

IMAC-XXXVI

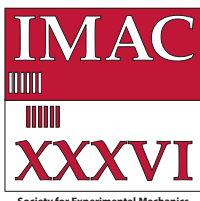
Conference and Exposition on Structural Dynamics
IT' NOT JUST MODAL ANYMORE

ADVANCE PROGRAM

Engineering Extremes: Unifying Concepts in
Shock, Vibration and Nonlinear Mechanics

Pre-conference Courses: February 11, 2018
Conference and Exposition: February 12-15, 2018

Rosen Plaza, Orlando, FL USA



Organized by the

Society for Experimental Mechanics, Inc.

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Engineering Extremes: Unifying Concepts in Shock, Vibration and Nonlinear Mechanics

IT' NOT JUST MODAL ANYMORE



Al Wicks, IMAC
Conference Director

IMAC has become a comprehensive meeting on a broad spectrum of technologies related to structural dynamics. Technologists and researchers will find presentations, tutorials and products of interest. We link a technical agenda with an exposition that features a wide variety of products and services related to structural dynamics. In addition to the tutorials, short courses are available prior to the conference, making this conference a comprehensive event and value added to your professional career.

One of the unique attributes of IMAC, nurtured over the years, is the mix of analytical and experimental topics, bringing the analyst and the experimentalist together as a team. The traditional barriers have been removed to foster constructive dialog between academics, industry and the governmental labs. It is from these meetings, that technologies are shared, enhancing our aerospace industries, infrastructure, our educational endeavors and improving society in general. As lofty as this sounds, IMAC remains a friendly meeting where exhibitors, presenters and attendees spend several days exchanging the ideas that fuel the coming year.

This advance program is your invitation to join us in February and share the vision of Dick DeMichele who initiated this conference 36 years ago and set it on its course. A variety of technical programs are available including short courses, tutorials and technical paper sessions. Browse the program and highlight the activities that will contribute to your efforts. We are constantly working to make IMAC XXXVI an impact on your career.



Jim DeClerck, IMAC
Advisory Board Chair

IMAC 36 will begin with three pre-conference courses that cover a broad range of interests. As always, the “Basics of Modal Analysis for the New Engineer” sessions will be on Monday. Novice and experienced engineers attend this popular session which provides an overview of the foundational concepts that are applied in the technical program.

I encourage all IMAC participants to join one or more Focus Group or Technical Division. Although many of these groups only meet during IMAC, they are active all year developing most of the technical program. Your participation and ideas are needed to keep IMAC responsive to the needs of the structural dynamics community.

See you in Orlando!

IMAC-XXXVI - What's Happening

IT'S NOT JUST MODAL ANYMORE

The IMAC Board made an interesting observation while reviewing the IMAC 36 program submissions from the Technical Divisions and Focus Groups. Modal analysis, which originally brought the community together, has branched out to verification and validation, shock, rotating machinery, health monitoring and many other diverse fields and applications represented in more than 400 presentations at IMAC 36. Describing IMAC as a "Structural Dynamics Exposition" falls short of what IMAC has become. The new tag line, "It's Not Just Modal Anymore" reminds us of the foundation of our community and removes any implied boundary for the IMAC stage.

DOOR PRIZES

The following Exhibitors have sponsored Door Prizes. Names of pre-registered attendees will be drawn and announced during coffee breaks.

- OROS
- Vibrant Technology, Inc.
- Vibration Research
- APS Dynamics, Inc.
- Data Physics
- Spectral Dynamics, Inc.

HOW TO GET PUBLISHED

Organized by: Louisa Strain, SAGE Publishing
Tuesday February 13, 2018 - 6:00 PM

This session will cover the fundamentals of preparing a manuscript for publication in an academic journal with reference to the Journal of Intelligent Materials Systems and Structures. The session will include an overview of the publishing landscape; how the publishing landscape is evolving; how to select a relevant publication; preparing your manuscript for submission to a journal; an overview of the peer review process; publication ethics and author rights and how to promote your article once published.

This session is suitable for students, post-grads and junior researchers who are at the beginning of their academic careers, in terms of publishing, or have yet to publish their first journal article and would like to learn more about the process and tips for successful publishing.

OVER 400 PAPER PRESENTATIONS

The IMAC 2018 session organizers and technical division chairs have put together a fabulous technical program with over 400 presentations being given during our four day conference. Presentations complement our technical divisions including; Dynamics of Civil Structures, Dynamic Substructures, Modal Analysis/Dynamic Systems, Model Validation and Uncertainty Quantification (MVUQ), Nonlinear Structures & Systems, and Sensors and Instrumentation. If this is your first IMAC conference, then please join us for our Tuesday pizza lunch to learn of the activities of our technical divisions and sit with the members as they gather to enjoy lunch and share ideas for the 2019 program.

PRE-CONFERENCE COURSES

Sunday, February 11, 2018

Teaching, Learning & Performing Vibration Analysis – Using the Free ABRAVIBE MATLAB Toolbox
Anders Brandt—*University of Southern Denmark*

Instrumentation, Monitoring and Analysis of Recorded Motions from Structures Using OMA
Prof. Rune Brincker—Aarhus University
Prof. Carlos E. Ventura—University of British Columbia

Theory, Experiments & Applications for Structure Monitoring & Machine Learning – Design, Build & Analyze Real Data Using Low Cost Sensors
Haeyoung Noh—Carnegie Mellon University
Fernando Moreu, PE—University of New Mexico

EARLY BIRD REGISTRATION RATES

Register Early to Avoid Price Increases
Early Bird Rates - Until 1/15/18 @ 5:00PM EST

Member - \$780
Non-Member - \$890
Student Member - \$250
Student Non-Member - \$325

* to qualify at member rate SEM members must be in good standing prior to 12/1/2017

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Pre-Conference Courses

Course 101: Teaching, Learning & Performing Vibration Analysis – Using the Free ABRAVIBE MATLAB Toolbox

Sunday, February 11, 2018 | 9:00 a.m.–5:00 p.m

Course Objective

This course is designed for teachers, students and practicing engineers alike. The course demonstrates how the free, open ABRAVIBE toolbox can be used for teaching, learning, and applying vibration analysis. It gives in-depth descriptions of typical methods used for noise and vibration analysis, modal analysis, and order tracking. The ABRAVIBE toolbox and website includes powerful tools including time domain filtering, integration and differentiation etc., spectrum analysis tools, and very powerful simulation tools for illustration and simulation of mechanical systems. This allows teachers to design good and informative examples, students to learn by applying and looking through the provided tools, and practicing engineers get a powerful tool for vibration analysis.

Course Content

MATLAB Introduction

For the novice user of MATLAB, we start by giving a quick overview of the software architecture and describe why MATLAB is particularly suited for noise and vibration analysis.

Data Acquisition and Import

Before any NVH analysis can be done, data needs to be imported into MATLAB. So, in this part, we show how to use MATLAB Data Acquisition toolbox and/or how to import measured data into MATLAB.

Time Data Analysis

Before data are further analyzed, sometimes basic time data processing may be used, such as filtering, integration or differentiation etc. In this section we present some state-of-the-art tools for these tasks.

Mechanical System Simulation and Data Synthesis

Being able to simulate known mechanical models is essential in method development as well as in education. Therefore we give a thorough description of how the MATLAB platform can be used to simulate known mechanical models.

Spectrum Analysis

Experimental spectrum estimation is a common and important task in vibration analysis. In this part, we give an overview of how scaled spectra (FFT based as well as 1/1 and 1/n octaves) can be implemented and used.

Analysis of Rotating Machinery

For analysis of vibrations in engines, turbines and other rotating machinery, rpm-dependent frequency analysis is often used. This is also often called order tracking. The abravibe tools for treating tachometer signals, and creating spectrum and order maps etc. are presented here.

FRF Estimation

Estimating good frequency response functions is another very important application, particularly in modal analysis. We therefore give a thorough presentation of different ways of estimating FRFs, explaining advantages and disadvantages.

Experimental Modal Analysis

In the last session, we cover experimental modal analysis in MATLAB. Examples are given of simple SDOF methods as well as more advanced MDOF methods for curve fitting data.

Instructor:

Anders Brandt—University of Southern Denmark



Anders has thirty years of industrial and academic experience as a consultant, researcher, and teacher in applications of signal analysis in acoustics, experimental structural dynamics and mechanical wave propagation in structures. He is the author of "Noise and Vibration Analysis – Signal Analysis and Experimental Procedures," published by Wiley 2011. He is also the designer of the ABRAVIBE toolbox for teaching and learning vibration analysis, and is maintaining the website abravibe.com with additional resources for teaching, learning, and applying vibration analysis. Anders is a devoted and appreciated teacher and has held over 250 short-courses for industry around the world, on topics such as data acquisition, vibration analysis, and modal analysis, besides 20 years of teaching university courses.

Course Fee/Cancellation: The regular fee is \$500 and the student fee is \$250. Course fee includes course handout material and refreshment breaks. Lodging, additional food and other materials are not included. If the course is cancelled for any reason, the Society for Experimental Mechanics' liability is limited to the return of the course fees.

Course 102: Instrumentation, Monitoring and Analysis of Recorded Motions from Structures Using OMA

Sunday, February 11, 2018 | 9:00 a.m.–5:00 p.m

Course Description

This course covers various aspects of instrumentation, monitoring and analysis of recorded motions in structures arising from dynamic excitations. The course will discuss practical aspects of instrumentation of structures, as well as the theory behind operational modal analysis techniques for vibration data. The use of these techniques will be illustrated by several application examples from instrumented structures, which include laboratory tests as well as in-situ tests of buildings and bridges.

Who Should Attend

Engineers and researchers who have basic knowledge of structural analysis and who would like to expand their knowledge into the field of instrumentation of structures and Operational Modal Analysis. As design codes are now requiring instrumentation and monitoring of structures, this course will provide valuable insight into the usefulness of state of the art technology to better understand the dynamic response of structures and how to improve future designs.

Course Content

- Welcome and Introduction: What is Operational Modal Analysis (OMA)?; Practical value of instrumentation of structures; Modal identification of structural systems
- OMA basic assumptions and concepts: Gaussian white noise assumption; Transforms, Fourier, Laplace and Z-transform; Linear algebra tools, EVD, SVD
- Dynamic response of structures: Linear systems in continuous time; Free decays in discrete time; Closely spaced modes
- Instrumentation of structures: Classical OMA sensor planning; Instrumentation of large structures; The single input case problem
- Signal processing of recorded data: Preprocessing; Correlation function estimation; Spectral density estimation
- Time domain techniques: Polyreference, Ibrahim time domain, ERA; SSI
- Frequency domain techniques: Simple peak picking; Frequency domain decomposition (FDD), frequency domain polyreference
- Examples of identification: Buildings; Bridges; and other structures
- General discussion and future developments

Instructor(s):

Prof. Rune Brincker—Aarhus University



Rune Brincker is a civil engineer and received his M.Sc and Ph.D. from the Technical University of Denmark in 1977 and 1981, respectively. Since then he has been conducting research on various aspects of structural mechanics. Rune has

been employed as associate and full professor at several Danish universities. Presently he is a professor of structural dynamics at the Technical University of Denmark. During the last 30 years his research has been focused on operational modal analysis (OMA), and one of his major contributions to this field has been the development of the frequency domain decomposition (FDD) identification technique, which has been used in many practical applications of OMA. Rune Brincker is a co-founder of Structural Vibration Solutions (SVS) founded in 1999; and the founding chair of the International Operational Modal Analysis Conference (IOMAC).

Prof. Carlos E. Ventura—The University of British Columbia



Carlos Ventura is a Civil Engineer with specializations in structural dynamics and earthquake engineering. He has been a faculty member of the Department of Civil Engineering at the University of British Columbia (UBC) in Canada since 1992.

He is currently the Director of the Earthquake Engineering Research Facility (EERF) at UBC, and is the author of more than 470 papers and reports on earthquake engineering, structural dynamics and modal testing. Dr. Ventura has conducted research about earthquakes and structural dynamics for more than thirty years. In addition to his academic activities, Dr. Ventura is a recognized international consultant on structural vibrations and safety of large Civil Engineering structures. He is a member of the Canadian Academy of Engineering and Fellow of Engineers Canada, also a member of several national and international professional societies, advisory committees and several building and bridge code committees.

Course 103: Theory, Experiments & Applications for Structure Monitoring & Machine Learning – Design, Build & Analyze Real Data Using Low Cost Sensors

Sunday, February 11, 2018 | 1:00 p.m.–5:00 p.m.

Course Description

Structural health monitoring (SHM) has received significant attention in the community as a means to quantify different levels of performance and safety of structural systems. One of the core of SHM systems are the data acquisition systems that enable collecting data of interest for designers, managers, and decision makers. Data acquisition systems are expensive and complex to be operated by inspection personnel who were not trained to use them. The implementation of monitoring could become accessible and affordable if sensing monitoring were “groomed” by beginners who have not run DAQ or build sensors before. If owners of infrastructure can build their own sensors on their own desk, they will become familiar with the technology and willing to implement more advanced systems. Once the sensor is built and used, the value of machine learning from that data becomes tangible. This course presents advantages of using low-cost data acquisition platforms to measure simple responses of structures and algorithms to identify changes on damage and performance using quantitative data analysis. Students design, build, and test a low-cost sensor that combines low-cost microcontrollers, tilt-meters, and accelerometers. Data can be analyzed, clustered, and classified using fundamental exposure to machine learning protocols and definitions.

Course Objective

Structural health monitoring (SHM), embedded sensing, remote sensing, data processing for structural performance assessment, data clustering, off-the-shelf sensing technology, and experimental dynamics hands-on exposure.

Who Should Attend

First or second year graduate students who want to learn about sensors, data acquisition systems, signal processing, machine learning, and want to become familiar with experimental processes related to structure monitoring. Engineers, researchers and graduate students who deal with structural design, inspection, and assessment and want to become familiar with using vibration measurements using lowcost sensing technologies and quantitative data post-processing.

Hands-on Experience Related to this Course

There is a practical application of the use of the low-cost sensors with APS Dynamics on February 13 at 8am (www.apsdynamics.com). This practical application is to expose those taking this course to both low-cost sensing and industrial and sophisticated data acquisition systems, industrial and educational tools for structural dynamics.

Course Outline

Theory: Structural Health Monitoring

- Theory of cyber physical systems
- Maintenance, repair, replacements
- Consequence-based decisions: Structural performance
- Machine learning approaches for data quantification

Experiment: Off-the-shelf Sensing Assemblage

- Off-the-shelf micro-controllers
- Commercial DAQ
- Comparison of systems and Components descriptions
- Hardware and software assemblage
- Testing and validation

Applications: Structure Monitoring/Characterization

- Topic 1: shake table test for structure characterization
- Topic 2: human-induced floor vibration monitoring

Conclusions

- Industry application
- Future: wireless, battery, solar, robust learning, prognostics
- Survey and feedback

Instructor(s):

Haeyoung Noh—Carnegie Mellon University

Hae Young Noh is an Assistant Professor in the Department of Civil and Environmental Engineering with a courtesy appointment in the Electrical and Computer Engineering at Carnegie Mellon University. Noh’s research interests focus on indirect sensing to infer information about dynamic structural systems using statistical signal processing and machine learning techniques, particularly algorithm development for smart structures and systems to conserve energy and resources, provide safe, functional, and sustainable environments, and improve occupant’s quality of life.

Fernando Moreu, PE—University of New Mexico

Dr. Moreu is currently an Assistant Professor at the Department of Civil Engineering with a courtesy appointment in Electrical and Computer Engineering at the University of New Mexico. Dr. Moreu’s main research interests include structural health monitoring, performance assessment and quantification, and structural dynamics of civil structures; remote sensing; and structural optimization using consequence-based structural dynamics. He has eleven years of experience in the design, construction and replacement of bridges in the US.

Course Fee/Cancellation: The regular fee is \$500 and the student fee is \$250. Course fee includes course handout material and refreshment breaks. Lodging, additional food and other materials are not included. If the course is cancelled for any reason, the Society for Experimental Mechanics’ liability is limited to the return of the course fees.

Keynote—Jason Foley Engineering Extremes: Experiments at the Edge of the Envelope

Monday, February 12, 2018 | 11:10 a.m.

Keynote

As much as engineers try to accommodate “worst case” scenarios in the design process, there always seems to be harsher environments just waiting to test those designs to (and often beyond) their limits. Given this reality, how do we begin to develop truly robust systems for these extreme environments? In this talk, I will attempt to provide some ideas on how this can be accomplished using the design of extreme shock-survivable defense systems as a backdrop.

First, I propose that is very important to recognize that the tools of experimental mechanics—such as modal analysis and traditional shock analysis—are each an excellent foundation but neither is sufficient for the task of understanding and characterizing the response of systems in extreme events. Using an “impulse response” view of the world, the relevant concepts of both shock and vibration are linked using simple examples. More complex dynamics will be discussed as well: studies on the evolution of “real” interfaces under combined static and transient loads will be briefly reviewed.

This hints at another key issue in the design of extreme environment systems: describing and characterizing material response. A structural dynamicists’ view of systems describes materials in terms of stiffness and damping. Equivalently, a practitioner in shock mechanics will describe the system in terms of strength and dissipation. The dynamic properties of materials used in engineering applications can also vary wildly based on a host of factors: age, manufacturing process, thermal and/or mechanical history. I will discuss new experimental capabilities with the potential to address these realities, including techniques to perform in situ characterization of materials under mixed loading, varying temperatures, and a wide range of geometries.

We are also in the early stages of “designed response” across many length scales, from materials to components, assemblies, and structures. Innovations in manufacturing coupled with improved models are enabling exciting advances in developing optimized structures for particular applications. I will discuss this new paradigm in the context of both acoustic and shock applications.

Biography



Dr. Jason Foley earned a BS in physics (1998) and MS in aerospace engineering (1999) from Auburn University and MS (2002) and PhD (2007) degrees in mechanical engineering from Cornell University. Dr. Foley is currently an

International Program Officer at the U.S. Air Force’s European Office of Aerospace Research and Development in London (United Kingdom) where he funds basic research in physics, electronics, and materials at institutions throughout Europe, Africa, and the Middle East. He previously led a research group at the Air Force Research Laboratory where he performed basic and applied research in harsh environment-survivable electronics and sensors as well as material and structural dynamics in high rate loading conditions.

SAGE Publishing Young Engineer Lecture—Jacob Dodson High-Rate Structural Dynamics under Mechanical Shock - Sensing, Characterizing, and Making Microsecond Decisions

Tuesday, February 13, 2018 | 11:20 a.m.

Lecture

Future functionality of high-speed Air Force systems depend on instrumentation in harsh environments and methods for characterization of nonlinear dynamics. This will enable microsecond monitoring and decision making in high-rate dynamic systems. Extreme mechanical environments have rapidly changing input forces on the nonlinear and time-varying structures that can change the system's configuration in a few microseconds. The characterization of instrumentation in these extreme high-g environments is required for the accurate measurement of the dynamic response. Methods that provide insight to the nonlinear response and novel testing methods are critical for the understanding of the nonlinear dynamics in these mechanical shock environments. With accurate sensors and some understanding of the nonlinear structural dynamics, this information can be used to a very challenging application — monitoring the functional integrity of systems on microsecond scales. There are many challenges with the new technical area: algorithm development, hardware implementation, methods for decision making, and system reaction. This presentation will discuss the technical challenges and recent interdisciplinary efforts in novel instrumentation for extreme environments, characterization and testing of time-varying nonlinear structures, and the growing area of microsecond structural health monitoring for high-rate impact environments.

Biography



Jacob Dodson earned a Ph.D. degree in Mechanical Engineering in 2012 from Virginia Tech. He is research mechanical engineer at the Munitions Directorate, Air Force Research Laboratory at Eglin Air Force Base, Florida. His technical

publications cover the development and evaluation of shock sensors, microsecond structural health monitoring methods, and characterizing non-linear structures and materials for extreme environments. He is a member of the advisory committee for several technical groups including the Shock and Vibration Symposium, serves as a peer-review for 12 journals and conferences, and is a registered Professional Engineer.

Social and Award Events

IMAC-XXXVI Welcome Reception

Monday, February 12, 2018 | 7:00 p.m.

Everyone at IMAC-XXXVI is invited to attend the Welcome Reception. A staple at every IMAC, this reception is a terrific chance to reacquaint yourselves with fellow attendees, students, exhibitors, and guests, as well as meet those who are new. Located within the Exposition, it is a wonderful way to begin the conference.

IMAC-XXXVI Awards Luncheon*

Wednesday, February 14, 2018 | 12:20 p.m.

SEM President, Kathryn Dannemann, and IMAC Conference Director, Al Wicks, will conduct the Awards Luncheon ceremony by presenting various awards in recognition of outstanding achievements in structural dynamics and service to SEM/IMAC.

Awards and Recipients:

G.A. Brewer:

Gary C. Foss

D.J. DeMichele Award:

Charles D. Van Karsen

D.J. DeMichele Scholarship:

To be announced

SEM Fellow:

Charles Farrar

Carlos Estuardo Ventura

SEM Model Validation & Uncertainty

Quantification Technical Division's Best Paper:

To be announced

Continental Breakfast in the Exposition

Thursday, February 15, 2018 | 8:30 a.m.–10 a.m.

Get a good start to your last day at the conference! Come to the continental breakfast in the IMAC-XXXVI Exposition.

Spouse/Guest Hospitality

Monday–Thursday, February 12–15 | 8:30–10:00 a.m.

The Spouse/Guest Hospitality Room will be open Monday through Thursday from 8:30 a.m. to 10:00 a.m. Spouses and guests are invited to meet there to enjoy refreshments while renewing old friendships, making new acquaintances, and planning the day's activities.

Siemens PLM Software & PCB Piezotronics and The Modal Shop Hospitality Event

Tuesday, February 13, 2018

Stop by the Siemens PLM Software or the PCB/TMS booth in the IMAC-XXXVI Exposition for all the details!

Register Early!

Save \$100 if you register by January 15, 2018

Apply for your VISA now!

Obtaining a VISA can be a lengthy process. If you have not already obtained your VISA, please start that process now. We want to see you in Florida.

* One ticket to the luncheon is included in the conference registration fee. You must indicate you are attending the luncheon during the online conference registration. Additional tickets to the luncheon for guests may be purchased at the cost of \$75.00 per ticket.

Meetings

Open Meetings

Exhibit Planning Committee Meeting

Tuesday, February 12, 2018 | 12:20 p.m.

Experimental Techniques Editorial Meeting

Wednesday, February 14, 2018 | 11:00 a.m.

IMAC Program Planning Committee Meeting

Wednesday, February 14, 2018 | 9:00 a.m.

The committee will meet to receive feedback from Technical Divisions, Focus Groups, and others as to their plans for IMAC-XXXVII. **Each Technical Division and Focus Group is asked to send a representative to this meeting if possible.** If not possible, please BE SURE to return your TD/Focus Group form to the IMAC registration desk **prior** to this meeting.

Research Committee on the Mechanics of Jointed Structures

Tuesday, February 13, 2018 | 8:00 a.m.

The Research Committee on the Mechanics of Jointed Structures is holding their spring meeting at IMAC. This research organization focuses on developing collaborations across academia, industry, and government to advance the physical understanding of the behavior of jointed and assembled systems. This meeting will focus on the development of the new roadmap for joints research. The international community that composes this research committee focus on multiple fields of research: solid mechanics, nonlinear dynamics, uncertainty quantification, numerical methods, and tribology. For more information, please contact brake@rice.edu.

Closed Meetings

SEM Executive Board

Sunday, February 10, 2018 | 9:00 a.m.

IMAC Advisory Board

Monday, February 11, 2018 | 12:10 p.m.

SEM Handbook

Tuesday, February 13, 2018 | 9:30 a.m.

Highlighted Presentations

MVUQ Keynote: On the Monitoring-Driven Assessment of Engineered Systems

Tuesday, February 13, 2018 | 2:20 p.m.

Presented by:

Eleni Chatzi - ETH Zurich

Organized by:

SEM Model Validation & Uncertainty

Quantification Technical Division

Due to reasons relating to manufacturing, ageing, loading and boundary conditions, measurement errors, as well as the potential inefficiencies of simplified simulation models, almost every structural system is characterized by uncertainty. The propagation of uncertainty through such a system gives rise to corresponding uncertainties of the structural dynamics and, in turn, to the overall behavior of the structure. The problem becomes even more pronounced when the system at hand is described by nonlinear or time varying dynamics, thus furthering the complexity of the governing laws involved. Utilization of monitoring data in an inverse problem setting allows for improved estimates on structural response.

However, the inference of an adequate system model, either from monitoring data, or even conceptually for the purposes of pure simulation, is by default a non-trivial task, since admittedly, and despite refinement, some physical processes are yet to be captured through numerical simulation. This task becomes even more challenging when taking into account the lack of thorough a priori knowledge on defining structural properties. A further issue lies in susceptibility of the system properties to the level of load, giving rise to nonlinear behavior, but additionally to long-term effects owing to environmental variability or deterioration processes. A final source of uncertainty is attributed to the fact that only a finite number of sensors, even if dense, may be deployed.

In this presentation, a step-wise deconstructive take will be offered on how to deal with the aforementioned diverse sources of uncertainty for different classes on-line identification problems of varying complexity. Two separate model classes will be overviewed, namely the state-space and autoregressive model class, along with the distinctive features, which allow for the curbing of uncertainty.

Highlighted Presentations

Panel on Career Development

Monday, February 12, 2018 | 6:00 p.m.

Organized by:

Michael Mains - Brüel & Kjær

This panel will address topics relevant to developing a career in Structural Dynamics. These panel sessions have been popular at the Annual SEM conference and we believe they will also be advantageous to our engineers embarking or continuing their career in Structural Dynamics. This panel is comprised of active SEM members at various stages of their careers. Topics will include:

- Professional Development
- Work-life balance
- Service
- Teaching
- Mentoring and leadership development

Boundary Conditions in Environmental Testing Round Robin

Monday, February 12, 2018 | 5:30 p.m.

Organized by:

Julie Harvie - Sandia National Laboratories

The current practices for component-level shock & vibration testing may result in over- or under-stressing the component as compared to the stress experienced in the next level assembly. While the success of the component test is dependent on several factors, a significant contributor is the boundary condition in the component test. Common test practices cause the component to have notably different dynamic boundary conditions between the component test and system configuration. This may be causing false failures in the component tests that are not indicative of the true system environments and/or leading us to miss failures in the component tests that would have occurred in the system.

A test bed, the Box Assembly with Removable Component (BARC), has been designed for interested parties to study this problem in a common framework. This round robin will include an overview of the hardware and problem statement followed by a discussion among current and prospective participants regarding approaches for improving the issues associated with differing boundary conditions. Current efforts are primarily focused on improved test specifications and fixture design optimization. Please join us!

Sessions

Basics of Modal Analysis for the New/Young Engineer Program

*Monday and Wednesday–Thursday,
February 12, 14-15, 2018*

006. SINGLE AND MULTIPLE DEGREE OF FREEDOM THEORY

013. MODAL MEASUREMENTS & EXCITATION TECHNIQUES

020. EXCITATION TECHNIQUES & MODAL PARAMETER ESTIMATION

Vendor Presentations:

SESSIONS:

044, 051, 058, 065, 072

Developed by:

J.R. Blough, Michigan Technological University

B.J. Dilworth, MIT Lincoln Laboratory; T. Marinone

ATA Engineering; M.L. Mains, Brüel & Kjær

Instructors:

J.R. Blough, Michigan Technological University; B.J. Dilworth,

MIT Lincoln Laboratory; T. Marinone, ATA Engineering, Inc.; M.L.

Mains, Brüel & Kjær

Sponsored by:

Modal Analysis /Dynamic Systems Technical Division

The field of Modal Analysis continues to evolve and mature. In order to allow new or young engineers in the modal field to extract meaningful information from paper presentations at the IMAC Conference, a program has been developed to familiarize the new/young engineer with some of the very basic material related to modal analysis. Held on the first day of the conference, the Basics of Modal Analysis lecture sessions are geared towards those individuals who have very limited or no experience in the modal field or need a refresher on some of the basic modal nomenclature. The material is centered on the topics of single degree of freedom theory, multiple degree of freedom theory, measurements and parameter estimation. The intent is to familiarize the new/young modal engineer with the nomenclature and basic techniques involved in modal analysis; the most basic fundamental equations will be explained in an overview sense rather than developed from a theoretical standpoint. These tutorial sessions should not be considered a training seminar but rather an overview of basic definitions that are inherent in most of the presentations at the conference. By attending these sessions, the new or young engineer should be able to better appreciate and comprehend more of the material that is presented in the technical paper presentations.

The Basics of Modal Analysis for the New/Young Engineer Program will include several presentations where IMAC vendors will be conducting demonstrations of the topics that were covered during the lecture portion of the program, or material that complements the lecture material. Topics will include: Measurements for Modal Analysis, Impact Testing, Shaker Testing, Modal Parameter Estimation, Operating Modal Analysis (OMA), Rotating Machinery Analysis, Pre-Test Analysis, Test Analysis Verification (or Correlation) and Model Updating.

Course Notes:

The notes for these lectures will be available for download as part of the conference proceedings.

Nonlinear Sessions

Monday–Thursday, February 12-15, 2018

Sessions:

004. NONLINEARITY & SYSTEM IDENTIFICATION
011. NONLINEAR MODELING & SIMULATION I
018. NONLINEAR MODELING & SIMULATION II
025. EXPERIMENTAL NONLINEAR DYNAMICS I
032. EXPERIMENTAL NONLINEAR DYNAMICS II
039. EXPERIMENTAL NONLINEAR DYNAMICS III
046. NONLINEAR DAMPING I
053. NONLINEAR DAMPING II
060. NONLINEAR MODEL & MODAL INTERACTIONS I
067. NONLINEAR MODEL & MODAL INTERACTIONS II
074. DYNAMICS OF JOINTED STRUCTURES
081. MECHANICS OF JOINTED STRUCTURES
088. IDENTIFICATION OF JOINTED STRUCTURES

Organized by:

Nonlinear Structures and Systems Technical Division

The vast majority of real engineering structures behave nonlinearly. Therefore, it is necessary to include nonlinear effects in all the steps of the engineering design: in the experimental analysis tools (so that the nonlinear parameters can be correctly identified) and in the mathematical and numerical models of the structure (in order to run accurate simulations). In so doing, it will be possible to create a model representative of the reality which (once validated) can be used for better predictions.

The nonlinear sessions will address theoretical and numerical aspects of nonlinear dynamics (covering rigorous theoretical formulations and robust computational algorithms) as well as experimental techniques and analysis methods. There will also be several sessions dedicated to joints and interfaces.

Because nonlinearity and its impact on the dynamics of mechanical systems might still be obscure for many conference participants, the nonlinear sessions will comprise five tutorials on nonlinear oscillations given by Prof. Douglas Adams (Vanderbilt University), on reduced-order modeling given by Prof. Marc Mignolet (Arizona State University), on nonlinear modal interactions given by Prof. Steve Shaw (Florida Institute of Technology), on joints given by Prof. Matthew Brake (Rice University) and on experimental nonlinear modal analysis by Dr. L. Renson (Univeristy of Bristol).

Dynamics of Civil Structures Sessions

Monday–Thursday, February 12-15, 2018

Sessions:

007. STRUCTURAL VIBRATION I
014. STRUCTURAL VIBRATION II
021. STRUCTURAL VIBRATION III
028. HUMANS & STRUCTURES I
035. HUMANS & STRUCTURES II
042. INNOVATIVE MEASUREMENT FOR STRUCTURAL APPLICATIONS
049. SMART STRUCTURES AND AUTOMATION
056. MODAL IDENTIFICATION OF STRUCTURAL SYSTEMS
063. BRIDGES AND NOVEL VIBRATION ANALYSIS
070. FULL SCALE OPERATIONAL SID
077. STRUCTURAL IDENTIFICATION
084. SENSORS AND CONTROL
091. IDENTIFICATION OF RC STRUCTURES

Organized by:

Dynamics of Civil Structures Technical Division

The Dynamics of Civil Structures TD serves as a primary focal point within the SEM umbrella for technical activities devoted to civil structures analysis, testing, monitoring, and assessment. This TD covers dynamic testing and analysis of all type of civil engineering structures such as buildings, bridges, stadiums, dams, etc. Please note that the TD holds its annual meeting during IMAC (IMAC-XXXVI: Tuesday, Feb. 13, 12:20 PM). The Dynamics of Civil Structures TD welcomes members and guests to attend our annual meeting.

Special sessions focusing on civil engineering research and applications are scheduled during all four days of the conference. This year sessions and papers discuss a variety of topics including structural vibrations, damage identification, human-structure interaction, vibration control, model updating, modal analysis of in service structures, innovative measurement techniques and mobile sensing, bridge dynamics among many others topics. In addition, a number of technical sessions devoted to new analytical and experimental methods, non-linear dynamics, and other topic of interests are presented through the conference. The Dynamics of Civil Structures TD welcomes all attendees to enjoy a very full and diverse technical program organized in the multi-disciplinary style unique to IMAC and SEM.

Sessions

Modal Analysis and Dynamic Systems

Monday-Thursday, February 12-15, 2018

Sessions

003. PHOTOGRAMMETRY AND DIC I
010. MULTI DEGREE OF FREEDOM TESTING I
017. VIBRO-ACOUSTICS
024. MODAL APPLICATIONS
031. MULTI DEGREE OF FREEDOM TESTING II
038. ANALYTICAL METHODS I
045. PHOTOGRAMMETRY AND DIC II
052. PHOTOGRAMMETRY AND DIC III
059. BOUNDARY CONDITIONS IN ENVIRONMENTAL TESTING I
066. BOUNDARY CONDITIONS IN ENVIRONMENTAL TESTING II
073. ANALYTICAL METHODS II
078. EXPERIMENTAL TECHNIQUES III
079. MODAL APPLICATIONS II
086. OFFSHORE WIND TURBINE AND OPERATING MODAL ANALYSIS
087. ANALYTICAL METHODS III

Organized by:

SEM/IMAC Modal Analysis and Dynamic Systems Technical Division

The Modal Analysis and Dynamic Systems Technical Division serves as a primary focal point within SEM for technical activities devoted to general Modal Analysis and Structural Dynamics. The above sessions outline a track for all subjects pertaining to Modal Analysis.

Sensors & Instrumentation Tutorials

Tuesday, February 13, 2018

Sessions

001. & 008: TECHNOLOGY APPLICATIONS
022. INSTRUMENTATION
029. SHOCK MEASUREMENTS
036. ALTERNATIVE SENSING & ACQUISITION

Organized by:

E.T. Wee Sit, LearnSV.com; G.C. Foss, Boeing Test & Evaluation Northwest (retired); P.L. Walter, Texas Christian University; C. Walber, PCB; S. Seidlitz, Cummins Power Systems

Sponsored by:

Sensors and Instrumentation Technical Division

Credit for much of the progress in the field of modal analysis over the last thirty years is owed to substantial advancements in sensors, electronics, and computing platforms. Many of those involved in modal analysis and testing have personal and professional interests in the associated equipment and sensors. The SEM Sensors and Instrumentation Technical Division was reorganized in 2007 to address this interest within the IMAC community.

Achieving accurate test results depends on an adequate knowledge of the test equipment; its selection, use, and limitations. This series of tutorials, presented by a distinguished group of experts, is meant to offer IMAC attendees an opportunity to learn more about their test instrumentation and explore the application of emerging technologies, such as wireless communication and energy harvesting.

Technology Applications | Sessions 1 and 8

Monday, February 12, 2018 | 9:00 a.m. - 3:10 p.m.

Due to the continued great interest in this session at 2017 IMAC-XXXV, we are pleased to be able to offer it at 2018 IMAC-XXXVI. Several IMAC Exhibitors will provide brief presentations highlighting their hardware and software applications and services. Come visit this extremely timely session and then you will have the opportunity to obtain additional information from the exhibitors during the IMAC-XXXVI Exposition Hours.

Model Validation and Uncertainty Quantification Sessions

Monday-Thursday, February 12-15, 2018

Sessions

- 012. VALIDATION OF MODELS FOR OPERATING ENVIRONMENTS I
- 019. CONTROLLING UNCERTAINTY
- 026. VALIDATION OF MODELS FOR OPERATING ENVIRONMENTS II
- 033. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS I
- 040. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS II
- 047. COMPUTATIONAL UNCERTAINTY QUANTIFICATION TOOLS
- 054. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS III
- 061. UNCERTAINTY IN EARLY STAGE DESIGN I
- 068. UNCERTAINTY IN EARLY STAGE DESIGN II
- 075. MV&UQ AND DECISION MAKING
- 082. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS IIII
- 089. INVERSE PROBLEMS AND UNCERTAINTY QUANTIFICATION

Organized by:

Model Validation and Uncertainty Quantification (MVUQ)
Technical Division

Numerical models and simulations are approximate representations of the actual systems they represent. Verification and Validation (V&V) along with uncertainty quantification (UQ) activities provide a means to establish model credibility in a quantitative and objective manner. Model verification ensures that the mathematical model is being solved correctly while model validation ensures that model is sufficiently credible representation of reality. Uncertainty quantification seeks to evaluate the effects of uncertainties that originate from numerous sources and track the propagation of those uncertainties to the final prediction(s) of the model. MV&UQ processes are necessary to ensure that advanced numerical models may be relied upon with confidence.

The MV&UQ sessions at IMAX XXXVI are intended to be of interest to both newcomers and experienced hands in this field and should appeal to all conference attendees whose work makes use of model predictions. The full program of talks over the four days will cover a broad span of recent work in this field, from the development of new tools for uncertainty quantification through to industrial applications of validation procedures. The highlight of the Tuesday sessions will be. Highlights include a tutorial keynote talk by Prof. Eleni Chatzi of ETH Zurich on Tuesday afternoon, plus special sessions on Validation for Operating Environments and on novel and potentially powerful methods for Controlling Uncertainty.

Dynamic Substructures Sessions

Monday-Tuesday February 12-13, 2018

Sessions

009. Applications for Dynamic Substructures

016. METHODS FOR DYNAMIC SUBSTRUCTURES

023. FREQUENCY BASED SUBSTRUCTURING

030. TRANSFER PATH ANALYSIS

037. INTERFACES & SUBSTRUCTURING

Organized by:

Dynamic Substructures Technical Division

Substructuring is a general paradigm in engineering dynamics where a complicated system is analyzed based on the dynamics of each subcomponent and the interactions between subcomponents. In numerical simulations, substructuring allows one to reduce the size of the model for a subcomponent of the system and reduce the computational burden by discarding those dynamics that are not important to the assembly/environment of interest. In other applications, a subcomponent model is derived experimentally from hardware, which can be beneficial when the substructure is difficult to model or when there is not enough information to create an accurate finite element model. Substructuring can also be used to couple numerical simulation with real-time testing of components. Such approaches are known as hardware-in-the-loop or hybrid testing.

Whether experimental or numerical, all substructuring approaches have a common basis, namely the equilibrium of the substructures under the action of the applied and interface forces and the compatibility of displacements at the interfaces of the subcomponents. Experimental substructuring requires special care in the way the measurements are obtained to establish acceptable equilibrium and compatibility in the presence of noise and a relatively small number of sensor degrees of freedom. In numerical approaches, the fundamental quest is the efficient computation of reduced order models describing the substructure's dynamic motion. For hardware-in-the-loop applications difficulties include the fast computation of the numerical components and the proper sensing and actuation of the hardware component. Recent advances in experimental techniques, sensor/ actuator technologies, novel numerical methods, and parallel computing have rekindled interest in substructuring. The program this year includes a session on substructuring with nonlinear subcomponent models, organized jointly with the nonlinear systems focus group. Interest also continues in the SEM Ampair wind turbine test bed and in real time substructuring.

Tutorial– Nonlinear Oscillations: The Fundamentals

Monday, February 12, 2018 | Session 4

Presented by:

D.E. Adams, Vanderbilt University

Nonlinear oscillations are as useful as they are fascinating in structural dynamics. Natural frequencies, damping levels, mode shapes, and amplitudes of response can all change in seemingly surprising ways when nonlinear behaviors arise. How can we use the tools of modal analysis to understand nonlinear oscillations? How can we use nonlinear oscillations for engineering problem solving in areas like structural health monitoring? This tutorial is intended for participants who are new to nonlinear topics in vibration or who have begun to investigate nonlinear phenomena and want to engage in an interactive session on the topic. The tutorial will begin by introducing some of the fundamental mechanisms associated with nonlinear oscillations and will then use case studies to introduce tools and methods that analyze nonlinear oscillations. Case studies are drawn from aerospace and automotive applications involving advanced materials, components, and structures. Questions and discussion are encouraged.

Tutorial– Nonlinear Modal Testing

Tuesday, February 13, 2018 | Session 25

Presented by:

L. Renson, University of Bristol

Addressing the presence of nonlinearity is challenging because nonlinear systems can exhibit a wide range of complicated dynamic behaviours that are very difficult to predict accurately and have no linear equivalent. This tutorial discusses the key role that experimental testing has to play in this context. Fundamental aspects of nonlinear vibrations are reviewed to explain how standard vibration tests can be modified to account for the presence of nonlinearity and so gain additional insight into the nonlinear behaviour of a structure. Standard testing approaches are also shown to have limitations, which motivates the introduction of novel, control-based methods for testing nonlinear structures. This tutorial provides an informal overview of the recent developments in this area. An important part of the talk is devoted to the extension of experimental modal techniques to nonlinear systems and, in particular, phase resonance testing.

Tutorial– Nonlinear Modal Interactions

Wednesday, February 14, 2018 | Session 60

Presented by:

S. Shaw, University of Bristol

In this tutorial we provide an overview of how nonlinearities can result in modal interactions that are not captured by linear system models. We also offer examples where these interactions are important, both problematically and beneficially. We begin with a discussion of modeling, since physical systems are not “linear” or “nonlinear,” only the models describing their behavior can be so labeled, and a key issue is the use of an appropriate model in a given situation. The essential features of a linear model are those of superposition and invariance. Invariance implies that if a system is started with some distribution of energies in a set of modes and then undergoes free vibration, the energy in each mode will decay due to damping, but there will be no energy transfer between the modes. For free and forced vibration, linear modal analysis allows one to determine the response by considering the superposition of individual modes. Here we focus on systems in which the response is dominated by only a few degrees of freedom, but due to nonlinearity there is energy exchange between the linear modes.

There are a variety of situations in which one encounters such modal interactions, for example, when vibro-impacts occur, when subsystems have complicated connections, or when internal resonances arise. Here we focus on the latter situation, which is arguably the subtlest of these cases since nonlinear behavior can occur even when amplitudes are small if certain rational ratios exist between the linear natural frequencies. We demonstrate this behavior by examples with two interacting modes in systems with frequency ratios of 1:1, 1:2, and 1:3. We also describe generic models that reveal which nonlinear coupling terms are essential to describe this nonlinear behavior. The responses predicted by these models are outlined, showing how systems can behave with single mode or coupled mode dynamics, and how these are related by bifurcations. Lumped and distributed mass models where these behaviors are important are considered, including pendulums, strings, cables, beams, and plates, and a variety of simulation and experimental results for such systems are described. We also touch on some applications where modal energy transfer is beneficial, including the use of energy transfer for sustaining vibration of a selected mode, and using multi-mode responses for signal processing in micro-electro-mechanical-systems.

Tutorial– Bolted Joints and Tribomechadynamics

Thursday, February 15, 2018 | Session 74

Presented by:

M. Brake, Rice University

Tribology, contact mechanics, and structural dynamics are three sub-disciplines of mechanical engineering that are each concerned with the study of interfaces in mechanical systems. Despite this, these three sub-disciplines have remained separate due to length scale considerations, solution techniques, and response metrics. As a result, common problems solved within one of these sub-disciplines rarely affects research within the other sub-disciplines. To address this, the field of Tribomechadynamics was founded to bridge the scales from the nano- and micro-structural characterizations of tribology to the macroscale modeling of structural dynamics. The goal of this new field is three fold: to develop predictive models of jointed structures that can be used to affect the design phase of a product, to predict the degradation of an interface over time due to wear/fretting, and to enable the optimization of jointed structures to reduce weight, be wear resistant, or have advantageous properties. This tutorial presents an overview of joint mechanics in the context of the emerging field of Tribomechadynamics, in terms of the applications that it addresses (such as aeroturbines) and the basic research being used to advance our physical understanding of assembled systems. Through a series of experimental studies, Tribomechadynamics has been able to elucidate the sources of variability typically observed in jointed systems, allowing for repeatable measurements and validated numerical models. This tutorial concludes with open research questions and areas for future investigations in this nascent field.

Technical Division/Focus Group Meetings

All Technical Division Groups will meet on Tuesday, February 13 at 12:20 p.m.

Dynamics of Civil Structures Technical Division

The Dynamics of Civil Structures TD serves as a primary focal point for technical activities devoted to civil structures testing, monitoring, and assessment. The TD was established to address the needs of its SEM member community and to impact structural test and monitoring issues in the larger civil structures professional community and related technical disciplines. The TD holds its annual meeting during IMAC highlighting the significant technical content and TD member conference activities devoted to the study of civil structures under dynamic loads. The TD provides a unique multidisciplinary forum to disseminate and exchange information on new research and technical developments in the testing, analysis, identification, and assessment of civil structures.

TD goals include the identification of critical research needs and the validation and dissemination of emerging methods and promising technologies that address the unique demands of the civil structures test environment. Conference activities of the TD include organization of special sessions, program tracks, and short courses among others.

New members and conference participants are welcome to attend the TD annual meeting.

Nonlinear Structures and Systems Technical Division

The Nonlinear Systems Focus Group organizes sessions and tutorials related to analytical, numerical and experimental methods in nonlinear dynamics. We will meet to organize the nonlinear sessions for the next IMAC conference. All interested persons are welcome.

Modal Analysis/Dynamic Systems Technical Division

IMAC attendees interested in promoting modal analysis and dynamic systems activities within SEM are welcome to attend the annual meeting of this Technical Division. The Division is constantly seeking new ideas and volunteers to participate in activities which will further the scientific and educational knowledge of modal analysis and dynamic systems.

The Modal Analysis and Dynamic Systems TD has sponsored the Basics of Modal Analysis for the New/Young Engineer program for many years. The recent round robin sessions on Modal Parameter Estimation and Operating Modal Analysis have also been organized by this TD. This year the Vibro-acoustic Coupling, Additive Manufacturing, Shock and Vibration Testing and Multi-axis Shock and Vibration Testing sessions were also developed and sponsored by the Modal TD. If you have ideas for special sessions or programs at IMAC bring your ideas to this meeting.

At this year's meeting, we will be making plans for IMAC 2018, the 36th anniversary of the conference. In addition to plans for 2018, we will also be discussing how this Technical Division can serve all engineers and technicians working in the field by being a source of knowledge and information. Once again, all are welcome to attend. Please bring us your ideas.

Sensors & Instrumentation Technical Division

All IMAC attendees are invited to the annual meeting of the SEM Sensors and Instrumentation Technical Division. Our mission is to promote and encourage the exchange of non-proprietary information relating to electronic systems and components used to measure structural dynamic behavior. We have again organized a series of IMAC tutorial sessions for those who want to improve their knowledge and skill in the use of instrumentation. If you have an interest in sensors and measurement hardware or would like to offer ideas about other potential session topics, tutorials, or activities, please join us.

Technical Division/Focus Group Meetings

Model Validation & Uncertainty Quantification Technical Division

Model Validation and Uncertainty Quantification (MV&UQ) refers to a broad range of activities carried out to provide evidence that measurements and predictions are credible and scientifically defensible. The purpose of the MV&UQ Technical Division is to advance the capabilities and disseminate knowledge of MV&UQ methods with an emphasis in Structural Dynamics. Among the goals of the Technical Division is an aim to broaden the impact of MV&UQ practices incorporating all stakeholders, from industry to academia, to ensure that MV&UQ practices continue to grow and mature in a manner that benefits all. Over the past ten years, the TD has been very active in organizing technical sessions and tutorials at SEM conferences and awards an MV&UQ Best Paper award during IMAC. All who share our interest for MV&UQ are welcome to attend the meeting, join the TD, and help to define its role and mission.

Dynamic Substructuring Technical Division

The Experimental Dynamics Substructuring Focus Group is eagerly organizing sessions, tutorials, and activities of interest for both analytical and experimental-analytical substructuring. We will meet to organize sessions, tutorials, and panel discussions for the next IMAC conference and to coordinate efforts on the SEM Ampair benchmark system. The benchmark system is a small wind turbine of which there are currently five copies being tested by various organizations around the world. All interested and curious persons are welcome.

Scanning LDV Methods IMAC Focus Group

All IMAC attendees with or without expertise in laser vibrometry are welcome to join this focus group on Scanning LDV methods. Measurement techniques based on laser vibrometry have developed considerably over the past two decades, thus becoming part of established testing procedures applied in several industrial environments, such as automotive, aerospace and bioengineering. This group aims to discuss the most recent developments on scanning laser vibrometry measurement technologies and their applications to real engineering test cases.

Topics for discussion of the focus group are also the use of 3D-SLDV systems for enhanced experimental Model Validation, the specific benefits of Continuous Scanning measurement methods. One of the goals of the group is to develop a strategic path for establishing smart measurement techniques in engineering testing. Therefore, it should aim to identify and quantify the specific benefits that can be obtained by using either stepped or continuous scanning measurement approaches. Other goals of the Group are to develop sessions for future IMACs to explore the use of SLDV technologies in the areas of model validation, biomechanics, diagnostics, strain measurement and sub-structuring.

PRELIMINARY TECHNICAL PROGRAM

The most up-to-date program can be found on the IMAC web page. At the conference please refer to the Conference App or the Final Program for the correct schedule.

Preliminary Technical Program

001. TECHNOLOGY APPLICATIONS I

February 12, 2018 | 09:00 AM - 10:45 AM | Salon 8

Organizer: J. Normandin, SEM

Chair Person(s): E. Wee Sit, LearnSV.com

- 09:00 AM Estimation of a Power Spectral Density from a Known Noise Source | 36i-39 | Andrew Cogbill
- 09:15 AM Ultra-High Temperature Sensors (UHT-12™) for Research and Monitoring: Extreme Sensors for Extreme Temperatures | 36i-470 | Chad Walber
- 09:30 AM Eco-Friendly Vibration Test Systems - Significant Reduction of Energy Consumption and CO2 Emissions. | 36i-448 | Shinichi Hirokawa
- 09:45 AM Scanning and Multipoint Laser Vibrometers for Triaxial Modal Analysis | 36i-443 | David Oliver
- 10:00 AM Use Scenarios of Mobile Signal Generator for Simulating Accelerometers for Field Setup Verification | 36i-446 | Scott Mayo
- 10:15 AM Portable Sensor Digitization Made Easy | 36i-447 | Bruce Lachey
- 10:30 AM LabAmp® Signal Conditioning with Integrated DAQ | 36i-493 | Bill Zwolinski

002. TEACHING PRACTICES IN VIBRATION ENGINEERING COURSES

February 12, 2018 | 09:00 AM - 10:40 AM | Salon 9

Organizer: A. Brandt, University of Southern Denmark

Chair Person(s): A. Brandt, University of Southern Denmark

- 09:00 AM Realtime Hybrid Testing: Challenges and Experiences from a Teaching Point of View | 36i-129 | Markus Hochrainer
- 09:20 AM Vibration Analysis by Pictures | 36i-463 | Robert Randall
- 09:40 AM Engineering Dynamics and Vibration in the Mechanical Engineering Curriculum at the Technical University of Munich | 36i-281 | Daniel Rixen
- 10:00 AM Combining Virtual Simulation with Hands-on Experiments for Teaching Mechanical Vibration | 36i-348 | Suri Ganeriwala
- 10:20 AM Enhancing the Teaching of Structural Dynamics using Additive Manufacturing | 36i-154 | Lawrie Virgin

003. PHOTOGRAMMETRY AND DIC I

February 12, 2018 | 09:00 AM - 10:40 AM | Salon 12

Organizer: J. Baqersad, Kettering University

Chair Person(s): J.Sirohi, University of Texas; J.Baqersad, Kettering University

- 09:00 AM A Multiple Stereo-Vision Approach using Three Dimensional Digital Image Correlation for Utility-Scale Wind Turbine Blades | 36i-415 | Peyman Poozesh
- 09:20 AM Light Field Imaging of Three-Dimensional Structural Dynamics | 36i-301 | Andre Green
- 09:40 AM Development of Modal Sensors for Large Beam Displacements using Digital Image Correlation and Modal Analysis | 36i-346 | Jason Tran
- 10:00 AM Extracting Natural Frequencies of Layered Beams using a Continuous Variation Model and Modal Analysis | 36i-211 | Arnaldo Mazzei
- 10:20 AM A Multi-View DIC Approach to Extract Operating Mode Shapes of Structures | 36i-159 | Javad Baqersad

004. NONLINEARITY & SYSTEM IDENTIFICATION

February 12, 2018 | 09:00 AM - 10:20 AM | Salon 14

Organizer: J.P. Noel, G. Kerschen, University of Liège

Chair Person(s): G. Kerschen, J.P.Noel, University of Liège

- 09:00 AM Tutorial: Nonlinear Oscillations: The Fundamentals (60-min) | 36i-472 | Douglas Adams
- 10:00 AM Locating Nonlinearity in Mechanical Systems - A Dynamic Network Perspective | 36i-298 | Jean-Philippe Noël

Preliminary Technical Program

005. OPERATIONAL MODAL ANALYSIS

February 12, 2018 | 09:00 AM - 10:00 AM | Salon 10

Chair Person(s): R. Brincker, Technical University of Denmark

- 09:00 AM Comparison of two (Geometric) Algorithms for Auto OMA | 36i-66 | Martin Juul
- 09:20 AM Operational Modal Analysis On Wind Turbine Hub | 36i-67 | Martin Juul
- 09:40 AM Orthogonal Projection-based Harmonic Signal Removal for Operational Modal Analysis | 36i-44 | Szymon Gres

006. BASICS OF MODAL ANALYSIS I

February 12, 2018 | 09:00 AM - 10:40 AM | Salon 13

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T. Marinone, ATA Engineering

- 09:00 AM Young Engineers - SDOF and MDOF Theory (100-min) | 36i-460 | Jason Blough

007. STRUCTURAL VIBRATIONS I

February 12, 2018 | 09:00 AM - 10:40 AM | Salon 11

Organizer: A. Pavic, University of Exeter; S. Zivanovic, University of Warwick; V. Racic, Politecnico di Milano

Chair Person(s): B. Moaveni, Tufts University; M.Gul, University of Alberta

- 09:00 AM Dynamic Behavior of a 130 Years Old Building Under Excessive Sound Pressure | 36i-136 | Reto Cantieni
- 09:20 AM Protection of Critical Assets from the Effects of Ground Vibrations | 36i-222 | Brad Pridham
- 09:40 AM Paradigm Shift in Structural Vibration Serviceability: New Assessment Framework Based on Human's Experience of Vibration | 36i-338 | Vitomir Racic
- 10:00 AM Walking Load Identification Based on Structural Responses | 36i-456 | Ziping Han
- 10:20 AM The Prediction of Vibrations for Light Structures in Presence of Moving People | 36i-55 | Stefano Manzoni

008. TECHNOLOGY APPLICATIONS II

February 12, 2018 | 01:30 PM - 03:15 PM | Salon 8

Organizer: J. Normandin, SEM

Chair Person(s): E. Wee Sit, LearnSV.com

- 01:30 PM Subspace-based Structural Health Monitoring | 36i-437 | Niels Jacobsen
- 01:45 PM Selecting the Best Parameter Estimator for Each Modal Analysis Scenario | 36i-496 | Simone Manzato
- 02:00 PM Modal Testing Advancements and Implementation | 36i-485 | Timothy Marinone
- 02:15 PM Nonlinearities in Structural Dynamics: From Identification to Design | 36i-490 | Thibaut Detroux
- 02:30 PM Applications of Model Updating | 36i-491 | Eddy Dascotte
- 02:45 PM Improving Unit Under Test Protection During Environmental Testing. | 36i-495 | Chris Wilcox
- 03:00 PM General DIC Systems Overview with Emphasis on Analyzing Vibration Measurements | 36i-492 | Bluejay Robinson

009. APPLICATIONS FOR DYNAMIC SUBSTRUCTURES

February 12, 2018 | 01:30 PM - 03:10 PM | Salon 9

Chair Person(s): R. Mayes, AWE

- 01:30 PM A Comparison of two Reduction Techniques for Forced Response of Shrouded Blades with Contact Interfaces | 36i-185 | Stefano Zucca
- 01:50 PM Experimental-Analytical Substructuring of a Complicated Jointed Structure using Nonlinear Modal Models | 36i-209 | Daniel Roettgen
- 02:10 PM Predicting Assembly Effective Mass from two Component Effective Mass Models | 36i-50 | Randall Mayes
- 02:30 PM Transmission Simulator Mass Loading Effects in Experimental Substructuring-A Study of the Ampair 600 Benchmark System | 36i-286 | Andreas Linderholt
- 02:50 PM Dynamic Substructuring Applied to the Decoupling of Acoustic-structure Systems | 36i-334 | Ryan Schultz

Preliminary Technical Program

010. MULTI DEGREE OF FREEDOM TESTING I

February 12, 2018 | 01:30 PM - 03:10 PM | Salon 12

Organizer: T. Schoenherr, G. Nelson, Sandia National Laboratories

Chair Person(s): T. Schoenherr, Sandia National Laboratories

- 01:30 PM Evaluation of MIMO Input Derivations and their Physical Context | 36i-237 | Arup Maji
- 01:50 PM A Primer on Multiple Degree of Freedom Vibration Test for Aerospace and Military Applications | 36i-287 | Luke Martin
- 02:10 PM Off-Axis Input Characterization of Random Vibration Laboratory Data for Model Credibility | 36i-263 | Jill Blecke
- 02:30 PM Derivation of Six Degree of Freedom Shaker Inputs Using Sub-Structuring Techniques | 36i-17 | Tyler Schoenherr
- 02:50 PM A Systematic Evaluation of Test Specification Derivation Methods for Multi-Axis Vibration Testing | 36i-83 | Garrett Nelson

011. NONLINEAR MODELING & SIMULATION I

February 12, 2018 | 01:30 PM - 03:10 PM | Salon 14

Organizer: A. Cammarano, University of Glasgow

Chair Person(s): A. Cammarano, University of Glasgow; T.Hill, University of Bristol

- 01:30 PM An Improved Shape Reconstruction Methodology for Long rod like Structures using Cosserat Kinematics- Including the Poisson's Effect | 36i-133 | Michael Todd
- 01:50 PM On Euler Buckling and Snap-Through | 36i-85 | Richard Wiebe
- 02:10 PM Solitons in Cyclic and Symmetric Structures | 36i-97 | Filipe Fontanela
- 02:30 PM Passive Linearization of a Thin Plate by Topology Optimization | 36i-300 | Jongsuh Lee

012. VALIDATION OF MODELS FOR OPERATING ENVIRONMENTS I

February 12, 2018 | 01:30 PM - 02:50 PM | Salon 10

Organizer: I. Sever, Rolls-Royce

Chair Person(s): I. Sever, Rolls-Royce

- 01:30 PM An Experimental Case Study for Nonlinear Model Validation: Effect of Nonlinearities in an Aero-Engine Structure | 36i-138 | Samson Cooper
- 01:50 PM Nonlinearities of an Aircraft Piccolo Tube: Identification and Modeling | 36i-212 | Tilan Dossogne
- 02:10 PM Validation of Lightweight Antenna Reflector Model for Environmental Acoustic Testing Operating Conditions | 36i-243 | Mariano Alvarez Blanco

013. BASICS OF MODAL ANALYSIS II

February 12, 2018 | 01:30 PM - 03:30 PM | Salon 13

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T.Marinone, ATA Engineering

- 01:30 PM Modal Measurements (60-min) | 36i-344 | Brandon Dilworth
- 02:30 PM Excitation Techniques (60-min) | 36i-54 | Timothy Marinone

014. STRUCTURAL VIBRATIONS II

February 12, 2018 | 01:30 PM - 03:10 PM | Salon 11

Organizer: A. Pavic, University of Exeter; S. Zivanovic, University of Warwick; V. Racic, Politecnico di Milano

Chair Person(s): F.N. Catbas, University of Central Florida; A. Stavridis

- 01:30 PM Advanced Fourier-based Model of Bouncing Loads | 36i-457 | Vitomir Racic
- 01:50 PM Vibrational Response of Structures Exposed to Human-induced Loads | 36i-191 | Jonas Knudsen
- 02:10 PM Measurement of Human Loads Using Computer Vision | 36i-274 | Ozan Celik
- 02:30 PM Footbridge Vibrations Predicted by Stochastic Load Model | 36i-98 | Lars Pedersen

Preliminary Technical Program

015. ADVANCED EXPERIMENTAL METHODS USING SCANNING LDV

February 12, 2018 | 03:30 PM - 05:30 PM | Salon 8

Organizer: D. Di Maio, University of Bristol

Chair Person(s): D. Di Maio, University of Bristol

- 03:30 PM Dynamic Measurements on Miniature Springs for Flaw and Damage Detection | 36i-282 | Daniel Rohe
- 03:50 PM Exploiting Laser Doppler Vibrometry in Large Displacement Tests | 36i-341 | Paolo Castellini
- 04:10 PM Delamination Identification of Laminated Composite Plates Using a Continuously Scanning Laser Doppler Vibrometer System | 36i-128 | Yongfeng Xu
- 04:30 PM Pushing 3D Scanning Laser Doppler Vibrometry to Capture Time Varying Dynamic Characteristics | 36i-250 | Bryan Witt
- 04:50 PM Rapid and Dense 3D Vibration Measurement by Three Continuously Scanning Laser Doppler Vibrometers | 36i-163 | Da-Ming Chen
- 05:10 PM Using High-Resolution Measurements to Update Finite Element Substructure Models | 36i-283 | Daniel Rohe

016. METHODS FOR DYNAMIC SUBSTRUCTURES

February 12, 2018 | 03:30 PM - 05:30 PM | Salon 9

Chair Person(s): A. Linderholt, Linnaeus University

- 03:30 PM A Comparison of Craig-Bampton Approaches for Systems with Arbitrary Viscous Damping in Dynamic Substructuring | 36i-72 | Fabian Gruber
- 03:50 PM Recent Advances to Estimation of Fixed-Interface Modal Models using Dynamic Substructuring | 36i-318 | Matthew Allen
- 04:10 PM Modeling an Electrodynamics Shaker using Experimental Substructuring | 36i-36 | Benjamin Moldenhauer
- 04:30 PM Real-Time Hybrid Substructuring Shake Table Test of a Seismically Excited Building | 36i-168 | Muammer Avci
- 04:50 PM Parallel RTHS with Self-tuning Robust Control System: A Nonlinear Physical Substructure Application | 36i-213 | Johnny Condori

017. VIBRO-ACOUSTICS

February 12, 2018 | 03:30 PM - 05:30 PM | Salon 12

Organizer: E. Stasiunas, NASA - Marshall Space Flight Center

Chair Person(s): E. Stasiunas, NASA - Marshall Space Flight Center

- 03:30 PM Experimental Demonstration of a Tunable Acoustoelastic System | 36i-335 | Dhiraj Bansal
- 03:50 PM Numerical Modeling of an Enclosed Cylinder | 36i-336 | Micah Shepherd
- 04:10 PM Mode Shape Effects on the Measurability of Bragg Scattered Acoustic Signals in Underwater Localization Applications | 36i-203 | Dagny Joffre
- 04:30 PM A Computational Investigation into the Interactions between Acoustic Mode Shapes and Structural Damage of Composite Subscale Cavity Structures | 36i-244 | Christopher Beale
- 04:50 PM Parametric Experimental Modal Analysis of a Modern Violin Based on a Guarneri del Gesù Model | 36i-350 | Elvio Bonisoli

018. NONLINEAR MODELING & SIMULATION II

February 12, 2018 | 03:30 PM - 04:30 PM | Salon 14

Organizer: A. Cammarano, University of Glasgow

Chair Person(s): A. Cammarano, University of Glasgow; T. Hill, University of Bristol

- 03:30 PM Investigating Modal Contributions using a Galerkin Model | 36i-117 | Alexander Elliott
- 03:50 PM Effect of Boundary Conditions on Finite Element Submodeling | 36i-74 | Michael Sracic

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019. CONTROLLING UNCERTAINTY

February 12, 2018 | 03:30 PM - 05:30 PM | Salon 10

Organizer: R. Platz, Fraunhofer Institute for Structural Durability and System Reliability LBF; G. Stevens, Los Alamos National Laboratory

Chair Person(s): R. Platz, Fraunhofer Institute for Structural Durability and System Reliability LBF

- 03:30 PM Finite Element Model Updating of a Connecting Structure Based on Strain | 36i-188 | Ming Zhan
- 03:50 PM Material Parameter Identification and Response Prediction of shearing Process for Flying Shear Machine based on Model Validation | 36i-355 | Qin-tao Guo
- 04:10 PM Augmented Reality for Next Generation Infrastructure Inspections | 36i-315 | Alessandro Cattaneo
- 04:30 PM Reliability Analysis of Existing Bridge Foundations for Reuse | 36i-214 | Nathan Davis
- 04:50 PM Bayesian Calibration of High-speed Train Suspensions Parameters using Kriging Metamodeling | 36i-73 | David Lebel

020. BASICS OF MODAL ANALYSIS III

February 12, 2018 | 03:30 PM - 05:30 PM | Salon 13

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T. Marinone, ATA Engineering

- 03:30 PM Excitation Techniques | 36i-54 | Timothy Marinone (continues)
- 04:10 PM Modal Parameter Estimation (80-min) | 36i-51 | Michael Mains

021. STRUCTURAL VIBRATIONS III

February 12, 2018 | 03:30 PM - 05:10 PM | Salon 11

Organizer: A. Pavic, University of Exeter; S. Zivanovic, University of Warwick; V. Racic, Politecnico di Milano

Chair Person(s): M. Todd, University of California, San Diego

- 03:30 PM Why a Curb Shouldn't be Kicked to the Curb: The Importance of Non-Structural Elements in Dynamic Modelling | 36i-121 | Michael Wesolowsky
- 03:50 PM Effects of Pedestrian Excitation on Two Short-Span FRP Footbridges in Delft | 36i-184 | Stana Živanovic
- 04:10 PM Experimental Characterisation of the Dynamics Performance of an All-FRP Truss Bridge | 36i-233 | Stana Živanovic
- 04:30 PM Vibration Response of Floors due to Single and Multiple People Walking Excitation | 36i-82 | Aleksandar Pavic

022. INSTRUMENTATION

February 13, 2018 | 09:00 AM - 10:40 AM | Salon 8

Chair Person(s): C. Walber, PCB Piezotronics; B. Joyce, USAF

- 09:00 AM Effect of Piezoelectric Material in Mitigation of Aerodynamic Forces | 36i-116 | Gholamreza Amirinia
- 09:20 AM Ultrasonic Wedge Imaging of Internal Flaws with Synthetic Aperture Focus | 36i-167 | Simone Sternini
- 09:40 AM Design and Installation Considerations of Dynamic Strain Gages for Thermo-Acoustic Aerospace Structures Test | 36i-325 | Matt Stefanski
- 10:00 AM Performance Assessment of Several Low-Cost Consumer-Grade Analog-to-Digital Conversion Devices | 36i-33 | Grady Wetherington, Jr.
- 10:20 AM Multi-tonal Based Impedance Measurements for Microsecond State Detection | 36i-291 | Anton Steven

023. FREQUENCY BASED SUBSTRUCTURING

February 13, 2018 | 09:00 AM - 10:40 AM | Salon 9

Chair Person(s): D. Roettgen, Sandia National Laboratories

- 09:00 AM Introducing SEMM: A Novel Method for Hybrid Modelling | 36i-232 | Steven Klaassen
- 09:20 AM Experimental & Numerical Modelling of an Industrial Substructure using the VIBES Toolbox for MATLAB | 36i-317 | Maarten van der Seijs
- 09:40 AM A Comparative Study into Virtual Point Transformation, Interface Reduction and the Transmission Simulator | 36i-394 | Eric Pasma
- 10:00 AM Automated Correction of Sensor Orientation in Experimental Dynamic Substructuring | 36i-152 | Michael Haeussler
- 10:20 AM Modeling Transverse Vibration in Spider Webs using Frequency-based Dynamic Substructuring | 36i-288 | Andrew Otto

024. MODAL APPLICATIONS

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February 13, 2018 | 09:00 AM - 10:20 AM | Salon 12

Chair Person(s): J. Blecke, Sandia National Laboratories

- 09:00 AM Modal Analysis Results of ARL/PSU 12" Water Tunnel Test Section with and without Water | 36i-113 | Eric Myer
- 09:20 AM Simulation of the Dynamic Behavior of a Bi-cable Ropeway with Modal Bases | 36i-46 | Gabriel Hurel
- 09:40 AM Effect of Boundary Conditions on the Modal Parameters of an Aircraft Fuselage Panel | 36i-337 | Travis Wyen
- 10:00 AM The Influence of Edge Boundary Conditions and Cracks on Vibrational Modes of Multilayer Ceramic Capacitors | 36i-79 | Jonel Ortiz

025. EXPERIMENTAL NONLINEAR DYNAMICS I

February 13, 2018 | 09:00 AM - 10:20 AM | Salon 14

Organizer: R. Wiebe, Univ. of Washington; S. Spotswood, Air Force Research Lab; R. Ehrhardt, Ehrhardt Engineering; R. Perez, Universal Technology Corp.

Chair Person(s): R. Wiebe, University of Washington; R. Ehrhardt, Ehrhardt Engineering

- 09:00 AM A Tutorial on Nonlinear Modal Testing (60-min) | 36i-462 | Ludovic Renson
- 10:00 AM Linear and Nonlinear Response of a Curved Panel Subjected to Localized Heating | 36i-356 | David Ehrhardt

026. VALIDATION OF MODELS FOR OPERATING ENVIRONMENTS II

February 13, 2018 | 09:00 AM - 10:40 AM | Salon 10

Organizer: I. Sever, Rolls-Royce

Chair Person(s): I. Sever, Rolls-Royce

- 09:00 AM A Distribution-Based Damping Estimation Method for Random Vibration Response and its Applications | 36i-351 | Ibrahim Sever
- 09:20 AM Validation of Container System Component Models for Drops | 36i-76 | Thomas Hall
- 09:40 AM Validation of Container System Finite Element Models for IAEA Compliance | 36i-77 | Philip Ind
- 10:00 AM International Space Station Modal Correlation Analysis | 36i-269 | Michael Laible
- 10:20 AM International Space Station Accelerometer Measurement Synchronization | 36i-270 | Michael Laible

027. ROTATING MACHINERY I

February 13, 2018 | 09:00 AM - 10:40 AM | Salon 13

Chair Person(s): D. Rohe, Sandia National Laboratories

- 09:00 AM Analysis of the Dynamic Response of Coupled Coaxial Rotors | 36i-182 | Alexander Haslam
- 09:20 AM Characterization of Torsional Vibrations: Torsional Order Based Modal Analysis | 36i-190 | Emilio Di Lorenzo
- 09:40 AM A Rational Basis for Determining Vibration Signature of | 36i-347 | Suri Ganeriwala
- 10:00 AM Influence of the Harmonics on the Modal Behavior of Wind Turbine Drivetrains | 36i-359 | Nicoletta Gioia
- 10:20 AM Operational Modal Analysis of Rotating Machinery | 36i-187 | Palle Andersen

028. HUMANS+STRUCTURES I

February 13, 2018 | 09:00 AM - 10:40 AM | Salon 11

Organizer: H.Y. Noh, Carnegie Mellon University

Chair Person(s): J. Caicedo, University of South Carolina; P. Tarazaga, Virginia Tech

- 09:00 AM Human Activity Benchmark Classification using Multilayer Artificial Neural Network | 36i-278 | Juan Caicedo
- 09:20 AM State-of-the-Art and Future Directions for Predictive Modelling of Offshore Structure Dynamics using Machine Learning | 36i-361 | Ulf Tygesen
- 09:40 AM Evaluation of a New Energy-Based Human Tracking Method in a Smart Building Using Floor Vibration Measurements | 36i-402 | Sa'ed Alajlouni
- 10:00 AM Support Section Machine-Based Face Direction Detection using an Infrared Array Sensor | 36i-411 | Ya Wang

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029. SHOCK MEASUREMENTS

February 13, 2018 | 02:20 PM - 03:40 PM | Salon 8

Chair Person(s): J. Dodson, Air Force Research Laboratory; C. Walber, PCB Piezotronics

- 02:20 PM High-g Shock Acceleration Measurement using Martlet Wireless Sensing System | 36i-37 | Yang Wang
- 02:40 PM High Shock Measurement Technology: A Summary through Today (Part I) | 36i-302 | Patrick Walter
- 03:00 PM High Shock Measurement Technology: A Summary through Today (Part II) | 36i-303 | Patrick Walter

030. TRANSFER PATH ANALYSIS

February 13, 2018 | 02:20 PM - 03:20 PM | Salon 9

Chair Person(s): D. Rixen, Technische Universitat Munchen

- 02:20 PM Blocked Force Characterisation of In-Stationary Source Vibrations | 36i-316 | Maarten van der Seijs
- 02:40 PM An Overview on TPA Methods with PAK | 36i-357 | Dejan Arsic

031. MULTI DEGREE OF FREEDOM TESTING II

February 13, 2018 | 02:20 PM - 03:40 PM | Salon 12

Organizer: T. Schoenherr, G. Nelson, Sandia National Laboratories

Chair Person(s): G. Nelson, Sandia National Laboratories

- 02:20 PM Multi-point Control for Single-Axis Vibration Testing | 36i-342 | Michael Maestas
- 02:40 PM The Cross Spectrum in Multiple Input Multiple Response Vibration Testing | 36i-80 | Garrett Nelson
- 03:00 PM Multi-Input Multi-Output Active Vibration Control for High Frequency Random Vibration | 36i-35 | Aabhas Singh
- 03:20 PM Driving a Motion Platform with a Vibration Control Software for Multi-Axis Environmental Testing: Challenges and Solutions | 36i-352 | Umberto Musella

032. EXPERIMENTAL NONLINEAR DYNAMICS II

February 13, 2018 | 02:20 PM - 03:40 PM | Salon 14

Organizer: R. Wiebe, Univ of Washington; S. Spottswood, Air Force Research Lab; R. Ehrhardt, Ehrhardt Engineering; R. Perez, Universal Technology Corp

Chair Person(s): R. Wiebe, University of Washington; R. Ehrhardt, Ehrhardt Engineering

- 02:20 PM On the Geometric Conditions for Multiple Equilibria in Curved Structures | 36i-153 | Lawrie Virgin
- 02:40 PM Application of Control-based Continuation to a Nonlinear System with Harmonically Coupled Modes | 36i-208 | Ludovic Renson
- 03:00 PM Buckling and Snap-Through Response of a Panel in Supersonic Flow | 36i-58 | Stephen Spottswood
- 03:20 PM High Speed 3D DIC Displacement and Strain Random Vibration Measurement of a Thin Panel Subjected to High Speed Flow | 36i-314 | Timothy Bebernis

033. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS I

February 13, 2018 | 02:20 PM - 03:40 PM | Salon 10

Organizer: B. Moaveni, Tufts University; C. Papadimitriou, University of Thessaly

Chair Person(s): B. Moaveni, Tufts University; C. Papadimitriou, University of Thessaly

- 02:20 PM Keynote: On the Monitoring-Driven Assessment of Engineered Systems (40-min) | 36i-488 | Eleni Chatzi
- 03:00 PM Confidence in the Prediction of Unmeasured System Output Using Roll-up Methodology | 36i-256 | Kyle Neal
- 03:20 PM Analysis of Contact Dynamics using Controlled Impact Excitations | 36i-429 | Shivang Shekhar

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034. ENERGY HARVESTING

February 13, 2018 | 02:20 PM - 03:40 PM | Salon 13

Chair Person(s): A. Wicks, Virginia Tech

- 02:20 PM Broadband Energy Harvesting Performance of a Piezoelectrically Generated Bistable Laminate | 36i-9 | Andrew Lee
- 02:40 PM Energy Harvesting from Multiple Sources | 36i-193 | Julian Gosliga
- 03:00 PM Dynamic Behavior and Performance Analysis of Piezoelectric Energy Harvesters Under Model and Parameter Uncertainties | 36i-219 | Paulo Varoto

035. HUMANS+STRUCTURES II

February 13, 2018 | 02:20 PM - 03:40 PM | Salon 11

Organizer: H.Y. Noh, Carnegie Mellon University

Chair Person(s): H.Y. Noh, Carnegie Mellon University; R. Razvan, Florida Institute of Technology

- 02:20 PM Modeling Human-structure Interaction using Control Models: External Excitation | 36i-273 | Ahmed Alzubaidi
- 02:40 PM Characterizing Structural Changes to Estimate Walking Gait Balance | 36i-420 | Jonathon Fagert
- 03:00 PM Classification of Human Walking Patterns through Singular Value Decomposition Projection | 36i-397 | Ellis Kessler
- 03:20 PM Experimental Modal Analysis Study of a Standing Soldier and Rifle System | 36i-21 | Razvan Rusovici

036. ALTERNATIVE SENSING & ACQUISITION

February 13, 2018 | 04:40 PM - 05:40 PM | Salon 8

Chair Person(s): C. McKinion, Air Force Research Laboratory; C. Walber, PCB Piezotronics

- 04:40 PM Direct Reference-free Dynamic Deflection Measurement of Railroad Bridge under Service Load | 36i-247 | Fernando Moreu
- 05:00 PM A Low-Cost Modular Impact-Based Experimental Setup for Evaluation of EMI Based Structural Health Monitoring at High Rates | 36i-280 | Ekramul Ehte
- 05:20 PM Real-time Low-cost Wireless Reference-free Displacement Sensing of Railroad Bridges | 36i-290 | Ali Ozdagli

037. INTERFACES & SUBSTRUCTURING

February 13, 2018 | 04:40 PM - 06:00 PM | Salon 9

Chair Person(s): M.S. Allen, University of Wisconsin-Madison

- 04:40 PM On the Problem of Describing the Coupling Interface between Sub-structures: An Experimental Test for 'Completeness' | 36i-331 | Joshua Meggitt
- 05:00 PM Interface Reduction in Component Mode Synthesis of Bladed Disks by Orthogonal-polynomial Series | 36i-362 | Luigi Carassale
- 05:20 PM Dynamic Substructuring with a Sliding Contact Interface | 36i-217 | Walter D'Ambrogio
- 05:40 PM Experimental Verification of a Recently Developed FRF Decoupling Method for Nonlinear Systems | 36i-141 | Taner Kalaycioglu

038. ANALYTICAL METHODS I

February 13, 2018 | 04:40 PM - 05:40 PM | Salon 12

Chair Person(s): B. Dilworth, MIT Lincoln Laboratory

- 04:40 PM Comparison of Computational Generalized and Standard Eigenvalue Solutions of Rotating Systems | 36i-149 | Ali Tatar
- 05:00 PM Forced Response of 2-Dof Gyroscopic Systems with Stable Eigenvalues | 36i-25 | Oliviero Giannini

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039. EXPERIMENTAL NONLINEAR DYNAMICS III

February 13, 2018 | 04:40 PM - 06:00 PM | Salon 14

Organizer: R. Wiebe, Univ of Washington; S. Spottswood, Air Force Research Lab; R. Ehrhardt, Ehrhardt Engineering; R. Perez, Universal Technology Corp

Chair Person(s): S. Spottswood, Air Force Research Lab; R. Perez, Universal Technology Corporation

- 04:40 PM Nonlinear Behavior of a 3-dof Mass-spring System | 36i-155 | Yue Guan
- 05:00 PM System Identification to Estimate the Nonlinear Modes of a Gong | 36i-49 | Daniel Piombino
- 05:20 PM Experimental Path Following of Unstable Static Equilibria for Snap-Through Buckling | 36i-16 | Tyler van Iderstein

040. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS II

February 13, 2018 | 04:40 PM - 06:00 PM | Salon 10

Organizer: B. Moaveni, Tufts University; C. Papadimitriou, University of Thessaly

Chair Person(s): C. Papadimitriou, University of Thessaly; B. Moaveni, Tufts University

- 04:40 PM Material Uncertainty and Response Bounds: Novel Super-Ellipsoidal Analysis | 36i-380 | Isaac Elishakoff
- 05:00 PM Quantifying Uncertainty in System Identification of Bridges using a Bayesian-based Multiple Model Approach | 36i-306 | Nathaniel Dubbs
- 05:20 PM Bayesian Model Updating of a Damaged School Building in Sankhu, Nepal | 36i-370 | Mehdi Akhlaghi
- 05:40 PM Hierarchical Bayesian Calibration and Response Prediction of a 10-Story Building Model | 36i-305 | Mingming Song

041. AIRCRAFT/AEROSPACE & AEROSPACE TESTING TECHNIQUES

February 13, 2018 | 04:40 PM - 05:40 PM | Salon 13

Chair Person(s): R. Singhal, David Florida Lab-Canadian Space Agency

- 04:40 PM Performing a Large-Scale Modal Test on the B2 Stand Crane at NASA's Stennis Space Center | 36i-451 | Eric Stasiunas
- 05:00 PM Experimental and Analytical Approaches for Numerical Spacecraft Vibration Test Prediction | 36i-241 | Steffen Waimer
- 05:20 PM TESS Vibration Testing: A Boundary Condition Case Study | 36i-345 | Alexandra Karlicek

042. INNOVATIVE MEASUREMENT FOR STRUCTURAL APPLICATIONS

February 13, 2018 | 04:40 PM - 06:00 PM | Salon 11

Chair Person(s): A. Pavic, University of Exeter

- 04:40 PM Vision-based Vibration Monitoring using Existing Cameras Installed within a Building | 36i-403 | Philip Harvey, Jr.
- 05:00 PM Fatigue Life Estimation of a Steel Bridge from Acceleration Data by Using Deep Learning | 36i-408 | Nur Sila Gulgec
- 05:20 PM Development of Displacement Measurement for Structural Health Monitoring using Optical Flow and Deep Learning | 36i-266 | Chuan-Zhi Dong
- 05:40 PM Automatic Detection of Structural Deficiencies using 4D Hue-Assisted Analysis of Color Point Clouds | 36i-275 | Ali Khaloo

043. ACTIVE CONTROL I

February 14, 2018 | 09:00 AM - 10:20 AM | Salon 8

Chair Person(s): P. Hunter, Sandia National Laboratories

- 09:00 AM Active Control of Flexible Cylinders Undergoing Vortex-induced Vibrations using Piezo Stripe Actuators | 36i-206 | Jason Dahl
- 09:20 AM Experimental Implementation of a Nonlinear Feedback Controller for a Stroke Limited Inertial Actuator | 36i-374 | Mattia Dal Borgo
- 09:40 AM Noise Rejection Capabilities of Electromagnetic Actuators in Rotor-Shaft Systems | 36i-428 | Shivang Shekhar
- 10:00 AM Dynamic Behavior of a Compliant Mechanism Driven by Stacked Piezoelectric Actuators | 36i-271 | Anil Koyuncu

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044. BMA - VENDOR PRESENTATIONS & TUTORIALS I

February 14, 2018 | 09:00 AM - 10:20 AM | Salon 9

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T. Marinone, ATA Engineering

- 09:00 AM Measurements (40-min) | 36i-228 | William Fladung
- 09:40 AM ODS Measurements Using Digital Image Correlation (40-min) | 36i-157 | Bluejay Robinson

045. PHOTOGRAMMETRY AND DIC II

February 14, 2018 | 09:00 AM - 10:20 AM | Salon 12

Organizer: J. Baqersad, Kettering University

Chair Person(s): J. Slavic, University of Ljubljana; A. Sarrafi, University of Massachusetts Lowell

- 09:00 AM Development of a Semi-Autonomous Drone for Structural Health Monitoring of Structures using Digital Image Correlation (DIC) | 36i-160 | Kedar Bharadwaj
- 09:20 AM Identifying Mode Shapes of Turbo-machinery Blades using Principal Component Analysis and Support Vector Machines | 36i-53 | Jaron Ellingson
- 09:40 AM Enhancing Standard GVT Measurements with Local Full-field Stereo Photogrammetry Data | 36i-111 | Simone Manzato
- 10:00 AM Modal Parameter Extraction from High Speed Interferometer Data | 36i-395 | James Sanders

046. NONLINEAR DAMPING I

February 14, 2018 | 09:00 AM - 10:20 AM | Salon 14

Organizer: G. Chevallier, E. Sadoulet-Reboul, UBFC - FEMTO-ST

Chair Person(s): G. Chevallier, E. Sadoulet-Reboul, UBFC - FEMTO-ST

- 09:00 AM A General Framework for Time Domain Finite Element Analysis of Viscoelastically Damped Structures | 36i-378 | Jean-Francois Deü
- 09:20 AM Experimental Analysis of Non-linear Damping in Composites Materials Thanks to Local Transduction-dissipation Phenomenon | 36i-181 | Guilhem Michon
- 09:40 AM Fixed Point Algorithm Resolution and Model Reduction in Jointed Structures Simulation | 36i-260 | Nicolas Peyret
- 10:00 AM Performances of an Architected Composite Plate with Nonlinear Stick-Slip Interactions for Vibration Reduction | 36i-27 | Emeline Sadoulet-Reboul

047. COMPUTATIONAL AND UNCERTAINTY QUANTIFICATION TOOLS

February 14, 2018 | 09:00 AM - 10:20 AM | Salon 10

Organizer: I. Lopez, Lawrence Livermore National Laboratory

Chair Person(s): I. Lopez, Lawrence Livermore National Laboratory

- 09:00 AM Platform for Uncertainty Quantification of Complex Dynamical Models (40-min) | 36i-381 | Israel Lopez
- 09:40 AM An Introduction to the Dakota Software (40-min) | 36i-440 | Angel Urbina

048. PASSIVE VIBRATION SUPPRESSION

February 14, 2018 | 09:00 AM - 9:40 AM | Salon 13

Chair Person(s): B. Zwink, Sandia National Laboratories

- 09:00 AM Metastructures for Light-weight Vibration Suppression | 36i-207 | Katherine Reichl

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049. SMART STRUCTURES & AUTOMATION

February 14, 2018 | 09:00 AM - 10:20 AM | Salon 11

Chair Person(s): K. Grimmelman, Intelligent Infrastructure Systems

- 09:00 AM Modal Parameter Uncertainty Estimates as a Tool for Automated Operational Modal Analysis: Applications to a Smart Building | 36i-238 | Rodrigo Sarlo
- 09:20 AM Damage Detection Threshold of Wind Turbine Blade Sensors for Condition Based Maintenance | 36i-412 | Bhavana Valeti
- 09:40 AM Comparison of Modal Testing Approaches for a Light Pole Exhibiting Fatigue Failure due to Vortex Shedding | 36i-261 | Nathaniel Dubbs
- 10:00 AM Structural Identification for Dynamic Strain Estimation in Offshore Wind Turbines | 36i-385 | Babak Moaveni

050. EXPERIMENTAL TECHNIQUES I

February 14, 2018 | 11:00 AM - 12:20 PM | Salon 8

Chair Person(s): D. Roettgen, Sandia National Laboratories

- 11:00 AM ODS & Modal Testing Using a Transmissibility Chain | 36i-78 | Brian Schwarz
- 11:20 AM Correlating Spectral Measurements | 36i-81 | Shawn Richardson
- 11:40 AM Estimation of Railway Track Longitudinal Profile using Vehicle-based Inertial Measurements | 36i-196 | Eugene Obrien
- 12:00 PM Damage Detection Integrating ISHM and LWSHM Techniques | 36i-258 | Lucas Rocha

051. BMA - VENDOR PRESENTATIONS & TUTORIALS II

February 14, 2018 | 11:00 AM - 12:20 PM | Salon 9

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T. Marinone, ATA Engineering

- 11:00 AM Modal Parameter Estimation Demonstration (40-min) | 36i-88 | Michael Mains
- 11:40 AM Modal Model Validation (40-min) | 36i-87 | Michael Mains

052. PHOTOGRAMMETRY AND DIC III

February 14, 2018 | 11:00 AM - 12:20 PM | Salon 12

Organizer: J. Baqersad, Kettering University

Chair Person(s): Y. Yang, Los Alamos National Laboratory; P. Poozesh, University of Massachusetts Lowell

- 11:00 AM Relating Vibration and Thermal Losses using the Damping Heat Coefficient | 36i-295 | Slavic Janko
- 11:20 AM Full-field Modal Analysis using a DSLR Camera | 36i-69 | Jaka Javh
- 11:40 AM Identification of Frequency and Mode Shape Correspondence using Phase-Based Video Magnification in Utility Scale Structures | 36i-294 | Aral Sarrafi

053. NONLINEAR DAMPING II

February 14, 2018 | 11:00 AM - 12:00 PM | Salon 14

Organizer: G. Chevallier, E. Sadoulet-Reboul, UBFC - FEMTO-ST

Chair Person(s): G. Chevallier, E. Sadoulet-Reboul, UBFC - FEMTO-ST

- 11:00 AM Design of Poroelastic Coatings for Optimal Damping in Fuzzy Oscillators Attached to a Host Structure | 36i-34 | Utku Boz
- 11:20 AM Operational Modal Analysis based Stress Estimation in Friction Systems | 36i-62 | Tobias Friis
- 11:40 AM Identification of Nonlinear Viscoelastic Parameters Based on an Enhanced Oberst Beam Method | 36i-358 | Kévin Jaboviste

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054. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS III

February 14, 2018 | 11:00 AM - 12:20 PM | Salon 10

Organizer: B. Moaveni, Tufts University; C. Papadimitriou, University of Thessaly

Chair Person(s): B. Moaveni, Tufts University; C. Papadimitriou, University of Thessaly

- 11:00 AM Bayesian History Matching for Forward Model-Driven Structural Health Monitoring | 36i-311 | Paul Gardner
- 11:20 AM Fatigue Monitoring and Remaining Lifetime Prognosis using Operational Vibration Measurements | 36i-279 | Costas Papadimitriou
- 11:40 AM Utilizing an Augmented Kalman Filter for Output-Only Response Prediction in a Steel Beam Excited by a Series of Moving Masses | 36i-307 | Saeed Eftekhar Azam

055. MODAL PARAMETER IDENTIFICATION

February 14, 2018 | 11:00 AM - 12:20 PM | Salon 13

- 11:00 AM A Colored Complex Mode Indicator Function for Selecting a Final Mode Set | 36i-312 | Daniel Rohe
- 11:20 AM Application of Frequency-Domain Decomposition Identification Technique to Half Spectral Densities | 36i-441 | Sandro Amador
- 11:40 AM Influence of Noise in Correlation Function Estimates for Operational Modal Analysis | 36i-61 | Esben Orlowitz

056. MODAL IDENTIFICATION OF STRUCTURAL SYSTEMS

February 14, 2018 | 11:00 AM - 12:20 PM | Salon 11

Chair Person(s): O. Oiseth; E.Tacioglu

- 11:00 AM Modal Properties of a Model of a Chinese Pagoda | 36i-452 | Carlos Ventura
- 11:20 AM Dynamic Characterization of the Little Belt Suspension Bridge by Operational Modal Analysis | 36i-48 | Silas Christensen
- 11:40 AM Structural Identification of the Five-Story NSET Building in Nepal | 36i-372 | Mehdi Akhlaghi
- 12:00 PM Hell Bridge Test Arena – Sensor Testing, Damage Detection and Inspections of Steel Bridges; Challenges and Opportunities | 36i-164 | Anders Ronnquist

057. NOVEL TECHNIQUES

February 14, 2018 | 02:00 PM - 03:00 PM | Salon 8

Chair Person(s): J. Akers, NASA Glenn Research Center

- 02:00 PM Bio-Inspired Nonlinear Control of Artificial Hair Cells | 36i-400 | Sheyda Davaria
- 02:20 PM Modal Analysis of Hypersonic Aerostructural Systems | 36i-242 | Joseph Schoneman
- 02:40 PM Developing a Passive Vibration Absorber to Generate Traveling Waves in a Beam | 36i-414 | Seyedmostafa Motaharibidgoli

058. BMA - VENDOR PRESENTATIONS & TUTORIALS III

February 14, 2018 | 02:00 PM - 03:40 PM | Salon 9

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T. Marinone, ATA Engineering

- 02:00 PM From Test Planning to FE Model Updating (60-min) | 36i-297 | Eddy Dascotte
- 03:00 PM Shaker Excitation Techniques for New/Young Engineers (40-min) | 36i-264 | Marc Lamparelli

Preliminary Technical Program

059. BOUNDARY CONDITIONS IN ENVIRONMENTAL TESTING I

February 14, 2018 | 02:00 PM - 03:00 PM | Salon 12

Organizer: J. Harvie, Sandia National Laboratories

Chair Person(s): J. Harvie, Sandia National Laboratories

- 02:00 PM Designing Hardware for the Boundary Condition Round Robin Challenge | 36i-89 | David Soine
- 02:20 PM Initial Modal Results and Operating Data Acquisition of Shock/Vibration Fixture | 36i-459 | William Larsen
- 02:40 PM Comparison of Time-Domain Objective Functions in Dynamic Fixture Optimization | 36i-216 | Michael Starr

060. NONLINEAR MODEL & MODAL INTERACTIONS I

February 14, 2018 | 02:00 PM - 03:40 PM | Salon 14

Organizer: L. Renson, University of Bristol

Chair Person(s): L. Renson, University of Bristol; S. Shaw, Florida Institute of Technology

- 02:00 PM Nonlinear Modal Interactions: A Tutorial (60-min) | 36i-471 | Steven Shaw
- 03:00 PM In Vivo Nonlinear Vibration Analysis of the Human Brain | 36i-172 | Thibaut Detroux
- 03:20 PM Numerically Assessing the Relative Significance of Nonlinear Normal Modes to Forced Responses | 36i-221 | Thomas Hill

061. UNCERTAINTY IN EARLY STAGE DESIGN I

February 14, 2018 | 02:00 PM - 03:40 PM | Salon 10

Organizer: R. Platz, Fraunhofer Institute for Structural Durability and System Reliability LBF; G. Stevens, Los Alamos National Laboratory

Chair Person(s): R. Platz, Fraunhofer Institute for Structural Durability and System Reliability LBF; G. Stevens, Los Alamos National Laboratory

- 02:00 PM Bayesian Multivariate Validation Approach to Quantify the Uncertainty in the Finite Element Model of a Suspension Strut | 36i-248 | Shashidhar Mallapur
- 02:20 PM Assessing Structural Reliability at the Component Test Stage using Real-Time Hybrid Substructuring | 36i-234 | Connor Ligeikis
- 02:40 PM Approach in Uncertainty Quantification to Predict the Vibration Control Performance of Tuned Absorbers in Early Design Stage | 36i-262 | Roland Platz
- 03:00 PM Recent Developments in Hardware-in-the-Loop Testing | 36i-215 | Jonathan Millitzer

062. ROTATING MACHINERY II

February 14, 2018 | 02:00 PM - 03:20 PM | Salon 13

Chair Person(s): D. Epp, Sandia National Laboratories

- 02:00 PM Modal Control of Magnetic Suspended Rotors | 36i-169 | Marcus Oliveira
- 02:20 PM On the Implementation of Metastructures in Rotordynamics | 36i-177 | Carlo Rosso
- 02:40 PM Dynamic Modelling and Vibration Control of a Turbomolecular Pump with Magnetic Bearings in the Presence of Blade Flexibility | 36i-229 | Alysson Barbosa Moreira
- 03:00 PM Remote Damage Detection of Rotating Machinery | 36i-328 | Tyrel Rupp

063. BRIDGES & NOVEL VIBRATION ANALYSIS

February 14, 2018 | 02:00 PM - 03:40 PM | Salon 11

Chair Person(s): C. Ventura, University of British Columbia

- 02:00 PM A Novelty Measure for SHM and Damage Diagnosis | 36i-64 | Iason Iakovidis
- 02:20 PM A Novelty Measure for SHM and Damage Diagnosis: Application to Bridge Data | 36i-65 | Iason Iakovidis
- 02:40 PM Modal Parameter Identification from Measurements of Vehicle-bridge Interaction | 36i-387 | Yi Liu
- 03:00 PM Identifying Modal Characteristics of Reinforced Concrete Bridges Using Smartphones | 36i-422 | Osman Ozbulut
- 03:20 PM Bridge Structural Identification using Moving Vehicle Acceleration Measurements | 36i-388 | Soheil Sadeghi

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064. ACTIVE CONTROL II

February 14, 2018 | 04:10 PM - 05:10 PM | Salon 8

Chair Person(s): B. Pacini, Sandia National Laboratories

- 04:10 PM Probabilistic Robustness Analysis of an Actively Controlled Structure that Operates in Harsh and Uncertain Environments | 36i-332 | Christopher D'Angelo
- 04:30 PM Investigation on the Performance of a Velocity Feedback Control unit for Structural Vibration Control: Theory and Experiments | 36i-366 | Stefano Camperi

065. BMA - VENDOR PRESENTATIONS & TUTORIALS IV

February 14, 2018 | 04:10 PM - 05:30 PM | Salon 9

Organizer: M. Mains, Brüel & Kjær North America

Chair Person(s): M. Mains, Brüel & Kjær North America; T. Marinone, ATA Engineering

- 04:10 PM Introduction to Rotor Dynamics and Balancing (80-min) | 36i-166 | Brian Damiano

066. BOUNDARY CONDITIONS IN ENVIRONMENTAL TESTING II

February 14, 2018 | 04:10 PM - 05:10 PM | Salon 12

Organizer: J. Harvie, Sandia National Laboratories

Chair Person(s): A. Morello, Los Alamos National Laboratory

- 04:10 PM Force Customization to Neutralize Fixture-Test Article Dynamic Interaction | 36i-125 | Jesus Reyes
- 04:30 PM Using Modal Substructuring to Improve Shock & Vibration Qualification | 36i-257 | Julie Harvie
- 04:50 PM Combined Mechanical Environments for Design and Qualification | 36i-118 | Brian Owens

067. NONLINEAR MODEL & MODAL INTERACTIONS II

February 14, 2018 | 04:10 PM - 05:30 PM | Salon 14

Organizer: L. Renson, University of Bristol

Chair Person(s): L.Renson -University of Bristol; S.Shaw -Florida Institute of Technology

- 04:10 PM Experimental and Numerical Nonlinear Modal Analysis of a Beam with Impact: Part I - Numerical Investigation | 36i-105 | Frederic Schreyer
- 04:30 PM Experimental and Numerical Nonlinear Modal Analysis of a Beam with Impact: Part II - Experimental Investigation | 36i-108 | Simon Peter
- 04:50 PM Detection of Symmetry Breaking Bifurcations using Finite Element Analysis Packages | 36i-127 | Iqbal Alshahal
- 05:10 PM Direct Detection of Nonlinear Modal Interactions and Model Updating using Measured Time Series | 36i-19 | Keegan Moore

068. UNCERTAINTY IN EARLY STAGE DESIGN II

February 14, 2018 | 04:10 PM - 04:50 PM | Salon 10

Organizer: R. Platz, Fraunhofer Institute for Structural Durability and System Reliability LBF; G. Stevens, Los Alamos National Laboratory

Chair Person(s): G. Stevens, Los Alamos National Laboratory; R. Platz, Fraunhofer Institute for Structural Durability and System Reliability LBF

- 04:10 PM Reduced Order Quantities of Interest for Engineering Quantification of Margins and Uncertainties | 36i-384 | David Alexander
- 04:30 PM Scaling and Structural Similarity under Uncertainty | 36i-308 | Mohamad Eydani Asl

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069. FINITE ELEMENT TECHNIQUES

February 14, 2018 | 04:10 PM - 05:30 PM | Salon 13

Chair Person(s): G. Tipton, Sandia National Laboratories

- 04:10 PM A Differential Evolution Markov Chain Monte Carlo Algorithm for Bayesian Model Updating | 36i-143 | Marwan Sherri
- 04:30 PM Skin Performance in the Rollover Crashworthiness Analysis of a Cutaway Bus | 36i-174 | MohammedReza Seyedi
- 04:50 PM Efficient Estimation of Clamped Step-thickness Plates FRFs in Industrial Systems | 36i-47 | Yum Ji Chan
- 05:10 PM Modeling, Experimental Verification and Optimization of Seat Structure per ECE R14 | 36i-60 | Yunus Ozcelik

070. FULL SCALE OPERATIONAL SID

February 14, 2018 | 04:10 PM - 05:30 PM | Salon 11

Chair Person(s): V. Racic, Politecnico di Milano; P. Tarazaga, Virginia Tech

- 04:10 PM Dynamic Response Dependency on the Travelling Load Direction for a Multi Span Cable System by Operational Modal Analysis | 36i-101 | Petter N avik
- 04:30 PM Using Correlation Functions as Free Decays | 36i-94 | Rune Brincker
- 04:50 PM Experiences from the Five-year Monitoring of a Long-span Pontoon Bridge -WhatWent Right, WhatWent Wrong and What's Next? | 36i-162 | Knut Andreas Kv ale

071. EXPERIMENTAL TECHNIQUES II

February 15, 2018 | 10:00 AM - 12:00 PM | Salon 8

Chair Person(s): M. Arviso, Sandia National Laboratories

- 10:00 AM Experimental Studies and Remote Monitoring of a Benchmark Test Frame | 36i-373 | Saeid Allahdadian
- 10:20 AM A Method for Cancelling Force Transducer Mass and Inertia Effects | 36i-43 | Garrett Lopp
- 10:40 AM Experimental Assessment of the Effect of Different Tires on Comfort of Construction Truck Operators | 36i-435 | Edoardo Sabbioni
- 11:00 AM Tool Wear Inspection of Poly-crystalline Cubic Boron Nitride Inserts | 36i-438 | Chandula Wickramarachchi
- 11:20 AM Across the Picket Fence – Influence of Sampling Frequency in Automatic Impact Modal Testing | 36i-186 | Daniel Alarc on
- 11:40 AM Experimental Modal Analysis of Structures Using Conventional vs. Contact-free Suspension | 36i-198 | Peter Blaschke

072. BMA - VENDOR PRESENTATIONS AND TUTORIALS V

February 15, 2018 | 10:00 AM - 12:00 PM | Salon 9

Organizer: M. Mains, Br uel & Kj er North America

Chair Person(s): M. Mains, Br uel & Kj er North America; T. Marinone, ATA Engineering

- 10:00 AM Considerations for Acquiring High-quality Modal Data (60-min) | 36i-144 | John Hiatt
- 11:00 AM Leveraging Early FEA Models to Increase Modal Testing Efficiency – Pre-test Analysis (60-min) | 36i-145 | John Hiatt

073. ANALYTICAL METHODS II

February 15, 2018 | 10:00 AM - 11:40 AM | Salon 12

Chair Person(s): A. Mazzei, Kettering University

- 10:00 AM On the Sensitivity of Energy Metrics to Failure Types in a Complex Structure | 36i-59 | Vit Babuska
- 10:20 AM Approximate General Responses of Tuned and Mistuned 4-Degree-of-Freedom Systems with Parametric Stiffness | 36i-379 | Ayse Sapmaz
- 10:40 AM Stochastic Modal Appropriation (SMA) | 36i-8 | Maher Abdelghani
- 11:00 AM Non-Model Based Expansion from Limited Points to Full-Field using Chebyshev Polynomial. Part 1, Modal Shape Expansion | 36i-386 | Yuanchang Chen
- 11:20 AM Non-Model Based Expansion from Limited Points to Full-Field using Chebyshev Polynomial. Part 2, Dynamic Response Expansion | 36i-389 | Yuanchang Chen

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074. DYNAMICS OF JOINTED STRUCTURES

February 15, 2018 | 10:00 AM - 12:00 PM | Salon 14

Organizer: M. Brake, Rice University

Chair Person(s): M. Brake, Rice University

- 10:00 AM Tutorial: Bolted Joints and Tribomechadynamics (60-min) | 36i-479 | Matthew Brake
- 11:00 AM Modelling and Testing Flexible Friction Dampers: Challenges and Peculiarities | 36i-109 | Alfredo Fantetti
- 11:20 AM Dynamics of Bending and Torsion Modes for a Flanged Joint | 36i-119 | Micah Shepherd
- 11:40 AM Modal Analysis of Axially Deforming Rods with Isolated Lap Joints | 36i-349 | D. Dane Quinn

075. MVUQ AND DECISION MAKING

February 15, 2018 | 10:00 AM - 11:20 AM | Salon 10

Organizer: A. Urbina, Sandia National Laboratories

Chair Person(s): A. Urbina, Sandia National Laboratories

- 10:00 AM Experimental Credibility and its Role in Model Validation and Decision Making | 36i-122 | Sarah Kieweg
- 10:20 AM Validation Assessment of a Coupled Dynamics Model | 36i-259 | Kyle Neal
- 10:40 AM A Case Study on Integrating Comp/Sim Credibility, UQ and Evidence Theory Outcomes to Support Risk Informed Decision Making | 36i-353 | George Orient

076. NONLINEAR REDUCED-ORDER MODELING I

February 15, 2018 | 10:00 AM - 12:00 PM | Salon 13

Organizer: P. Tiso, ETH Zürich; R. Kuether, Sandia National Laboratories

Chair Person(s): P. Tiso, ETH Zürich

- 10:00 AM Nonintrusive Reduced Order Modeling of the Nonlinear Geometric Response of Structures (60-min) | 36i-178 | Marc Mignolet
- 11:00 AM Automated Computation of Autonomous Spectral Submanifolds in Nonlinear Modal Analysis | 36i-140 | Sten Ponsioen
- 11:20 AM Contact Parameter Identification and Model Verification for a Blade-Like Experimental Beam with a Large Frictional Contact | 36i-254 | Mainak Mitra
- 11:40 AM The Relation between Conservative and Nonconservative Nonlinear Normal Modes | 36i-458 | George Haller

077. IDENTIFICATION

February 15, 2018 | 10:00 AM - 12:00 PM | Salon 11

Chair Person(s): S. Zivanovic, University of Warwick

- 10:00 AM Using the Random Decrement Technique on Short Records with Varying Signal-to-noise Ratios | 36i-110 | Ronwaldo Aquino
- 10:20 AM Scenario Based Approach for Load Identification | 36i-142 | Michael Vigsø
- 10:40 AM Performance Characterization of Modal Identification Algorithms, the case of Automated Modal Analysis of Palazzo Lombardia | 36i-28 | Marcello Vanali
- 11:00 AM Probabilistic Analysis of Modal Properties for Floor Systems with Uncertain Support Conditions | 36i-100 | Lars Andersen
- 11:20 AM Condition Assessment of Bridge Structures with Statistical Indicators | 36i-401 | Navid Zolghadri

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078. EXPERIMENTAL TECHNIQUES III

February 15, 2018 | 01:00 PM - 02:40 PM | Salon 8

Chair Person(s): D. Osterholt, ATA Engineering

- 01:00 PM Model Validation of a Fully-clamped, Thin Plate with Flush-mounted Piezoelectric Actuators for Traveling Wave Generation | 36i-323 | Patrick Musgrave
- 01:20 PM Modal Testing of a Composite Bladed Disc Using Travelling Wave Excitation Method | 36i-26 | Dario Di Maio
- 01:40 PM Using Manual Excitation for Large Displacement on a Highly Damped System | 36i-313 | Douglas Osterholt
- 02:00 PM Advanced Hammer Excitation Technique for Impact Modal Testing on Lightweight Materials using Scalable Automatic Modal Hammer | 36i-231 | Tarun Teja Mallareddy

079. MODAL APPLICATIONS II

February 15, 2018 | 01:00 PM - 02:20 PM | Salon 9

Chair Person(s): K. Spak, Exponent

- 01:00 PM Modal Comparison of Stock and Performance Brake Rotors | 36i-90 | Kaitlin Spak
- 01:20 PM On the Veering Phenomenon Potential in High Speed Gears Design | 36i-102 | Fabio Bruzzone
- 01:40 PM Vibrational Analysis of Hydrogels for Novel Applications in the Field of Medical Engineering | 36i-363 | Sascha Schwarz
- 02:00 PM Modal Analysis of a Vertical-axis Darrieus Wind Turbine Blade with a Troposkein Shape | 36i-390 | Amr Saleh

080. ANALYTICAL METHODS II

February 15, 2018 | 01:00 PM - 03:00 PM | Salon 12

Chair Person(s): B. Witt, Sandia National Laboratories

- 01:00 PM Harmonic Forcing of a Two-Segment Timoshenko Beam | 36i-10 | Arnaldo Mazzei, Jr.
- 01:20 PM Fastener Fatigue Analysis Using Time Domain Methods for Multiaxial Random Vibration | 36i-13 | Michael Ross
- 01:40 PM Probability Distribution of von Mises Stress in the Presence of Pre-Load | 36i-255 | Daniel Segalman
- 02:00 PM Principal Component Analysis Based Feature Extraction for Acoustics Based Damage Detection from Cavity Structures | 36i-245 | Jaclyn Solimine
- 02:20 PM Feature Extraction for Vibration-Based Damage Detection Using Spatio-Temporal Structural Patterns | 36i-246 | Peter Fickenwirth

081. MECHANICS OF JOINTED STRUCTURES

February 15, 2018 | 01:00 PM - 02:00 PM | Salon 12

Organizer: M. Brake, Rice University

Chair Person(s): M. Brake, Rice University

- 01:00 PM In Situ Measurements of Interfacial Contact Pressure During Impact Hammer Test | 36i-132 | Benjamin Seeger
- 01:20 PM The Effect of Non-Flat Interfaces on System Dynamics | 36i-112 | Iyabo Lawal
- 01:40 PM Inverse Methods for Characterizing of Contact Areas in Mechanical Systems | 36i-30 | Matthew Fronk

082. UNCERTAINTY QUANTIFICATION IN STRUCTURAL DYNAMICS IV

February 15, 2018 | 01:00 PM - 02:00 PM | Salon 10

Organizer: B. Moaveni, Tufts University; C. Papadimitriou, University of Thessaly

Chair Person(s): C. Papadimitriou, University of Thessaly; B. Moaveni, Tufts University

- 01:00 PM Uncertainty Analysis of Identified Structural Parameters of a Bridge using Measurements from a Mobile Actuator-Sensor | 36i-240 | Rajdip Nayek
- 01:20 PM Uncertainty Quantification in Nanoscale Impact Experiment in Energetic Materials | 36i-391 | Chandra Prakash

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083. NONLINEAR REDUCED-ORDER MODELING II

February 15, 2018 | 01:00 PM - 02:40 PM | Salon 13

Organizer: P. Tiso, ETH Zürich; R. Kuether, Sandia National Laboratories

Chair Person(s): P. Tiso, ETH Zürich

- 01:00 PM Interface Reduction on Hurty/Craig-Bampton Substructures with Frictionless Contact | 36i-11 | Patrick Hughes
- 01:20 PM Reduced Order Modelling for Non-Linear Rotating Systems in ALE Formulation with Contact | 36i-199 | Tim Weidauer
- 01:40 PM Adaptive Reduced-order Modeling of Thermo-mechanical Systems | 36i-319 | Shobhit Jain
- 02:00 PM Time-varying Spectral Submanifolds: Analytic Calculation of Backbone Curves and Forced Response | 36i-57 | Thomas Breunung
- 02:20 PM Reduced Order Modeling of Structures with Preloaded Bolted Joints by the use of Trial Vector Derivatives | 36i-450 | Wolfgang Witteveen

084. SENSORS & CONTROL

February 15, 2018 | 01:00 PM - 02:20 PM | Salon 11

Chair Person(s): O. Ozbulut, University of Virginia; M.Halling

- 01:00 PM Development of a 3-DOF Structural Displacement Sensor Based on a Two-Stage Kalman Filter | 36i-171 | Hoon Sohn
- 01:20 PM The Role of Control Structure Interaction in Deployable Autonomous Control Systems | 36i-409 | Kevin Goorts
- 01:40 PM Usage of MEMS Capacitive Acceleration Sensors for Structural Monitoring | 36i-107 | Bill Zwolinski
- 02:00 PM The Realisation of An Inerter-Based System using Fluid Inerter | 36i-147 | Predaricka Deastra

085. STRUCTURAL HEALTH MONITORING

February 15, 2018 | 03:00 PM - 05:00 PM | Salon 8

Chair Person(s): M. Raymer, Sandia National Laboratories

- 03:00 PM An Experimental Test Bed with Time-varying Parameters for Developing High-rate Structural Health Monitoring Methods | 36i-329 | Bryan Joyce
- 03:20 PM Adaptive Observers for Structural Health Monitoring of High-rate, Time-varying Dynamic Systems | 36i-330 | Bryan Joyce
- 03:40 PM Noise Field Acoustic Impulse Response Reconstruction: Application to High-Speed Rail Inspection | 36i-230 | Albert Liang
- 04:00 PM Active Learning Approaches to Structural Health Monitoring | 36i-251 | Lawrence Bull
- 04:20 PM Structural Health Monitoring of Additively Manufactured Parts Using Fiber Bragg Gratings | 36i-327 | Elon Gordon

086. OFFSHORE WIND TURBINE AND OPERATING MODAL ANALYSIS

February 15, 2018 | 03:00 PM - 05:00 PM | Salon 9

Chair Person(s): A. Brandt, University of Southern Denmark.DK

- 03:00 PM Determination of Representative Offshore Wind Turbine Locations for Fatigue Load Monitoring by Hierarchical Clustering | 36i-285 | Andreas Ehrmann
- 03:20 PM Long-Term Automatic Tracking of the Modal Parameters of an Offshore Wind Turbine Drivetrain System in Standstill Condition | 36i-210 | Mahmoud El-Kafafy
- 03:40 PM Summarizing Results for Scaling OMA Mode Shapes by the OMAH Technique | 36i-23 | Anders Brandt
- 04:00 PM Effect of Friction-Induced Nonlinearity on OMA-Identified Dynamic Characteristics of Offshore Platform Models | 36i-320 | Evangelos Katsanos
- 04:20 PM Two ways to use Cepstral Analysis for Operational Modal Analysis | 36i-343 | Robert Randall

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087. ANALYTICAL METHODS III

February 15, 2018 | 03:00 PM - 05:00 PM | Salon 12

Chair Person(s): J. Akers, NASA Glenn Research Center

- 03:00 PM Finite Element Model Updating Using the Local Correspondence Principle | 36i-364 | Sandro Amador
- 03:20 PM Modal Truncation in Experimental Modal Analysis | 36i-106 | Marius Tarpø
- 03:40 PM Updated Reduced Order Model Development for Forced Response Predictions | 36i-124 | Peter Avitabile
- 04:00 PM Comparing Free-Free and Shaker Table Model Correlation Methods Using Jim Beam | 36i-126 | James Ristow
- 04:20 PM A Study on the Generation and Propagation of Traveling Waves in Strings | 36i-289 | Isil Anakok
- 04:40 PM Residual States for Modal Models Identified from Accelerance Data | 36i-151 | Mladen Gibanica

088. IDENTIFICATION OF JOINTED STRUCTURES

February 15, 2018 | 03:00 PM - 04:40 PM | Salon 14

Organizer: M. Brake, Rice University

Chair Person(s): M. Brake, Rice University

- 03:00 PM System Identification of Jointed Structures: Nonlinear Modal Testing vs. State-Space Model Identification | 36i-71 | Maren Scheel
- 03:20 PM Nonlinear System Identification for Joints Including Modal Interactions | 36i-40 | Alexander Haslam
- 03:40 PM Damping Estimation of Friction Systems in Random Vibrations | 36i-63 | Tobias Friis
- 04:00 PM An Enhanced Static Reduction Algorithm for Predictive Modeling of Bolted Joints | 36i-56 | Seyed Iman Zare Estakhraji
- 04:20 PM Experimental Characterization of a new Benchmark Structure for Prediction of Damping Nonlinearity | 36i-31 | Aabhas Singh

089. INVERSE PROBLEMS AND UNCERTAINTY QUANTIFICATION

February 15, 2018 | 03:00 PM - 05:00 PM | Salon 10

Organizer: Z. Mao, University of Massachusetts Lowell

Chair Person(s): Z. Mao, University of Massachusetts Lowell; B.Qiao, Xi'an Jiaotong University

- 03:00 PM Sparse Deconvolution for the Inverse Problem of Multiple-impact Force Identification | 36i-20 | Baijie Qiao
- 03:20 PM Probabilistic Remaining Useful Life Prediction Via Bayesian Filters with Markov Chain Monte Carlo and Subspace Simulations | 36i-369 | Michael Shiao
- 03:40 PM Using 2D Phase-Based Motion Estimation and Video Magnification for Damage Identification on a Wind Turbine Blade | 36i-293 | Aral Sarrafi
- 04:00 PM Nonlinear Squeezing Wavelet Transform for Rotor Rub-impact Fault Detection | 36i-93 | Chaowei Tong
- 04:20 PM Feasibility of Applying Phase-Based Video Processing for Modal Identification of Concrete Gravity Dams | 36i-292 | Gaohui Wang

090. NONLINEAR REDUCED-ORDER MODELING III

February 15, 2018 | 03:00 PM - 05:00 PM | Salon 13

Organizer: P. Tiso, ETH Zürich; R. Kuether, Sandia National Laboratories

Chair Person(s): P. Tiso, ETH Zürich

- 03:00 PM Reduced-order Modelling for Investigating Nonlinear FEM Systems | 36i-235 | Irene Tartaruga
- 03:20 PM Experiments and Nonlinear Modeling for the Sonic Fatigue Problem | 36i-52 | Joseph Hollkamp
- 03:40 PM Computing Nonlinear Normal Modes of Aerospace Structures using the Multi-Harmonic Balance Method | 36i-134 | Christopher Van Damme
- 04:00 PM Nonlinear Reduced Order Modeling of a Built-up Structure with Strong Asymmetry through Thickness | 36i-176 | Marc Mignolet
- 04:20 PM Selection of Basis in Nonlinear Reduced Order Modeling: A Revisit of a Curved Beam Example | 36i-179 | Marc Mignolet

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091. RC STRUCTURES

February 15, 2018 | 03:00 PM - 04:40 PM | Salon 11

- 03:00 PM Dynamic Characterization of a Prestressed Concrete Bridge by Strain and Acceleration Measurements | 36i-399 | Kirk Grimmelman
- 03:20 PM Load Rating of a Reinforced Concrete T-beam Bridge Through Ambient Vibration Testing and Finite Element Model Updating | 36i-421 | Osman Ozbulut
- 03:40 PM Model Updating and Damage Assessment of a Dynamically Tested Two-Story RC Structure using a Non-Linear Finite Element Model | 36i-424 | Seyedsina Yousefianmoghadam
- 04:00 PM Cracking Influence on Dynamic Parameters of Reinforced Concrete Floors | 36i-326 | William Miranda

099. ACCEPTED/TO BE PROGRAMED

- A Modification to Unified Matrix Polynomial Approach (UMPA) for Modal Parameter Identification | 36i-24 | Seyed Ehsan Haji Agha Mohammad Zarbaf
- A New Approach to Dynamic Analysis of a Multi-Span Beam Structure with Multiple Moving Oscillators | 36i-484 | Hao Gao
- A Numerical Investigation of a Gravity-Compensated Nonlinear Energy Sink for the Passive Control of Flooring Systems | 36i-418 | Nicholas Wierschem
- A Review of the Vibration Environment Onboard Small Unmanned Aircraft | 36i-489 | William Semke
- Active Vehicle Suspension with Weighted Multitone Optimal Controller - Considerations of Energy Consumption | 36i-476 | Waldemar Raczka
- An Efficient Likelihood-free Bayesian Computation for Model Selection and Parameter Estimation Applied to Structural Dynamics | 36i-360 | Anis Ben Abdesslem
- Application of the Transfer Matrix Method for the Analysis of Lateral Vibrations of Drillstrings with Parameter Uncertainties | 36i-267 | Ilja Gorelik
- Applying Concepts of Complexity to Structural Health Monitoring | 36i-500 | Charles Farrar
- Bridge Damage Detection from a Passing Vehicle using Mel Frequency Cepstral Coefficients | 36i-175 | Qiwei Mei
- Consolidation of Weakly Coupled Experimental System Modes | 36i-277 | Robert Coppolino
- Continuation Analysis of Post-Flutter Response in Hypersonic Flow | 36i-239 | Thomas Hill
- Damage Precursor Indicator for Aluminum 7075-T6 Based on Nonlinear Dynamics | 36i-204 | Robert Haynes
- Defining Groupings and Classification of Human Gait using Correlation of Ground Reaction Force Measurements | 36i-482 | Ellis Kessler
- Direct Frequency Domain Identification of time Varying Systems | 36i-224 | Lee Mazurek
- Dynamic Substructuring Applied to the Coupling of Acoustic-structure Systems | 36i-333 | R. Benjamin Davis
- Effects of Variable Thickness Circular Plates on Frequency Response Functions and Shock Response Spectrum | 36i-464 | William Larsen
- Evaluation of Traveling Wave Models for Complex-Modes-Based Carangiform Swimming | 36i-419 | Mahdieh Tanha
- Experimental Examples for Identification of Structural Systems using Neural Network and DOF-Based Reduction Method | 36i-170 | Heejun Sung
- Experimental Test of Spacecraft Parachute Deployment using Real-Time Hybrid Substructuring | 36i-227 | Michael Harris
- Floquet-Type Analysis of Transient Vibrations of a Horizontal Axis Wind Turbine | 36i-410 | Brian Feeny
- Impact Reconstruction using Modal Filters | 36i-383 | Patrick Logan
- Inverse Force Estimation for Resonant Shock Plate Application | 36i-465 | William Larsen
- Low Order Nonlinear Dynamic Modelling of Fuel Supply Pipes | 36i-45 | Alberto Sanchez
- Modal Analysis of a Brake-Ruess Beam and Computational Modeling at the Undergraduate Level | 36i-276 | Curtis O'Malley
- Modal Analysis of Healthy and Cracked Isotropic Plates in Peridynamics | 36i-449 | Andris Freimanis
- Modal Survey of the MPCV Orion European Service Module Structural Test Article Using a Multi-Axis Shaker System | 36i-445 | Kevin Napolitano
- Modal Testing of Metal Parts Created with Selective Laser Melting | 36i-442 | Brian West
- Model Updating of a Wing-Engine Structure with Nonlinear Connections | 36i-304 | Mingming Song
- Multimodal Damping of a Nonlinear Structure with a Passive Piezoelectric Network | 36i-252 | Boris Lossouarn
- Natural Frequency Testing and Model Correlation of Rocket Engine Structures in Liquid Hydrogen | 36i-469 | Andrew Brown
- NDE of Additively Manufactured Parts via Directly Bonded and Mechanically Attached Electromechanical Impedance Sensors | 36i-396 | Charles Tenney
- Nonlinear Characterization of a Machine Tool Energy Absorber | 36i-454 | Steven Whittican
- Nonlinear Forced Response of a Composite fan Blade Actuated by Piezoelectric Patches: Simulation and Testing | 36i-236 | Antoine Mabilia
- Nonlinear Identification of an Aero-Engine Component Using Structured Nonlinear Feedback Models | 36i-137 | Samson Cooper
- Nonlinear Stiffness, Inertial and Damping Effects in an Oscillating Cantilevered Beam | 36i-393 | Earl Dowell
- Non-structural Masses and Their Influence on Floor Natural Frequencies | 36i-99 | Christian Frier
- Optimal Maintenance of Naval Vessels Considering Service Life Uncertainty | 36i-478 | Yan Liu

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Output-Only Structural Identification of a Portal Frame with Frequency Domain Decomposition (FDD) Method | 36i-18 | Gholamreza Jahangiri
Pareto Optimization of a Nonlinear Tuned Mass Damper to Control Vibrations in Hand Held Impact Machines | 36i-22 | Viktor Berbyuk
Performance of Nonlinear Modal Model in Predicting Complex Bilinear Stiffness | 36i-42 | Benjamin Pacini
Predicting Geometric Tolerance Thresholds in a Five-Axis Machining Centre | 36i-299 | Tim Rooker
Quantification of Dynamic Model Validation Metrics using Uncertainty Propagation from Requirements | 36i-468 | Andrew Brown
Samurai Sudoku-Based Space-Filling Designs | 36i-475 | Peter Chien
Sliding Mode Controller for Vehicle Body Roll Reduction Using Active Suspension System | 36i-477 | Jaroslaw Konieczny
Study on the Soft Suspension Behavior for Aircraft Ground Vibration Test Set-up | 36i-467 | Airton Nabarrette
Subspace-based Identification of a Distributed Nonlinearity in Time and Frequency Domains | 36i-192 | Dario Anastasio
The Influence of Geometrical Correlation in Modal Validation Using Automated 3D Metrology | 36i-434 | Tarun Teja Mallareddy
Towards the Development of a Model for Nonlinear Elements in Machine Tools | 36i-453 | Steven Whitan
Traveling Wave Identification on Cable Systems Applying Wavelet Transform on Field Measurements | 36i-104 | Stefano Derosa
Variable Amplitude Fatigue Testing Apparatus and its Dynamical Characterization | 36i-354 | Hewenxuan Li

Exhibitor Directory

Exposition Hours:

Monday, February 12	7:00 p.m.–8:30 p.m. (Welcome Reception in the Exposition Hall)
Tuesday, February 13	9:30 a.m.–4:30 p.m.
Wednesday, February 14	10:00 a.m.–12:00 p.m. and 1:30pm–4:30pm
Thursday, February 15	8:00 a.m.–11:00 a.m. (8:00am–Breakfast in the Exposition Hall)

 = SEM Corporate Member

APS Dynamics, Inc.

APS DYNAMICS is the world's leading supplier of Long Stroke Shakers (ELECTRO-SEIS® vibration exciters) for Modal Testing and Low Frequency Calibration. APS Ball Bearing Shakers are used for studying the dynamic characteristics of various structures like floors, bridges, models, aircraft, spacecraft and piping systems. APS Air Bearing Shakers are used mainly for calibration purposes in the very low frequency range down to 0.1 Hz. The APS product range is completed by a Portable Shaker, Dual Mode Voltage / Current Amplifiers well adapted to support the capabilities of APS shakers, and Vibration Control Systems that support a broad range of testing applications.

ATA Engineering, Inc.

ATA Engineering, Inc. (ATA) is an engineering consulting firm that provides innovative solutions through test- and analysis-driven design by focusing on the engineering needs of manufacturers in addressing their cost, quality, and time-to-market challenges for mechanical and aerospace systems. ATA supports the IMAC community as modal test and analysis experts.

Brüel & Kjær North America Inc.

Brüel & Kjær is a world leader in sound and vibration instrumentation serving customers involved in all areas of sound and vibration testing-compliance, research, product development, and manufacturing. Stop by the Brüel & Kjær booth to see our broadened product range complemented by our global service and consulting offering.

Correlated Solutions, Inc.

Correlated Solutions, Inc. develops and manufactures turn-key Digital Image Correlation (DIC) measurement systems for non-contact full-field analysis of shape, motion, deformation, strain, and vibration applications. The VIC-3D HS FFT system is capable of measuring ODS's with frequencies up to 50 kHz with nanometer resolution and has a large dynamic range.

Crystal Instruments

Crystal Instruments (CI) is a leading supplier of dynamic measurement systems and software for machine monitoring, vibration detection, and acoustic testing. Backed by over 30 years of engineering expertise, CI's products are used for machine diagnosis, design verification, product testing, and process improvement by manufacturers of electronic and mechanical products.

Data Physics

Data Physics has pioneered high performance vibration control and analysis processes to the noise and vibration community since 1984. Data Physics is a leading provider of comprehensive vibration applications, offering a complete range of Electrodynamic Shakers including both air cooled and water cooled systems, Vibration Controllers and Dynamic Signal Analyzers.

Exhibitor Directory

DEWESoft LLC

DEWESoft, a privately held company, is a World leading provider of data acquisition software and hardware serving all. The DEWESoft software and hardware synchronizes Analog, Digital, Video, GPS, CAN, ARINC 429/1553, PCM and Chapter 10 support. The instruments have wide temperate and shock ranges and are available in many configurations.

Dynamic Design Solutions

Dynamic Design Solutions develops the FEMtools suite of software products (www.femtools.com) for structural dynamics simulations, dynamics substructuring, structural optimization, modal test planning and virtual testing, modal analysis, test-analysis correlation, and finite element model verification, validation and updating. An integrated scripting language provides unlimited extension, automation, and customization of the program. Typical applications include development of custom solutions for automated modal analysis, structural health monitoring and damage identification.

Dytran Instruments, Inc.

Founded in 1980, Dytran Instruments, Inc. is a leading manufacturer and designer of piezoelectric and DC MEMS sensors. Dytran offers a complete range of impulse hammers, piezoelectric force and pressure sensors, electronics, cables, and accessories for dynamic measurements, with full in-house customization capabilities.

ETS Solutions

ETS Solutions offers affordable, high quality vibration test equipment. ETS is now delivering our new induct-a-ring shaker rated for 11,000 and 22,000 lbf, available 3 pk-pk continuous displacement, and 300 Volt output IGBT amplifier. All systems comply with the European CE standards with certification from TUV-SUD Product Service GmbH.

IMV Corporation

Since it was founded in 1957, IMV CORPORATION is a world's leading supplier of high reliability vibration test systems in Japan offering single-axis, sequential and simultaneous (up to 6 degree of freedom) multi-axis vibration test systems, vibration diagnostic instruments and engineering consultancy services with physical location in Anaheim, CA, USA.

Instrumented Sensor Technology

Instrumented Sensor Technology(IST) designs, manufactures and sells portable, ruggedized data recorders for field shock and vibration measurement and analysis. Self contained instruments ranging from 1 to nine channels, from 10 Hz to 50kHz sampling rates. Built in in-situ accelerometers in most models for entirely self contained measurement and recording. Applications include transportation monitoring, drop test, modal test, ground vibration, flight test, crash test and more. Celebrating our 30th year.

Kistler Instrument Corporation

Kistler is the global leader providing modular solutions in dynamic measurement technology for pressure, force, torque and acceleration applications.

Laboratory for Verification & Validation (LVV), The University of Sheffield

The University of Sheffield's Laboratory for Verification and Validation (LVV) is a world-leading acoustics and vibration testing facility open to both academia and industry. It enables testing of large engineering structures under realistic environmental and dynamic conditions, helping to validate the computer simulation models used in the engineering design process.

Exhibitor Directory

m+p international inc.

Improving Unit Under Test Protection during Testing. Environmental testing of high value items requires redundant systems to protect from over testing. m+p will be demonstrating two new products to protect both the unit under test as well as the facilities being used. These products greatly reduce risk while providing data for the moments surrounding the anomaly.

Meggitt Sensing Systems

Meggitt Sensing Systems is a leading supplier of high-performance sensing and monitoring systems for physical parameter measurements in extreme environments. The Endevco® range of piezoelectric, piezoresistive, Isotron® and variable capacitance accelerometers, piezoresistive pressure transducers, acoustic sensors and electronic instruments ensure critical accuracy and reliability within aerospace, automotive, defense, industrial, medical, power generation, R&D, space and test and measurement applications.

The Modal Shop

The Modal Shop, MTS Systems Corporation, specializes in sound and vibration testing solutions. A complete line of proven, turnkey dynamic calibration systems, a wide selection of electrodynamic shakers, and an extensive Rental Program can help you meet your sound and vibration testing needs. Please visit us on the web: www.modalshop.com.

Morgan & Claypool Publishers

Morgan & Claypool is an independent book publisher for the Engineering, Computer Science & Information, Life Sciences, and Physics research communities. We publish 75 to 150 page "lectures," which are longer and more detailed than journal articles but not as unwieldy as handbooks or monographs.

Müller-BBM VibroAkustik Systeme Inc.

Müller-BBM provides data acquisition solutions for customers who design, build and test vehicles and their subcomponents. Our products and services can eliminate retesting and integrate with current equipment to optimize workflow. MBBM's U.S. based technical support is responsive and available to minimize time loss and expenses.

NOLISYS

NOLISYS provides innovative solutions for the detection, identification and utilization of nonlinearities in aerospace, mechanical and automotive structures. Our Nonlinear Identification to Design (NI2D) software includes, among others, advanced signal processing, modal and frequency response analyses of nonlinear systems. Visit our booth for a demonstration, and to learn more about our consultancy services and training sessions.

OROS

Visit the OROS booth to see the latest in portable analyzers, cascadeable high-channel count systems and modal analysis software. For over 3-decades, OROS has been a trendsetter in modal measurement and analysis technologies.

PCB Piezotronics

PCB Piezotronics, Inc. is a designer and manufacturer of microphones, vibration, pressure, force, torque, load, and strain sensors, as well as the pioneer of ICP® technology used by design engineers and predictive maintenance professionals worldwide for test, measurement, monitoring, and control requirements in automotive, aerospace, industrial, R&D, military, educational, commercial, OEM applications, and more.

Exhibitor Directory

Polytec, Inc.

Polytec is the global leader in high precision non-contact vibration measurement using lasers. Our Laser Doppler Vibrometers measure from 0 Hz to the GHz range with sub-picometer resolution. Scanning Vibrometers offer solutions for studying the complete dynamic motion characteristics of structures, providing full field data. Stop by our booth to discover Polytec's wide range of vibration solutions including our revolutionary Multipoint vibrometer for characterizing non-linear response, transient and non-stationary events. Learn more about the most advanced technology available for measuring 1-D and 3-D vibrations. Polytec is "Advancing Modal Analysis by Light."

Precision Filters, Inc.

Founded in 1975, Precision Filters, Inc. is a manufacturer and global distributor of high performance instrumentation for test measurements. PFI designs and manufactures precision product solutions that include a complete family of analog signal conditioning, filtering and switching systems.

SAGE Publishing

Sara Miller McCune founded SAGE Publishing in 1965 to support the dissemination of usable knowledge and educate a global community. SAGE publishes journals, books, and library products spanning a range of subject areas. SAGE remains majority-owned by our founder, who has ensured that the company will remain permanently independent. www.sagepublishing.com.

Shock and Vibration Exchange (SAVE)

The Shock and Vibration Exchange was founded in 2012 in order to serve as a clearing house for persons interested in shock and vibration and related specialties. The primary goals of "SAVE" are to maintain the continuity and offerings of the annual Shock and Vibration Symposium and its two 5-day shock courses.

Siemens PLM Software

Siemens PLM Software is a provider of product lifecycle management (PLM) software, systems and services with nine million licensed seats worldwide. Siemens PLM Software helps companies make great products by giving customers the information they need, when they need it, to make the smartest decisions, from planning through manufacturing.

Spectral Dynamics, Inc.

In its 55th year, SD continues to provide world class vibration control systems for both single and multi-axis applications. Our controllers are industry best especially in random fatigue and sine testing with true digital tracking filters. Complete modal systems including MISO and MIMO with easy to use STAR7 software. Check out our new Rotating Machinery Analysis Software!

SpectraQuest, Inc.

SpectraQuest, Inc. provides state-of-the-art systems for enhancing product reliability and quality assurance. We develop and manufacture training and diagnostic systems for industrial maintenance and vibration analysis. These products are ideal platform for research and education in machine fault diagnosis/prognosis, teaching dynamics and vibration courses, and wind turbine studies.

Exhibitor Directory

Springer

Springer is a leading publisher of engineering books and journals. Visit our booth at IMAC to pick up free sample journal copies and the chance to browse through our bestselling and recently published books in Structural Dynamics, with special discounts for SEM members and conference participants.

Structural Vibration Solutions A/S

Structural Vibration Solutions A/S is developer of the software called ARTeMIS Modal. It covers all the tools an engineer needs to perform a high quality modal analysis without knowing the forces acting on the structure and while the structure is in operation. This technology is in general known as Operational Modal Analysis. We will be showing the latest version of ARTeMIS Modal with new tools e.g. for effective modal analysis of rotating machinery during operation.

Tritek / TEAC Data Recorders

Tritek is proud to be the Authorized North American Distributor for TEAC Data Recorders. TEAC offers a complete range of Instrumentation Data Recorders, utilizing flash-memory card, SDD, and HDD recording media, with onboard signal conditioning. The innovative WX-7000 Series Wideband Data Recorder, featuring 80kHz max bandwidth, 16/24-bit resolution, DC/AC/IEPE input, and expansion to 128 channels, will be exhibited. The WX Series can operate in stand-alone mode with front panel control and monitoring, or by PC software controlled mode via Gigabit-Ethernet interface. IRIG-B/GPS input options are available. The portable and rugged LX-110/120 Series will be exhibited featuring 16/24-bit resolution, DC/IEPE and Strain inputs, stand-alone recording to CF memory card, and front-end recording to PC via Ethernet interface. The new VR-24 Video/Data Recorder, providing portable synchronized 2-channel video with 4-channel DC/IEPE data recording, and front-panel display and control will be on exhibit. The VR-2 provides 4 data channels of up to 40 kHz bandwidth per channel, 2 HD video channels at 30 fps per camera, and CAN/GPS/Pulse inputs, with synchronized PC playback.

Vibrant Technology, Inc.

Founded in 1991, Vibrant Technology is a leader in developing tools for post processing vibration and acoustic test data. Vibrant Technology software is used by structural testing and machinery maintenance professionals in a wide variety of industries. The primary product of Vibrant Technology is the ME'scope software series. ME'scope is designed to aid engineers and technicians working on new product research and development, predictive maintenance, manufacturing quality control, and monitoring of critical machines and structures.

Vibration Research

Vibration Research offers testing products, software and support with unrivaled value. Our VR9500 Controller and ObserVR1000 DAQ/Analyzer, along with VibrationVIEW and ObserVIEW software, include patented innovations used by world-wide testing labs and engineers. iDOF™, FDS, FDR, and Kurtosion® are some of VR's applications that ensure accurate, fast vibration testing.

VTI Instruments Corporation

VTI Instruments provides high accuracy measurement instrumentation and full-featured software for your most demanding NVH application requirements. Step up to VTI Instruments' new SentinelEX platform and realize the benefits of a platform that features multi-channel independent 24-bit digitizers and comprehensive signal conditioning with the ability to record high-speed, gap-free data ensuring that your mission critical data is ready for processing. Unique playback features and multi-vendor support utilities greatly simplify the data analysis process.

Hotel Information

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- Five minutes to Universal Orlando®
- 10 minutes to Walt Disney World® Resort
- One mile to SeaWorld®
- Across the street from Pointe Orlando

TRANSPORTATION AND PARKING

Transtar Transportation Group, Inc

- Town Cars, SUV's, Vans, Meter Taxis
- For Reservations Call Toll Free 866-888-5530

Mears Shuttle Information

- A \$3 coupon will be available on the SEM website
- Airport (OIA) to Hotel available 24-hrs. (no reservations required; booths located on Levels 1 & 2)
- Hotel to Airport(OIA) trips every 40 minutes past the hour. Reservations required (407) 423-5566
- Group shuttle discounts available
- Children 3 and under are free
- Adults (12 years +) \$21 one-way, \$33 roundtrip
- Prices subject to change and do not include gratuity

Hotel Parking

- Self-parking \$13.00 per day
- Valet parking available for \$22.00 overnight

SEM RATES

Single/Double: \$179.00 Additional
Person: \$20.00

HOTEL CHECK-IN/CHECK-OUT

Arrival: After 3:00 p.m.
Departure: 11:00 AM

RESERVATIONS

Reservations must be made directly with Rosen Plaza Hotel by calling the toll-free number (800) 627-8258 or using the link below. Please request the group rate for Society For Experimental Mechanics, Inc. 2018 IMAC Conference & Exposition on Structural Dynamics.

*Complimentary Tier One in-room internet.

Hotel reservation discounts and links can be found at

www.sem.org

Note: Individual departure dates will be reconfirmed upon check-in. Any adjustments to departure dates should be made at that time. Shortened lengths of stay, thereafter, will result in a one-time \$50.00 administrative fee, + state and local taxes, currently 12.5% plus an Orange County fee currently 1% for a total tax of 13.5%. No charge for children ages seventeen (17) and under, utilizing existing bedding.

Registration Information

CONFERENCE:

February 12-15, 2018

Take advantage of preregistration savings, and be eligible for door prizes awarded at the Exposition.

PRE-CONFERENCE COURSES:

February 11, 2018

Course fee includes lunch each day of the course, course handout materials, and refreshment breaks. Lodging and additional food or materials are not included.

TEAM DISCOUNTS FOR COURSE ATTENDEES

10% discount allowed for 3-4 registrants; 15% for five+. Registrants must be from the same organization.

Only ONE purchase order[†] may be submitted when applying for a team discount.

REGISTRATION POLICY

Online registration and payment/PO[†] must be received by January 15, 2018 for prepayment savings. On January 15, 2018 on-site registration prices will prevail. All checks must be in US funds, drawn on a US bank. Cancellations received in writing prior to January 15, 2018 will be refunded less a \$75.00 handling fee.

CANCELLATION POLICY

If the course or conference is canceled for any reason, the Society for Experimental Mechanics' liability is limited to the return of the registration fees.

We understand that circumstances may arise that require you to cancel. If you need to cancel, your conference fee, less a \$75.00 nonrefundable cancellation fee, will be refunded when the cancellation is made in writing and received by January 15, 2018. No refunds will be given for cancellations received after January 15, 2018. Cancellation notification should be faxed or emailed to Shari Matthews: Fax: 203-790-4472; shari@sem.org.

[†] Payments made with PO must be submitted no later than January 12, 2018. After January 12, 2018 PO will not be accepted as a form of payment. + Payment Net 30 days.

* to qualify at member rate SEM members must be in good standing prior to 12/1/2017

CONFERENCE REGISTRATION

Registration fee entitles the registrant to free download of the Conference Proceedings (available for 30 days after the conference) and includes the following: Welcome Reception on Monday, February 12, Exposition, and one ticket to the Awards Luncheon on Wednesday, February 14.

Paying non-member registration fee entitles you to membership in SEM for one year. However, you must check the appropriate box on the registration form if you would like to become a member. Additional membership add-on options can be found on the following page. Conference participants, including authors, coauthors, students, and session chairs, should preregister online at sem.org. Your badge, tickets, and other conference materials will be ready for you when you arrive at the registration desk. A completed registration form should be attached to government purchase orders.

All those who register prior to the January 15, 2018 deadline are eligible to win one of many door prizes being offered by IMAC Exhibitors.

STUDENTS

All full-time engineering and science students (graduate or undergraduate) not working should register online at www.sem.org. A letter with proof of full-time status MUST be emailed to Shari Matthews at shari@sem.org. Post-Doctoral does not qualify as a student and must pay regular rates.

CONFERENCE REGISTRATION HOURS

Course Only Registration:

Sunday, February 11, 2018	8:10 a.m.– 10:00 a.m.
Sunday, February 11, 2018	12:00 p.m.– 1:00 p.m.

Conference Registration:

Sunday, February 11, 2018	4:00 p.m.– 7:00 p.m.
Monday, February 12, 2018	7:00 a.m.– 4:00 p.m.
Tuesday, February 13, 2018	7:30 a.m.– 4:00 p.m.
Wednesday, February 14, 2018	7:30 a.m.– 4:00 p.m.
Thursday, February 15, 2018	7:30 a.m.– 1:00 p.m.

Membership

SEM MEMBERSHIP ADD-ON OPTIONS

Experimental Techniques (Print)	\$75
Experimental Mechanics (Print)	\$75
Journal of Dynamic Behavior of Materials (Print)	\$75
BSSM Membership	\$116
MTDM	\$65
MSSP	\$159
JVC	\$77

SEM Membership has its benefits! Among those benefits is free electronic access to a number of journals. To sign up for any of the above options, enter it in the “Social Events and Miscellaneous” section on the IMAC Registration form.

Contact SEM

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Memories from 2017



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