MEASURING MECHANICAL & PYRO SHOCK

A Training Course for Successful Shock Measurement

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PCB PIEZOTRONICS
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BODIE TECHNOLOGY, INC.
The Noisy Data Experts™

MEASURING MECHANICAL & PYRO SHOCK

Lecture Topics

1. Introduction to the Measurement of Shock

- Brief introduction into the topic

2. Accelerometer Types Used for Shock

- Key technology choices including sensing type (PR & ICP®), mechanical isolation, and onboard analog filtering

3. Cables and Interconnects

- How cables can add unwanted noise and lowpass filtering effects, and how to avoid this

4. Signal Conditioning

- Typical approaches for PR and ICP® accelerometers
- Advantages of adjustable constant current controls in PCB ICP® signal conditioners for driving long cables

5. PCB Accelerometer Evaluation Activities

- Zero shifting (sources and examples) and other measurement distortions
- PCB recommendations related to calibration

6. DSP Fundamentals - Data Sampling, Avoiding Aliasing, FFT, Filtering

- Clearly explain issues with collecting analog signals digitally, avoiding aliasing, and common DSP tools
- Examples demonstrating proper sampling, decimation, and upsampling

7. System Requirements for Shock Measurements

- Typical components in a measurement system and guidance in setting up a valid measurement

8. Brief Overview of Shock Response Analysis (SRS)

- Explanation of Absolute Acceleration SRS and PVSS (Pseudo Velocity Shock Spectrum), what are they and how to use them
- Advantages of making 4CP (four coordinate paper) plots for PVSS

9. Post Processing of a Typical Shock Measurement

- Demonstrate typical calculations done on measured acceleration data
- Includes Importance of using DSP properly in data processing of shock

10. Comparing Different Accelerometer's Performance During Severe Impact

- Assess both PR and ICP® accelerometer performance
- Discuss error sources to be aware of when recording mechanical shock

11. Comparing and Correlating Physical Measurements with Numerical Simulations

- Outline the key differences between tests and simulations that cause apparent discrepancies
- Describe proper workflows and calculations to have the best chance of correlation in both the time domain and frequency domain

12. Summary of Best Practices for Transient Accelerometer Measurements From Mechanical Shock

- Summary of the key course take-aways

At This Training, Participants Will Learn:

- Recommended approaches and challenges for making transient acceleration measurements of severe mechanical shock and pyro shock
- Key technology choices related to piezoresistive and ICP® transducers
- The importance of proper cabling and signal conditioning, especially for tests requiring long cables
- Various causes that distort measurements with high frequency noise, zero shifts, and/or other problems
- The importance of proper DAQ selection, sampling rates, and filtering (both analog and digital)
- The dangers of aliasing and how to avoid it
- Suggested workflows to process measured accelerometer data including calculations to help assess measurement plausibility, methods to check for signal distortions, and approaches to minimize them
- What Shock Response Spectra is, how to calculate it, and why PVSS analysis is such a powerful way to assess accelerometer data

Instructor Bios

Ted Diehl, PhD

President and CEO, Bodie Technology, Inc.

Ted is responsible for strategy and technology development for Bodie Tech and is the developer of the Kornucopia® ML™ software tool suite. He is also a Corporate Fellow at Magic Leap, Inc.

Ted has been an active participant in FEA and Physical Testing community for over 30 years, representing companies in several industries. His primary focus is developing methods to solve industrial problems through a creative, yet pragmatic, mix of experimental, computational, and theoretical approaches. Dr. Diehl pioneered many FEA-oriented digital signal processing algorithms, initially for use in cell-phone impact mechanics, and then expanded to a host of noisy data problems for both physical testing and transient FEA simulations. Dr. Diehl received his PhD in Mechanical Engineering from the University of Rochester.

Mr. Bob Metz

Director of Aerospace & Defense at PCB/Endevco

Bob holds a Bachelor of Science degree in Aeronautical and Astronautical Engineering from The Ohio State University and a Master of Business Administration from the State University of New York. Bob has been an instrumentation engineer for 27 years, focusing on acoustic, vibration, pressure and force measurement using piezoelectric and piezoresistive sensors, and is currently the Director of the Aerospace & Defense Division of PCB Piezotronics and Endevco.

This training is designed for test personnel and their managers; design and analysis staff who use test measurements for model, component and full-scale system verification; calibration laboratory staff; data reduction personnel; and more generally anyone whose work depends on the output from accelerometers for the measurement of severe mechanical shock and pyro shock.

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