

Proceedings of the ASME

**INTERNATIONAL DESIGN ENGINEERING TECHNICAL
CONFERENCES & COMPUTERS AND INFORMATION IN
ENGINEERING CONFERENCE
- 2020 -**

VOLUME 9

**40TH COMPUTERS AND INFORMATION IN
ENGINEERING CONFERENCE (CIE 2020)**

presented at

ASME 2020 INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES &
COMPUTERS AND INFORMATION IN ENGINEERING CONFERENCE

AUGUST 17-19, 2020

ONLINE

sponsored by

DESIGN ENGINEERING DIVISION AND COMPUTERS AND INFORMATION IN
ENGINEERING DIVISION, ASME

**THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Two Park Avenue * New York, NY. 10016**

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Statement from By-Laws: The Society shall not be responsible for statements or opinions
Advanced in papers. . .or printed in its publications (7.1.3)

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY ASME 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.

For authorization to photocopy material for internal or personal use under 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

Requests for special permission or bulk reproduction should be addressed to permissions@asme.org.

ISBN NO. 978-0-7918-8398-3

© 2020 ASME

All rights reserved.

Printed in U.S.A with permission by Curran Associates, Inc. (2020)

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

CONTENTS

40TH COMPUTERS AND INFORMATION IN ENGINEERING CONFERENCE (CIE 2020)

AMS: COMPUTATIONAL MULTIPHYSICS APPLICATIONS

- DETC2020-22632**..... **V009T09A001**
Investigating the Coupled Effects Between Rotor-Blade Aeroelasticity and Tip Vortex Stability
Steven N. Rodriguez, Athanasios P. Iliopoulos, John G. Michopoulos, Justin W. Jaworski

AMS: CYBER-PHYSICAL SYSTEMS

- DETC2020-22045**..... **V009T09A002**
Cyber-Physical Infrastructures for Advancing Pyrolysis Conversion Process: A Case Study of Biochar Production
Benjamin Hersh, Amir Mohajeri, Amin Mirkouei, Min Xian

- DETC2020-22661**..... **V009T09A003**
Design of Trustworthy Cyber-Physical-Social Systems With Discrete Bayesian Optimization
Yan Wang

AMS: HUMAN MODELING AND SIMULATION IN ENGINEERING

- DETC2020-22115**..... **V009T09A004**
Two-Dimensional Team Lifting Prediction With Different Box Weights
Asif Arefeen, Yujiang Xiang

- DETC2020-22120**..... **V009T09A005**
Three-Dimensional Symmetric Maximum Weight Lifting Prediction
Rahid Zaman, Yujiang Xiang, Jazmin Cruz, James Yang

- DETC2020-22668**..... **V009T09A006**
Predictive Human-in-the-Loop Simulations for Assistive Exoskeletons
Xianlian Zhou

- DETC2020-22688**..... **V009T09A007**
Perineum Pressure Distribution Among Various Bicycle Saddles
Jazmin Cruz, Mario Garcia, Elizabeth Jackson, James Yang

AMS: INVERSE PROBLEMS IN SCIENCE AND ENGINEERING

- DETC2020-22047**..... **V009T09A008**
An Initial Guess Free Method for Least Squares Parameter Estimation in Nonlinear Models
Guanglu Zhang, Douglas Allaire, Jonathan Cagan

DETC2020-22434..... **V009T09A009**
Inverse Identification of Non-Linear ODEs for the Dynamic Control of Material Testing Systems
Evelyn M. Lunasin, Athanasios P. Iliopoulos, John G. Michopoulos, John C. Steuben

DETC2020-22474..... **V009T09A010**
Multiscale Tomographic Wave-Matter Interaction Modeling to Enable Artifact-Free Material Defect Reconstruction
J. C. Steuben, J. G. Michopoulos, A. P. Iliopoulos, B. D. Graber, A. J. Birnbaum

DETC2020-22500..... **V009T09A011**
A Computational Framework for the Inverse Identification of Temperature-Dependent Dielectric Permittivity of Materials at Giga-Hertz Frequencies
A. P. Iliopoulos, B. D. Graber, J. G. Michopoulos, J. C. Steuben, A. J. Birnbaum, E. P. Gorzkowski, E. A. Patterson, R. P. Fischer, L. A. Johnson, P. A. Bernhardt, J. M. Coombs

AMS: MATERIAL CHARACTERIZATION METHODS AND APPLICATIONS

DETC2020-22482..... **V009T09A012**
Measuring Dielectric Properties of Ceramic Powders at Microwave Frequencies for Material Processing Applications
B. D. Graber, A. P. Iliopoulos, J. G. Michopoulos, J. C. Steuben, A. J. Birnbaum, R. P. Fischer, L. A. Johnson, P. A. Bernhardt, J. M. Coombs, E. P. Gorzkowski, E. A. Patterson

AMS: SIMULATION IN ADVANCED MANUFACTURING

DETC2020-22032..... **V009T09A013**
Spiral Tool Path Generation for CNC Machining Using Cloud of Points
Mandeep Dhanda, Aman Kukreja, S. S. Pande

DETC2020-22628..... **V009T09A014**
Scalable Thermal Simulation of Powder Bed Fusion
Yaqi Zhang, Vadim Shapiro, Paul Witherell

AMS: UNCERTAINTY QUANTIFICATION IN SIMULATION AND MODEL VERIFICATION AND VALIDATION

DETC2020-22184..... **V009T09A015**
srMO-BO-3GP: A Sequential Regularized Multi-Objective Constrained Bayesian Optimization for Design Applications
Anh Tran, Mike Eldred, Scott McCann, Yan Wang

DETC2020-22234..... **V009T09A016**
Multi-Fidelity Surrogate Model-Assisted Fatigue Analysis of Welded Joints
Lili Zhang, Tingli Xie, Jiexiang Hu, Ping Jiang, Jasuk Koo, Seung-Kyum Choi

DETC2020-22259..... **V009T09A017**
Inverse Multi-Scale Robust Design of Composite Structures Using Design Capability Indices
Soban Babu Beemaraj, Rizwan Khan Pathan, Amit G. Salvi, Gehendra Sharma, Farrokh Mistree, Janet K. Allen

AMS/SEIKM/CAPPD: DESIGN, SIMULATION, AND OPTIMIZATION FOR ADDITIVE MANUFACTURING

DETC2020-22198..... **V009T09A018**
Optimizing Support for Heat Dissipation in Additive Manufacturing
Cunfu Wang, Xiaoping Qian

DETC2020-22280..... **V009T09A019**
Analysis of Extrusion Parameters for the Fused Deposition Modeling Process
Wenqiang Yu, Zhengwei Nie, Yuyi Lin, Huakai Jiang

DETC2020-22451..... **V009T09A020**
Simulation Informed Effects of Solidification Rate on 316L Single Tracks Produced by Selective Laser Melting
A. L. K. Rawlings, A. J. Birnbaum, J. G. Michopoulos, J. C. Steuben, A. P. Iliopoulos, H. Ryou

DETC2020-22455..... **V009T09A021**
Morphological Analysis of 316L Laser Powder Bed Fusion Melt-Pool via the Enriched Analytical Solution Method
J. G. Michopoulos, J. C. Steuben, A. J. Birnbaum, A. P. Iliopoulos, J. Aroh, A. D. Rollett, B. Gould

DETC2020-22478..... **V009T09A022**
Measured Data Alignments for Monitoring Metal Additive Manufacturing Processes Using Laser Powder Bed Fusion Methods
Shaw C. Feng, Yan Lu, Albert T. Jones

DETC2020-22496..... **V009T09A023**
Parallelized Additive Manufacturing of Variably Partitioned Volumes for Large Scale 3D Printing With Localized Quality
Mahmoud Dinar

DETC2020-22530..... **V009T09A024**
Statistical Analysis of Tensile Tests Performed on 316L Specimens Manufactured by Directed Energy Deposition
A. P. Iliopoulos, J. P. Thomas, J. C. Steuben, R. Saunders, J. G. Michopoulos, A. Bagchi, A. J. Birnbaum

DETC2020-22542..... **V009T09A025**
The Material Testing of Nanoparticle Doped 3D Printed ABS Strain Gages for Resisitance and Stiffness
Sara M. Damas, Cameron J. Turner

DETC2020-22549..... **V009T09A026**
A Neighborhood-Based Neural Network for Melt Pool Prediction and Control
Yaqi Zhang, Vadim Shapiro, Paul Witherell

DETC2020-22583..... **V009T09A027**
Simulation of Hyper-Elasticity by Shape Estimation
Christopher-Denny Matte, Tsz-Ho Kwok

DETC2020-22615..... **V009T09A028**
Hybrid Modeling Approach for Melt Pool Prediction in Laser Powder Bed Fusion Additive Manufacturing
Tesfaye Moges, Zhuo Yang, Kevontrez Jones, Shaw Feng, Paul Witherell, Yan Lu

DETC2020-22711..... **V009T09A029**
Architecting the Cooperative 3D Printing System
Laxmi Poudel, Lucas Galvan Marques, Robert Austin Williams, Zachary Hyden, Pablo Guerra, Oliver Luke Fowler, Stephen Joe Moquin, Zhenghui Sha, Wenchao Zhou

CAPPD: HUMAN MODELING: METHODS AND APPLICATIONS IN ENGINEERING

DETC2020-22312..... **V009T09A030**
On Supporting the Learning of Biomechanics Using Multidisciplinary Physical Prototyping
Sebastian Hernandez, Sofiane Achiche, Daniel Spooner, Aurelian Vadean, Maxime Raison

DETC2020-22485..... **V009T09A031**
Knee Prostheses Reverse Engineering: A Preliminary Investigation
Marco Rossoni, Daniele Regazzoni, Andrea Vitali, Giorgio Colombo, Luca Spandre, Francesca De Caro

DETC2020-22528..... **V009T09A032**
Muscle Contracture Modeling and Optimal Control for Crouch Gait Prediction
Matilde Tomasi, Alessio Artoni

DETC2020-22616..... **V009T09A033**
Comparing Segmentation Approaches for Learning-Aware Wireframe Generation on Human Model
Jida Huang, Tsz-Ho Kwok

DETC2020-22723..... **V009T09A034**
Kinesthetic Perceptual Symmetry in Bi-Manual Interactions: An Exploratory Study
Ronak R. Mohanty, Riddhi R. Adhikari, Vinayak R. Krishnamurthy

COMPUTER-AIDED PRODUCT AND PROCESS DEVELOPMENT (CAPPD GENERAL)

DETC2020-22444..... **V009T09A035**

Design, Development and Characterization of a Wrap Spring Clutch/Brake Mechanism As a Knee Joint for an Assistive Exoskeleton

Vishnu Aishwaryan Subra Mani, Nathaniel Goldfarb, Gregory S. Fischer

DETC2020-22611..... **V009T09A036**

A Vocabulary of Function Features for Computer Aided Modeling of Thermal-Fluid Systems

Lakshmi N. A. Venkatanarasimhan, Ahmed Chowdhury, Chiradeep Sen

DETC2020-22630..... **V009T09A037**

A Formal Representation of Conjugate Verbs in Function Modeling

Ahmed Chowdhury, Lakshmi N. A. Venkatanarasimhan, Chiradeep Sen

METHODS, PROCESSES, AND STRATEGIES FOR USER INTERFACE (MPS-UI)

DETC2020-22126..... **V009T09A038**

Data Mining From Endmill Tool Catalog Information Based on the Use of a Machine Learning Method

Akihito Asakura, Toshiki Hirogaki, Eiichi Aoyama, Hiroyuki Kodama

SEIKM: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN DESIGN AND MANUFACTURING

DETC2020-22048..... **V009T09A039**

A Convolutional Neural Network-Based Patent Image Retrieval Method for Design Ideation

Shuo Jiang, Jianxi Luo, Guillermo Ruiz Pava, Jie Hu, Christopher L. Magee

DETC2020-22112..... **V009T09A040**

A Defect Prevention Concept Using Artificial Intelligence

Douglas Eddy, Sundar Krishnamurty, Ian Grosse, Michael White, Damon Blanchette

DETC2020-22150..... **V009T09A041**

Machine Learning Aided Design and Optimization of Conformal Porous Structures

Zhenyang Gao, Daniele Sossou, Yaoyao Fiona Zhao

DETC2020-22335..... **V009T09A042**

Automated Classification of Components for Manufacturing Planning: Single-View Convolutional Neural Network for Global Shape Identification

Andrew Barclay, Jonathan Corney

DETC2020-22377..... **V009T09A043**

Design Science Meets Data Science: Curating Large Design Datasets for Engineered Artifacts

Satchit Ramnath, Payam Haghighi, Jiachen Ma, Jami J. Shah, Duane Detwiler

DETC2020-22487..... **V009T09A044**
Orthogonal Distance Fields Representation for Machine-Learning Based
Manufacturability Analysis
Aditya Balu, Sambit Ghadai, Soumik Sarkar, Adarsh Krishnamurthy

DETC2020-22647..... **V009T09A045**
Structural Design Synthesis Through a Sequential Decision Process
Maximilian E. Ororbia, Gordon P. Warn

DETC2020-22662..... **V009T09A046**
3D Build Melt Pool Predictive Modeling for Powder Bed Fusion Additive
Manufacturing
Zhuo Yang, Yan Lu, Ho Yeung, Sundar Kirshnamurty

SEIKM: COMPLEX SYSTEMS ENGINEERING AND DESIGN

DETC2020-22009..... **V009T09A047**
Architecting a Modular Battery Electric Truck
David Williamsson, Ulf Sellgren

DETC2020-22092..... **V009T09A048**
System Design Method of Complex Product Based on Heterogeneous Language
Information Environment
Guan Wang, Yusheng Liu, Xiaoping Ye, Jianjun Zhao

DETC2020-22297..... **V009T09A049**
Task Taxonomy for Autonomous Unmanned Aerial Manipulator: A Review
*Charles Coulombe, Jean-Francois Gamache, Olivier Barron, Gabriel Descoteaux, David
Saussie, Sofiane Achiche*

DETC2020-22360..... **V009T09A050**
A Method to Specify Part of a System to Change in Improvement Design
Kazuya Oizumi, Kazuhiro Aoyama

DETC2020-22396..... **V009T09A051**
Exploring System of Systems Resilience vs. Affordability Trade-Space Using a Bio-
Inspired Metric
Abheek Chatterjee, Richard Malak, Astrid Layton

DETC2020-22568..... **V009T09A052**
Agent Based Resilient Transportation Infrastructure With Surrogate Adaptive
Networks
Andre A. Apostol, Cameron J. Turner

SEIKM: INDUSTRIAL ONTOLOGIES: SPECIAL SESSION

DETC2020-22672..... **V009T09A053**
Enabling Traceability in Agri-Food Supply Chains Using an Ontological Approach
Farhad Ameri, Evan Wallace, Reid Yoder

SEIKM: KNOWLEDGE CAPTURE, REUSE, AND MANAGEMENT

DETC2020-22151..... **V009T09A054**

Automated Heuristic Induction From Human Design Data
Lucas Puentes, Jonathan Cagan, Christopher McComb

DETC2020-22356..... **V009T09A055**

A Framework for a Motorcycle Design Computer-Based Intelligent Tool
Sean Agius, Philip Farrugia, Emmanuel Francalanza

SEIKM: SMART MANUFACTURING INFORMATICS

DETC2020-22310..... **V009T09A056**

Additively Manufactured Tags for Cast Part Traceability Using Two-Dimensional Digital Code Direct-Part-Marking
Tekin Uyan, Kalle Jalava, Juhani Orkas, Kevin Otto

DETC2020-22579..... **V009T09A057**

Unsupervised Method of Determining Cycle Times of Manual Assembly Processes
Rahul Sharan Renu

SEIKM: SYSTEMS ENGINEERING

DETC2020-22040..... **V009T09A058**

Application of Munich Agile Concept for MBSE by Means of Automated Valet Parking Functions and the 3D Environment-Data
Vahid Salehi, Jihad Taha, Shirui Wang

DETC2020-22085..... **V009T09A059**

Multi-Objective Implementation of Additive Manufacturing in Make-to-Stock Production
Ping Chong Chua, Seung Ki Moon, Yen Ting Ng

DETC2020-22380..... **V009T09A060**

Towards a Zero Trust Hybrid Security and Safety Risk Analysis Method
Nikolaos Papakonstantinou, Douglas L. Van Bossuyt, Joonas Linnosmaa, Britta Hale, Bryan O'Halloran

DETC2020-22582..... **V009T09A061**

Is Verifying Frequently an Optimal Strategy? A Belief-Based Model of Verification
Aditya U. Kulkarni, Alejandro Salado, Christian Wernz, Peng Xu

SYSTEMS ENGINEERING INFORMATION KNOWLEDGE MANAGEMENT (SEIKM GENERAL)

DETC2020-22664..... **V009T09A062**

Evolutionary Approach to Function Model Synthesis: Development of Parameterization and Synthesis Rules
Amaninder Singh Gill, Chiradeep Sen

VES: METHODS, PROCESSES, AND STRATEGIES FOR TECHNOLOGY

DETC2020-22300..... **V009T09A063**

Linking Performance Data and Geospatial Information of Manufacturing Assets Through Standard Representations

Aaron Hanke, Teodor Vernica, William Z. Bernstein

DETC2020-22416..... **V009T09A064**

Medical Assessment Test of Extrapersonal Neglect Using Virtual Reality: A Preliminary Study

Daniel Lanzoni, Andrea Vitali, Daniele Regazzoni, Caterina Rizzi

DETC2020-22654..... **V009T09A065**

A Flexible Multi-Modal Multi-User Traffic Simulation for Studying Complex Road Design

Jack Miller, Vijay Kalivarapu, Michael Holm, Tor Finseth, Jordan Williams, Eliot Winer

VES: METHODS, PROCESSES, AND STRATEGIES FOR USER INTERFACE

DETC2020-22443..... **V009T09A066**

Survey of Digital Tools for the Generation of Ideas

Marco Rossoni, Patrizia Bolzan, Giorgio Colombo, Monica Bordegoni, Marina Carulli

VIRTUAL ENVIRONMENTS AND DESIGN VISUALIZATION (VES GENERAL)

DETC2020-22308..... **V009T09A067**

A Low Cost Motion Analysis System Based on RGB Cameras to Support Ergonomic Risk Assessment in Real Workplaces

Alex Altieri, Silvia Ceccacci, Abudukaïyoumu Talipu, Maura Mengoni

DETC2020-22326..... **V009T09A068**

Virtual Reality to Simulate an Inflatable Modular Hydroponics Greenhouse on Mars

Francesca Bruno, Alessandro Ceriani, Zhang Zhan, Giandomenico Caruso, Antonio Del Mastro

DETC2020-22413..... **V009T09A069**

Virtual Reality to Improve the User Experience of Traditional Museums

Elena Spadoni, Marina Carulli, Monica Bordegoni

DETC2020-22414..... **V009T09A070**

Development of Virtual Reality Training Scenario for Avalanche Rescue

Michael Joseph Messina, Simon Teves, Giulia Wally Scurati, Marina Carulli, Francesco Ferrise

DETC2020-22486..... **V009T09A071**

A Study of Human Balance and Coordination Using a Head Mounted Display

Daniel Gracia De Luna, Roel Tijernia, Alley Butler, Emmett Tomai, Douglas Timmer, Dumitru Caruntu

DETC2020-22624.....
Multi-Context Generation in Virtual Reality Environments Using Deep Reinforcement
Learning

V009T09A072

James Cunningham, Christian Lopez, Omar Ashour, Conrad S. Tucker