
Vibration and Shock Test Control Techniques

Course No. 194-3

FOR WHOM INTENDED Engineering or technical personnel involved in specifying, tailoring (e.g. MIL-STD-810) and performing state-of-the-art random vibration and shock tests; those who obtain/analyze/ review field and laboratory test data; and those who design/certify hardware/structures/instrumentation to meet dynamic environmental requirements. Members of the automotive, aerospace, aircraft, shipboard and weapons technical communities will benefit.

COURSE DESCRIPTION The course is an overview of vibration-testing technology with emphasis on the practical everyday problems that are encountered in testing laboratories. Emphasis is placed on the basic principles of vibration hardware, control systems, and analysis techniques used for random, sine, and shock testing. Capabilities and limitations of available systems will be discussed.

This course presents an application-oriented approach to digital computer control of random vibration and shock testing on shakers and analysis of vibration and shock data. Complex mathematical concepts are reduced to graphic form for intuitive understanding. Illustrative examples from the "real world" are used throughout.

The course is presented as a series of highly interactive lecture/discussion sessions. Problems for individual and group solution are interspersed throughout the course to act as training aids and to evaluate class progress. Special-interest discussions are encouraged outside of the regular course sessions.

DIPLOMA PROGRAMS This course, when combined with course 196, satisfies the 194 requirement for [TTi's Dynamic Test Specialist \(DTS\) Diploma Program](#) and may be used as an elective for any other [TTi specialist diploma program](#).

RELATED COURSES Course 194-3 is presented [on-site](#) only. In the "Open" presentations of [Course 194](#), the content of Course 194-3 is combined with [Course 196, Digital Data Acquisition](#).

PREREQUISITES Participants should previously have participated in TTI's Course 116, [Fundamentals of Vibration for Test Applications](#) and Course 196, [Digital Data Acquisition](#), or in related training. In addition, it would be helpful if participants have some experience in specifying and/or conducting computer-controlled tests on shakers and some exposure to spectrum analysis.

TEXT Each student will receive 180 days access to the on-line electronic course workbook. Renewals and printed textbooks are available for an additional fee.

INTERNET COMPLETE COURSE 194 features over 18 hours of video as well as more in-depth reading material. All chapters of course 194 are also available as OnDemand Internet Short Topics. See the [on-line course outline](#) for details.

COURSE HOURS, CERTIFICATE AND CEUs Class hours/days for on-site courses can vary from 14–35 hours over 2–5 days as requested by our clients. Upon successful course completion, each participant receives a certificate of completion and one Continuing Education Unit (CEU) for every ten class hours.

Course Outline

- Review of Data Acquisition
- Introduction and Basic Concepts
 - Structural Resonances, Time History and Spectral Analysis
- Test Objectives and Philosophy
 - Damage Potential
 - MIL-STD Testing
- Environmental Simulation Concepts
 - Sine, Random, and Simulated Shock Excitation.
 - Vibration and Shock History Reproduction
 - Test Specification
- Simulation Methods
 - "Programmed" Excitation
 - Excitation Hardware
 - Electrodynamic and Electrohydraulic Shakers
 - Specifications and Real-World Behavior
 - Excitation Functions
 - "Impact" and "Drop" Machines
- Fixtures
- Simulation "Accuracy" using different approaches.
- Measurement Systems
 - Transducers for Vibration and Shock
- Data Acquisition Requirements and Methods
- Analysis Tools
 - Averaging Concepts, Degrees of Freedom
 - Power Spectral Density (PSD) and Shock Response Spectrum (SRS)
- Control Systems
 - Closed-Loop Control Concepts
 - Random Control
 - Spectral Control
 - Response and Force Limiting
 - Sine Controllers
 - Shock Synthesis and Control
 - Real-World Systems
 - System Demonstration—videos
 - System/Physical/Method Limitations
 - What do the Control Parameters Mean?
 - How do they effect the results?
- Multiple-Degree-of-Freedom Systems
 - Hardware Implementation
 - Control Strategies
- Random Vibration for HALT, HASS and ESS applications
- Review of currently available hardware
- Real-World Test Laboratory Applications
- Student Topic/Problem Discussion
- Final Review
- Award of Certificate for Successful Completion



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