

**Proceedings of ASME 2025
International Design Engineering
Technical Conferences and
Computers and Information in
Engineering Conference**

(IDETC-CIE2025)

Volumes 1-6

**27th International Conference on Advanced Vehicle Technologies
(AVT)**

45th Computers and Information in Engineering Conference (CIE)

51st Design Automation Conference (DAC)

22nd International Conference on Design Education (DEC)

**30th Design for Manufacturing and the Life Cycle Conference
(DFMLC)**

**37th International Conference on Design Theory and
Methodology (DTM)**

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: 978-0-7918-8919-0
VOLUME 2A ISBN: 978-0-7918-8920-6
VOLUME 2B ISBN: 978-0-7918-8921-3
VOLUME 3A ISBN: 978-0-7918-8922-0
VOLUME 3B ISBN: 978-0-7918-8923-7
VOLUME 4 ISBN: 978-0-7918-8924-4
VOLUME 5 ISBN: 978-0-7918-8925-1
VOLUME 6 ISBN: 978-0-7918-8926-8

TABLE OF CONTENTS

Agent-Based Modeling of Classroom Dynamics for Participatory Design.....	1
<i>Tyler Nanoff, Hugo Gonzalez Villasanti</i>	
A Digital Twin Model Updating Method to Capture Lifecycle System Degradation.....	11
<i>Yifan Tang, Mostafa Rahmani Dehaghani, G. Gary Wang</i>	
Real-Time Decision-Making Under Uncertainty in Digital Twins: Robust Model Predictive Control Using Time-Series Deep Quantile Learning.....	21
<i>Yi-Ping Chen, Ying-Kuan Tsai, Vispi Karkaria, Wei Chen</i>	
Numerical Estimation of the Sensitivity of Optimal Plant Design to Control Perturbations.....	33
<i>Elena Fernandez Bravo, Melkior Ornik, Bjorn Dierks, James T. Allison</i>	
Design of Experiments-Based Analysis of a Hybrid Wind-Wave Energy System With a Spar-Torus Combination	42
<i>Saeid Bayat, Lei Zuo</i>	
Multi-Generation Control Co-Design for Digital Twin-Enabled Systems With Deep Reinforcement Learning	54
<i>Ying-Kuan Tsai, Vispi Karkaria, Yi-Ping Chen, Wei Chen</i>	
A Spatiotemporal-Dependent Structural Reliability Analysis Method Based on a Reduced-Order Surrogate Model for Wind Turbines	69
<i>Jianhao Fang, Weifei Hu, Jiquan Yan, Tongzhou Zhang, Na Dong, Liwen Wang, Zhi Zeng, Zhenyu Liu</i>	
An Automated Functional Decomposition Method Based on Large Language Models.....	84
<i>Zebin Cai, Rucong Liu, Qianzhi Jing, Haoyu Zuo, Lingyun Sun, Peter Childs, Liuqing Chen</i>	
Learning-Aided Bigraph Matching Approach to Multi-Crew Restoration of Damaged Power Networks Coupled With Road Transportation Networks	94
<i>Nathan Maurer, Harshal Kaushik, Roshni Anna Jacob, Jie Zhang, Souma Chowdhury</i>	
Accelerating Electric-Magnetic Machine Simulation Using the Fourier Neural Operator (FNO)	105
<i>Zhengke Guo, Xianfeng David Gu, Shikui Chen</i>	
Fatigue Analysis and Validation of a Deep Learning-Enhanced Finite Element Model for Acetabular Cup Screw Fixation in Total Hip Arthroplasty: A Comparative Biomechanical Assessment	118
<i>Emily T. Yan, Jacob Stroud, Benita Ibabaza, Kyle Walker, Chung Hyun Goh</i>	
Self-Supervised Geometric Representation Learning for Fine-Scale Feature Preservation in AI- Driven Surrogate Modeling.....	129
<i>Yu-hsuan Chen, Jonathan Cagan, Levent Burak Kara</i>	
VLAG: Graph-Based Planning for Vision-Language-Action Models in Long Horizon Manipulation Tasks.....	143
<i>Ardalan Aryashad, Yan Jin</i>	
Predicting Corrosion in Multi-Material System Using Hybrid Multi-Task Learning.....	154
<i>Parth Bansal, Zhiqiao Dong, Yulun Wu, Chenhui Shao, Pingfeng Wang, Yumeng Li</i>	

GenCAD-3D: CAD Program Generation Using Multimodal Latent Space Alignment and Synthetic Dataset Balancing.....	164
<i>Nomi Yu, Md Ferdous Alam, A. John Hart, Faez Ahmed</i>	
Heterogeneous Metamaterials Design via Multiscale Neural Implicit Representation	180
<i>Hongrui Chen, Liwei Wang, Levent Burak Kara</i>	
Evaluating the Role of Model Size in Agentic AI for Expert-Like Material Selection	195
<i>Megan Y. Ying, Daniele Grandi, Allin Groom, Christopher McComb</i>	
Enhancing Medical Tool Detection With UV Fluorescent Paint: Exploring the LUV Method for Simulation-Based Training	211
<i>Xinsheng Zhou, Sanaz Motamedi, Jason Moore, Scarlett Miller</i>	
Automating Common Design Methods With ChatGPT	220
<i>Lauren Bertelsen, Ada-Rhodes Short</i>	
Structural and Component Configuration Design Exploration Using a Reinforcement Learning Trained Transformer	228
<i>Alexander Demagall, Daniel Selva</i>	
Efficient Design Optimization Over Mixed-Combinatorial Spaces Enabled by Graph-Learning.....	239
<i>Feng Liu, Souma Chowdhury, Achira Boonrath, Eleonora M. Botta</i>	
Enhancing Demand Forecasting With Machine Learning and Transformers: A Comparative Study	253
<i>Sara Hajihashemi, Iman Ghamarian, Janet K. Allen, Farrokh Mistree</i>	
WheelSDF: Implicit Representation-Based 3D Shape Generation and Interpolation for Wheel Design.....	269
<i>Hayata Morita, Kohei Shintani, Chenyang Yuan, Frank Permenter</i>	
Decoupled Dynamics Framework With Neural Fields for 3D Spatio-Temporal Prediction of Vehicle Collisions.....	279
<i>Sanghyuk Kim, Sunwoong Yang, Minsik Seo, Namwoo Kang</i>	
Comparison of Data-Driven Modeling Approaches for Control Optimization of Floating Offshore Wind Turbines	289
<i>Athul Sundarrajan, Daniel R. Herber</i>	
Pi-GenAI: Personality-Incorporated Generative AI for Design Concept Evaluation	305
<i>Seyoung Park, Kangcheng Lin, Harrison Kim</i>	
Flow Battery Manifold Design With Heterogeneous Inputs Through Generative Adversarial Neural Networks	315
<i>Eric Seng, Hugh O'Connor, Adam Boyce, Josh J. Bailey, Anton van Beek</i>	
Integrating Image Segmentation and Digital Human Modeling Through Multi-Fidelity Gaussian Process for Driver Visibility Analysis	327
<i>M. Amin Firouzi, Yitong Bu, H. Onan Demirel, Christopher Hoyle</i>	
Data-Driven Predictions of Thermal Runaway Propagation Behaviors Considering Battery Pack Design Parameters.....	338
<i>Yiyue Jiang, Zheng Liu, Pingfeng Wang</i>	
Entropy-Based Adaptive Sampling Strategy for Gaussian Process Regression	348
<i>Chenlong Xu, Jiayi Zhao, Pingfeng Wang</i>	

CAD-Coder: An Open-Source Vision-Language Model for Computer-Aided Design Code Generation	357
<i>Anna C. Doris, Md Ferdous Alam, Amin Heyrani Nobari, Faez Ahmed</i>	
Wavelet CNN-Based Condition Monitoring for Offshore Wind Turbine Tower Using Multivariate Time-Series Data	372
<i>Fazlur Rahman Bin Karim, Ipsita Mishra, Soroush Senemmar, Mario A. Rotea, D. Todd Griffith, Jie Zhang</i>	
Hybrid Powertrain Optimization for Regional Aircraft Integrating Hydrogen Fuel Cells and Aluminum Air Batteries	382
<i>Harshal Kaushik, Ali Mahboub Rad, Korebami Adebajo, Sobhan Badakhshan, Nathaniel Cooper, Austin Downey, Jie Zhang</i>	
Co-Optimize Condenser Water Temperature and Cooling Tower Fan Using High-Fidelity Synthetic Data	390
<i>Gulai Shen, Gurpreet Singh, Ali Mehmani</i>	
Fluid-Thermal Topology Optimization With Applications to Heat Sinks, Cooling Jackets and Battery Cooling Plates.....	399
<i>Dimitrios I. Papadimitriou, Robert Sandboge</i>	
Hybrid Modeling Approach for Designing Variable Twist Blades: Implementing CFD and Data Driven Models for Ocean Current Turbine Twist Optimization	410
<i>Aditya Atre, James Roetzer, Ben Janke, Praveen Ramaprabhu, John Hall</i>	
Electric Vehicle Charging Network Optimization Considering Regional Resource Dependencies	420
<i>Yinshuang Xiao, Harshal D. Kaushik, Jingbo Wang, Jie Zhang, Zhenghui Sha</i>	
Cold Plate Optimization With Entropy Minimization Using Bayesian Optimization	435
<i>Chengda Li, Trent Kinion, Vignesh Bhaskaran, Christopher Hoyle</i>	
Jitterbug: A Hybrid Digital Fabrication Platform for Rapid Prototyping of Printed Electronics.....	445
<i>Vinh Q. Nguyen, Anika E. Harding, Kaito Yan, Nadya Peek, Corie L. Cobb</i>	
A Preliminary Data Fusion Study to Assess the Feasibility of Foundation Process-Property Models in Laser Powder Bed Fusion.....	457
<i>Oriol Vendrell-Gallart, Nima Negarandeh, Zahra Zanjani Foumani, Mahsa Amiri, Lorenzo Valdevit, Ramin Bostanabad</i>	
Multimodal Rag-Driven Anomaly Detection and Classification in Laser Powder Bed Fusion Using Large Language Models	466
<i>Kiarash Naghavi Khanghah, Zhiling Chen, Lela Romeo, Qian Yang, Rajiv Malhotra, Farhad Imani, Hongyi Xu</i>	
An EV Powertrain Parameter Design Framework Supported by Market System Simulation and Reliability-Based Optimization	478
<i>Lingjia Zhang, Youyi Bi</i>	
Remaining Useful Life Prediction for Hall Thrusters Based on Adaptive Self-Cognizant Dynamic System and Multi-Physics Modeling.....	489
<i>Yuan Jiang, Alexandra N. Leeming, Joshua L. Rovey, Pingfeng Wang</i>	
Fault Detection and Pressure-Time Curve Prediction for Fluid-Structure Interactions With Physics-Based Modeling and Machine Learning.....	499
<i>Parth Bansal, In-Bum Chung, Mohammad Mundiwala, Chao Hu, Pingfeng Wang</i>	

Recovery Optimization of a Power Distribution Network Considering a Coupling With Transportation Network for Dispatching Resources.....	509
<i>In-Bum Chung, Lei Wu, Pingfeng Wang</i>	
Prediction of Electromigration Failure of Solder Joints via Surrogate Model Integrated With Conformal Inference.....	520
<i>Zheng Liu, Hao Wu, Parth Bansal, Pingfeng Wang, Yumeng Li</i>	
A Framework for Co-Designing Manufacturing Supply Networks for Robustness and Resilience.....	529
<i>Mathew Baby, Anand Balu Nellippallil</i>	
Adaptive Surrogate Modeling for High Dimensional Problems Using Autoencoder Gaussian Process.....	547
<i>Jiayi Zhao, Yanwen Xu, Pingfeng Wang</i>	
Sensitivity Analysis of Reward Weights in Multi-Agent Learning: A Box-Pushing Case Study	556
<i>Hao Ji, Julian Jiang, Chuanhui Hu, Bingling Huang</i>	
Extracting Design Process Heuristics: A Systematic Computational Approach.....	569
<i>Vikranth S. Gadi, Zoe Szajnfalber, Jitesh H. Panchal</i>	
Design and Optimization of Spherical Parallel Manipulator for Lower-Body Locomotion Interface.....	585
<i>Jungsoo Park, An-Chi He, Isaac Pressgrove, Benjamin Beiter, Kaveh Akbari Hamed, Alexander Leonessa</i>	

Author Index