

**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

Enhancing Lithium-Ion Battery Safety and Performance Through Immersion Cooling: Insights from Thermal Propagation Studies..... <i>Swapnil S. Salvi, Andre Swarts, Daniel Juarez-Robles</i>	1
Unraveling the Thermo-Electrochemical Behavior of Lithium-Ion Batteries Under Operational Extremes..... <i>Anuththara S. J. Alujjage, Avijit Karmakar, Bairav S. Vishnugopi, Yevgen Barsukov, David Magee, Partha P. Mukherjee</i>	9
Electrochemical Model Based Degradation Analysis of a Lithium Ion Battery Using Computation Fluid Dynamics Tools..... <i>Jonathan Bowyer, Sohel Anwar</i>	19
Investigation of Vent Gas Ignition During Thermal Runaway of an 18650 Li-Ion Cell..... <i>Nicholas Baehl, Jason K. Ostanek, Byoungchul Kwon, Vinay Premnath, Judith A. Jeevarajan</i>	28
Battery Degradation Addition to Sandia Labs QuEST 2.0 Software <i>David Braese, David Rosewater, Alexander Headley</i>	35
Parameter Estimation of Equivalent Circuit Model for a Vanadium Redox Flow Battery Using Particle Swarm Optimization..... <i>Shazeb Syed, Ammar Ali, Sohel Anwar</i>	41
Design and Testing of a Fuel Cell Fixture for High Temperature PEMs..... <i>Prantik Roy Chowdhury, Adam C. Gladen</i>	48
Understanding the Influence of Temporal Temperature Evolution on Li-Ion Battery Degradation Mechanisms..... <i>Parisa Akhtari Zavareh, Krishna Shah</i>	58
Deep Neural Network-Based Modeling of Electro-Thermal Lithium-Ion Batteries Responses Leveraging Hybrid Pulse Power Characterization..... <i>Connor Madden, Jarrett Peskar, Austin R. J. Downey, Kerry Sado, Jamil Khan</i>	67
Manufacturing and Measuring Lithium-Ion Batteries to Isolate Reduction of Performance from Mechanical Damage <i>John Sherman, Anthony Bombik</i>	73
Uncertainty-Aware Surrogate-Accelerated Chemo-Mechanical Phase-Field Fracture Modeling of Fatigue Crack Growth in Lithium-Ion Batteries..... <i>Avinandan Modak, Abhinav Gupta, Rajib Chowdhury, Ravindra Duddu</i>	80
Charge-Discharge Cycle Experiment and Mechanical Damage of Electrode Materials in Lithium-Ion Batteries (LiBs)..... <i>Yuzuki Kawashima, Daisuke Sumiya, Akio Yonezu</i>	87
State of Health Evaluation for Large Lithium-Ion Batteries Using Pseudo-EIS <i>Daniel Juarez-Robles, Swapnil S. Salvi, Andre Swarts, Jayant V. Sarlashkar</i>	93
Bio-Oil and Bio-Crude Gasification for Syngas Production: Energy, Exergy and Environmental Analyses <i>Ana Buelvas, Daniel A. Quintero - Coronel, Juan Fajardo, Deibys Barreto, Antonio Bula, Arturo Gonzalez - Quiroga</i>	100

Analyzing Energy Efficiency of Rooftop Units Utilizing Different Refrigerant Types - An Uncertainty and Game Theory Analysis.....	113
<i>Hugh Allen-Magande, Javad Khazaii, Amin Esmaeili, Ali Khazaei</i>	
A Battery Stacking System for Effective Thermal Management Using Finned Heat Pipe.....	119
<i>L. V. R. S. V. Prasad Chilamkurti, Ravindranadh Koutavarapu, Upendra Kumar Potnuru</i>	
Performance Assessment of a Novel Drain Water Heat Recovery-Coupled Shallow Ground Source Heat Pump System in a Cold Climate	126
<i>Charaka Beragama Jathunge, Seth B. Dworkin, Aggrey Mwesigye</i>	
Optimization of a New Double Hybrid Heat Pump System: Performance in Heating and Cooling Modes with R-454B as a Sustainable Alternative to R-410A.....	137
<i>Koorosh Khosravi, Matthew Desmarais, Theodorian Borca-Tasciuc</i>	
CFD Modelling of CO ₂ Adsorption onto Activated Carbon: Influence of Cooling, and Injection Strategies	145
<i>Ali M. Sefidan, Jari Vepsalainen</i>	
CFD Analysis of Steam and CO ₂ Gasification of Biochar in a Downdraft Reactor	152
<i>Md Mahmudul Hasan, Prakashbhai R. Bhoi</i>	
Evaluating Emission Reduction in EAF Steelmaking: The Role of Renewable Energy and Circular Economy Solutions.....	163
<i>Kabir A. Akinyemi, Olusegun M. Ilori, Noel Perera, Lynsey Melville, Jamiu A. Dauda</i>	
Optimal Planning of Flexible Hybrid Renewable Energy Microgrids for Decarbonized Multi-Vector Energy Systems	170
<i>Maryam Hamidi, Alireza Asadbeygi</i>	
Energy Analysis of McDonnell Douglas Hall	179
<i>Elizabeth Dolan, Jessica Rutherford, Danahe Marmolejo</i>	
Enhancing Flexibility in Integrated Building Energy Systems: A Marginal Cost and Demand-Side Optimization Approach	185
<i>Annalisa Bringiotti, Mehdi Ali Ehyaei, Fabiano Pallonetto, Mattia De Rosa</i>	
Bidirectional Charging EV Integration with EnergyPlus and Schedule Optimization to Assess Benefits of Residential EV Energy Storage.....	193
<i>Tomy Tran, Yulin Zeng, Yuhong Liu, Hohyun Lee</i>	
Performance Analysis of Helium Gas Jet Impingement Heat Transfer Enhanced Concentrating Solar Receiver	201
<i>Peiwen Li, Patrick Kupiec, Sheng Li</i>	
Feasibility and Performance Analysis of a Solar Chimney Power Plant in Abha, Saudi Arabia: Harnessing Elevation and Solar Irradiance for Sustainable Energy Generation.....	211
<i>Saad Alshahrani</i>	
Enhancing Solar Energy Absorption and Stability for Photocatalytic Hydrogen Generation Using Cu-SAPO-34@TiO ₂ Photocatalyst	221
<i>Valantine Takwa Lukong, Peter Ozaveshe Oviroh, Tien-Chien Jen</i>	
Impact of Gas Cooler Pressure on the Performance of a Solar-Assisted Direct Expansion Transcritical CO ₂ Heat Pump.....	227
<i>Ali Pakbaz, Adam C. Gladen</i>	

Long-Term Performance Analysis and Predictive Modeling of a Solar Photovoltaic System	237
<i>S. M. Faisal Rahman, Mehmet Sozen</i>	
Numerical Investigation of the Overall Performance of a Square Receiver for a High-Temperature Concentrating Photovoltaic Thermal System	246
<i>Timothy Otukoya, Wahiba Yaici, Abdulmajeed Mohamad, Aggrey Mwesigye</i>	
Fresnel Amplification for Decentralized Solar Thermal Power Production	255
<i>Basel Alsayyed, Cameron J. Patterson, Valerie Castro</i>	
Recycling Energy from Watercooled Photovoltaic Panel for Domestic Applications: An Energy Sustainable Approach	267
<i>Ayati Vyas, Suraj Madhav, Yagnik Chilamakuri, Sohail H. Zaidi, Vimal Viswanathan</i>	
Robust Swivel-Based Mooring System for Marine Energy Devices to Improve System Reliability	275
<i>Michael Smith, Caroline Lowcher, Trip Taylor, Justin Logan, Devin Hill, Ulises Guillen</i>	
Understanding the Effect of Scaling on Aerodynamic Force Analysis of NREL Phase VI Wind Turbine Blade	285
<i>Patrick R. West, Shrabanti Roy, Xiaoyun Shao</i>	
Parametric Control-Oriented Framework for a Coastal-Structure Integrated Wave Energy Converter Powered Reverse Osmosis Desalination System	292
<i>David Koffi, Maciej Noras, Wesley Williams, Michael Smith</i>	
Development and Experimental Investigation of a Pendulum-Based Wave Energy Converter for Met-Ocean Sensing	302
<i>Ahmed Shalaby, Mahmoud E. Abd El-Latif, Ahmad Shah, Ruben Paredes, Jia Mi, Raju Datla</i>	
Environmental Analysis of the Production and Liquefaction of Green Hydrogen	310
<i>Jimena Incer-Valverde, Sudheep Senthilkumar, George Tsatsaronis, Tatiana Morosuk</i>	
Evaluating the Performance of Elastomeric Sealing Materials Under Medium-Pressure Hydrogen Aging: Implications for Reliability in Hydrogen Infrastructure	321
<i>Md Monjur Hossain Bhuiyan, Zahed Siddique</i>	
Model for Green Hydrogen Integration in South Africa's Transportation Sector	332
<i>Kingsley Ukoba, Tien-Chien Jen</i>	
Dynamic Performance Analysis of High Temperature Steam Electrolysis System in an Integrated Energy Ecosystem	344
<i>Temitayo O. Olowu, Jan W. Lambrechtsen, Jeremy L. Hartvigsen, Micah J. Casteel</i>	
Computational Fluid Dynamics Analysis of Single, Double Stack, and Triple Stack Fuel Cells	353
<i>Umar F. Alqsair</i>	
Design Considerations for Electrospinning Manufacturing in Polymer-Based Filter Media Research	360
<i>Megan Berry, Daniel Ellis, Alta Knizley</i>	
Economic Impact of the Design Strategies for Decarbonization and Resilience of a Multi-Energy System	367
<i>Enrico Dal Cin, Gianluca Carraro, Sergio Rech</i>	
The Role of Different Applications of Photovoltaic Technologies in Large Scale Energy Systems	377
<i>Francesco Bertele, Enrico Dal Cin, Gianluca Carraro, Sergio Rech</i>	

Demand Response Strategies to Optimize the Design and Operation of a Residential Energy System Considering Loss of Comfort	387
<i>Gianluca Carraro, Giacomo Olivan, Enrico Dal Cin, Konstantinos Braimakis, Sotirios Karellas, Andrea Lazzaretto</i>	
Improving the Performance of Industrial Batch-Processes Via Pinch-Analysis: Application to a Brewery Process	397
<i>Roberto Carapellucci, Marco Di Bartolomeo, Lorena Giordano</i>	
Off-Design Performance for the Large-Scale High-Temperature Adiabatic Compressed Air Energy Storage System	407
<i>Xilong Han, Zheng Yang, Yue Cao, Zhikun Zhong, Fengqi Si</i>	
Evaluating Circular Economy of Household Appliances: End of Life Assessment of a Washer-Dryer System.....	417
<i>Angelina James, Amy Keller, Seung-Jin Lee, Heather Dillon</i>	
Assessment of the Dynamic Behaviour of an Organic Rankine Cycle (ORC)-Based Carnot Battery System	425
<i>Fabio Fatigati, Davide Di Battista, Roberto Carapellucci</i>	
Evaluation of Inter-Cooling in the Absorption Column for CO ₂ Capture Using Diglycolamine Amine: Benefits and Economic Assessment	433
<i>Carlos D. Fischer, Miguel C. Mussati, Tatiana Morosuk, Sergio F. Mussati</i>	
Energy Inventory in the Saint Louis Metropolitan Area: Analyzing the Transportation Sector	441
<i>Jose Montoya, Clayton Stout, Danahe Marmolejo, J. S. Onesimo Sandoval</i>	
Optimization of Low-Grade Solar Thermal Desalination Powerplant	449
<i>Lihui Cai, Tawhidur Rahman, Khaled A. Sallam</i>	
Multi-Inlet Hydraulic Ram Pump System with Integrated Wastewater Recirculation Unit	458
<i>Ashokkumar M. Sharma, Maitri Bhakta, Avery Appleton, Srikanth B. Pidugu, Venkata S. Bhrugubanda</i>	
Enhanced Waste Heat Utilization on a Supercritical CO ₂ Brayton Cycle for Dual Multi-Effect Desalination (MED) in Concentrated Solar Power Systems	464
<i>Sattam Alharbi</i>	
Development of PEM Fuel Cell Performance Through Simulations and Gas Diffusion Layer Assessment, Considering Degradation and Quality Control	474
<i>Hoe-Gil Lee, Alexandru Herescu, Kiera Gregg, Tara Harmon</i>	
Performance Comparison of a Pumping System in a Natural Gas Combined Cycle Based on On-Design and Off-Design Conditions	485
<i>Said F. Bravo, Hector J. Bravo</i>	
Enhanced Wind Energy Harvesting Using Magnetic Coupling and Reduction Gears for Piezoelectric Transduction.....	492
<i>Saleh Alhumaid</i>	
Variable and Fixed Geometry Turbocompressors: Comparison and Optimization for Heavy Vehicles	498
<i>Roberto Capata, Alfonso Calabria, Yuri Ferrari</i>	

Pilot Study of Annoyance of Wind Farm Noise with and Without Amplitude Modulation: Methodological Issues	505
<i>Heather L. Lai, Anne C. Balant</i>	
Comprehensive Thermodynamics Analysis of a 1260 MW Steam Power Plant: Energy and Exergy Evaluation.....	514
<i>Saad A. Alsamraee, Sanjeev Khanna</i>	
Estimation of the Heating Value of Fuels by a Regression Analysis Model.....	524
<i>Carlos Castro, Didier Sanchez, Rui Ribeiro, Jose Teixeira, Margarida Goncalves</i>	
Theoretical Investigation of a Flat Sheet Multistage Vacuum Air Gap Membrane Distillation for Water Desalination	532
<i>Mohamed Antar, Ahmed Omera</i>	
Exergetic and Exergoeconomic Analysis of a Combined Cycle Power Generation System at a Refinery in the Feedstock Scenario with Natural Gas and Hydrogen Mix Fuel.....	539
<i>Deibys Barreto, Julian Gonzalez, Diana Osorio, Ana Buelvas, Arturo Gonzalez-Quiroga, Camilo Cardona, Juan Fajardo</i>	
A Game Theory Analysis for Optimizing Using Electricity and Natural Gas for Energy Consumption in Commercial Office Buildings	550
<i>Hugh Allen-Magande, Javad Khazaii, Amin Esmaeili, Ali Khazaei</i>	
Transition to a Low-Carbon Energy System Or Energy Transformation: Perspective on Africa	555
<i>Peter Ozaveshe Oviroh, Tien-Chien Jen</i>	
Bio-Inspired Structural Design for Enhanced Crashworthiness of Electric Vehicles' Battery Frame.....	564
<i>Arefeh Salimi Beni, Mohammadamin Ezazi, Fadwa Dababneh, Hossein Taheri</i>	
Design and Controls Development for Application Testing of Electrospun Nanofiber Filter Media	573
<i>Jeremy Adriano, Alta Knizley, Gentry Berry</i>	
A Novel Holistic Business Model Approach for Solar Charging Stations Assisted Adoption in Urban Electric Mobility Initiatives: A Colombian Case	584
<i>Lesme Corredor, Alma Nouar Rodriguez, Gabriela Insignares Quiroz, Juliana Insignares Quiroz, Jorge Echeverry Roman, Maicol Marengo</i>	
Advancing Transactive Energy in Industry 5.0: A Cyber-Physical Decision-Making Framework.....	594
<i>Maryam Yaghoubirad, John Hall</i>	
Deep Learning-Based Prediction of Thermal Runaway Temperature of Lithium Iron Phosphate Batteries Under Multivariate Influences.....	603
<i>Yuyao Cao, Ya Peng, Zhenxiang Tao, Hui Zhang</i>	
Meta-Heuristics Optimized Neuro-Fuzzy Modelling and Feature Importance Analysis of Bio-Oil Yield Via Biomass Pyrolysis	613
<i>Oluwatobi Adeleke, Tien-Chien Jen</i>	
STA-DRL: A Spatial-Temporal Attention Deep Reinforcement Learning Framework for HVAC Optimization Using Python-Based Simulation.....	620
<i>Abdullahi Elnaiem, Amanuel Tereda, M. A. Muktedir, Sun Yi</i>	
Transfer Learning for the Classification and Characterization of Wind Farm Acoustical Emissions.....	627
<i>Heather L. Lai, Chih-Yang Tsai</i>	

Hybrid Approach Based on Simulation and Experimental Data for Surrogate-Based Modeling: A Case Study of a High-Temperature Heat Pump.....	632
<i>Loukas Kyriakidis, Ashish Thapa</i>	
BatteryLLM: A Multi-Modal Temporal Fusion and Physics Prior Enhanced Framework for Battery Management	642
<i>Yangyang Wei, Junge Shen, Yidong Wang, Zhaoyong Mao</i>	
Inferring Battery State of Charge Using Strain Sensing and Machine Learning	649
<i>George Anthony, Ryan Yount, Austin R. J. Downey, Kerry Sado</i>	
Influences of Thermal Energy Storage Systems on the Performances of an Adiabatic Compressed Air Energy Storage System Under Off-Design Working Conditions	653
<i>Chaocheng Zhao, Ming Liu, Guangtao Ni, Wei Han, Junjie Yan</i>	
Comparative Analysis of MgO-ZnO and MgO-Al ₂ O ₃ Hybrid Nanofluids to Enhance Thermal Performance of PCM-Metal Foam Based Heat Exchanger	662
<i>Hurmat Khan, Huseyin Kaya, Atiq Ur Rehman Fareedi, Abdul Qadeer Khoso, Ihsan Ur Rahman, Bernardo Buonomo, Oronzio Manca, Sergio Nardini</i>	
CFD Simulations Featuring Unsteady RANS/LES for Assessing Liquid Piston Compression Performance for Energy Storage	669
<i>Nithin Panicker, Thien Nguyen, Steve Kowalski</i>	
Experimental Validation of CFD Models Capturing a Cold-Shock Transient in Liquid Metal Cooled Reactor Plena.....	679
<i>John M. Matulis, Andrew Long, Hitesh Bindra</i>	
Designing the Vendor Irradiation Graphite Experiment in the Advanced Test Reactor.....	686
<i>Grant Hawkes, Michael Fanning, Angelica Mata Cruz</i>	

Author Index