SEM Experimentally Speaking...

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Message from the President

Daniel Rixen, SEM President, 2020-2021

IN THIS ISSUE

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A GREAT IMAC, INDEED!

After a successful online SEM Annual Congress last September, we were all quite curious to see how the first online IMAC conference (8-11 February) would go, if longstanding SEM members would attend, if young graduate students would want to make their first conference experience in such a new format, if networking would be possible. The feedback we received was unanimous: while nothing can replace face-to-face interaction, the conference, although online, was not "virtual" but inspiringly real.

More than 250 papers were presented and 364 registered. That is less than the record numbers of last year, but still an unexpected massive participation for this first online IMAC. There were 12 exhibitors show-casing their latest technologies and 3 sponsors.

The authors prepared with great care video presentations that could be watched by the attendees two weeks before the conference and remained online up to 2 weeks after the conference. The online chat and Q&A in the Whova conference platform were extensively used to comment and discuss the videos even before the conference started. During the live online-sessions of the conference, each author was given 3 minutes to pitch her or his contribution, followed by 7 minutes of live discussion with the audience. Thanks to the professional technical support of the SEM staff and the devotion of the session chairs, discussions were even more vivid and passionate than when in person. This could be due to the fact that attendees could prepare the discussion efficiently thanks to the

"While nothing can replace face-to-face interaction, the conference, although online, was not "virtual" but inspiringly real"

recordings, but also due to the legendary "friendly" and respectful connections in the SEM community. Or was it because we all were eager to debate exciting topics beyond discussions about the pandemic?

The theme of IMAC was "Next Frontier in Structural Dynamics". It was refreshing to see that, next to well-established sessions at IMAC, topics such as Data-Based Modeling, Deep Learning or Video-based Measurements found their way into structural dynamics applications to open new opportunities in our field. The keynotes were extremely well attended and gave unique perspective of dynamic processes that govern our modern world. In the first keynote, Russ Salakhutdinov (Carnegie Mellon University) gave an inspiring overview of recent developments and new challenges related to deep learning. The second keynote, by Elliott Wolf (Lineage Logistics) gave an astonishing look behind the scenes of the dynamics and management of distribution chains of perishable food in pandemic times. In the SAGE Young Engineer Lecture, Luke Martin (Naval Surface Warfare Center) shared unique knowhow built on his practical

Message from the President *continued from pg.1*

experience in the modeling of viscoelastic material and its use in challenging applications. All in all, a lot to be learned and I am convinced that, as expected from SEM conferences, many of us "went home" with plenty of new ideas.

The online format was not yet fully perfect, but the interaction and the exchanges both during the sessions and during the social events held in spatial.chat were very intensive. All credits go to the enthusiastic attendees, to the SEM office and the IMAC Advisory Board led by David Epp and to the Conference Director, Mike Mains.

At the end of the conference, all attendees were invited to share their comments on the new format by mail and in an online meeting. Many thanks for all the constructive and very useful ideas to improve further the online format. A committee composed of a large and representative panel of SEM members has been formed to evaluate all the positive outcomes in order to further optimize both the technical platform and the planning for the online Annual Conference in June. Feel free to continue sharing your feedback and ideas with us. The experience we are gathering in this challenging period will enable us to enrich our future face-to-face conferences with virtual components and learn more about the advantages of online communication. The committee will also brainstorm on possible hybrid conference formats in the future, where meetings in person (we all hope to attend soon) could be combined with the virtual presence of attendees that cannot travel to the venue. Let us all make the future better and more exciting than the old normal! ■

Yours sincerely,

Daniel Rixen

From the Directors

WITH THIS MESSAGE, we would like to highlight the outcomes from IMAC-XXXIX—our first virtual IMAC conference.

IMAC was held virtually with the TD meetings occurring the week of February 1-5, 2021 followed by the technical program February 7-10, 2021. The conference was a success in attendance and energy with 364 individuals, 124 of whom attended for the first time.

We have our IMAC Advisory Board, our Program Planning Committee, our session organizers and Technical Division chairs and the SEM staff to thank for putting together an outstanding technical program and conference.

We have our IMAC Advisory Board, our Program Planning Committee, our session organizers and Technical Division chairs and the SEM staff to thank for putting together an outstanding technical program and conference. Their active involvement in the virtual activities, including social events and coffee gatherings, clearly hit the mark. Our Conference success rests in large part on the success of the Technical Program.

We will be publishing, with Springer/Nature, nine volumes of the IMAC Conference Proceedings, which will be available in mid-summer. Two of our newest Technical Divisions, Computer Vision and Laser Vibrometry, and Data Science, brought in new energy, new participation and excellent Keynote speakers. These new TDs along with the Dynamic Environments Testing Focus Group represent emerging growth areas for IMAC and have been recruiting and programming numerous papers over the past three years.

We continue to assess the lack of interest in IMAC attendees publishing in one of SEM's three peer-reviewed journals. This year we invited all conference registrants to indicate whether or not they would be interested in publishing their research in one of SEM's journals. The three Editors-in-Chief, Professor Alan Zehnder for Experimental Mechanics, Dr. Jennifer Jordan for the Journal of Dynamic Behavior of Materials and Dr. Bonnie Antoun for Experimental Techniques sent an email to the interested conference participants inviting them to submit to the journal that best fit their area of research. We hope that this helps to build the number of our conference participants publishing in SEM journals. Please visit the SEM website, sem.org/journals to learn more. SEM's goal is to provide our SEM/IMAC members and conference participants a journal to publish their work.

Our Annual Conference will also be virtual this year. We have 304 papers being programmed into 11 tracks with three symposia, two panels, and one course over four days that are sure to make our second virtual Annual Conference a success. Please visit the SEM website at sem.org/annual to learn more.

SEM is defined by its ability to remain agile, focused and open to all experimental mechanicians who enjoy and use our conference environment as the go-to place to learn and grow as experts in their field of study. Our relatively small conference size enables our agility, allowing us to keep our finger on the pulse of what is next, create a conference track to represent an emerging area of interest, and carve out our niche in that new area – a niche that sends the message to our conference participants that SEM's IMAC, Annual and Fall conferences are the ones to attend. This, we believe, is one of the keys to what defines SEM and gives strength to the meaning of the "friendly society."

We look forward to your questions or comments so please don't hesitate to email or call.

To those of you that attended IMAC, we want to personally thank you for a successful conference. And we look forward to being able to meet in-person in Orlando, FL, in 2022 as we celebrate IMAC-XL.

To those planning on attending the Annual Conference in June, we look forward to seeing and speaking with you in SEM's new virtual conference environment. As you register for the conference, please be sure to consider either renewing your membership or becoming a new member of SEM! ■

Kristin Zimmerman, Executive Director
Nuno Lopes, Managing Director

DeMichele Winner

The D. J. DeMichele award, established in 1990 in honor of Dominick J. DeMichele (1916-2000), recognizes an individual who has demonstrated "exemplary service and support of promoting the science and educational aspects of modal analysis technology."

Dr. Jason Blough is the 2021 recipient of this award *"for thirty years of contributing research, education, and developing quality engineers making an impact across a variety of industries."* ■

Technical Division/Focus Group Best Paper Awards

We would like to offer a special thank you to all the Technical Division and Focus Group leadership for putting together a process to judge the many submissions that were considered for best paper awards. We also want to acknowledge the time the judges took from their busy schedules to review all the content. And finally, congratulations to the many winners listed below. ■

COMPUTER VISION AND LASER VIBROMETRY

#10526 Multi-Level Damage Detection using Octree Partitioning Algorithm
by Mehrdad S. Dizaji, Zhu Mao, University of Massachusetts, Lowell
Sponsored by Polytec, Inc.

COMPUTER VISION LASER VIBROMETRY

#10610 Full-Field 3D Experimental Modal Analysis from Dynamic Point Clouds Measured using a Time-of– Flight Imager
by Moise Silva, Federal University of Pará; Andre W. Green, John Morales, Peter, Meyerhofer, Los Alamos National Laboratory; Yongchao Yang, Michigan Tech University; David D.L. Mascarenas, Los Alamos National Laboratory; Eloi Figueiredo, Universidade Lusófona de Humanidades e Tecnologias
Sponsored by Trillion Quality Systems

DATA SCIENCE

#10218 On an Application of Graph Neural Networks in Population Based SHM
by Georgios Tsialiamanis, University of Sheffield; Charilaos Mylonas, Eleni Chatzi, ETH Zürich; David Wagg, Nikolaos Dervilis, Keith Worden, University of Sheffield
Sponsored by Los Alamos Dynamics, LLC.

DYNAMIC ENVIRONMENTS TESTING

#10161 Investigation of Transmission Simulator Based Response Reconstruction Accuracy
by Matthew J. Tuman, Christopher A. Schumann, Matthew S. Allen, University of Wisconsin-Madison; Washington J. DeLima, Eric Dodgen, Honeywell Federal Manufacturing & Technologies

DYNAMIC SUBSTRUCTURES

#10604 Introducing pyFBS: An Open-Source Python Package for Frequency Based Substructuring and Transfer Path Analysis
by Tomaž Bregar, Gorenje d.o.o.; Ahmed El Mahmoudi, Technische Universität München; Miha Kodric, Gregor Cepon, Miha Boltezar, University of Ljubljana; Daniel J. Rixen, Technische Universität München

DYNAMICS OF CIVIL STRUCTURES

#10605 Physics-Guided Sparse Coding for Multiple Occupant Identification Using Floor Vibration Sensing
by Jonathon Fagert, Carnegie Mellon University; Mostafa Mirshekari, Stanford University; Pei Zhang, Carnegie Mellon University; Hae Young Noh, Stanford University

DYNAMICS OF CIVIL STRUCTURES

#10635 Transfer Learning from Audio Domains a Valuable Tool for Structural Health Monitoring
by Eleonora M. Tronci, Columbia University; Homayoon Beigi, Recognition Technologies, Inc.; Maria Q. Feng, Raimondo Betti, Columbia University

continued on next page

DYNAMICS OF CIVIL STRUCTURES

#10655 Experimental Evaluation of Drive-by Health Monitoring on a Short Span Bridge Using OMA Techniques
by William R. Locke, Laura Redmond, Matthias J. Schmid, Clemson University

MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION

#10505 Uncertainty Quantification of Inducer Eigenvalues using Conditional Assessment of Models and Modal Test of Simpler Systems
by Andrew M. Brown, Timothy J. Wray, NASA/Marshall Space Flight Center; Jennifer L. DeLessio, JSEG/ESSCA-NASA/ Marshall Space Flight Center
Sponsored by Los Alamos Dynamics, LLC

NONLINEAR STRUCTURES AND SYSTEMS

#10312 Effects of the Geometry of Friction Interfaces on the Nonlinear Dynamics of Jointed Structures
by Jie Yuan, Loic Salles, Christoph Schwingshackl, Imperial College Londonw

IMAC by the Numbers

250 VIDEOS

3,244,961 seconds of video watched

TOP 5 *videos by views*

#**10277**–Identifying Operations and Environmental-Insensitive Damage Features

#**10131**–Lumped Parameter Approach for Fixture Design

#**10445**–NIXO-Based Identification of the Dominant Terms in a Nonlinear Equation of Motion

#**10253**–Damage Localization on Lightweight Structures with Non-Destructive Testing and Machine Learning Techniques

#**10457**–DIRAC: Next Generation Test-Based Modelling

ATTENDEES REPRESENTING:

22 COUNTRIES

108 UNIVERSITIES

50+ NATIONAL LABS & INDUSTRIAL COMPANIES

35 U.S. STATES

364 total attendees

124 first-time attendees

Member News

Remembering Sia Nemat-Nasser

UNIVERSITY OF CALIFORNIA San Diego engineering professor emeritus Siavouche "Sia" Nemat-Nasser passed away on January 4, 2021 due to complications of acute myeloid leukemia (AML). He was 84 years old.

Professor Nemat-Nasser was a Distinguished Professor of Mechanics and Materials in the Department of Mechanical and Aerospace Engineering at the UC San Diego Jacobs School of Engineering. He was a long time SEM member and establish an award "for distinguished, innovative and outstanding work that has realized the impact of experimental mechanics on other scientific and engineering fields through an integrated multidisciplinary research."

A full remembrance can be found at www.jacobsschool.ucsd.edu/news/release/3199 ■

Yong Zhu

SEM MEMBER, DR. YONG ZHU of North Carolina State University, has been selected to receive a Friedrich Wilhelm Bessel Research Award. The nomination was submitted to the Foundation and its selection committee by Dr. Christian Liebscher, Max-Planck-Institut für Eisenforschung GmbH/Germany.

This award is conferred in recognition of the award winner's entire academic record to date. In addition, award winners are invited to carry out research projects of their own choice in cooperation with specialist colleagues in Germany.

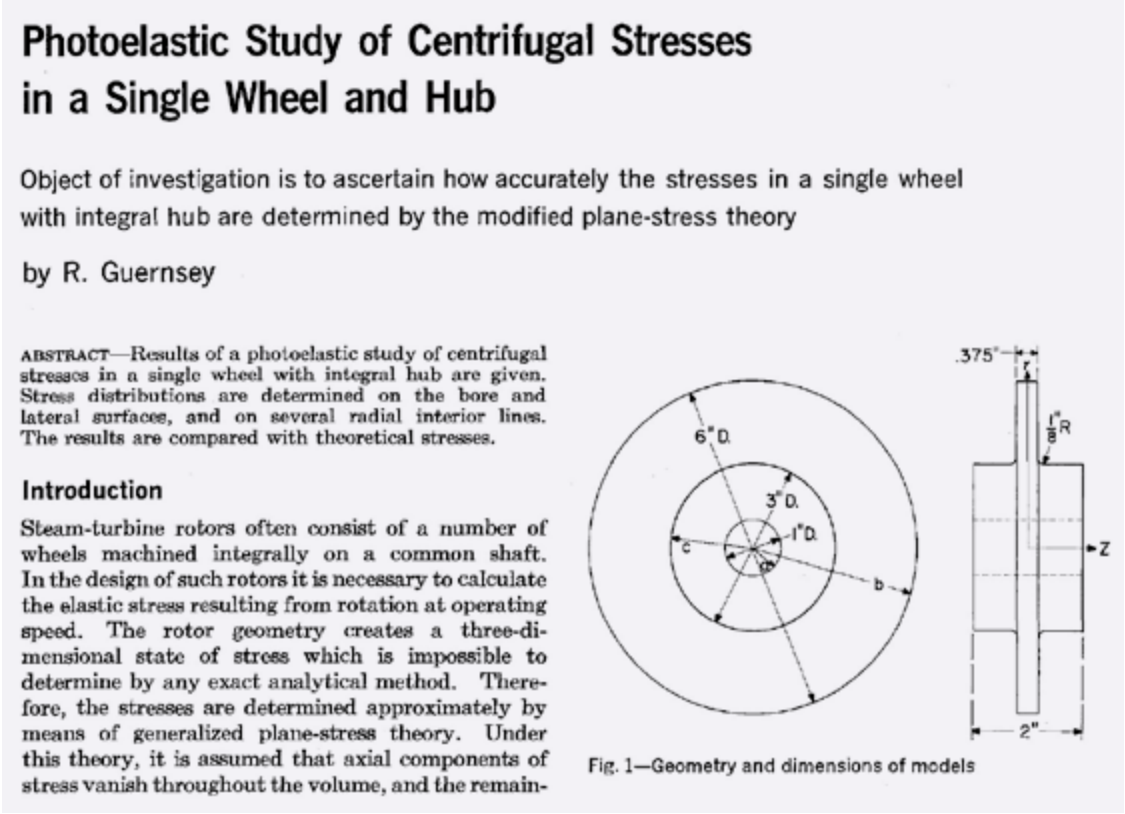
The Alexander von Humboldt Foundation sponsors distinguished international scientists and scholars irrespectively of their academic discipline or nationality and maintains an international network of academic cooperation and trust. ■

Michael Sutton

CONGRATULATIONS TO DR. MICHAEL SUTTON, co-founder of Correlated Solutions, for winning the Engineering Science Medal which is awarded in recognition of a singularly important contribution to engineering science by The Society of Engineering Science. In Dr. Sutton's case, the medal was awarded "for pioneering contributions to experimental solid mechanics and materials characterization by inventing the Digital Image Correlation (DIC) method to access full-field displacement and strain information on deforming bodies." ■

Experimental Mechanics Turns 60

WE ARE A LONG WAY OFF from January of 1961 when Mr. Roscoe Guernsey, Jr. had the first published manuscript in a newly introduced journal, *Experimental Mechanics*. Mr. Guernsey led off the inaugural issue with "Photoelastic Study of Centrifugal Stresses in a Single Wheel and Hub" which was an investigation to ascertain how accurately the stresses in a single wheel with integral hub are determined by the modified plane-stress theory. The seven-page manuscript was a continuation of his work previously presented at the 1960 SESA Annual Meeting held in Berkeley, Calif., on October 19-21. SESA would eventually become SEM in 1943.



Photoelastic Study of Centrifugal Stresses in a Single Wheel and Hub

Object of investigation is to ascertain how accurately the stresses in a single wheel with integral hub are determined by the modified plane-stress theory

by R. Guernsey

ABSTRACT—Results of a photoelastic study of centrifugal stresses in a single wheel with integral hub are given. Stress distributions are determined on the bore and lateral surfaces, and on several radial interior lines. The results are compared with theoretical stresses.

Introduction

Steam-turbine rotors often consist of a number of wheels machined integrally on a common shaft. In the design of such rotors it is necessary to calculate the elastic stress resulting from rotation at operating speed. The rotor geometry creates a three-dimensional state of stress which is impossible to determine by any exact analytical method. Therefore, the stresses are determined approximately by means of generalized plane-stress theory. Under this theory, it is assumed that axial components of stress vanish throughout the volume, and the remain-

Fig. 1—Geometry and dimensions of models

January of 2021 marked 60 years that *Experimental Mechanics* has been in continuous publication. At the time of writing this article, *Experimental Mechanics* has published 482 issues, 23 of those being special issues on topics ranging from Advances in DIC to Transparent Armor Materials culminating in over 41,000 pages of content.

Besides the support of the Society, over the decades, the only other constant has been change. The journal has seen changes in publishing frequency, the format from cut/paste boards to digital layout, numerous technological advances in experimental mechanics and most critically, changes in its Editor-in-Chief, a role currently occupied by Professor Alan T. Zehnder, the Associate Dean for Undergraduate Programs in the Sibley School of Mechanical and Aerospace Engineering at Cornell University. Professor Zehnder took on the role of EIC beginning in January of 2021 as *Experimental Mechanics* celebrated its 60th anniversary.

Experimental Mechanics coverage extends from research in solid and fluid mechanics to fields at the intersection of disciplines such as physics, chemistry, and biology. The development of new devices and technologies for metrology applications in a wide range of industrial sectors are also covered.

The journal's reputation has certainly been earned and *Experimental Mechanics* currently has an Impact Factor of 2.496 with a five-year impact factor of 2.655 (2019). This success rests largely on the shoulders of the current EIC, the previous EIC Ioannis Chasiotis and the more than 20 technical editors that volunteer their time and effort to elevate the journal's standing.

Of course, no journal can stand solely with an EIC and a team of technical editors and reviewers. It is due to the submissions of authors, like you and your research, that success can be achieved. It is the Society's goal to continue publication for another six decades and more with your help and the contributions of those like Mr. Roscoe Guernsey, Jr. in 1961. *Experimental Mechanics* will continue to welcome your work for the many decades to follow. For details on the Aims and Scope and how to submit your manuscripts, please visit www.springer.com/journal/11340.

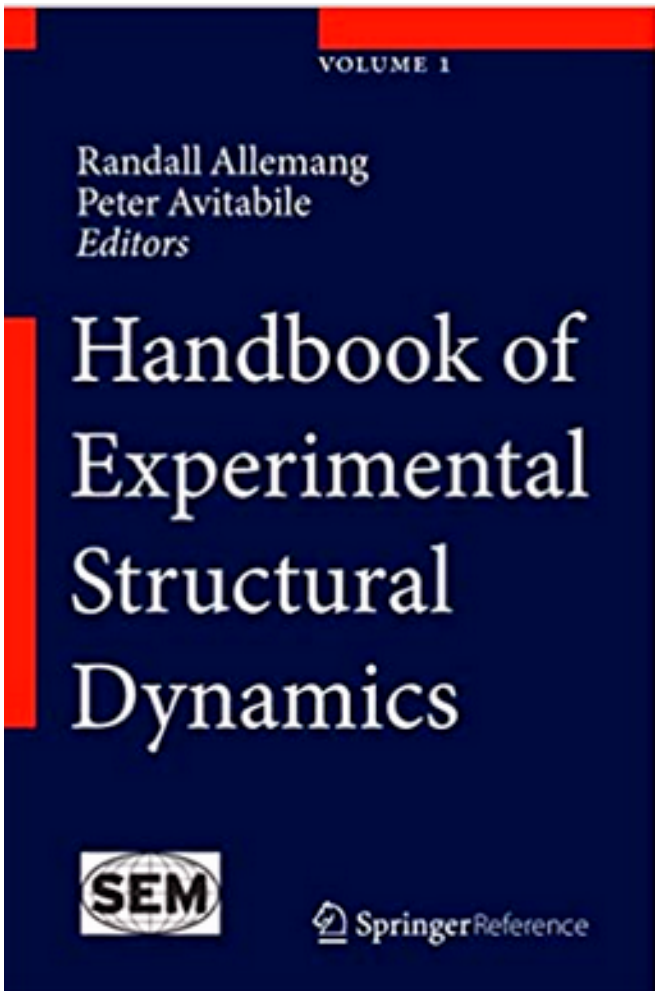
Thank you to all those that have made this journal what it has become over the years, your time, effort and contributions have been welcome and appreciated and will continue to be well into the future. ■

SEM *Handbook of Experimental Structural Dynamics*

THE FIRST EDITION of the SEM *Handbook of Experimental Structural Dynamics* was recently released. This Handbook stands as a comprehensive overview and reference for its subject, applicable to workers in research, product design and manufacture, and practice. The Handbook is devoted primarily to the areas of structural mechanics served by the Society for Experimental Mechanics IMAC community, such as modal analysis, structural health monitoring, shock and vibration, sensors and instrumentation, aeroelasticity, ground testing, finite element techniques, model updating, sensitivity analysis, verification and validation, experimental dynamics sub-structuring, quantification of margin and uncertainty, and testing of civil infrastructure. Chapters offer comprehensive, detailed coverage of decades of scientific and technologic advance and all demonstrate an experimental perspective. Several sections specifically discuss the various types of experimental testing and common practices utilized in the automotive, aerospace, and civil structures industries.

Contributions present important theory behind relevant experimental methods as well as application and technology. Topical authors emphasize and dissect proven methods and offer detail beyond a simple review of the literature. Additionally, chapters cover practical needs of scientists and engineers who are new to the field. In most cases, neither the pertinent theory nor, in particular, the practical issues have been presented formally in an academic textbook. Each chapter in the Handbook represents a 'must read' for someone new to the subject or for someone returning to the field after an absence. Reference lists in each chapter consist of the seminal papers in the literature.

Of the twenty-four chapters that are currently complete, fourteen are already published online. The balance of the ten chapters are expected to be available within a year. The Handbook chapters include:



Click image to view Handbook

- History of Experimental Structural Mechanics
- DIC Methods - Dynamic Photogrammetry
- LDV Methods
- Applied Digital Signal Processing
- Introduction to Spectral - Basic Measurements
- Structural Measurements - FRF
- Random and Shock Testing
- Rotating System Analysis Methods
- Sensors Signal Conditioning Instrumentation
- Design of Modal Tests
- Experimental Modal Parameter Evaluation
- Operating Modal Analysis Methods
- Experimental Modal Methods
- Analytical Numerical Substructuring
- Finite Element Model Correlation
- Model Updating
- Damping of Materials and Structures
- Model Calibration and Validation in Structures
- Uncertainty Quantification: UQ, QMU and Statistics
- Nonlinear System Analysis Methods (Experimental)
- Structural Health Monitoring and Damage Detection
- Experimental Substructure Modeling
- Modal Modeling
- Response (Impedance) Modeling
- Nonlinear Normal Mode Analysis Techniques (Analytical)
- Modal Modeling with Nonlinear Connection Elements (Analytical)
- Acoustics of Structural Systems (VibroAcoustics)
- Automotive Structural Testing
- Civil Structural Testing
- Aerospace Perspective for Modeling and Validation
- Sports Equipment Testing
- Applied Math for Experimental Structural Mechanics

Upcoming Events

2021

2021 SEM Annual Virtual | June 14-17, 2021

iDICs Conference | Oct 25-27, 2021
La Cité Nantes Events Center
Nantes, France

2022

IMAC-XL | February 7–10, 2022
Rozen Plaza Hotel
Orlando, FL USA

2022 SEM Annual | June 13-16, 2022
Omni William Penn Pittsburgh
Pittsburgh, PA US:

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AN MTS COMPANY