SAVE
SHOCK & VIBRATION
EXCHANGE

TRAINING GUIDE
TUTORIALS & TRAININGS

SEPTEMBER 24 - 28, 2023
ATLANTA, GEORGIA
WWW.SAVECENTER.ORG

ABOUT OUR TRAINING: TYPES & COSTS

TUTORIALS

DESCRIPTION:
THREE HOUR COLLEGE LEVEL COURSES (UNLESS OTHERWISE DESIGNATED) ON A SPECIFIC TOPIC. AVAILABLE TUTORIALS ARE LISTED HEREIN WITH A BRIEF DESCRIPTION OF THE MATERIAL TO BE COVERED.

WHAT'S INCLUDED?
REGISTERED ATTENDEES WILL RECEIVE A SET OF NOTES AND A CERTIFICATE OF COMPLETION. SOME STATES MAY AWARD CEUs/PDHs BASED ON THIS CERTIFICATE OF COMPLETION. ALL NOTES PROVIDED ARE PROPRIETARY TO THE PRESENTER. PERMISSION FOR DUPLICATION OR DISPERSION MUST BE ACQUIRED BY THE PRESENTER.

COST:
EACH THREE HOUR COURSE COSTS $225 OR ONE COURSE PER AVAILABLE TIME SLOT IS INCLUDED IN THE TRAINING PACKAGE. ATTENDEE MUST PRE-REGISTER TO ENSURE AVAILABILITY OF SPACE AND NOTES.

TRAININGS

DESCRIPTION:
COURSES RANGE IN DURATION FROM 45 MINUTES TO 120 MINUTES. ENTRY LEVEL PROFESSIONAL COURSES ON A SPECIFIC TOPIC. AVAILABLE TRAININGS ARE LISTED HEREIN WITH A BRIEF DESCRIPTION OF THE MATERIAL TO BE COVERED.

WHAT'S INCLUDED?
NO CERTIFICATE OF COMPLETION IS AWARDED FOR THESE COURSES. AVAILABILITY OF NOTES FOR EACH TOPIC DEPENDS ON INSTRUCTOR AVAILABILITY. ALL NOTES PROVIDED ARE PROPRIETARY TO THE PRESENTER. PERMISSION FOR DUPLICATION OR DISPERSION MUST BE ACQUIRED BY THE PRESENTER.

COST:
TRAININGS ARE PROVIDED TO PAID SYMPOSIUM ATTENDEES AT NO ADDITIONAL FEE. FOR ATTENDEES NOT ATTENDING THE TECHNICAL PROGRAM FOR THE 92ND SHOCK AND VIBRATION SYMPOSIUM, THE TRAINING PACKAGE MUST BE SELECTED AND PAID IN ADVANCE OF TRAINING ATTENDANCE. THERE IS, HOWEVER, NO NEED TO REGISTER IN ADVANCE FOR EACH SELECTED TRAINING TOPIC.

HOW TO REGISTER

TO REGISTER IN CONJUNCTION WITH THE 93RD SHOCK AND VIBRATION SYMPOSIUM, PLEASE VISIT ***WWW.SAVECENTER.ORG/SYMPOSIUM*** AND FOLLOW THE LINKS FOR REGISTRATION.

TO REGISTER FOR THE TRAINING PACKAGE WITHOUT ATTENDANCE TO THE SHOCK AND VIBRATION SYMPOSIUM, PLEASE USE THE SAME WEBSITE WHILE FOLLOWING ADDITIONAL PROMPTS FOR TRAINING PACKAGE REGISTRATION.

MONDAY
SEPTEMBER 25

TUTORIAL SESSION I
8:00 - 11:00AM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

MIL-DTL-901E SHOCK QUALIFICATION TESTING

ROOM TBD

Mr. Kurt Hartsough (NSWC Philadelphia)
Mr. Domenic Urzillo (NSWC Carderock)

The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD-SSES) Code 333 is NAVSEA 05P1's Delegated Approval Authority (DAA) for MIL-DTL-901E Surface Ship Shock. As the DAA, Code 333 engineers are responsible for review and approval of all Government Furnished Equipment (GFE) and heavyweight shock tested equipment. NSWCCD Code 333 will be presenting the requirements for shock qualification testing as detailed in MIL-DTL-901E and interpreted by NAVSEA 05P1. Shock testing theory, MIL-DTL-901E shock test devices and facilities, detailed specification requirements, cost avoidance and clarification and MIL-DTL-901E IC#2 will be covered. Attendees should include anyone involved in the acquisition, specification, review and approval of Navy shipboard equipment including PARMs and LCMs and contracting officers, contractors having to deal with the Navy and wishing to supply shock qualified equipment to the Navy, Ship Program Managers and Ship Logistic Managers responsible for the acquisition & maintenance of shock hardened Navy ships and shock qualification test facilities.

DDAM 101

ROOM TBD

Mr. George D. (Jerry) Hill (SERCO)

The U.S. Navy Dynamic Design Analysis Method (DDAM) has been in general use since the early 1960s. It is a method of estimating peak shock response of equipment and outfitting on naval combatants using normal mode theory, originally extended from earthquake analysis methods. The DDAM requires linearelastic model behavior and employs a statistical method of modal superposition yet has persisted to today as the U.S. Navy required method for shock qualification by analysis. This, in spite of the rapid advancement of dynamic transient simulation technology and techniques for representing nonlinearities including material plasticity and contact behavior. The tutorial will address: how the method works, how the shock spectral input values are presented in DDS-072-1, what is the role of modal weights and participation factors, why has the method persisted including what are its strengths and also what are its weaknesses. The tutorial will provide a basic understanding of the method, requirements, and procedures to those who expect to be involved in shock analysis and will demystify the procedure for many who are current users.

FUNDAMENTALS OF CLASSIC SHOCK AND SRS SHAKER TESTING

ROOM TBD

Mr. Chris Sensor (Siemens)
Mr. Bob Metz (PCB Piezotronics)

This tutorial will cover the fundamental concepts of shaker shock testing, from field data acquisition to Classic Shock and Shock Response Spectrum (SRS) wavelet synthesis in a vibration controller. Shock data acquisition and analysis, classic shock pulses, SRS concepts, SRS and Pseudo Velocity Shock Spectrum (PVSS) data analysis, Fatigue Damage Spectrum, a review of Classic Shock and SRS test methods in MIL-STD-810H (including the “new” method of Te and TE), shock test tailoring and SRS wavelet synthesis for shaker SRS testing will all be discussed during the tutorial. A segment covering specialty shock sensors and instrumentation will also be presented. Topics will be reinforced with live demonstrations of data acquisition and shaker testing. Attendee interaction, questions and discussion are welcome and encouraged.

TUTORIAL SESSION I
8:00 - 11:00AM
(CONTINUED)

INTRODUCTION TO PYROSHOCK TESTING
Dr. Vesta Bateman (Mechanical Shock Consulting)

ROOM TBD

This course discusses the concepts of Near Field, Mid Field Pyroshock and Far Field Pyroshock and their criteria. Instrumentation used for measurement of pyroshock and structural response to pyroshock is described. The development of pyroshock specifications using primarily the Shock Response Spectra is discussed in detail, and various other analysis techniques are presented as well. Simulation techniques for near field, mid field and far field pyroshock are presented and include both pyrotechnic simulations and mechanical simulations. Examples of actual test specifications and the resulting laboratory test configuration and measured results are discussed. In addition, recent problems and issues in the pyroshock community are described and analyzed.

MONDAY
SEPTEMBER 25

TUTORIAL SESSION II
NOON - 3:00PM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

MIL-DTL-901E SHOCK QUALIFICATION TESTING EXTENSIONS

ROOM TBD

Mr. Kurt Hartsough (NSWC Philadelphia)
Mr. Domenic Urzillo (NSWC Carderock)

The Naval Surface Warfare Center Carderock Division Philadelphia (NSWCCD SSES) Code 333 is NAVSEA 05P1's Delegated Approval Authority (DAA) for MIL-DTL-901E Surface Ship Shock. As the DAA, Code 333 engineers are responsible for review and approval of all Government Furnished Equipment (GFE) and heavyweight shock tested equipment. NSWCCD Codes 333 will be presenting the requirements for shock qualification extensions as detailed in MIL-DTL-901E and interpreted by NAVSEA 05P1. Shock extension specification requirements, MIL-DTL-901E design guidelines and shock design lessons learned will be covered. Attendees should include anyone involved in the acquisition, specification, review and approval of Navy shipboard equipment including PARMs and LCMs and contracting officers, contractors having to deal with the Navy and wishing to supply shock qualified equipment to the Navy, Ship Program Managers and Ship Logistic Managers responsible for the acquisition & maintenance of shock hardened Navy ships and shock qualification test facilities.

AN INTRODUCTION TO ALIASING, FFT, FILTERING, SRS & MORE FOR FEA USERS AND TEST ENGINEERS

ROOM TBD

Dr. Ted Diehl (Bodie Technology)

Working with either physical test data and/or numerical simulations related to severe mechanical shock, impact, failure, etc. is extremely challenging. Some of the biggest challenges in this type of work are 1) properly collecting the initial raw data while avoiding aliasing [especially from numerical simulations], 2) utilizing robust methods to identify and separate the “noise & distortions” from the “true” frequency-rich content in the data, and 3) determining what portion of the “true” frequency-rich content is meaningful and what does it tell you. For a given problem, the initial appearance of raw time-domain data in this class of work may be vastly different between physical testing and data derived from transient simulation codes (LS-Dyna, Abaqus/Explicit, RADIOSS…). While the data might look different, the rules of DSP (Digital Signal Processing) are the same. Most importantly, understand and utilizing DSP properly is a critical requirement to success in BOTH types of approaches, especially to obtain correlation between physical tests and simulation of the same specific problem.

The 3-hour seminar provides guidance to both simulation analysts and test engineers on how to properly collect and process such data; ultimately uncovering significantly improved results. The course covers highlights of DSP theory in the language of Mechanical Engineering pertinent to simulation analysts and test engineers. This seminar introduces key aspects of working with transient data – specifically, clearly explaining time-domain and frequency domain analysis (DFS, FFT, PSD); data collection (sampling, up-sampling, decimation, and aliasing); filtering (lowpass, highpass, IIR, and FIR), how to avoid aliasing, calculating Shock Response Spectrum (Accel SRS & PVSS) from transient data, and numerous unique aspects related to explicit dynamics FEA data (non-constant time increments, massively over-sampled data, short transient signals with non-zero end conditions, and more). Simplified demonstrations are presented to solidify key DSP aspects, along with many relevant real-world examples. Both FEA users and experimentalists will benefit from this training.

TUTORIAL SESSION II
NOON - 3:00PM
(CONTINUED)

MONDAY
SEPTEMBER 25

DATA INTEGRITY
Mr. John Hiatt (DEWESoft)

ROOM TBD

The data integrity training is designed as an overview of the data acquisition process and how each step in the measurement chain can affect your measured data. Primary focus of this session is on the data acquisition system (DAS). We will learn what happens in each step of the process and how to mitigate common measurement errors. The idea is to get the best possible data first time. Its hard to make good decisions with bad data. We also cover DAS specifications so users can be better prepared to compare system specifications.

INTRODUCTION TO WEAPONS EFFECTS AND SHIP COMBAT SURVIVABILITY ANALYSIS
Mr. Jan Czaban (Zenginworks Limited)

ROOM TBD

This short course provides a practical understanding of naval ship combat survivability and methods to assess the effects of various weapons. The introduction will review terminology, concepts and current practice involved in setting, achieving and verifying survivability requirements. Naval threats and weapon types will be reviewed and methods for predicting their resultant loads and damage mechanisms explained. Primary weapons effects will include attacks from underwater explosions, above water explosions, internal blast, fragments and ballistic projectiles. Sample problems will be provided to demonstrate how to estimate the extent of damage sustained by ship structures and how to apply and interpret damage using standard terms of capability degradation. Methods for hardening ship systems and structures will be reviewed with an introduction provided to explain dynamic load effects tolerance, armour systems and simplified pass/fail global design assessment techniques. The course material will be entirely based on public domain sources and includes a comprehensive list of references and applicable military standards.

MONDAY
SEPTEMBER 25

TUTORIAL SESSION III
4:00 - 7:00PM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

MIL-DTL-901E SUBSIDIARY COMPONENT SHOCK TESTING & ALTERNATIVE TEST VEHICLES

ROOM TBD

Mr. Kurt Hartsough (NSWC Philadelphia)
Mr. Domenic Urzillo (NSWC Carderock)

The MIL-DTL-901E Subsidiary Component Shock Testing and Alternate Test Vehicles course will cover the following areas: NAVSEA 05P1's current policy for testing subsidiary components, description of test environment requirements, examples of recent successful test programs, alternate test vehicle descriptions, alternate test vehicle limitations, discussions on shock spectra, Multi-Variable Data Reduction (MDR) and various shock isolation systems. This course is intended to give the necessary information to equipment designers and program managers who intend to shock qualify COTS equipment that will require frequent upgrades due to obsolescence, equipment upgrades, change in mission, etc. Although not required, it is recommended that those attending this course also attend courses on Shock Policy, MIL-DTL-901E testing and particularly MIL-DTL-901E extensions offered by the same instructors (Urzillo and Kurt Hartsough).

DIGITAL SIGNAL PROCESSING - FILTERING AND THE FOURIER TRANSFORM (GOING FROM TIME TO FREQUENCY DOMAIN)

ROOM TBD

Mr. John Hiatt (DEWESoft)

Two of the most common Digital Signal Processing (DSP) techniques are filtering and transforming data from the time domain to the frequency domain with the Fourier transform (FFT). Both mathematical processes can create unwanted effects on the data. This session will examine these effects on your data and how they can be mitigated. For the Fourier transform, we will also discuss the assumptions, inputs to the FFT and possible reasons FFT's calculated with two different software packages do not match. This training is designed to help new users understand how these processes and how they work to help prevent data processing mistakes.

REMOVING THE BOUNDARY CONDITION HOBGOBLINS FOR BASE MOUNTED COMPONENTS IN VIBRATION QUALIFICATION TESTING

ROOM TBD

Mr. Troy Skousen (Sandia National Laboratories)
Mr. Randy Mayes (Consultant)

How a modal technique provides a simple modification to the base input mitigating the field-to-laboratory impedance mismatch for high confidence component qualification

Random vibration laboratory testing is used to qualify components to survive in-service responses to system environments. Using realistic research hardware and an analytical rocket system, we show that traditional single degree of freedom (SDOF) shaker test specifications guarantees large response uncertainties when compared with the field environment responses due to the difference in laboratory boundary conditions. A brief review is provided showing how fixed-base mode shapes are derived from test data. A model utilizing fixed-base and rigid body modes of the component on its vibration test fixture is used to decompose the component field motion into a few intuitive responses. This model demonstrates why 6DOF laboratory control can eliminate large uncertainties in traditional SDOF testing with a corresponding boost in qualification confidence. In fact, the model leads to modified base inputs for a greatly improved SDOF or 3DOF test.

TUTORIAL SESSION III
4:00 - 7:00PM
(CONTINUED)

MONDAY
SEPTEMBER 25

ROOM TBD

OVERVIEW OF UNDERWATER EXPLOSION PHENOMENOLOGY AND BULK CHARGE WEAPON EFFECTS

NOTE: LIMITED DISTRIBUTION D (SECURITY PAPERWORK REQUIRED)

Mr. Greg Harris (Consultant)

This tutorial will provide an overview of underwater explosion (UNDEX) phenomenology relevant to bulk charge underwater warheads. The phenomenology discussion includes UNDEX shock wave propagation, bulk cavitation effects, and UNDEX bubble dynamics. UNDEX testing and analysis procedures for characterizing the shock wave and bubble performance of explosive compositions will be described. Finally, a brief discussion of the damage mechanisms used by bulk charge underwater weapons such as mines and torpedoes will be given using illustrative examples from UNDEX testing programs and recent naval encounters.

This talk contains Controlled Unclassified Information (CUI) / Distribution Statement D: Distribution authorized to DOD agencies and US DOD contractors.

TUESDAY
SEPTEMBER 26

TUTORIAL SESSION IV
8:00 - 11:00AM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

ANALYSIS FOR A MEDIUM WEIGHT SHOCK TEST

ROOM TBD

Mr. Josh Gorfain (Applied Physical Sciences)

While a shock test is essentially the bottom line for a shock qualification, a lot of analysis often goes into the mix before the test. The reasons for this are many: The equipment manufacturer wants his equipment to pass and will often commission some kind of pre-test prediction to maximize the likelihood of success or to high-light design problems. Since the weight and frequency of the tested equipment can affect the response of the test significantly, the system may need to be examined to assure that the tested environment is correct. This tutorial will first review the Medium Weight Shock Machine (MWSM) and its use in shock qualification testing, followed by presentation of the test environment. Next, the types of analysis that can be performed to estimate the test environment experienced by a given piece of equipment will be described. The intention of these analyses is to provide an assessment of equipment response subject to a MWSM test in an effort to assure a successful test. Additionally, the merits and limits of these methods are discussed so the most appropriate method may be rationally selected for a given application. Examples will be presented that illustrate the different types of analyses and how they may be applied.

MIL-DTL-901E ENGINEERING TOPICS

ROOM TBD

Mr. Domenic Urzillo (NSWC Carderock)

MIL-DTL-901E Engineering topics is a follow-on course to the MIL-DTL-901E Test and Extension training courses and is aimed at providing the NAVSEA acquisition and engineering communities with a more in-depth review of engineering mathematics routinely used in equipment shock qualification. Topics covered include shock spectrum as it relates to MIL-DTL-901E testing, digital data filtering, shock response frequency, shock test fixture design fundamentals and FSP deck simulation fixtures.

INTRODUCTION TO UNDERWATER EXPLOSION PHENOMENA WITH BASIC APPLICATIONS TO STRUCTURES

ROOM TBD

Mr. Fred Costanzo (Consultant)

This tutorial is divided into two major parts. The first segment consists of a brief primer in underwater explosion (UNDEX) fundamentals and shock physics. Included in this discussion are the features of explosive charge detonation, the formation and characterization of the associated shock wave, bulk cavitation effects, gas bubble formation and dynamics, surface effects and shock wave refraction characteristics. In addition, analyses of associated measured loading and dynamic response data, as well as descriptions of supporting numerical simulations of these events, are presented. The second segment involves basic applications of UNDEX-induced dynamic shock wave loadings to the estimation of both local and global responses of simple floating and submerged structures. Three primary well-documented methodologies are presented, including the Taylor Flat Plate analogy for estimating the responses of both air-backed and water-backed plates, the Peak Translational Velocity method for estimating the response of submerged cylindrical bodies, and the application of the conservation of momentum principle for estimating the vertical kickoff velocity of floating structures (Spar Buoy approach). Derivations of the governing equations associated with each of these solution strategies are briefly presented, along with a description of the appropriate ranges of applicability. Applications of each of these methodologies will be illustrated using simple examples. Finally, some case studies are presented that illustrate the power of applied numerical methods in the form of finite differences to obtain approximate solutions to some classical nonlinear mechanics problems.

TUTORIAL SESSION IV
8:00 - 11:00AM
(CONTINUED)

TUESDAY
SEPTEMBER 26

FUNDAMENTALS OF DIGITAL IMAGE CORRELATION (DIC)
ROOM TBD
Mr. Chris Sensor (Siemens)

This tutorial will cover the fundamental concepts of Digital Image Correlation (DIC) for both static and dynamic vibration scenarios. The basic concepts of DIC will be explained, followed by live demonstrations of both static and dynamic DIC data acquisition. An overview of the required test equipment and it's set-up will be presented. Advantages of DIC such as strain measurements, multi-plane response measurement, and contactless measurement will be compared and contrasted to traditional data acquisition methods.

AIR BLAST AND CRATERING: AN INTRODUCTION TO THE ABC'S OF EXPLOSION EFFECTS IN AIR AND ON LAND
ROOM TBD
Mr. Denis Rickman (USACE ERDC)

This three-hour course introduces the effects of explosions in air and on land. Topics covered include airblast, soil/rock/pavement cratering, and ground shock phenomena produced by explosive detonations. There is a little math, but for the most part, the focus is on aspects and principles that are of practical use to those conducting (and utilizing) blast-related research. Most researchers in the blast arena have some grasp of explosion effects fundamentals, but very few have a good, broad-based understanding of how it all works. The goal is to provide the participants with enough of an understanding that they can appreciate the various explosion phenomena and those parameters that affect blast propagation and blast loading of objects in a terrestrial setting.

WEDNESDAY
SEPTEMBER 27

TUTORIAL SESSION V
3:30 - 6:30PM

OPTIONAL THREE HOUR COURSES. ATTENDEES WILL RECEIVE A CERTIFICATE OF COMPLETION AND MAY RECEIVE CEUs/PDHs (VARIES BY STATE). ADDITIONAL FEES APPLY TO ATTEND.

SHOCK TEST FAILURE MODES

ROOM TBD

Mr. Kurt Hartsough (NSWC Philadelphia)
Mr. Domenic Urzillo (NSWC Carderock)

This tutorial will cover examples of shock test failures typically experienced by equipment exposed to MIL-DTL-901E shock levels. MIL-DTL-901E provides guidance for designers responsible for meeting the requirements of MIL-DTL-901E. This tutorial will show how and why equipment failures occur and show how minor design changes can prevent shock failures. Hands on demonstrations, real time high speed video and analysis will be used to demonstrate both failures and corrective actions.

PEAK RESPONSE OF LINEAR STRUCTURES IN RANDOM VIBRATION

ROOM TBD

Dr. Thomas Paez (Thomas Paez Consulting)

The main focus of fundamental studies in random vibration of linear structures is the characterization of the distribution of mean square signal content in the frequency domain. A basic development of random vibration theory starts with probability and random process theory (The latter requires an understanding of Fourier analysis.), the theory of deterministic structural dynamics, and then proceeds to establish the fundamentals of random vibration. Most important in random vibration are the concepts of the spectral density of stationary excitation and response random processes, and the fundamental relation of random vibration, i.e., the equation that expresses the spectral density of a linear response in terms of the spectral density of an excitation and a structural property. Most of the important experimental and analytical activities in random vibration are supported by the fundamental activities described here. However, there are many other more advanced facets to random vibration, and some of those can be developed directly. For example, the problems of low- and high-cycle fatigue, and the peak response of structures in random vibration are important. This tutorial develops the latter subject, peak response. The first half of the tutorial is a review of the basic ideas of linear random vibration. The spectral density and the fundamental relation of random vibration are developed. The second half of the tutorial deals with development of the probability distribution, mean and variance of peak response. These results are first obtained for a narrow-band random response and then generalized to the realistic case of wide-band response. Examples are included. MATLAB scripts and functions for establishing the probabilistic measures of peak response are provided to attendees. An electronic copy of the color slides is provided as well.

INTRODUCTION TO MIL-STD-461G- THE ELECTROMAGNETIC INTERFERENCE CONTROL REQUIREMENTS FOR DOD SUBSYSTEMS AND EQUIPMENT

ROOM TBD

Mr. Jeff Viel (NTS/Element)

This 3 hour tutorial provides a detailed technical overview of MIL-STD-461G addressing the electromagnetic interference (EMI) emission and susceptibility test methods and control requirements for subsystems and equipment and subsystems designed or procured for the Department of Defense (DoD). This tutorial starts from the very beginning discussing the basis for EMI control testing, including a historical case study, to the progressive development of test methods and requirements adapted to modern day technologies and electromagnetic environments. While the standard is broadly designed to address all DOD platforms, this tutorial is focused to specifically address shipboard and submarine application requirements.

TUTORIAL SESSION V
3:30 - 6:30PM
(CONTINUED)

WEDNESDAY
SEPTEMBER 27

EFFECTIVE SOLUTIONS FOR SHOCK AND VIBRATION CONTROL

ROOM TBD

Mr. Alan Klembczyk (Taylor Devices)
Mr. Ken Lussky (BAE Systems)

Part 1 of this Tutorial provides an outline of various applications and methods for implementing isolation control of dynamic loads and damping within a wide array of dynamic systems and structures. Photos, videos, and graphical results are presented of solutions that have been proven effective and reliable in the past. Design examples are given and typical applications are reviewed. Additionally, key definitions and useful formulae are presented that will provide the analyst or systems engineer with the methods for solving isolation problems within the commercial, military, and aerospace sectors. A wide range of isolation mounts and systems are covered including liquid dampers, elastomer and wire rope isolators, tuned mass dampers, and engineered enclosures. Engineering guidelines are presented for the selection and evaluation of isolation control products.

Part 2 of this Tutorial addresses characterization of shock and vibration environments and finite element analysis (FEA) of shock and vibration isolation performance. Methods used to characterize shock and vibration responses and their application are defined. For shock these include spectral definitions (SRS shock response spectrum and PVSS pseudo velocity shock spectrum) and time-history definitions (peak velocity, peak acceleration, average acceleration and displacement). These are discussed with respect to their application to shock input severity, and equipment fragility and damage potential. Shock test qualification methods, their input definitions, and how they are represented in FEA are discussed. Also addressed are the value of damping in shock isolation and how shock and vibration isolation systems are represented in FEA. For vibration the spectral definition of Acceleration Spectral Density (ASD) is discussed. Other topics addressed are the application of UERD Tools for shock characterization, and when to engage with the appropriate shock and vibration Technical Warrant Holders (TWH).

GENERAL CRADLE TO GRAVE QUALITY CONTROL TECHNIQUES FOR MAXIMIZING ACCURACY AND MINIMIZING DISCRETE OR BASIC ERRORS IN MIL-DTL-901E SHOCK AND MIL-STD-167 VIBRATION CLASSICAL AND NUMERICAL DYNAMIC ANALYSIS

ROOM TBD

Dr. Christopher Merrill (CM&A Engineering)

This training provides general simple techniques for use in parallel with long term Classical and Numerical Dynamic Analysis of Systems subjected to US Navy shock and vibration requirements to maximize accuracy and minimize errors in Dynamic Analysis of systems. The interaction of the US Navy shock and vibration requirements is a major driver of the efficacy of long-term Dynamic Analysis from the start. Apart from major issues that occur on any major long-term developmental programs, simple, seemingly minor, errors present in the analysis from the beginning can lead to huge cost and schedule impacts generally at the worst time for the program (FAT). Fortunately, there are procedural long-term Dynamic Analysis Quality Control techniques that can be used from the beginning and in parallel during the long-term dynamic analysis to mitigate the risk of such errors. This training will provide examples of types and genesis of such errors, as well as, a process to perform at the beginning and in parallel with the long-term dynamic analysis in order to perform quality control comparisons with it. Finally, the importance of comparison of FAT dynamic test results to dynamic analysis including failure and use of prototyping will be included. The training will end with an exercise where the trainer will attempt to stump the trainee with balky computer model results. The trainee will leave the training with a list of types of and genesis of discrete and basic errors, a process chart and algorithm for applying these Quality Control Techniques at the start and in parallel with the long-term dynamic analysis, and insight into how they might improve their techniques when they return.

TRAININGS

SAMPLE TRAINING TOPICS (CONFIRMED TOPICS TO BE LISTED IN SUMMER 2023)

INTRODUCTION TO MEDIUM WEIGHT SHOCK TESTING	120 MINUTES
SHOCK RESPONSE SPECTRUM PRIMER	90 MINUTES
USING SUPERVISED LEARNING (PYTHON) TO QUANTIFY UNCERTAINTIES ABOUT A SHOCK EVENT	45 MINUTES
INTRODUCTION TO HEAVYWEIGHT SHOCK TESTING	120 MINUTES
INTRODUCTION TO UNDERWATER EXPLOSION PHENOMENA WITH BASIC APPLICATIONS TO STRUCTURES	90 MINUTES
CAN METHODS FOR NUMERICAL TIME INTEGRATION IN COMMON USE BE REPLACED BY EQUIVALENT DIGITAL FILTERS?	120 MINUTES
DSSM SHOCK TESTING (MIL-DTL-901E TOPIC)	60 MINUTES

QUESTIONS?

CONTACT OUR OFFICE

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