Proceedings of ASME 2025 International Mechanical Engineering Congress and Exposition (IMECE2025) Volumes 1-9

November 16–20, 2025
Memphis, Tennessee, USA

Sponsored by ASME

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

© 2025, The American Society of Mechanical Engineers, 290 W. Mount Pleasant Avenue, Suite 1400, Bldg. 4, Livingston, NJ 07039, USA (www.asme.org)

All rights reserved. "ASME" and the above ASME symbols are registered trademarks of the American Society of Mechanical Engineers. No part of this document may be copied, modified, distributed, published, displayed, or otherwise reproduced in any form or by any means, electronic, digital, or mechanical, now known or hereafter invented, without the express written permission of ASME. No works derived from this document or any content therein may be created without the express written permission of ASME. Using this document or any content therein to train, create, or improve any artificial intelligence and/or machine learning platform, system, application, model, or algorithm is strictly prohibited.

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FROM SOURCES BELIEVED TO BE RELIABLE. HOWEVER, NEITHER ASME NOR ITS AUTHORS OR EDITORS GUARANTEE THE ACCURACY OR COMPLETENESS OF ANY INFORMATION PUBLISHED IN THIS WORK. NEITHER ASME NOR ITS AUTHORS AND EDITORS SHALL BE RESPONSIBLE FOR ANY ERRORS, OMISSIONS, OR DAMAGES ARISING OUT OF THE USE OF THIS INFORMATION. THE WORK IS PUBLISHED WITH THE UNDERSTANDING THAT ASME AND ITS AUTHORS AND EDITORS ARE SUPPLYING INFORMATION BUT ARE NOT ATTEMPTING TO RENDER ENGINEERING OR OTHER PROFESSIONAL SERVICES. IF SUCH ENGINEERING OR PROFESSIONAL SERVICES ARE REQUIRED, THE ASSISTANCE OF AN APPROPRIATE PROFESSIONAL SHOULD BE SOUGHT.

ASME shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B7.1.3). Statement from the Bylaws.

For authorization to photocopy material for internal or personal use under those circumstances not falling within the fair use provisions of the Copyright Act, contact the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, tel:978-750-8400, www.copyright.com.

Requests for special permission or bulk reproduction should be addressed to the ASME Publishing Department, or submitted online at: https://www.asme.org/publications-submissions/journals/information-for-authors/journalguidelines/rights-and-permissions

VOLUME 1 ISBN: 978-0-7918-8932-9
VOLUME 2 ISBN: 978-0-7918-8933-6
VOLUME 3 ISBN: 978-0-7918-8934-3
VOLUME 4 ISBN: 978-0-7918-8935-0
VOLUME 5 ISBN: 978-0-7918-8936-7
VOLUME 6 ISBN: 978-0-7918-8937-4
VOLUME 7 ISBN: 978-0-7918-8938-1
VOLUME 8 ISBN: 978-0-7918-8939-8
VOLUME 9 ISBN: 978-0-7918-8940-4

TABLE OF CONTENTS

Acoustic Response of a Multilayered Acoustic Foam Composite (MAFC) via Reinforcement of CNT Into Polyurethane Foam for Undersea Applications 1
Trey Brauch, Hassan Mahfuz, Pierre-Philippe Beaujean

Detailed Design of Vibration Reduction Through the Tank Reinforcement of the Transformer 7
Minok Yun

Wireless Surface Acoustic Wave Sensor for Vibration and Bioprinting Monitoring 14
Luyu Bo, Teng Li, Jiali Li, Yingshan Du, Bowen Cai, Zhenhua Tian

Time-Reversal Imaging of Impact Damage in Laminate Composites via Nonlinear Guided Wave Mode Conversion 19
Shuai Zhou, Yiran Tian, Yanfeng Shen

Piezoelectric Composite Frequency Steerable Acoustic Transducers for Damage Detection via Directional Wave Mixing 28
Shulong Zhou, Yanfeng Shen, Chunquan Wang, Bao Wang, Yuan Tian

Damage Detection via Nonreciprocal Nonlinear Guided Wave Propagation Through Metasurfaces 38
Hexuan Xu, Yiran Tian, Yanfeng Shen

Modulated Nonlinear Guided Wave Tomography for Impact Damage Imaging in Composite Structures 45
Houfu Jiang, Yanfeng Shen

Ceramic Nuclear Fuel Cladding Safety Evaluation Based on Guided Wave Dispersion Analysis 53
Bowen Cai, Teng Li, Jiali Li, Luyu Bo, Yingshan Du, Chuangchuang Sun, Zhenhua Tian

Geometric Phase-Based Inverse Problems Under Uncertainty for the Prediction of Soil Property Change 60
Harry Mayrhofer, Samy Missoum, Pierre Deymier, Araceli Hernandez-Granados, Keith Runge, Susan Beck

Determination of Sound Production Maps for a Trumpet Acoustic Model As a Function of a Player's Control Parameters 67
Harry Mayrhofer, Samy Missoum, Christophe Vergez

AI Based Free Vibration Analysis of Sandwich Shells With Viscoelastic Core 75
Sukesh Chandra Mohanty, Jagesh Kumar Prusty

Using Non-Contact Anti-Corrosion Under Insulation Materials to Increase Efficiency of Acoustic Insulation for Pipes 81
Richard Pamley, Mark Swift, Ahmad Rk Rana, Graham Brigham

Reinforcement of Polyurethane Foams With Recycled Brewer's Spent Grain Fillers: A Sustainable Approach for Aerospace Acoustic Insulation Applications 90
Leyre B. Fernandez, Christian Johnson, Longyan Chen, Xiaoxu Ji

Machine Learning Approaches for Designing 1-D Elastic Superlattices With Non-Conventional Topological Acoustic Waves 95
Kamaljeet Singh, Hao Helen Zhang, Pierre Deymier, Keith Runge, Pierre Lucas

Deep Learning-Based Object Detection and Analysis for Underground Water and Utility Line Localization 106
Mahmoud Rezk, Mariam Alnaqbi, Thani Althani, Mohit Vohra

Machine Learning and Sensory Integration for Real-Time Road Surface Assessment 114
Artem Abzaliev, Rutchanon Hatasen, Hussein Kokash, Linda Zhu, Jun Chen, Mihai Burzo

Classification of Spatially Distributed Data Harvesting Positions of the Vibrations of a Carbon-Fiber Cylindrical Shell. Model Compression and Weight Space Analysis via the Framework of the Advanced Proper Orthogonal Decomposition Algorithm 126
Konstantinos Liontos, Ioannis Georgiou

Reduced-Order Modeling of Structural Panels for Random Vibrations Using Proper Orthogonal Decomposition and Radial Basis Function Interpolation 136
Spencer Armstrong, Jean-Michel Dhainaut

Characterization and Modeling of Ultrasonic Backscatter Communication During Misalignment 144
Kaleb McGillivray-Seaton, Deborah Munro

Noise Mitigation Analysis in Relief Valves Using a Hybrid CFD-Acoustics Approach 154
Salar Taghizadeh, Jan Oravec, Sujan Dhar

Improving Screw Compressor Displacement and Efficiency by Increasing Rotor Profile Depth 166
Nikola Stosic, Ian K. Smith, Ahmed Kovacevic

Design and Implementation of an Advanced LED Lighting System for Heavy Rail Transit Vehicles 173
Zida Wang, Long Zhang, Meishan Li, Qiang Lyu, Yanbo Yin, Xi Zhang, Baide Feng, Yuxuan Tang

Design and Optimization Integrated Approach for Robotic Welding Processes of Car Chassis 188
Fabio Pini, Alessandro Dimauro, Enrico Dalpadulo, Francesco Leali

Intelligent Bio-Inspired Robotic Gripper With 3D Object Modeling and Adaptive Force Modulation 195
Saquib Shahriar, Wenhua Yang, Chang Duan, Jaejong Park

Design of a Lab-Scale Molded Pulp Machine 201
Lucas Dassonville, Samuel Austin, Xiaofang Bai, Jooyeoun Jung, John P. Parmigiani

Design and Prototyping of an Electric Pulsed Fields System for Water Treatment 208
Livingston Castro, Juan D. Orellana, Giovanny A. Romero, Arturo S. Palacios-Ponce

Robustness of Priority Metric-Based Traffic Signal Control Algorithm 215
Minjung Kim, Hwan-Sik Yoon

Topology Optimization of Orthotropic Materials: Enhancing Sustainability and Performance in Additive Manufacturing 224
Enrico Dalpadulo, Fabio Pini, Francesco Leali

Optimal Design of Die Casting Gating System for Parking Brake Housing to Prevent Gas Defects 231
Daichi Minamide, Ken'ichi Yano, Yasuhiro Hata, Yusuke Yamashita, Tadao Kondo

Enhancing Racing Bicycle Powertrain Efficiency by Reducing Frictional Losses Through Modified Chain Pitch 237
Michael Hemmerlin, Sohel Anwar

Achieving Integrated Top-Down and Bottom-Up Functional Synthesis by Clustering Solution-Neutral and Form-Independent Function Units Based on the Domain Synthesis Theory in Quotient Space 245
Yu-Tong Li, Yu-Xin Wang

Virtual Crane Training- Enhancing Safety and Skill Development in the Steel Industry 255
Rohit Kumar Reddy Kovvuri, Kyle Toth, John Moreland, Chenn Zhou, Jeffery Maxfield, Henry Mitchell

Procedural Design Error Detection in CAD Modeling Operations Using Graph-Based Neural Networks 262
Hunter Nguyen, Yunjian Qiu

Enhancing Competitiveness in North American Automotive Industry: Cost and Time Reduction in Infotainment Cockpit Electronics Through Simplified Architectures and High-Performance Materials 271
Miguel Angel Temoltzi-Guzman, Marcelo Lopez-Parra

Lighter, Ventilated, and Safer: A Topology-Optimized Hard Hat for Civil Engineers 281
Serniabat Wasit Tawassaf, Tayaf Mahamud, Chowdhury Sadid Alam

Multi-Objective Optimization of Barocaloric Refrigeration Devices: Balancing Specific Cooling Power and Coefficient of Performance 289
Lagouge Tartibu, Bikram Bhatia

Self-Monitoring Engine Oil System 296
Basel Alsayyed, Wagdi Elabasi

Surrogate Model-Based Structural Analysis Optimization of Missiles 302
Esra Gozde Yalcin Yildirim, Tayfur Yildirim

Effects of Infill Density and Raster Angle on Additively Manufactured PLA and PETG Polymers Using the Grid Infill Pattern 308
Aaron Adams, Edgar Bryant, Mechack Nduwa, Cameron Coates, David Stollberg

Improving Impact Resistance in 3D-Printed Structures Through Parameter Optimization 316
Aaron L. Adams, Mechack M. Nduwa, Edgar Bryant, David Stollberg, Cameron Coates

The Business Digital Twin: Unlocking Industrial Engineering and Reengineering Capabilities of the Manufacturing Workforce 322
Stefan Stefanov, Trifon Stefanov, Dana Bachvarova

Investment Analysis of Digital Twins 332
Douglas S. Thomas

Real-Time Monitoring Platform for Commercial Refrigerators Using Digital Twin Aggregates 340
Alessandro Stefanone, Matteo Sala, Roberto Zanetti, Matteo Pirotta, Marco Rossoni, Giorgio Colombo

Building a Digital Twin for Mobile Robots: a Step-By-Step Development Guide 348
Charles Przechocki, Vedang Chauhan

MQTT-UNS and OPC UA in RAMI4.0: A Comparative Analysis for Industrial Communication 355
Luis Freitas, Filipe Pereira, Helena Lopes, Camelia Avram, Nuno Leal, Jose Machado

Can We Achieve Accurate Automatic Shoulder Bone Segmentation With a Limited Number of CT Scans? 362
Anna Ghidotti, Paola Pinetti, Daniele Regazzoni, Caterina Rizzi

Propulsion of a Small-Scale Hyperloop Pod With YBCO Superconductors: A Simulation Study 369
Hinal Ahir, Sohail Zaidi, Vimal Viswanathan

Enabling Proliferation of Unmanned Aerial Systems in Contested Environments 380
Andrea Riddle, John Macune, Jonathan Passander, Wade Alford, Christopher Aliperti, Alberto Squatrito

Walk Ease: A Hands-Free Crutch Alternative 386
Timothy J. Pozda, Alex Mischell, Brianna Briggs, Sydney R. Daniels, Zahabul Islam, Sonia Chacko

AI-Driven Prediction of Optical Turbulence and Communication Reliability 391
Hani Hamdan, Jinan Charafeddine, Wafaa M. R. Shakir, Sabrine Ayari, Zeinab Mhanna

Roadside Traffic Surveillance System for Optimal Traffic Control 399
Shenglin Li, Hwan-Sik Yoon

Reduced Order Model to Predict the Fatigue Life of Oil and Gas Drill Collar Portholes 408
Ralston Fernandes, Haitao Zhang, Yaou Wang, Amandine Battentier

Development of an Augmented Reality Application for Surface-Only Visualization of Finite Element Analysis Results 416
Md Muhtasim Fuad, Karim H. Muci-Kuchler

Author Index