

# **2022 Annual Modeling and Simulation Conference (ANNSIM 2022)**

**San Diego, California, USA  
18-20 July 2022**

**Pages 1-448**



**IEEE Catalog Number:** CFP22AJ3-POD  
**ISBN:** 978-1-6654-7314-9

**Copyright © 2022, The Society for Modeling and Simulation International (SCS)  
All Rights Reserved**

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP22AJ3-POD
ISBN (Print-On-Demand):	978-1-6654-7314-9
ISBN (Online):	978-1-71-385288-9

**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  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## TABLE OF CONTENTS

Composing Modeling and Simulation with Machine Learning in Julia .....	1
<i>Chris Rackauckas, Maja Gwozdz, Anand Jain, Yingbo Ma, Francesco Martinuzzi, Utkarsh Rajput, Elliot Saba, Viral B. Shah, Ranjan Anantharaman, Alan Edelman, Shashi Gowda, Avik Pal, Chris Laughman</i>	
Taxonomy, Tools, and a Framework for Combining Simulation Models with AI/ML Models.....	18
<i>Vijay Gehlot, Peter Rokowski, Elliot B. Sloane, Nilmini Wickramasinghe</i>	
Devs Model Construction as a Reinforcement Learning Problem .....	30
<i>Istvan David, Eugene Syriani</i>	
Automated Generation of Patient Population for Discrete-Event Simulation Using Process Mining.....	42
<i>Jules Le Lay, Julia Neveu, Benjamin Dalmas, Vincent Augusto</i>	
Automated Model Discovery for Steering Behavior Simulation.....	54
<i>Hai Le, Xiaolin Hu</i>	
On the Modeling of P2P Systems as Temporal Networks: A Case Study with Data Streaming.....	66
<i>Luca Serena, Mirko Zichichi, Gabriele D'Angelo, Stefano Ferretti</i>	
Knowledge Structures Over Simulation Units.....	78
<i>Eduard Kamburjan, Einar Broch Johnsen</i>	
A New Modeling Framework for Cyber-Physical and Human Systems .....	90
<i>Milad Poursoltan, Nathalie Pinède, Bruno Vallespir, Mamadou Kaba Traore</i>	
Integration of the Mape-K Loop in Digital Twins.....	102
<i>Hao Feng, Cláudio Gomes, Santiago Gil, Peter H. Mikkelsen, Daniella Tola, Peter Gorm Larsen, Michael Sandberg</i>	
The Modular Design Evaluation Model: Support for Decision-Making in Cyber-Physical Systems Design.....	114
<i>Marina Rantanen-Modéer</i>	
A Digital Twin Based Approach for Ensuring Business Continuity Plan and Safe Return to Workplace .....	126
<i>Souvik Barat, Dushyanthi Mulpuru, Abhishek Yadav, Anwesha Basu, Vinay Kulkarni, Savitha Samudrala, Avinash Bhide, Prabha Thomas, Keerthi Krishna, Arun Yadav, Abhijit Mazumder</i>	
Model and Evaluation of a Superconducting-Logic Based Hybrid CPU-Accelerator System.....	140
<i>Meenatchi Jagasivamani, Christine Fong, Kenneth Goodnow, Robert Voigt</i>	
The Effects of Numerical Precision in Scientific Applications .....	152
<i>Raul Murillo, Alberto A. Del Barrio, Guillermo Botella</i>	
Encoding Protest Duration in an Agent-Based Model as Characteristic Phase Transitions .....	164
<i>Brian J. Goode, Bianica Pires</i>	
Toward a Movement Paradigm for Artificial Human Agents .....	176
<i>Thomas Clemen, Nima Ahmady-Moghaddam, Daniel Glake, Ulfia A. Lenfers, Florian Ocker, Daniel Osterholz, Jonathan Ströbele</i>	

How Can We Provide Better Simulation-Based Policy Support? .....	188
<i>Andreas Tolk, Thomas Clemen, Nigel Gilbert, Charles M. Macal</i>	
Using Generative Adversarial Networks to Assist Synthetic Population Creation for Simulations.....	199
<i>Srihan Kotnana, David Han, Taylor Anderson, Andreas Züfle, Hamdi Kavak</i>	
Validation of EPSim - An Embedded Platform Simulator for Control-Embedded Co-Design.....	211
<i>Ken Vanherpen, Paul De Meulenaere, Yon Vanommeslaeghe, Davy Maes</i>	
A MSaaS Platform for Business Process Modeling & Simulation.....	223
<i>Paolo Bocciarelli, Andrea D'Ambrogio, Matteo Maria Emanuele Cialei</i>	
LUUNU — Blockchain, MISP, Model Cards and Federated Learning Enabled Cyber Threat Intelligence Sharing Platform.....	235
<i>Eranga Bandara, Sachin Shetty, Ravi Mukkamala, Abdul Rahaman, Xueping Liang</i>	
Adversarial Machine Learning Using Convolutional Neural Network with Imagenet .....	246
<i>Utsab Khakurel, Danda B. Rawat</i>	
Analysis of the Impact of Cyber Attack on Semiconductor Manufacturing Energy Quantification .....	258
<i>Busra Ezici, Paulo Costa, Jie Xu</i>	
Synthesizing Diagnostic Burn Images for Deep Learning Applications .....	270
<i>Bernhard Schenkenfelder, Sophie Kaltenleithner, Bertram Sabrowsky-Hirsch, Christoph Klug, David B. Lumenta, Josef Scharinger</i>	
Implementation of a Dynamic and Extensible Mechanical Ventilator Model for Real-Time Physiological Simulation.....	282
<i>Jeffrey B. Webb, Aaron Bray, Harald Scheirich, Joseph Vanpelt, Rachel B. Clipp, Justina Gerard, Stefan Frembgen</i>	
Time- And Frequency-Based Independent Evaluation of QRST Cancellation Techniques for Single-Lead Electrocardiograms During Atrial Fibrillation .....	294
<i>Nicholas F. Price, Omer Berenfeld, Vijay Devabhaktuni, Makarand Deo</i>	
Interactive Hemodynamic Simulation Model of a Cross-Scale Cardiovascular System .....	305
<i>Sarah Hofmann, Andreas Müller, Sebastian Von Mammen</i>	
Multi-Modality Breast MRI Segmentation Using NNU-NET for Preoperative Planning of Robotic Surgery.....	317
<i>Motaz Alqaoud, John Plemmons, Eric Feliberti, Krishnanand Kaipa, Siqin Dong, Gabor Fichtinger, Yiming Xiao, Michel Audette</i>	
Extensive Simulation of Human-Robot Interaction for Critical Care Telemedicine .....	329
<i>Inki Kim, Anthony Nepomuceno, Shandra Jamison, Jon Michel, Thenkurussi Kesavadas</i>	
Modeling Cardiac Cell Biophysics Using Long-Short-Term Memory Networks .....	341
<i>Bruna Gonçalves, Makarand Deo</i>	
Simulation-Based Framework to Develop a Control System for Functional Electrical Stimulation.....	351
<i>Minsik Hong, Brady A. Hasse, Andrew J. Fuglevand, Jerzy W. Rozenblit</i>	
Fall Detection Using Self-Supervised Pre-Training Model.....	361
<i>Haben Yhdego, Michel Audette, Christopher Paolini</i>	
Context-Aware Security Modes for Medical Devices .....	372
<i>Michael Riegler, Johannes Sametinger, Jerzy W. Rozenblit</i>	

Integrative Physiology-Coupled Pilot-Centered Flight Simulation .....	383
<i>Shawn Harrison, Anna Bulysheva, Brett Newman, Michelle Audette, Rachel Clipp, Jeff Webb, Marsha Mitchum</i>	
Fully Automated Conversion of Glioma Clinical MRI Scans into a 3D Virtual Reality Model for Presurgical Planning .....	392
<i>Nick Tucker, Bradley P. Sutton, Chase Duncan, Colin Lu, Sanmi Koyejo, Andrew J. Tsung, Jane Maksimovic, Tate Ralph, Sister M. Pieta, Matthew T. Bramlet</i>	
Data Assimilation for Simulation-Based Real-Time Prediction/Analysis.....	404
<i>Xiaolin Hu</i>	
ESS: EMF-Based Simulation Specification, a Domain-Specific Language for Model Validation Experiments.....	416
<i>Joost Mertens, Joachim Denil</i>	
A Quantized State Integrator with Second Order Errors Over Monotonic Segments .....	428
<i>Rasika Mahawattege, James Nutaro</i>	
Model and Simulation Scalability Traits for Interaction (Nexus) Modeling of Water and Energy Systems.....	437
<i>Mostafa D. Fard, Hessam S. Sarjoughian</i>	
Geographical Sevird COVID-19 Model with Travel Restrictions.....	449
<i>Cristina Ruiz Martin, Nirmal Patel, Gabriel Wainer</i>	
Multi-Paradigm Modelling for Model Based Systems Engineering: Extending the FTG + PM.....	461
<i>Randy Paredis, Joeri Exelmans, Hans Vangheluwe</i>	
A Novel Multi-Criteria Workflow Based on Reverse Solar Envelopes for the Design of Residential Clusters.....	475
<i>Abel Sepúlveda, Francesco De Luca</i>	
Optimization-Based Design Exploration of the Mutual Influence Between Building Massing and Façade Design .....	487
<i>Xuehan Liu, Likai Wang, Guohua Ji</i>	
Infomorphism: Urban Planning for Renewable Energy Integration via Simulated Energy Exchange Networks .....	500
<i>Fengqi Li, Alexandros Tsamis, Kristen R. Schell</i>	
A Novel GAN-Based Method for Building Surface Wind Pressure Prediction .....	512
<i>Lin Sun, Shuqi Cao, Likai Wang, Guohua Ji</i>	
How the Urban Microclimate and Outdoor Thermal Comfort Can Affect Intra-City Mobility Patterns: Evidence from New York City .....	523
<i>Yang Yang, Desai Wang, Timur Dogan</i>	
Sketch to Build: An Intuitive Design Platform for Sustainable Housing Complexes .....	537
<i>Zhongming Peter Zhang, Taro Narahara</i>	
Exploring Spatial Patterns in Sustainable Integrated Districts: A Methodology for Early-Phase Urban Network Analysis .....	549
<i>Anjanaa Devi Srikanth, Srilalitha Gopalakrishnan, Chirag Hablani, Thomas Schroepfer</i>	

Determining Critical Points to Control Electric Lighting to Meet Circadian Lighting Requirements and Minimize Energy Use .....	559
<i>Belal Abboushi, Sarah Safranek</i>	
A Stochastic Approach to Simulate and Optimize the Coating Uniformity of Rotational Molding for Microalgae Facades .....	569
<i>Chengde Wu, Garrett Herbst, Arturo Lujan, Kyoung Hee Kim</i>	
Dynamic Subset Sensitivity Analysis for Design Exploration .....	581
<i>Laura Hinkle, Gregory Pavlak, Nathan Brown, Leland Curtis</i>	
An Optimization Framework and Tool for Context-Sensitive Solar-Driven Design Using Cellular Automata (SDCA) .....	593
<i>Seth Luitjohan, Mehdi Ashayeri, Narjes Abbasabadi</i>	
Server-Based Mixed-Reality System for Multiple Devices to Visualize a Large Architectural Model and Simulations .....	605
<i>Ryoma Tsujimoto, Tomohiro Fukuda, Nobuyoshi Yabuki</i>	
Building Envelope Object Detection Using YOLO Models.....	617
<i>Norhan Bayomi, Mohanned El Kholy, John E. Fernandez, Senem Velipasalar, Tarek Rakha</i>	
An Urban Feasibility Study into Balancing Upfront Embodied Carbon Emissions Through Integrated Green Areas as Carbon Offsets .....	631
<i>Emily Newmarch, Michael Donn, Simon Twose, David Dowdell, Fiona Short</i>	
Integrating Immersive Virtual Environment User Studies into Architectural Design Practice: A Pre-Occupancy User Study of Train Station Waiting Preferences with VREVAL.....	644
<i>Grayson Bailey, Olaf Kammler, René Weiser, Sven Schneider, Ekaterina Fuchkina</i>	
Predicting Cooling Energy Demands of Adaptive Facades Using Artificial Neural Network .....	656
<i>Ammar Alammar, Wassim Jabi</i>	
Software Architecture for Integrating Devs Simulation into BIM .....	670
<i>Mitali Patel, Vinu Subashini Rajus, Gabriel Wainer</i>	
Shading Design for Outdoor Learning in Warm and Hot Climates Using Evolutionary Computation: A Case Study in Houston TX .....	682
<i>Mili Kyropoulou</i>	
Natural Ventilation in a Warming Climate: An Evaluation of Computational Simulation Methods and Metrics .....	694
<i>Nada Tarkhan, Sarah Mokhtar, Ramon Elias Weber, Christoph Reinhart</i>	
Capturing Façade Diversity in Urban Settings Using an Automated Window to Wall Ratio Extraction and Detection Workflow.....	706
<i>Nada Tarkhan, Samuel Letellier-Duchesne, Christoph Reinhart</i>	
The Influence of Covid Related Ventilation Rate Changes on the Energy Consumption and Infection Probability of the Buildings: Underfloor and Overhead Air Distribution Systems.....	718
<i>Roshanak Ashrafi, Mona Azarbayjani, Hamed Tabkhi, Mohammadamin Sheikhhahrokhdehkordi</i>	
Deep Sandscapes: Design Tool for Robotic Sand-Shaping with GAN-Based Heightmap Predictions.....	730
<i>Ko Tsuruta, Simon Joris Griffioen, Jesús Medina Ibáñez, Ryan Luke Johns</i>	

A Simulation-Based Approach to Mitigate Disease Transmission Risk from Aerosol Particles in Buildings .....	742
<i>Hooman Parhizkar, Siobhan Rockcastle, Mark Fretz, Kevin G. Van Den Wymelenberg</i>	
Impact Assessment of Energy Conservation Measures on Building Energy Consumption, Carbon Emission, and Adaptation Cost Using Future Weather Data.....	753
<i>Zahra Zolfaghari, Twisha Raja, Patricia Kusumadjaja, Daniel Salinas, Udksha Nagaraj Kapini, Patrick Pease</i>	
Software-Defined Optical Local Area Network Architecture and Priority Traffic Performance Analysis.....	767
<i>Peristera A. Baziana</i>	
Incremental Text Clustering Algorithm for Cloud-Based Data Management in Scientific Research Papers .....	778
<i>Mahfuya Nilufar, Abdolreza Abhari</i>	
Controller Area Network Discrete-Event System Specification for Independent Node Testing.....	790
<i>Maaz Jamal, Joseph Boi-Ukeme, Gabriel Wainer</i>	
Distributed Resource Allocation in 5G Networks with Multi-Agent Reinforcement Learning .....	802
<i>Jon Menard, Ala 'A Al-Habashna, Gabriel Wainer, Gary Boudreau</i>	
Enabling Collaborative Modeling Through a Web Library of DEVS Models .....	814
<i>Hamza Qassoud, Bruno St. Aubin, Gabriel Wainer, Cristina Ruiz-Martin</i>	
Boolean Logical Operator Driven Selective Data Filtering for Large Datasets .....	824
<i>Glenn Davidson, Shikharesh Majumdar</i>	
An IoT Based Smart Monitoring System Detecting Patient Falls.....	839
<i>Hassan Rajaei</i>	
Video Analytic Data Reduction Model for Fog Computing.....	851
<i>Abdolreza Abhari, Dipak Pudasaini</i>	
Supply Chain Simulation as a Service to Increase Adaptation Capability in Manufacturing.....	863
<i>Tamas Kiss, Gabor Terstyansky, Resmi Arjun, Saskia Sardesai, Michael Dominik Goertz, Matthias Wangenheim</i>	
A Simulation Framework for Studying Foreign Reliance on Regional Supply Chains at the Industry Level.....	877
<i>Scott L. Rosen, Andrew E. Hong, Lauren A. Rayson, William S. Bland, Jennifer A. Richkus</i>	

## **Author Index**