

*Proceedings of the ASME*

**INTERNATIONAL DESIGN ENGINEERING TECHNICAL  
CONFERENCES & COMPUTERS AND INFORMATION IN  
ENGINEERING CONFERENCE  
- 2019 -**

---

**VOLUME 2A**

**45TH DESIGN AUTOMATION CONFERENCE**

presented at

ASME 2019 INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES &  
COMPUTERS AND INFORMATION IN ENGINEERING CONFERENCE

AUGUST 18-21, 2019

ANAHEIM, CALIFORNIA, USA

sponsored by

DESIGN ENGINEERING DIVISION, ASME

COMPUTERS AND INFORMATION IN ENGINEERING DIVISION, AMSE

**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](mailto:permissions@asme.org).

**ISBN NO. 978-0-7918-5918-6**

**© 2019 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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# CONTENTS

## 45TH DESIGN AUTOMATION CONFERENCE

### ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

**DETC2019-97399**..... **V02AT03A001**

Learning to Design From Humans: Imitating Human Designers Through Deep Learning

*Ayush Raina, Christopher McComb, Jonathan Gagan*

**DETC2019-97642**..... **V02AT03A002**

Analyzing Customer Needs of Product Ecosystems Using Online Product Reviews

*Jackie Ayoub, Feng Zhou, Qianli Xu, Jessie Yang*

**DETC2019-97689**..... **V02AT03A003**

Deep Reinforcement Learning for Transfer of Control Policies

*James D. Cunningham, Simon W. Miller, Michael A. Yukish, Timothy W. Simpson, Conrad S. Tucker*

**DETC2019-97830**..... **V02AT03A004**

Machine Learning-Augmented Stochastic Search for the Automated Synthesis and Optimization of Cooling Channels

*Jonas Schwarz, Kristina Shea*

**DETC2019-97975**..... **V02AT03A005**

A Neuroevolution-Based Learning of Reciprocal Maneuver for Collision Avoidance in Quadcopters Under Pose Uncertainties

*Amir Behjat, Krushang Gabani, Souma Chowdhury*

**DETC2019-98027**..... **V02AT03A006**

Gaussian Process Emulation for Big Data in Data-Driven Metamaterials Design

*Ramin Bostanabad, Yu-Chin Chan, Liwei Wang, Ping Zhu, Wei Chen*

**DETC2019-98115**..... **V02AT03A007**

Multi-Fidelity Physics-Constrained Neural Network and its Application in Materials Modeling

*Dehao Liu, Yan Wang*

### COMPUTATIONAL DESIGN FOR BIOMEDICAL APPLICATIONS

**DETC2019-97777**..... **V02AT03A008**

Computational Design of a Personalized Artificial Spinal Disc With a Data-Driven Design Variable Linking Heuristic

*Zhiyang Yu, Kristina Shea, Tino Stankovic*

**DETC2019-98190**..... **V02AT03A009**

Design and Biological Simulation of 3D Printed Lattices for Biomedical Applications

*Paul F. Egan*

## DATA-DRIVEN DESIGN

**DETC2019-97437**..... **V02AT03A010**

A Digital Twin-Driven Improved Design Approach of Drawing Bench for Brazing Material

*Bingtao Hu, Yixiong Feng, Yicong Gao, Hao Zheng, Jianrong Tan*

**DETC2019-97587**..... **V02AT03A011**

Computer-Aided Design Ideation Using InnoGPS

*Jianxi Luo, Serhad Sarica, Kristin L. Wood*

**DETC2019-97691**..... **V02AT03A012**

Product Service System Design in New Situations: Prediction of Demand Surfaces From Environment

*Bryan C. Watson, Cassandra Telenko*

**DETC2019-97881**..... **V02AT03A013**

Pseudo-Rigid Body Dynamic Modeling of Compliant Members for Design

*Vedant, James T. Allison*

**DETC2019-98000**..... **V02AT03A014**

Checking the Automated Construction of Finite Element Simulations From Dirichlet Boundary Conditions

*Kevin N. Chiu, Mark D. Fuge*

**DETC2019-98111**..... **V02AT03A015**

Using Bayesian Optimization With Knowledge Transfer for High Computational Cost Design: A Case Study in Photovoltaics

*Mine Kaya, Shima Hajimirza*

**DETC2019-98385**..... **V02AT03A016**

Data-Driven Dynamic Network Modeling for Analyzing the Evolution of Product Competitions

*Jian Xie, Youyi Bi, Zhenghui Sha, Mingxian Wang, Yan Fu, Noshir Contractor, Lin Gong, Wei Chen*

**DETC2019-98525**..... **V02AT03A017**

3D Shape Synthesis for Conceptual Design and Optimization Using Variational Autoencoders

*Wentai Zhang, Zhangsihao Yang, Haoliang Jiang, Suyash Nigam, Soji Yamakawa, Tomotake Furuhashi, Kenji Shimada, Levent Burak Kara*

## DECISION MAKING IN ENGINEERING DESIGN

**DETC2019-97301**..... **V02AT03A018**

Investigating Optimal Communication Frequency in Multi-Disciplinary Engineering Teams Using Multi-Agent Simulation

*Mojtaba Arezoomand, Jesse Austin-Breneman*

**DETC2019-97372**..... **V02AT03A019**  
Classification and Execution of Coupled Decision Problems in Engineering Design for  
Exploration of Robust Design Solutions  
*Gehendra Sharma, Janet K. Allen, Farrokh Mistree*

**DETC2019-97894**..... **V02AT03A020**  
Design of Composite Structures Through Decision Support Problem and Multiscale  
Design Approach  
*Rizwan Khan Pathan, Soban Babu Beemaraj, Amit Salvi, Gehendra Sharma, Janet K. Allen,  
Farrokh Mistree*

**DETC2019-98028**..... **V02AT03A021**  
Quantum Mechanical Perspectives in Reliability Engineering and System Design  
*Vijitashwa Pandey*

**DETC2019-98035**..... **V02AT03A022**  
A Proposal for a Decision Support Framework to Solve Design Problems in the  
Automotive Industry  
*Timothe M. Sissoko, Marija Jankovic, Christiaan J. J. Paredis, Eric Landel*

## **DESIGN AND OPTIMIZATION OF SUSTAINABLE ENERGY SYSTEMS**

**DETC2019-97171**..... **V02AT03A023**  
Sustainable Design of Residential Net-Zero Energy Buildings: A Multi-Phase and  
Multi-Objective Optimization Approach  
*Lan Lan, Kristin L. Wood, Chau Yuen*

**DETC2019-97190**..... **V02AT03A024**  
Designing Optimal Arbitrage Policies for Distributed Energy Systems in Building  
Clusters Using Reinforcement Learning  
*Philip Odonkor, Kemper Lewis*

**DETC2019-97964**..... **V02AT03A025**  
Optimization Model for Owner-Based Microgrids Using LSTM Predicted Demand for  
Rural Development  
*Anosh P. Amaria, Ryan Nguyen, Joshua A. Davison, Souma Chowdhury, John F. Hall*

**DETC2019-98205**..... **V02AT03A026**  
Self-Adapting Intelligent Battery Thermal Management System via Artificial Neural  
Network Based Model Predictive Control  
*Yuanzhi Liu, Jie Zhang*

## **DESIGN FOR ADDITIVE MANUFACTURING**

**DETC2019-97248**..... **V02AT03A027**  
Stress Field Guided Lattice Structure Design Based on Hexahedral Mesh  
*Lingyun Liu, Yizhou Liao, Shuming Gao*

<b>DETC2019-97478</b> .....	<b>V02AT03A028</b>
But Will it Print?: Assessing Student Use of Design for Additive Manufacturing and Exploring its Effect on Design Performance and Manufacturability	
<i>Rohan Prabhu, Scarlett R. Miller, Timothy W. Simpson, Nicholas A. Meisel</i>	
<b>DETC2019-97480</b> .....	<b>V02AT03A029</b>
A Comparative Study of Virtual Reality and Computer-Aided Design to Evaluate Parts for Additive Manufacturing	
<i>John K. Ostrander, Lauren Ryan, Snehal Dhengre, Christopher McComb, Timothy W. Simpson, Nicholas A. Meisel</i>	
<b>DETC2019-97492</b> .....	<b>V02AT03A030</b>
Simulation-Based Process Optimization of Metallic Additive Manufacturing Under Uncertainty	
<i>Zhuo Wang, Pengwei Liu, Zhen Hu, Lei Chen</i>	
<b>DETC2019-97607</b> .....	<b>V02AT03A031</b>
Digital Design Automation to Support In-Situ Embedding of Functional Components in Additive Manufacturing	
<i>Manoj Malviya, Swapnil Sinha, Nicholas A. Meisel</i>	
<b>DETC2019-97649</b> .....	<b>V02AT03A032</b>
Optimization of Parts Consolidation for Minimum Production Costs and Time Using Additive Manufacturing	
<i>Zhenguo Nie, Sangjin Jung, Levent Burak Kara, Kate S. Whitefoot</i>	
<b>DETC2019-97775</b> .....	<b>V02AT03A033</b>
Computational Design of Active Lattice Structures for 4D Printed Pneumatic Shape Morphing	
<i>Cosima du Pasquier, Pascal Koller, Tino Stankovic, Kristina Shea</i>	
<b>DETC2019-97840</b> .....	<b>V02AT03A034</b>
A Design Modification System for Additive Manufacturing: Towards Feasible Geometry Development	
<i>Seyedeh Elaheh Ghiasian, Prakhar Jaiswal, Rahul Rai, Kemper Lewis</i>	
<b>DETC2019-97863</b> .....	<b>V02AT03A035</b>
Lattice Structure Design for Additive Manufacturing: Unit Cell Topology Optimization	
<i>Bradley Hanks, Mary Frecker</i>	
<b>DETC2019-97865</b> .....	<b>V02AT03A036</b>
Evaluating the Potential of Design for Additive Manufacturing Heuristic Cards to Stimulate Novel Product Redesigns	
<i>Alexandra Blosch-Paidosh, Saeema Ahmed-Kristensen, Kristina Shea</i>	
<b>DETC2019-97913</b> .....	<b>V02AT03A037</b>
An Optimal Quantity of Scheduling Model for Mass Customization-Based Additive Manufacturing	
<i>Yosep Oh, Sara Behdad</i>	

**DETC2019-97915**..... **V02AT03A038**  
Design for Additive Manufacturing Using a Master Model Approach  
*Anton Wiberg, Johan Persson, Johan Olvander*

**DETC2019-98024**..... **V02AT03A039**  
Rule of Mixtures Model to Determine Elastic Modulus and Tensile Strength of 3D  
Printed Carbon Fiber Reinforced Nylon  
*Kaiyue Deng, Hamid Khakpour Nejadkhaki, Felipe M. Pasquali, Anosh P. Amaria, Jason N.  
Armstrong, John F. Hall*

**DETC2019-98068**..... **V02AT03A040**  
Substrate Optimization for Hybrid Manufacturing  
*Brandon R. Massoni, Matthew I. Campbell*

**DETC2019-98103**..... **V02AT03A041**  
Voxel-Based CAD Framework for Planning Functionally Graded and Multi-Step Rapid  
Fabrication Processes  
*Cole Brauer, Daniel M. Aukes*

## **DESIGN FOR MARKET SYSTEMS**

**DETC2019-97379**..... **V02AT03A042**  
Designing the Customer Order Decoupling Point to Facilitate Mass Customization  
*Lin Guo, Suhao Chen, Janet K. Allen, Farrokh Mistree*

**DETC2019-97680**..... **V02AT03A043**  
Word-of-Mouth Recommendations in an Automobile Market System  
*Amineh Zadbood, Nicholas Russo, Steven Hoffenson*

**DETC2019-97835**..... **V02AT03A044**  
Influence of Omitted Variables in Consumer Choice Models on Engineering Design  
Optimization Solutions  
*Waleed Gowharji, Kate S. Whitefoot*

**DETC2019-98114**..... **V02AT03A045**  
Implications of Competitor Representation on Optimal Design  
*Arthur H. C. Yip, Jeremy J. Michalek, Kate S. Whitefoot*

**DETC2019-98219**..... **V02AT03A046**  
The Impact of Consumer Preference Distributions on Dynamic Electricity Pricing for  
Residential Demand Response  
*Samuel Dunbar, Scott Ferguson*

## **DESIGN OF COMPLEX SYSTEMS**

**DETC2019-97456**..... **V02AT03A047**  
Integrated System Design and Control Optimization of Hybrid Electric Propulsion  
System Using a Bi-Level, Nested Approach  
*Li Chen, Huachao Dong, Zuomin Dong*

**DETC2019-98393**..... **V02AT03A048**  
Structural Consequence Analysis: Towards the Quantification of Component  
Consequential Importance in System Architecture Design  
*Hannah S. Walsh, Mohammad Hejase, Daniel Hulse, Guillaume Brat, Irem Y. Tumer*

**DETC2019-98404**..... **V02AT03A049**  
An Excess Based Approach to Change Propagation  
*Daniel Long, Scott Ferguson*

**DETC2019-98428**..... **V02AT03A050**  
Estimating the Value of Excess: A Case Study of Gaming Computers, Consoles and  
the Video Game Industry  
*Darshan Yadav, Daniel Long, Beshoy Morkos, Scott Ferguson*

**DETC2019-98429**..... **V02AT03A051**  
Using Semantic Fluency Models Improves Network Reconstruction Accuracy of Tacit  
Engineering Knowledge  
*Thurston Sexton, Mark Fuge*

## **DESIGN OF ENGINEERING MATERIALS AND STRUCTURES**

**DETC2019-97370**..... **V02AT03A052**  
Topology Optimization of Multi-Material Lattices for Maximal Bulk Modulus  
*Hesaneh Kazemi, Ashkan Vaziri, Julian Norato*

**DETC2019-97390**..... **V02AT03A053**  
Inverse Thermo-Mechanical Processing (ITMP) Design of a Steel Rod During Hot  
Rolling Process  
*Anand Balu Nellippallil, Pranav Mohan, Janet K. Allen, Farrokh Mistree*

**DETC2019-97547**..... **V02AT03A054**  
Gaussian Process Based Crack Initiation Modeling for Design of Battery Anode  
Materials  
*Zhuoyuan Zheng, Yanwen Xu, Bo Chen, Pingfeng Wang*

**DETC2019-97617**..... **V02AT03A055**  
Generative Design of Multi-Material Hierarchical Structures via Concurrent Topology  
Optimization and Conformal Geometry Method  
*Long Jiang, Shikui Chen, Xianfeng David Gu*

**DETC2019-97628**..... **V02AT03A056**  
Thermomechanical Topology Optimization of Lattice Heat Transfer Structure Including  
Natural Convection and Design Dependent Heat Source  
*Tong Wu, Joel C. Najmon, Andres Tovar*

**DETC2019-97659**..... **V02AT03A057**  
Design of Gradient Nanotwinned Metal Materials Using Adaptive Gaussian Process  
Based Surrogate Models  
*Haofei Zhou, Xin Chen, Yumeng Li*



<b>DETC2019-97672</b> .....	<b>V02AT03A058</b>
Distributed Design of Two-Scale Structures With Unit Cells <i>Xingchen Liu</i>	
<b>DETC2019-97675</b> .....	<b>V02AT03A059</b>
A Framework of Multi-Fidelity Topology Design and its Application to Optimum Design of Flow Fields in Battery Systems <i>Kentaro Yaji, Shintaro Yamasaki, Shohji Tsushima, Kikuo Fujita</i>	
<b>DETC2019-97722</b> .....	<b>V02AT03A060</b>
Visualizing and Evaluating High-Dimensional Mappings of Sets of High Performance Designs <i>Clinton B. Morris, Michael R. Haberman, Carolyn C. Seepersad</i>	
<b>DETC2019-97774</b> .....	<b>V02AT03A061</b>
Computational Design of 4D Printed Shape Morphing Multi-State Lattice Structures <i>Thomas Lumpe, Kristina Shea</i>	
<b>DETC2019-97833</b> .....	<b>V02AT03A062</b>
Topology Design With Conditional Generative Adversarial Networks <i>Conner Sharpe, Carolyn Conner Seepersad</i>	
<b>DETC2019-97905</b> .....	<b>V02AT03A063</b>
Stress-Constrained Design of Functionally Graded Lattice Structures With Spline-Based Dimensionality Reduction <i>Jenmy Zimi Zhang, Conner Sharpe, Carolyn Conner Seepersad</i>	
<b>DETC2019-97934</b> .....	<b>V02AT03A064</b>
Multimaterial Topology Optimization of Thermoelectric Generators <i>Xiaoqiang Xu, Yongjia Wu, Lei Zuo, Shikui Chen</i>	
<b>DETC2019-98105</b> .....	<b>V02AT03A065</b>
Bayesian Optimization of Equilibrium States in Elastomeric Beams <i>David Yoo, Carson Wiley, Andrew Gillman, Vincent Chen, Abigail Juhl, Philip Buskohl</i>	
<b>DETC2019-98222</b> .....	<b>V02AT03A066</b>
Data-Centric Mixed-Variable Bayesian Optimization for Materials Design <i>Akshay Iyer, Yichi Zhang, Aditya Prasad, Siyu Tao, Yixing Wang, Linda Schadler, L. Catherine Brinson, Wei Chen</i>	
<b>DETC2019-98341</b> .....	<b>V02AT03A067</b>
Multi-Scale Design of Meta-Materials With Offset Periodicity <i>Rushabh Sadiwala, Georges Fadel</i>	
<b>DETC2019-98386</b> .....	<b>V02AT03A068</b>
Optimizing Topology and Fiber Orientations With Minimum Length Scale Control in Laminated Composites <i>Chuan Luo, James K. Guest</i>	

**DETC2019-98463**..... **V02AT03A069**

An Adaptive and Efficient Boundary Approach for Density-Based Topology  
Optimization

*Reza Behrou, Reza Lotfi, Josephine V. Carstensen, James K. Guest*