked as design verification and reliability engineer for the Air Force, as an Environmental Test Engineer for Lockheed Missiles and Space company, and finally spent 18 years with Kaiser Electronics in San Jose, where he managed the Environmental Test Lab and was involved with the design of hardware intended for severe environments. Steve has been working as an independent consultant in the reliability testing field since 1996. Steve's experience includes the entire range of climatic and dynamic testing, including ESS, HALT, HASS and long term reliability testing.