MEGGITT
smart engineering for
extreme environments

MEGGITT SENSING SYSTEMS
Endevco® short course guide

Shock and vibration measurement technology I
Shock and vibration measurement technology II

Instructors:
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Michael Phan, Meggitt Sensing Systems

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Shock and vibration measurement technology I

Presented by: Meggitt Sensing Systems, at our facility in Irvine, CA.

Instructor: Jon Wilson, Fellow Member of IEST with over 40 years in dynamic testing and measurement.

Course includes: 3-day applications-oriented short course on shock and vibration measurement. Course includes an extensive plant tour and equipment demonstrations.

Who should attend: Engineers, technicians and quality assurance personnel involved in shock and/or vibration measurement; test laboratory, field test, flight test, instrument selection and/or application.

Course outline:

1. **Introduction to vibration**
   Sources of vibration, effects of vibration and noise, introduction to dynamic motion, specialized language of vibration
2. **Shock motion**
   Transient motion, terms and definitions, sources of shock, structural response to shock, shock response spectrum, physics of shock
3. **How shock and vibration are measured**
   Optical and fixed reference, seismic transducers, measuring displacement, measuring velocity, measuring acceleration, measuring vibratory force, and what to measure.
4. **Accelerometer performance characteristics and error sources**
   Mounting effects, phase shift and damping, transverse sensitivity, amplitude range and linearity, temperature effects, humidity effects, strain effects, EMI/RFI, nuclear radiation, zero shift, stability and aging.
5. **Accelerometer designs and performance**
   Piezoelectric effect, crystals and ceramics, comparison of material properties, PE accelerometers, compression, shear, flexure, multi-axial, high temperature designs, IEPE designs, silicon accelerometers, MEMS, PR accelerometers, variable capacitance accelerometers, smart sensors, TEDS, network sensors, comparison of PE, PR, IEPE, VC.
6. **Signal conditioning, systems and readouts**
   Cables and connections, PE conditioners, IEPE conditioners, PR conditioners, VC conditioners, smart sensor conditioners, frequency response and filtering, integration, noise and noise rejection, isolation and shielding, signal distortion problems, programmable conditioners, readout and recording.
7. **Accelerometer calibration**
   Static accelerometer calibration, what is a g?, accuracy, error and uncertainty,

dynamic checks, laser interferometry, reciprocity calibration, comparison vibration calibration, frequency response calibration, automated calibration systems, comparison shock calibration, high amplitude shock calibration, extreme temperature calibration, transverse sensitivity calibration, informal procedures, do's and don'ts of calibration.

8. **Application considerations**
   Extreme temperatures, modal testing, shock testing, flight vibration testing, vehicular crash testing, and nuclear radiation environments.
9. **Special cases**
   Angular acceleration, torsional motion, rotating machinery vibration, aircraft engine monitoring, and navy shipboard vibration monitoring.
10. **Selecting the best system for your application**
    Selection and application checklist.
11. **Glossary**
12. **Plant tour**

Shock and vibration measurement technology II

Presented by: Meggitt Sensing Systems, at our facility in Irvine, CA.

Instructors: Jon Wilson, Fellow Member IEST with over 40 years experience in dynamic testing and measurement and Michael Phan, Meggitt Sensing Systems Hardware Engineer for AACS Calibration System with over 15 years experience in Shock and Vibration Measurement.

Course includes: One-day supplement to Shock and Vibration Measurement Technology I, emphasizing equipment demonstrations and hands-on operation by students.

Who should attend: Students who have completed Shock and Vibration Measurement Technology I (S&V II is usually presented immediately following Shock and Vibration Measurement I).

Course outline: Demonstrations and hands-on student activities demonstrating many of the concepts, performance characteristics and environmental effects discussed in Shock and Vibration Measurement Technology I. Demonstrations and hands-on testing may include mounting effects, transverse sensitivity, amplitude range and linearity, temperature effects, strain effects, EMI/RFI, and both shock and vibration calibrations. Students are encouraged to bring one of their accelerometers to perform a calibration (traceable) on it.

Both courses are regularly presented at the Meggitt facility in Irvine, CA. S&V I is normally presented from 8:00 AM to 4:00 PM Tuesday through Thursday, followed by S&V II on Friday. Lunches are provided and there is ample opportunity for students to interact with Meggitt personnel.

Both courses can also be presented on-site at a customer's facility or a nearby meeting location. S&V II on-site requires access to the customer's vibration or calibration lab for the hands-on activities.

For scheduling, fees and other arrangements, contact Anne Bowman (contact information above). For questions about technical content, contact the Instructor, Jon Wilson at 480-699-9274 or dynamic-consultant@cox.net.

Bio

About Jon S. Wilson

Principal, Jon S. Wilson Consulting, LLC

Jon S. Wilson has served for more than 35 years as facilitator of Endevco's popular Shock & Vibration and Dynamic Pressure Measurement short courses and Accelerometer Calibration workshop.

Since 1985, he has served as Principal Consultant of The Dynamic Consultant, LLC, and Jon S. Wilson Consulting, LLC, firms specializing in the technical writing of testing standards, specifications and procedures; witnesses and audits of test performance, specification and procurement of test equipment and services; and training of engineers, technicians, and non-technical personnel on all phases of dynamic and environmental testing and instrumentation.

Jon's experience encompasses all phases of dynamic, environmental, functional, electrical, mechanical, and chemical testing of automotive, industrial and aerospace equipment and components. His professional experience includes assignments as Test Engineer, Senior Test Engineer, Laboratory Manager, Applications Engineering Manager, Marketing Manager, Instructor and Consultant. He has worked for Chrysler Corporation, ITT Cannon Electric Company, Motorola Semiconductor Products Division, and Endevco® Division of Meggitt Aerospace.

He has more than 45 years of experience in writing and presenting training courses and technical papers, and has written and/or presented more than 30 technical articles and papers. In addition, Jon has written or edited proprietary textbooks on instrumentation and testing for Endevco and

Technology Training Incorporated, and served as editor-in-chief of the recently published "Sensor Technology Handbook", which has quickly become a "must have" test engineering reference guide.

Jon has participated in national and international standards committees and technical divisions of SAE, ISA and IEST (Institute of Environmental Sciences and Technology). He has been an active member of IEST since 1966, having once served as National Director of the Orange County Chapter. In 2004, he was elected an IEST Fellow. Jon is also a Senior Lifetime Member of ISA and SAE, and has been active in Toastmasters International for more than 25 years. He holds a BSME from Oklahoma University, a Masters in Automotive Engineering from Chrysler Institute of Engineering, and a MSE in Industrial Engineering from Arizona State University.

Meggitt Sensing Systems, a division of Meggitt PLC, is a leading supplier of high-performance sensing and monitoring systems for physical parameter measurements in extreme environments. It has operated since 1927 through its antecedents —ECET, Endevco, Ferroperm Piezoceramics, Lodge Ignition, Sensorex, Vibro-Meter and Wilcoxon Research —whose portfolios form the basis of product lines offered by today's Meggitt Sensing Systems. Meggitt's Endevco range of piezoelectric, piezoresistive, Isotron® and variable capacitance accelerometers, piezoresistive pressure transducers, acoustic sensors, electronic instruments and calibration systems ensure critical accuracy and reliability within aerospace, automotive, defense, industrial, medical, power generation, R&D, space and test and measurement applications.