# **2016 Winter Simulation Conference (WSC 2016)**

# Washington, DC, USA 11-14 December 2016

Pages 1-689



IEEE Catalog Number: ISBN:

CFP16WSC-POD 978-1-5090-4487-0

# **Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc All Rights Reserved**

*Copyright and Reprint Permissions*: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. 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:	
ISBN (Print-On-Demand):	
ISBN (Online):	
ISSN:	

CFP16WSC-POD 978-1-5090-4487-0 978-1-5090-4486-3 0891-7736

#### 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 Web: www.proceedings.com



# **Table of Contents**

Opening and Keynote	
Many Model Thinking	1
Scott E. Page	
Adventures in Policy Modeling!	
Adventures in Policy Modeling!	2
Edward H. Kaplan	
A Data Farmer's Almanac	
A Data Farmer's Almanac	3
Susan M. Sanchez	

### **Cross-Fertilization**

**Keynote and Titans** 

# Dark Matter And Super Symmetry: Exploring And Explaining The Universe With Simulations At The LHC

Dark Matter And Super Symmetry: Exploring And Explaining The Universe With Simulations At The LHC Oliver Gutsche	4
Towards the Rational Design of Solvents That Give Rise to Highly Efficient Solution-processed Perovskite Solar Cells	ient
Towards the Rational Design of Solvents That Give Rise to Highly Efficient Solution processed Perovskite Solar Cells	- N/A
Paulette Clancy, Blaire Sorenson, Angela Harper, James M. Stevenson	
Control of an HIV Epidemic among Injection Drug Users: Simulation Me Complex Networks	odeling on
Control of an HIV Epidemic among Injection Drug Users: Simulation Modeling on Complex Networks	23

Alexander R. Rutherford, Bojan Ramadanovic, Lukas Ahrenberg, Warren Michelow, Brandon D. L. Marshall, Will Small, Kathleen Deering, Julio S. G. Montaner, Kristztina Vasarhelyi

### **Introductory Tutorials**

Introduction to Simulation	
The Basics of Simulation K. Preston White. Jr., Ricki G. Ingalls	38
Introduction to System Dynamics	
System Dynamics: a Behavioral Modeling Method Martin Kunc	53
Introduction to Agent Based Modeling	
Agent-Based Modeling: An Introduction and Primer Christopher W. Weimer, J.O. Miller, Raymond R. Hill	65
Performing Simulation Projects	
A Clue, the Cash, the Commitment, and Courage: The Keys to a Successful Simulation Project Melanie R. Barker, Nancy B. Zupick	80
Conceptual Modeling	
<b>Tutorial on ABCmod: An Activity Based Discrete Event Conceptual Modelling Framework</b> Gilbert Arbez, Louis G. Birta	88
Input Modeling	
A Tutorial on How to Select Simulation Input Probability Distributions Averill M. Law	103
Simulation Output Analysis	
A Practical Introduction to Analysis of Simulation Output Data Christine S.M. Currie, Russell C.H. Cheng	118
Introduction to Hybrid Simulation	
A Primer for Hybrid Modeling and Simulation Ignacio J. Martinez-Moyano, Charles M. Macal	133
Simulation Programming Environments	
Introduction to Simulation Using JavaScript Gerd Wagner	148

## **Advanced Tutorials**

#### A Tutorial on the Operational Validation of Simulation Models

A Tutorial on the Operational Validation of Simulation Models	163
Robert G. Sargent, David M. Goldsman, Tony Yaacoub	

Advanced Tutorial: Input Uncertainty and Robust Analysis in Stochastic Simulation

Advanced Tutorial: Input Uncertainty and Robust Analysis in Stochastic Simulation Henry Lam	178
Exact Simulation vs Exact Estimation	
Exact Simulation vs Exact Estimation Peter W. Glynn	193
From Desktop To Large-scale Model Exploration with Swift/T	
From Desktop To Large-scale Model Exploration with Swift/T Jonathan Ozik, Nicholson T. Collier, Justin M. Wozniak, Carmine Spagnuolo	206
Inside Discrete-event Simulation Software: How It Works and Why It Matter	S
Inside Discrete-event Simulation Software: How It Works and Why It Matters Thomas J. Schriber, Daniel T. Brunner, Jeffrey S.Q Smith	221
Healthcare Simulation Tutorial: Methods, Challenges, and Opportunities	
Healthcare Simulation Tutorial: Methods, Challenges, and Opportunities Michelle M. Alvarado, Mark Lawley, Yan Li	236
Technology Transfer of Simulation Analysis Methodology: One Man's Opinion	I
Technology Transfer of Simulation Analysis Methodology: One Man's Opinion Barry L. Nelson	248
Tutorial on the Engineering Principles of Combat Modeling and Distributed Simulation	
Tutorial on the Engineering Principles of Combat Modeling and Distributed Simulation Andreas Tolk	255
Analysis Methodology	
Analysis for Simulation	

<b>Discretization Error of Reflected Fractional Brownian Motion</b> Peter McGlaughlin, Alexandra Chronopoulou	270
Three Asymptotic Regimes for Ranking and Selection with General Sample Distributions	277
Jing Dong, Yi Zhu	
Extensions of the Regenerative Method to New Functionals Zeyu Zheng, Peter Glynn	289
Variance Reduction and Data Reuse	
Variance Reduction for Estimating a Failure Probability with Multiple Criteria Andres Alban, Hardik A. Darji, Atsuki Imamura, Marvin K. Nakayama	302

Logarithmically Efficient Simulation for Misclassification Probabilities in Sequential Multiple Testing Yanglei Song, Georgios Fellouris	314
The Effects of Estimation of Heteroscedasticity on Stochastic Kriging Wenjing Wang, Xi Chen	326
Rare-event Simulation	
Efficient Estimation of Tail Probabilities of the Typical Distance in Preferential Attachment Models Morgan R. Grant, Dirk P. Kroese	338
Estimating Tail Probabilities of Random Sums of Infinite Mixtures of Phase-type Distributions Hui Yao, Leonardo Rojas-Nandavana, Thomas Taimre	347
An M-estimator for Rare-event Probability Estimation Zdravko Botev, Ad Ridder	359
Input Models and Uncertainty	
Input Uncertainty Quantification for Simulation Models with Piecewise-constant Non- stationary Poisson Arrival Processes Lucy E. Morgan, Andrew Charles Titman, David J. Worthington, Barry L. Nelson	370
Survival Distributions Based on the Incomplete Gamma Function Ratio Andrew Glen, Lawrence M. Leemis, Daniel J. Luckett	382
Approximating Data-driven Joint Chance-constrained Programs Via Uncertainty Set Construction	389
Simulation Output Analysis	
Fourier Trajectory Analysis for Identifying System Congestion Xinyi Wu, Russell R. Barton	401
Learning Stochastic Model Discrepancy Matthew Plumlee, Henry Lam	413
New History-based Delay Predictors for Service Systems Mamadou Thiongane, Wyean Chan, Pierre L'Ecuyer	425
Simulation Analytics	
A Simulation Analytics Approach to Dynamic Risk Monitoring Guangxin Jiang, L. Jeff Hong, Barry L. Nelson	437
Simulation Analytics for Virtual Statistics via k Nearest Neighbors Yujing Lin, Barry L. Nelson	448
A Simulation-Based Comparison of Maximum Entropy and Copula Methods for Capturing Non-Linear Dependence Ehsan Salimi, Ali E. Abbas	460

### Input Modeling

KE Tool: An Open Source Software For Automated Input Data In Discrete Event Simulation Projects PANAGIOTIS Barlas, Cathal Heavey	472	
BRAWLER to CFAM: Incorporating Stochastic Engagement-Level Data in Deterministic Campaign Models	484	
Colibrating a Dependent Failure Model for Computing Deliphilities in	400	
Telecommunication Networks	490	
Omar Matus, Javiera Barrera, Eduardo Moreno, Gerardo Rubino		
Output Analysis		
Multiple Comparisons with a Standard Using False Discovery Rates Dashi Singham, Roberto Szechtman	501	
Simulation Screening and False Discovery Rate Control for Both Main and Interaction Effects	512	
Wen Shi, Jennifer Shang, Zhigang Zhang		
Null Hypothesis Significance Testing in Simulation Marko A. Hofmann	522	
Simulation and Optimization		
Approximate Bayesian Inference As A Form Of Stochastic Approximation: A New Consistency Theory With Applications Ye Chen, Ilya O. Ryzhov	534	
Coupling Optimization and Statistical Analysis with Simulation Models Benjamin Thengvall, Fred Glover, David Davino	545	
ASTRO-DF: Adaptive Sampling Trust-Region Optimization Algorithms, Heuristics, and Numerical Experience. Sara Shashaani, Susan Hunter, Raghu Pasupathy	554	
Metamodeling		
Simulation Metamodeling in the Presence of Model Inadequacy Xiaowei Zhang, Lu Zou	566	
Sensitivity Analysis of Expensive Black-Box Systems Using Metamodeling Tom Van Steenkiste, Joachim van der Herten, Ivo Couckuyt, Tom Dhaene	578	
Extended Kernel Regression: A Multi-Resolution Method to Combine Simulation Experiments with Analytical Methods Ziwei Lin, Andrea Matta, Na Li, J. George Shanthikumar	590	

# **Simulation Optimization**

Large-scale Simulation Optimization

	Simulation Optimization for a Large-scale Bike-sharing System Nanjing Jian, Daniel Freund, Holly M. Wiberg, Shane G. Henderson	602
	Randomized Block Coordinate Descendant STRONG for Large-Scale Stochastic Optimization Wenyu Wang, Hong Wan, Kuohao Chang	614
	Parallel Empirical Stochastic Branch and Bound for Large-scale Discrete Optimization via Simulation Scott Rosen, Peter Salemi, Brian Wickham, Ashley Williams, Christine Harvey, Erin Catlett, Sajjad Taghiyeh, Jie Xu	626
	Random Search for Simulation Optimization	
	A Quantile-based Nested Partition Algorithm for Black-box Functions on a Continuous Domain David Linz, Hao Huang, Zelda Zabinsky	638
	Simulation Optimization via Promising Region Search and Surrogate Model Approximation Qi Fan, Jiaqiao Hu	649
	AlphaGo and Monte Carlo Tree Search: The Simulation Optimization Perspective Michael Fu	659
9	Sampling-based Simulation Optimization	
	V-shaped Sampling Based on Kendall-distance to Enhance Optimization with Ranks Haobin Li, Giulia Pedrielli, Min Chen, Loo Hay Lee, Ek Peng Chew, Chun-Hung Chen	671
	<b>Optimal Computing Budget Allocation With Exponential Underlying Distribution</b> Fei Gao, Siyang Gao	682
	eg-VSSA: An Extragradient Variable Sample-size Stochastic Approximation Scheme: Error analysis and Complexity trade-offs Afrooz Jalilzadeh, Uday V. Shanbhag	690
(	Gradient-based Simulation Optimization I	
	A Stochastic Compositional Gradient Method Using Markov Samples Mengdi Wang, Ji Liu	702
	Si-admm: a Stochastic Inexact Admm Framework for Resolving Structured Stochastic Convex Programs Yue Xie, Uday Shanbhag	714
	Optimizing Conditional Value-at-Risk via Gradient-based Adaptive Stochastic Search Helin Zhu, Joshua Hale, Enlu Zhou	726
I	Ranking & Selection I	
	Empirical Analysis of the Performance of Variance Estimators in Sequential Single Run Ranking & Selection: the Case of Time Dilation Algorithm Giulia Pedrielli, Yinchao Zhu, Loo Hay Lee, Haobin Li	738
	Speeding Up Pairwise Comparisons for Large Scale Ranking and Selection	749

Jeff Hong, Jun Luo, Ying Zhong	
Sequential Sampling for Bayesian Robust Ranking and Selection Xiaowei Zhang, Liang Ding	758
Bayesian and Non-parametric Methods in Simulation Optimization	
Warm Starting Bayesian Optimization Matthias Poloczek, Peter I. Frazier, Jialei Wang	770
A Bayesian Approach to Feasibility Determination Roberto Szechtman, Enver Yucesan	782
The Empirical Likelihood Approach to Simulation Input Uncertainty Henry Lam, Huajie Qian	791
Surrogate-based Simulation Optimization	
G-STAR: A New Kriging-based Trust Region Method for Global Optimization Giulia Pedrielli, Szu Hui Ng	803
Improving the Efficiency of Evolutionary Algorithms for Large-Scale Optimization with Multi-Fidelity Models	815
Combined Global and Local Method for Stochastic Simulation Optimization with an AGLGP Model Qun Meng, Szu Hui Ng	827
Ranking & Selection II	
<b>Optimal Computing Budget Allocation with Input Uncertainty</b> Siyang Gao, Hui Xiao, Enlu Zhou, Weiwei Chen	839
<b>Tractable Sampling Strategies for Quantile-based Ordinal Optimization</b> Dongwook Shin, Mark Broadie, Assaf Zeevi	847
Multiobjective Ranking And Selection Based On Hypervolume Juergen Branke, Wen Zhang, Yang Tao	859
Simulation Optimization Applications	
Mixed Optimization for Constrained Resource Allocation, An Application to a Local Bus Service Felisa Vazquez-Abad, Larry Fenn	871
A Computational Method for Optimizing Storage Placement to Maximize Power Network Reliability	883
Debarati Bhaumik, Daan Crommelin, Bert Zwart	
Lot-sizing in Sequential Auctions While Learning Bid and Demand Distributions Mahshid Salemi Parizi, Archis Ghate	895
Gradient-based Simulation Optimization II	

A Randomized Algorithm for Continuous Optimization	907
Ajin George Joseph, Shalabh Bhatnagar	

Yijie Peng, Michael C. Fu, Jianqiang Hu

# **Modeling Methodology**

#### **Simulation Architectures**

A PaaS-based Framework for Automated Performance Analysis of Service-oriented Systems	931
Andrea D'Ambrogio, Paolo Bocciarelli, Antonio Mastromattei	
Extensible Discrete-Event Simulation Framework in SimEvents Wei Li, Ramamurthy Mani, Pieter Mosterman	943
Programming Agent-based Demographic Models with Cross-state and Message- exchange Dependencies: A Study with Speculative Pdes and Automatic Load-sharing Alessandro Pellegrini, Cristina Montanola-Sales, Francesco Quaglia, Josep Casanovas-Garcia	955
Risk and Error Modeling	
A Method for Bounding Error in Multi-rate and Federated Simulations James Nutaro	967
ADD-MORE: Automated Dynamic Display of Measures of Risk and Error Ashkan Negahban, Mohammadnaser Ansari, Jeffrey Smith	977
Outplacement Time and Probability Estimation using Discrete Event Simulation Sudhanshu Shekhar Singh, Rakesh Rameshrao Pimplikar, Ritwik Chaudhuri, Gyana Parija	989
Generative Modeling	
The Goal-Hypothesis-Experiment Framework: A Generative Cognitive Domain Architecture for Simulation Experiment Management Levent Yilmaz, Sritika Chakladar, Kyle Doud	1001
A Modeling Language Generator for a Discrete Event Simulation Language in MATLAB Guy L. Curry, Amarnath Banerjee, Hiram Moya, Harry L. Jones	1013
Cadis: Aspect-oriented Architecture for Collaborative Modeling and Simulation Arthur Valadares, Cristina Videira Lopes, Rohan Achar, Mic Bowman	1024
Modeling Tools	
Automated Production System Simulations Using Commercial Off-the-shelf Simulation Tools	1036
George Thiers, Timothy Sprock, Leon McGinnis, Adam Graunke, Michael Christian	
<b>Evaluation of Modeling Tools for Autocorrelated Input Processes</b> Tobias Uhlig, Sebastian Rank, Oliver Rose	1048
Discrete Simulation Software Ranking – A Top List of the Worldwide Most Popular and Used Tools	1060

Luis Miguel Silva Dias, Antonio Amaro Costa Vieira, Guilherme Pereira, José Oliveira

### **Process and State Modeling**

Process Modeling for Simulation: Observations and Open Issues Gerd Wagner, Mamadou Seck, Frederick McKenzie	1072
Improving a Linearly Implicit Quantized State System Method Franco Di Pietro, Gustavo Migoni, Ernesto Kofman	1084
Random Vector Generation from Mixed-Attribute Datasets using Random Walk Andrew Alojz Skabar	1096
Advances in Simulation Performance	
Green Simulation with Database Monte Carlo Mingbin Feng, Jeremy Staum	1108
Energy Consumption of Data Driver Traffic Simulations SaBra A. Neal, Richard M. Fujimoto, Michael P. Hunter	1119
ConVenus: Congestion Verification of Network Updates in Software-defined Networks Xin Liu, Dong Jin, Cheol Won Lee, Jong Cheol Moon	1131
Dynamic Data-Driven Application Systems	
<b>Dynamic Data Driven Application Systems For Smart Cities and Urban Infrastructures</b> Richard Fujimoto, Nurcin Celik, Haluk Damgacioglu, Michael Hunter, Dong Jin, Young-Jun Son,	<b>1143</b> Jie Xu
Supply Chain and Logistics	
Supply Chain Operations Reference Model For U.S. Based Powder Bed Metal Additive Manufacturing Processes	1158
Simulation Optimization in Discrete Event Logistics Systems: The Challenge of Operational Control Timothy Sprock, Leon McGinnis	1170
Ontology-Based Semantic Model of Supply Chains for Modeling and Simulation in Distributed Environment Juan Leonardo Sarli, María De los Milagros Gutiérrez, Horacio Leone	1182
Traffic Flow and Urban Dynamics	
Data Driven Adaptive Traffic Simulation Of An Expressway Abhinav Sunderrajan, Vaisagh Viswanathan, Wentong Cai, Alois Knoll	1194
Modeling Traffic Flow Using Simulation and Big Data Analytics Casey Bowman, John A. Miller	1206
An Approach To Integrate Inter-dependent Simulations Using HLA With Applications To Sustainable Urban Development Ajitesh Jain, David Caleb Robinson, Bistra Dilkina, Richard Fujimoto	1218

## **Agent-Based Simulation**

#### **Modeling Methods**

Towards a Multi-Scale Agent-Based Programming Language Methodology Endre Somogyi, Amit Hagar, James A. Glazier	1230
CASL: A Declarative Domain Specific Language For Modeling Complex Adaptive Systems	1241
Lachlan Birdsey, Claudia Szabo, Katrina Falkner	
Population-based CTMCs and Agent-based Models Tom Warnke, Oliver Reinhardt, Adelinde M. Uhrmacher	1253
Public Health and Humanitarian Modeling	
Norovirus Outbreaks: Using Agent-Based Modeling to Evaluate School Policies Amy Leigh Hill	1265
<b>Improving Patient Access To A Public Hospital Complex Using Agent Simulation</b> Fabian Zambrano, Pablo Concha, Francisco Ramis, Liliana Neriz, Maria Bull, Patricio Veloz, Jain	<b>1277</b> ne Carvajal
Agent-based Modeling and Strategic Group Formation: A Refugee Case Study Andrew James Collins, Erika Frydenlund	1289
Panel on Reproducible Research in Discrete Event Simulation	
Panel - Reproducible Research in Discrete Event Simulation - A Must or Rather a Maybe?	1301
Adelinde Uhrmacher, Sally Brailsford, Jason Liu, Markus Rabe, Andreas Tolk	
Infrastructure Modeling	
Managing Egress of Crowd during Infrastructure Disruption Teck-Hou Teng, Shih-Fen Cheng, Trong Nghia Truong, Hoong Chuin Lau	1316
An Agent-Based Framework To Study Occupant Multi-Comfort Level In Office Buildings Mohammad Barakat, Hiam Khoury	1328
Validating an Integer Non-linear Program Optimization Model of a Wireless Sensor Network Using Agent-based Simulation Mumtaz Karatas, Bhakti Stephan Onggo	1340

# **Hybrid Simulation**

### Hybrid Simulation in Health and Emergency Planning - I

Using Hybrid Simulation Modeling to Assess the Dynamics of Compassion Fatigue in	1352
Veterinarian General Practitioners	
Andrew J. Tekippe, Caroline C. Krejci	
Hospital Processes Within an Integrated System View: A Hybrid Simulation Approach	1364
Anatoli Djanatliev, Florian Meier	
A Hybrid Approach to Study Communication in Emergency Plans	1376

Gabriel Wainer, Cristina Ruiz-Martín, Youssef Bouanan, Gregory Zacharewicz, Adolfo López-Paredes

#### Panel on Hybrid Simulation

	<b>Hybrid Simulation: Historical Lessons, Present Challenges, and Futures</b> Tillal Eldabi, Mariusz Balaban, Sally C. Brailsford, Navonil Mustafee, Richard E. Nance, Bhakti S. Robert G. Sargent	<b>1388</b> Onggo,
ŀ	lybrid Simulation for Sustainable Systems Modelling	
	Modelling for the Triple-bottom Line: An Investigation of Hybrid Simulation for Sustainable Development Analysis Masoud Fakhimi, Navonil Mustafee, Lampros Stergioulas	1404
	A Review of Literature on Simulation-based Optimization of the Energy Efficiency in Production Anna Carina Roemer, Steffen Strassburger	1416
	Agile Design Meets Hybrid Models: Using Modularity to Enhance Hybrid Model Design and Use Kurt Kreuger, Kelvin Choi, Weicheng Qian, Nathaniel Osgood	1428
ŀ	lybrid Simulation: Methodological Implications	
	<b>Do Hybrid Simulation Models Always Increase Flexibility to Handle Parametric and Structural Changes?</b>	1439
	The Impact of Modeling Paradigms On The Outcome of Simulation Studies: An Experimental Case Study Saikou Diallo, Christopher Lynch, Jose Padilla, Ross Gore	1451
	Conflicts or Synergy When Combining Modeling Approaches – Perspectives from Psychology Kim Rand-Hendriksen, Joe Viana, Mathias Barra, Fredrik Dahl	1463
ŀ	lybrid Simulation in Applied Computing	
	Emulation/Simulation of PLC Networks with the S3F Network Simulator Vignesh Babu, David Malcolm Nicol	1475
	Adaptive Resolution Control in Distributed Cyber-physical System Simulation Dylan Pfeifer, Andreas Gerstlauer, Jonathan Valvano	1487
	Multi-Resolution Co-Design Modeling: A Network-on-Chip Model Soroosh Gholami, Hessam Sarjoughian	1499
ŀ	lybrid Simulation in Health and Emergency Planning - II	
	Designing Effective Hybridization for Whole System Modeling and Simulation in Healthcare David Bell, Claire Cordeaux, Tom Stephenson, Heather Dawe, Peter Lacey, Lucy O'Leary	1511
	Modeling of Healthcare Systems: Past, Current, and Future Trends Amr Arisha, Wael Rashwan	1523
	Modeling Healthcare Demand Using a Hybrid Simulation Approach	1535

Bozena Mielczarek, Jacek Zabawa

#### **Fundamentals of Hybrid Models**

Heterogeneous Models in a Multi-Model System Charles D. Turnitsa	1547
Learning Simulation Models Through Physical Objects Paul Fishwick	1559
On the Representation of Time in Modeling & Simulation Fernando Barros	1571
Applications of Hybrid Simulation - I	
A Combined Discrete-continuous Simulation Model for Analyzing Train-pedestrian Interactions	1583
Ronald Ekyalimpa, Nadia Porter, Michael Werner, Stephen Hague, Simaan AbouRizk	
Analysis of Future Uas-Based Delivery Mariusz A. Balaban, Thomas W. Mastaglio, Christopher Lynch	1595
Knowledge Discovery in Simulation Data: A Case Study of a Gold Mining Facility Niclas Feldkamp, Soeren Bergmann, Steffen Strassburger, Thomas Schulze	1607
Applications of Hybrid Simulation - II	
Towards Airspace Rules for Future UAS-Based Delivery Mariusz A. Balaban, Christopher Lynch, Thomas W. Mastaglio	1619
A Hybrid Simulation Model for Urban Weatherization Programs Caroline C. Krejci, Ulrike Passe, Michael C. Dorneich, Nathan Peters	1630
Hybrid Modeling for Vineyard Harvesting Operations Mohammed Mesabbah, Amr Mahfouz, Mohamed Ragab, Amr Arisha	1642

# **Environmental and Sustainability Applications**

#### **Change and Response**

Discrete Event Simulation of Green Supply Chain with Traffic Congestion Factor Ben Benzaman, Abdulla Al-Dhaheri, David Claudio	1654
Betting and Belief: Prediction Markets and Attribution of Climate Change John J. Nay, Martin Van der Linden, Jonathan M. Gilligan	1666
Dynamics of Individual and Collective Agricultural Adaptation to Water Scarcity Emily K. Burchfield, Jonathan Gilligan	1678
Environment and Adaptation	
Impact of Diverse Behavioral Theories on Environmental Management: Explorations with Daisyworld	1690

Marco Janssen

Success Biased Imitation Increases the Probability of Effectively Dealing with Ecological Disturbances Jacopo A. Baggio, Vicken Hillis	1702
Modeling The Adaptation of the Forest Sector to Climate Change: A Coupled Approach Matthew R. Sloggy, Andrew J. Plantinga, Greg S. Latta	1713
Energy and Behavior	
<b>Optimizing HVAC Operation In Commercial Buildings: A Genetic Algorithm Multi- Objective Optimization Framework</b> Sokratis Papadopoulos, Elie Azar	1725
Quantifying the Impact of Uncertainty in Human Actions on the Energy Performance of Educational Buildings	1736
Quantifying The Impact of Microgrid Location And Rehavior On Transmission	1745
Network Congestion	1/43
Jialin Liu, Maria Gabriela Martinez, C. Lindsay Anderson	

## **General and Scientific Applications**

#### **Energy and the Environment**

Accelerating Splitting Algorithms for Power Grid Reliability Estimation Wander S. Wadman, Mark S. Squillante, Soumyadip Ghosh	1757
<b>Bi-level Stochastic Approximation for Joint Optimization of Hydroelectric Dispatch</b> <b>and Spot-market Operations</b> Ebisa D. Wollega, Soumyadip Ghosh, Mark Squillante	1769
A Prototype Implementation of an Embedded Simulation System for the Study of Large Scale Ice Sheets Philip Dickens, Christopher Dufour, James Fastook	1781
Applications	
Evaluating the Fit of the Erlang A Model in High Traffic Call Centers Thomas R. Robbins	1790
Predicting the Effects of Automation Reliability Rates on Human-Automation Team Performance Anthony John Hillesheim, Christina F. Rusnock	1802
Reliable Signals and The Sexual Selection: Agent-based Simulation of The Handicap Principle Bartosz Pankratz, Bogumił Kamiński	1814
Distributed Computing	

Predicting Performance of Smoothed Particle Hydrodynamics Codes at Large Scales1825Guillaume Chapuis, David Nicholaeff, Stephan Eidenbenz, Robert Stephen Pavel1825

Kiwano: Scaling Virtual Worlds Raluca Diaconu, Joaquín Keller	1836
A Method to Avoid Smartphone Memory Errors Impacting Encryption Keys Jianing Zhao, Peter Kemper	1848
Aviation	
An Approach For Safety Assessment In UAS Operations Applying Stochastic Fast-Time Simulation With Parameter Variation	1860
Joao Luiz de Castro Fortes, Rafael Fraga, Kenneth Martin	
Simulation of Maintenance Processes in the Big Data Era Vitali Volovoi	1872
Applying a Disparate Network of Models for Complex Airspace Problems	1884

Frederick Wieland, Rohit Sharma, Ankit Tyagi, Michel Santos, Jyotirmaya Nanda, Yingchuan Zhang

# **Healthcare Applications**

#### **Capacity Planning/Bed Allocation**

Perioperative Bed Capacity Planning Guided By Theory of Constraints Vikram Tiwari, Warren Sandberg	1894
An Integrated Approach of Multi-Objective Optimization Model for Evaluating New Supporting Program in Irish Hospitals	1904
Wael Rashwan, Heba Habib, Amr Arisha, Garry Courtney, Sean Kennelly	
Constrained Optimizaton for Hospital Bed Allocation via Discrete Event Simulation with Nested Partitions	1916
Nugroho Artadi Pujowidianto, Loo Hay Lee, Chun-Hung Chen, Haobin Li, Giulia Pedrielli	
Emergency Response	
Characterizing Emergency Responses in Localities with Different Social Infrastructure using EMSSim	1926
Taesik Lee, Kyohong Shin, Hyun-Rok Lee, Hyun Jin Lee, Inkyung Sung, Jangwon Bae, Junseo Moon	k Lee, Il-Chul
NGOMSL Simulation Model in an Emergency Department	1938
Nithin Parameshwara, Jung Hyup Kim, Wenbin Guo, Kalyan S. Pasupathy	
A Structured Approach for Constructing High Fidelity ED Simulation Wonjun Lee, Kyohong Shin, Hyun-Rok Lee, Hayong Shin, Taesik Lee	1950
Emergency Department Capacity and Congestion Management	
Identifying the Optimal Configuration of an Express Care Area in an Emergency Department: A DES and Metamodeling Approach	1961
Hyojung Kang, Jennifer M. Lobo	

A Discrete-event Simulation Study for Emergency Room Capacity Management in a Hong Kong Hospital Zoie Shui Yee Wong, Albert Chau-Hung Lit, Sin-Yee Leung, Kwok-Leung Tsui, Kwai-Sang Chin	1970
A Simulation Model of Patient Flow Through the Emergency Department to Determine the Impact of a Short Stay Unit on Hospital Congestion Theresa Roeder, Amy Cochran, Keith Kocher, Valerie Washington, Gabriel Zayas-Caban	1982
Policy Planning	
A Compartmentalized Simulation Model for Evaluation of HPV Vaccination Policies in Colombia	1994
Daniela Angulo Díaz, Raha Akhavan-Tabatabaei, Ivan Mura	
Exploring Advantages in the Waiting List for Organ Donations Christine Harvey, James R. Thompson	2006
Designing and Analyzing Healthcare Insurance Policies to Reduce Cost and Prevent the Spread of Seasonal Influenza TingYu Ho, Paul A. Fishman, Zelda B. Zabinsky	2018
Patient Scheduling	
A Simulation of Variability Oriented Sequencing Bules on Block Surgical Scheduling	2020
Luisa Valentina Nino, Sean Paul Harris, David Claudio	2030
A Coordinated Scheduling Policy To Improve Patient Access To Surgical Services Gabriela Martinez, Todd Huschka, Mustafa Sir, Kalyan Pasupathy	2041
A Decision Support System for Real-Time and Dynamic Scheduling of Multiple Patient Classifications in Ambulatory Care Services William P. Millhiser, Emre A. Veral	2053
Clinical Care Planning	
A Model Predictive Control Approach for Discovering Nonstationary Fluence-maps in Cancer Radiotherapy Fractionation Ali Ajdari, Archis Ghate	2065
Analyzing Hepatitis C Screening And Treatment Strategies Using Probabilistic Branch And Bound	2076
Hao Huang, Zelda B. Zabinsky, Yuankun Li, Shan Liu	
Simulating 3-D Bone Tissue Growth Using Repast HPC: Initial Simulation Design and Performance Results John T. Murphy, Elif Seyma Bayrak, Mustafa Caadas Ozturk, Ali Cinar	2087
Ratient Centered Outcomes	
Patient-Hospital Communication: a Platform to Improve Outpatient Chemotherapy Guillaume Lamé, Oualid Jouini, Julie Stal-Le Cardinal, Muriel Carvalho, Christophe Tournigand, Wolkenstein	2099 Pierre
Integrating Simulation Modeling and Mobile Technology to Improve Day-of-Surgery Patient Care Kevin Taaffe, Nazanin Zinouri, Aditya Ganesh Kamath	2111

#### **Patient Care Planning**

Simulation Modeling for Primary Care Planning in Singapore David B. Matchar, John P. Ansah, Steffen Bayer, Peter Hovmand	2123
<b>Evaluation of Discovered Clinical Pathways Using Process Mining and Joint Agent- based Discrete-event Simulation</b> Vincent Augusto, Xie Xiaolan, Martin Prodel, Baptiste Jouaneton, Ludovic Lamarsalle	2135
A Conceptual Framework for Modeling Longitudinal Healthcare Encounter Data Hari Balasubramanian, Nora Murphy, Michael Rossi	2147
Improving Care Delivery	
Implementing Discrete Event Simulation to Improve Optometry Clinic Operations Michael D. Seminelli, James W. Wilson, Brandon M. McConnell	2157
The Impact of System Factors on Patient Perceptions of Quality of Care David P. Dzubay, Eduardo Perez	2169

## **JOS 10th Anniversary**

#### **Simulation: Past and Future**

Simulation: The Past 10 Yea	rs and the Ne	ext 10 Years			2180
Russell Cheng, Charles Maca	l, Barry Nelson	, Markus Rabe	, Christine Currie	John Fowler,	Loo Hay Lee

### Logistics, SCM, Transportation

#### Simheuristics for Logistics, SCM and Transportation (1)

A Simheuristic Algorithm for Horizontal Cooperation in Urban Distribution: Application to a Case Study in Colombia	2193
Carlos L. Quintero-Araujo, Jairo R. Montoya-Torres, Angel Juan, Andres Felipe Muñoz-Villamiz	zar
Combining Simulation with a GRASP Metaheuristic for Solving the Permutation Flow- Shop Problem with Stochastic Processing Times	2205
Daniele Ferone, Aljoscha Gruler, Paola Festa, Angel A. Juan	
A Simulation Framework for Real-Time Assessment of Dynamic Ride Sharing Demand Responsive Transportation Models	2216
M.Paz Linares, Lidia Montero, Jaume Barcelo, Carlos Carmona	
stribution Logistics	
An Approach for Modeling Collaborative Route Planning in Supply Chain Simulation Markus Rabe, Astrid Klueter, Uwe Clausen, Moritz Poeting	2228
valuation of Warehouse Bulk Storage Lane Depth and ABC Space Allocation Using Simulation	2239

Kelsey Clements, Kaleigh Sweeney, Abigail Tremont, Vipul Muralidhara, Michael Kuhl

Hybrid Order Picking Strategies for Fashion E-Commerce Warehouse Systems Giulia Pedrielli, Alessandro Duri, Albert Vinsensius, Ek Peng Chew, Loo Hay Lee, Haobin Li	2250
Supply Chains	
A Discrete Event Simulation for the Logistics of Hamad's Container Terminal of Qatar Mariam Kotachi, Ghaith Rabadi, Kais Msakni, Mohammad Al-Salem, Ali Diabat	2262
A Simulation Approach for Multi-stage Supply Chain Optimization to Analyze Real World Transportation Effects Andreas 1 Peirleitner, Klaus Altendorfer, Thomas Felberbauer	2272
<b>Evaluation of the General Applicability of Dragoon for the k-Center Problem</b> Tobias Uhlig, Peter Hillmann, Oliver Rose	2284
Uncertainty Modeling in Operations Planning	
Stochastic Simulation under Input Uncertainty for Contract-Manufacturer Selection in Pharmaceutical Industry Alp Akcay, Tugce Martagan	2292
A Simulation-Based Prediction Framework for Two-Stage Dynamic Decision Making Wei Xie, Yuan Yi	2304
Demand Fulfillment Probability Under Parameter Uncertainty Canan Gunes Corlu, Bahar Biller, Sridhar Tayur	2316
Simheuristics for Logistics, SCM and Transportation (2)	
A Multi-Start Simheuristic for the Stochastic Two-Dimensional Vehicle Routing Problem Daniel Guimarans, Oscar Domínguez, Angel A. Juan, Enoc Martínez	2326
A Simheuristic Approach to the Vehicle Ferry Revenue Management Problem Christopher Bayliss, Julia M. Bennell, Christine Currie, Antonio Martinez-Sykora, Mee-Chi So	2335
Combining Simulation with Metaheuristics in Distributed Scheduling Problems with Stochastic Processing Times Laura Calvet, Victor Fernandez-Viagas, Angel A. Juan, Jose Framinan	2347
Intermodal Transport	
Increasing Capacity Utilization of Shuttle Trains in Intermodal Transport by Investing in Transshipment Technologies for Non-cranable Semi-trailers Ralf Elbert, Daniel Reinhardt	2358
Modeling and Analysis of Intermodal Supply Paths to Enhance Sourcing Decisions Allen G. Greenwood, Travis Hill, Chase Saunders, Robbie Holt	2370
<b>Traffic Simulation Model for Port Planning and Congestion Prevention</b> Baoxiang Li, Kar Way Tan, Trong Khiem Tran	2382
Transportation Optimization	
A Deschied Circulation Annual of Gauge Effective Tread Disectable Control (C. 201	220 -

A Practical Simulation Approach for an Effective Truck Disaptching System of Open Pit 2394 Mines Using VBA

Yifei Tan, Soemon Takakuwa	
A Discrete Event Simulation Model of the Viennese Subway System for Decision Support and Strategic Planning David Schmaranzer, Roland Braune, Karl F. Doerner	2406
Warnings about Simulation Revisited: Improving Operations in Congonhas Airport Fabio Torres Vitor, Vanessa Antunes Santos, Leonardo Chwif	2418
Simulation in Digitized Production and Logistics	
Economic Justification of Virtual Commissioning in Automation Industry Nazli Shahim, Charles Møller	2430
Simulation of In-transit Services in Tracked Delivery of Project Supply Chains: A Case of Telecom Industry Giacomo Liotta, Jan Holmström	2442
Minimizing Recall Risk by Collaborative Digitized Information Sharing Between OEM and Suppliers: A Simulation Based Investigation Giacomo Liotta, Atanu Chaudhuri	2454
Simheuristics for Logistics, SCM and Transportation (3)	
Combining Monte Carlo Simulation with Heuristics to Solve a Rich and Real-life Multi- depot Vehicle Routing Problem Gabriel Alemany, Álvaro García-Sánchez, Jesica de Armas, Angel A. Juan, Roberto García-Meizo Ortega-Mier	<b>2466</b> oso, Miguel
Enriching Simheuristics with Petri Net Models: Potential Applications to Logistics and Supply Chain Management Juan-Ignacio Latorre-Biel, Javier Faulin, Angel A. Juan	2475
Bayesian Ranking and Selection Model for Second-best Network Pricing Problem Zhen Tan, Huizhu Oliver Gao	2487
MASM	
MASM Keynote	

The Engineering of Speed and Delivery Robert C. Leachman	2499
Applied Analytics	
A Demonstration Of Machine Learning For Explicit Functions For Cycle Time Prediction Using MES Data	2500
Birkan Can, Cathal Heavey	

Big Data Analytics for Modeling WAT Parameter Variation Induced by Process Tool in2512Semiconductor Manufacturing and Empirical Study

Chen-Fu Chien, Ying-Jen Chen, Jei-Zheng Wu

Run-to-Run Sensor Variation Monitoring for Process Fault Diagnosis in Semiconductor Manufacturing	2523
Jakey Blue, Jacques Pinaton, Agnès Roussy	
Iodeling and Optimization	
<b>Evaluation of Small Volume Production Solutions in Semiconductor Manufacturing:</b> <b>Analysis from a Complexity Perspective</b> Can Sun, Hans Ehm, Thomas Rose	2535
Modeling the Impact Of New Product Introduction On the Output Of Semiconductor Wafer Fabrication Facilities	2547
Atchyuta Bharadwaj Manda, Reha Uzsoy, Karl G. Kempf, Sukgon Kim	
Simulation-Enabled Development Lot Journey Smoothening in a Fully-Utilised Semiconductor Manufacturing Line	2559
Wolfgang Scholl, Matthias Foerster, Patrick Preuss, Andre Naumann, Boon Ping Gan, Peter Lei	ndermann
cheduling and Transportation	
<b>Evolving Control Rules for a Dual-constrained Job Scheduling Scenario</b> Jürgen Branke, Matthew Groves, Torsten Hildebrandt	2568
Decentralized Dispatching for Blocking Avoidance in Automated Material Handling Systems	2580
Yen-Shao Chen, Cheng-Hung Wu, Shi-Chung Chang	
Automated Transportation Of Auxiliary Resources In A Semiconductor Manufacturing Facility	2587
Moulaye Aidara Ndiaye, Stéphane Dauzère-Pérès, Claude Yugma, Lionel Rullière, Gilles Lamiab	le
Qualification and Variability Management	
A Literature Review on Variability in Semiconductor Manufacturing: The Next Forward Leap to Industry 4.0 Kean Dequeant, Philippe Vialletelle, Pierre Lemaire, Marie-Laure Espinouse	2598
An Optimization Model for Qualification Management in Wafer Fabr	2610
Denny Kopp, Lars Moench, Detlef Pabst, Marcel Stehli	2010
Ideal and Potential Flexibility Measures for Qualification Management in Semiconductor Manufacturing Amélie Pianne, Luis Rivero, Stéphane Dauzère-Pérès, Philippe Vialletelle	2621
upply Chain Management	
A CP Approach For Planning Lot Release Dates In A Supply Chain Of Semiconductor Manufacturing Dirk Doleschal, Gottfried Nieke, Gerald Weigert, Andreas Klemmt	2633
A Data Model for Planning in the Semiconductor Supply Chain Irfan Ovacik	2645
Available-To-Promise Systems in the Semiconductor Industry: A Review of Contributions and A Preliminary Experiment Jose M. Framinan, Paz Perez-Gonzalez	2652

#### **Cycle Time and Queuing Networks**

Mean Queue Time Approximation for a Workstation with Cascading Kan Wu, Ning Zhao	2664
Using Simulation to Improve Semiconductor Factory Cycle Time by Segregation of Preventive Maintenance Activities Kosta Rozen, Néill M. Byrne	2676
Mean Cycle Time Approximations for G/G/m Queueing Networks Using Decomposition without Aggregation with Application to Fab Datasets Jinho Shin, Dean Grosbard, James R. Morrison, Adar Kalir	2685
Production and Capacity Planning	
Robust Semiconductor Production Planning Under Yield Uncertainty Jonathan J. Lowe, Amin Khademi, Scott J. Mason	2697
<b>Optimizing Capacity Assignment of Multiple Identical Metrology Tools</b> Stéphane Dauzère-Pérès, MIchael Hassoun, Alejandro Sendon	2709
A Chance Constraint Based Multi-Item Production Planning Model Using Simulation Optimization Erinc Albey, Reha Uzsoy, Karl G. Kempf	2719
Scheduling	
Dedication Load Based Dispatching Rule for Photolithography Machines with Dedication Constraint	2731
Yong H. Chung, Kang H. Cho, Byung H. Kim, Sang C. Park	
Flexible Job Shop Scheduling Problem with Parallel Batch Processing Machine Andy M. Ham	2740
Scheduling Preventive Maintenance within a Queue Time for Maximum Throughput in Semiconductor Manufacturing Adar A. Kalir, Israel Tirkel	2750

### **Manufacturing Applications**

#### **Smart Manufacturing**

Standards Based Generation of a Virtual Factory Model	2762
Sanjay Jain, David Lechevalier	
Combining Virtual Reality Enabled Simulation with 3d Scanning Technologies towards	2774
Smart Manufacturing	

Windo Hutabarat, John Oyekan, Christopher Turner, Ashutosh Tiwari, Neha Prajapat, Xiao-Peng Gan, Anthony Waller

# Setu Optimization based on Virtual Tooling for Manufacturing in Order to Provide an2786Intelligent Work Preparation Process

Jens Weber, Raphael-Elias Reisch, Christoph Laroque, Christian Schröder

### Scheduling and Maintenance in Manufacturing Systems

Buffer Utilization Based Scheduling of Maintenance Activities by a Shifting Priority Approach – a Simulation Study	2797
Maheshwaran Gopalakrishnan, Anders Skoogh, Christoph Laroque	
Simulation-based Optimization for Solving a Hybrid Flow Shop Scheduling Problem Paul Aurich, Abdulrahman Nahhas, Tobias Reggelin, Juri Tolujew	2809
Potential of Data-driven Simulation-based Optimization for Adaptive Scheduling and Control of Dynamic Manufacturing Systems Mirko Kück, Jens Ehm, Torsten Hildebrandt, Michael Freitag, Enzo M. Frazzon	2820
Logistics and Transportation for Manufacturing Systems	
Module-Based Modeling and Analysis of a Manufacturing System Adopting a Dual- Card Kanban System with a Delivery Cycle Kanna Miwa, Junichi Nomura, Soemon Takakuwa	2832
Task Scheduling in a Full Roaming Shuttle System Martijn Gootzen, Ivo Adan, Jorine Heling, Bruno van Wijngaarden	2844
Lean Design and Analysis of a Milk-Run Delivery System: Case Study Ki-Hwan G. Bae, Lee A. Evans, Alan Summers	2855
Simulation Optimization for Manufacturing	
Simulation Based Optimization Package for Periodic Review Inventory Control André Freixo Santos, Carlos Filipe Bispo	2867
Discrete Event Optimization: Workstation and Buffer Allocation Problem in Manufacturing Flow Lines Mengyi Zhang, Andrea Matta, Giulia Pedrielli	2879
Two-stage Simulation Optimization for Optimal Development of Offshore Wind Farm under Wind Uncertainty Qing Li, Honggang Wang	2891
Advanced Control of Manufacturing Systems	
Time Bound Control In A Stochastic Dynamic Wafer Fab Tao Zhang, Falk Stefan Pappert, Oliver Rose	2903
Reducing Negative Impact of Machine Failures on Performance of Filling and Packaging Production Line – a Simulative Study Tomasz Bartkowiak, Pawel Pawlewski	2912
Targeted Incremental Debottlenecking of Batch Process Plants Satyajith Amaran, Bikram Sharda, Scott Bury	2924
Analysis of Manufacturing Processes	
A Bayesian Inference Based Simulation Approach for Estimating Fraction Nonconforming of Pipe Spool Welding Processes Wenying Ji, Simaan AbouRizk	2935

Impact of Time Bound Constraints and Batching on Metallization in an Opto- semiconductor Fab	2947
Falk Stefan Pappert, Tao Zhang, Fabian Suhrke, Jonas Mager, Thomas Frey, Oliver Rose	
HAFI - Highest Autocorrelated First: A New Priority Rule to Control Autocorrelated Input Processes at Merges	2958
Sebastian Rank, Frank Schulze, Thorsten Schmidt	
Modeling and Control of complex Manufacturing Systems	
Framework for Standardization of Simulation Integrated Production Planning Deogratias Kibira, Guodong Shao, Björn Johansson	2970
Modeling of Complex Decision Making using Forward Simulation Thomas Winkler, Paul Barthel, Ralf Sprenger	2982
Simulation-based Optimization for Integrated Production Planning and Capacity Expansion Decisions	2992
Timm Ziarnetzky, Lars Moench	

# Military, Homeland Security, Emergency Response

Military Keynote	
Modeling and Simulation's Role as a Service to Military and Homeland Security Decision Makers Todd E. Combs	3004
Simulation for Homeland Security	
Simulation Modelling of Alternatives to Avoid Interruptions of the X-Ray Screening Operation at Security Checkpoints Luisa Janer, Manuel David Rossetti	3005
Using Model-Based Simulation for Augmenting Incident Command System for Disaster Response David Wood, Meenakshi Nagarajan, Alexandra Opp, Subhashini Ganapathy, Michelle Cheatham, Gallagher, James Gruenberg, Jack Smith	<b>3017</b> John
Disaster Management Simulation and Research Integration's Virtual Test Bed Proposal for the Chilean National Research Center for Integrated Natural Disaster Manage (CIGIDEN) Andrea Vasquez, Luis Felipe Robledo	3028 ement
Engineering Applications in Defense Modeling	
Simulation Results for Localization and Mapping Algorithms	3040

Doris M. Turnage	
A Novel Scalable Model for Simulating Explosive Blast Propagation	3052
James Nutaro, Sudip K. Seal, David Sulfredge	
Tradespace Analysis for Multiple Performance Measures	3063

Alex D. MacCalman, Susan M. Sanchez, Mary L. McDonald, Simon R. Goerger, Andrew T. Karl

#### **Defense Operational Analyses**

Approximate Dynamic Programming Algorithms for United States Air Force Officer Sustainment	3075
Joseph C. Hoecherl, Matthew J. Robbins, Raymond R. Hill, Darryl K. Ahner	
Measuring the Operational Impact of Military SATCOM Degradation Paul J. Nicholas, Jeffrey C. Tkacheff, Chana M. Kuhns	3087
Modeling and Simulation-Based Analysis of Effectiveness of Tactical Level Chemical Defense Operations	3098
Sung-Gil Ko, Woo-Seop Yun, Tae-Eog Lee	
Simulation in Military Training	
An Analysis of Questionnaires and Performance Measures for a Simulation-Based Kinesic Cue Detection Task	3110
Jonathan Hurter, William Aubrey, Sushunova G. Martinez, Crystal S. Maraj, Irwin Hudson	
Software Engineering a Multi-Layer and Scalable Autonomous Forces "A.I." for Professional Military Training	3122
Michael Pelosi, Michael Scott Brown	
Sources of Unresolvable Uncertainties in Weakly Predictive Distributed Virtual Environments	3134
Jeremy R. Millar, Jason A. Blake, Douglas D. Hodson, J. O. Miller, Raymond R. Hill	

Networks and Communications

#### NetCom I

Simulation and Optimization of Content Delivery Networks Considering User Profiles and Preferences of Internet Service Providers Peter Hillmann, Tobias Uhlig, Gabi Dreo Rodosek, Oliver Rose	3143
A Quantitative Analysis Of Local Data Management For 3D Content Streaming Elvis S. Liu, Aditi Rungta	3155
Simulating and Optimizing Resource Allocation in a Micro-blogging Application Xavier Serra, Jésica de Armas, Joan Manuel Marquès	3167
NetCom II	
Using Simulation to Evaluate LTE Load Control for Priority Users Brittany L. Biagi, Nassissie Fekadu, David A. Garbin, Steven P. Gordon, Denise M. Masi	3177
Two-Stage Chance-Constrained Staffing with Agent Recourse for Multi-Skill Call Centers Wyean Chan, Thuy Anh Ta, Pierre L'Ecuyer, Fabian Bastin	3189
Approximate Zero-Variance Importance Sampling For Static Network Reliability Estimation With Node Failures And Application To Rail Systems	3201

# **Project Management and Construction**

#### **Building Energy**

Application of Wide-band Liquid Crystal Reflective Windows in Building Energy Efficiency: A Case Study of Educational Buildings	3213
Ali Komeily, Seyyed M. Salili, Hamed Shahsavan, Ravi S. Srinivasan, Antal Jakli	
Distributed Simulation Framework to Analyze the Energy Effects of Adaptive Thermal Comfort Behavior of Building Occupants	3225
Albert Thomas, Carol Menassa, Vineet Kamat	
Smart Building Energy Management Systems (BEMS) Simulation Conceptual Framework	3237
Jintaeck Ock, Raja Issa, Ian Flood	
Emerging Issues in Construction	
Reducing Computation Time of Stochastic Simulation-based Optimization Using Parallel Computing on a Single Mutli-core System Mohammed Mawlana, Amin Hammad	3246
A Study On The Management Of A Discrete Event Simulation Project In A Manufacturing Company With PMBOK®	3257
José Arnaldo Barra Montevechi, Tábata Fernandes Pereira, Vinicius Carvalho Paes, Amarnath Rachal Thomassie	Banerjee,
Modular Construction System Simulation Incorporating Off-Shore Fabrication and Multi-Mode Transportation	3269
Jiongyang Liu, Ming-Fung Francis Siu, Ming Lu	
Machine-Oriented Construction	
Heavy Lift Analysis at Feed Stage for Industrial Project Zhen Lei, Ulrich Hermann, Mohamed Al-Hussein, Ahmed Bouferguene	3281
A Prototype for Simulating the Kinematics of Crane Rigging Oscillatory Motion Using Simphony.Net	3290
Ronald Ekyalimpa, Martin Akolo Chiteri, Simaan AbouRizk	
Simulation of Automated Construction Using Wire Robots Hannah Mattern, Tobias Bruckmann, Arnim Spengler, Markus König	3302
Construction Analysis	
Evaluating Performance of Critical Chain Project Management to Mitigate Delays Based on Different Schedule Network Complexities	3314
Simulation-based Analysis of Operational Efficiency and Safety in a Virtual Environment	3325

Alireza Golabchi, SangUk Han, Simaan Abourizk, Jim Kanerva	
Analysis Tools for Stormwater Controls on Construction Sites Jintaeck Ock, Raja Issa, Ian Flood	3337
Facility and Infrastructure Management	
Simulation of Maintenance Strategies in Mechanized Tunneling Markus Scheffer, Hannah Mattern, Alena Conrads, Markus Thewes, Markus König	3345
Data-driven Simulation of Urban Human Mobility Constrained by Natural Disasters Qi Wang, John Taylor	3357
High Level Architecture (HLA) Compliant Distributed Simulation Platform for Disaster Preparedness and Response in Facility Management	3365
Sungjoo Hwang, Minji Choi, Richmond Starbuck, Seulbi Lee, SangHyun Lee, Moonseo Park	

### **Simulation Education**

#### **Simulation Education**

Using Simulation Games for Teaching and Learning Discrete-Event Simulation	3375
Jose J. Padilla, Hamdi Kavak, Christopher J. Lynch, Saikou Y. Diallo, Ross Gore, Anthony Barra Jenkins	co, Bakari

Learning Lean Philosophy through 3d Game-based Simulation	3385
Lucas Delago, Michael Machado, Flávio Brito, Gustavo Landgraf, Marcos Schroede	er, Cristiano Torezzan

Discrete Events Simulation on the Macintosh for Business Students - aGPSS and 3393 Alternatives

Ingolf Ståhl

### **Social and Behavioral Simulation**

#### **Markets and Policy**

The Impact of Human Relationship on Bankruptcy-related Evolution of Inter-firm Trade Network	3405
Shihan Wang, Mohsen Jafari Songhori, Shuang Chang, Takao Terano	
Auction Policy Analysis: An Agent-Based Simulation Optimization Model of Grain Market Jingsi Huang, Lingyan Liu, Leyuan Shi	3417
The Selfish Vaccine Recipe: A Simple Mechanism for Avoiding Free-riding Andrea Guazzini, Mirko Duradoni, Giorgio Gronchi	3429
Juman Robavier at the Workplace	

#### Human Behavior at the Workplace

Simulating the Effect of Workers' Mood on the Productivity of Assembly Lines3440Erfan Pakdamanian, Niroshni Shiyamsunthar, David Claudio3440

Towards Fine Grained Human Behavior Simulation Models Meghendra Singh, Mayuri Duggirala, Harshal Hayatnagarkar, Sachin Patel, Vivek Balaraman	3452
A Model of Online Collaboration for Knowledge Production Miles Manning, Marco Janssen, Lingfei Wu	3464
Social Media and Influence	
The Impact of Broadcasting on the Spread of Opinions in Social Media Conversations Chaitanya Kaligotla, Enver Yucesan, Stephen Chick	3476
Agent-Based Exploration of the Political Influence of Community Leaders on Population Opinion Dynamics Brant M. Horio, Juliette R. Shedd	3488
Simulating Political and Attack Dynamics of the 2007 Estonian Cyber Attacks Asmeret Naugle, Michael Bernard, Itamara V. Lochard	3500
Crime and Migration	
An Agent-Based Approach to Human Migration Movement Larry Lin, Kathleen M. Carley, Shih-Fen Cheng	3510
Active Shooter: An Agent-Based Model of Unarmed Resistance Thomas W. Briggs, William G. Kennedy	3521
The Lingering Effects Of Past Crimes Over Future Criminal Careers Ugo Merlone, Eugenio Manassero, Georgia Zara	3532

## **Industrial Case Studies**

### Industrial Case Studies - Aerospace

Simulation Testbed for the Analysis of Beneficial Bussiness Stratetgies for the Airbus A350 Production Ramp-Up	N/A
Arnd Schirrmann	
Raising the Dynamics: Simulation-based Performance Analysis for Lelystad Airport	N/A
Miguel Mujica Mota, Paolo Scala, Nico DeBock	
Optimization of Boarding Process on Remote Parking Positions in Terminal Puente Aéreo (BOG)	N/A
David Eduardo Soler Laverde, Maria Elena Cardenas Valenzuela, Jose Fidel Torres Delgado	
Industrial Case Studies - Logistics	
A Novel Approach: Simulating Earlier to Increase Benefits	N/A
Kurt Wiseth, Matthew Hobson-Rohrer	
Simulating a Pre-Archival System	N/A
Aineth Torres-Ruiz, Ariel Shtul	
Optimization of Storage Allocation using an automatically generated Warehouse Simulation Model	N/A

#### Industrial Case Studies - Healthcare 1

Helping Acute-Care Hospitals Run More Smoothly using Simulation and Census Data Analysis Wei Wang, Yugang Jia, Douglas Ranahan, Therese Fitzpatrick, Carole Miserendino, Nathan Co	N/A ohen
MD Anderson R8 Simulation Study Zhanting Gao, Olivia Pewzer	N/A
Application of Emergency Department Simulation Modeling for New Hospital Operational Planning Atipol Kanchanapiboon, Paula Antognoli	N/A
Industrial Case Studies - Healthcare 2	
Eradicating the Average: Answering Complex Healthcare Questions Using Discrete Event Simulation Laura Silvoy	N/A
Computer Simulation of Administrative Processes for Resource Planning and Risk Management Antonio R. Rodriguez, Joseph J. Wolski	N/A
University of Utah Ambulatory Care Complex Angela Chupa, Zhanting Gao	N/A
Industrial Case Studies - NIST Panel	
Standards Supporting Simulations of Smart Manufacturing Systems Kevin Lyons, Conrad Bock, Guodong Shao, Ronay Ak	N/A
Industrial Case Studies - Homeland Security	
Enhanced Operational Resilience of Airport Baggage Handling Systems Maurizio Tomasella, Bilyana Hristova, Zuzana Vancova, Burak Buke, Paul Hancock	N/A
Simulations Pay for Themselves at the National Guard Bureau Jason Bewley	N/A
Using Adaptive Modeling to Validate Cbrn Response Enterprise (cre) Capabilities James Rollins	N/A
Industrial Case Studies - Military	
Improving Navy Recruiting With Data Farming Allison Hogarth, Thomas Lucas, Connor McLemore	N/A
<b>RPS Simulation of U.S. Air Force F-16 Fleet Phase Maintenance Cycle</b> Christopher J. Bevelle	N/A
A Simulation-Optimization Framework for Manpower Modeling and Forecasting Aristotelis E. Thanos	N/A

Industrial Case Studies - Financial/Government/Healthcare

A 401(k) Market Simulation To Evaluate Autoportability For Small Investors Ricki G. Ingalls	N/A
Process Optimization - Helping the Knowledge Worker and Consumer Lloyd Dugan	N/A
Leveraging Simulation for Customer Management Needs: Virginia DMV Staffing Analysis Carrie E. Thompson	N/A
Industrial Case Studies - Manufacturing	
Automatically generating Flow Shop Simulation Models from SAP Data Patrick Kirchhof	N/A
A Simulation Study on the Evaluation of Alternative Plans and Drawing an Upper Limit for the Productivity Improvement of a Flow Shop Considering the Work Waiting Time	N/A

Jong Hun Woo, Philippe Lee

## **Vendor Track**

#### Vendor Session M1

The Impact of ExtendSim on Industry Anthony Nastasi	N/A
New Features and Capabilities in Arena 15.0 Robert A. Kranz, Nancy B. Zupick	N/A
Vendor Session M2	
Introduction to Simio Katie Prochaska, Renee M. Thiesing	N/A
AnalyticSolver.com: Simulation, Optimization and Predictive Analytics in Your Web Browser Daniel H. Fylstra	N/A
Vendor Session M3	
What The Cloud Can Do For Your Simulation Modeling Derek Magilton	N/A
Automod® : Outlasting the Competition through Performance, Scalability and Accuracy Daniel Muller	N/A
Vendor Session T1	
Innovative ExtendSim Solutions Anthony Nastasi	N/A
Twenty-Two Critical Pitfalls in Simulation Modeling and How to Avoid Them	N/A

Averill M. Law

#### Vendor Session T2

Simio Application In Scheduling Renee M. Thiesing, C. Dennis Pegden	N/A
Introduction to SAS Simulation Studio Edward P. Hughes, Emily K. Lada	N/A
Vendor Session T3	
Simulating Complex Service Systems in Arena Robert A. Kranz, Nancy B. Zupick	N/A
Applying Simulation to Your Supply Chain Analysis Mike Wilutis	N/A
Vendor Session T4 A	
Integrating Simulation Optimization within the Modeling Platform: MATLAB, Simulink and SimEvents Teresa Hubscher-Younger	N/A
Planning & Scheduling Issues in Semiconductor Manaufacturing and Mozart® Simulation Modeling Keyhoon Ko, Goo H. Chung, Byung H. Kim	N/A
Vendor Session T4 B	
Realtime Predictive and Prescriptive Analytics with Real-time Data and Simulation Hosni Adra	N/A
Modeling Complex Scenarios Using a Process Flow Approach Bill Nordgren	N/A

# Ph.D. Colloquium

#### Ph.D. Colloquium Keynote

Discrete Event Modeling and Simulation Methodologies: Past, Present and Future Gabriel Wainer	3653
Ph.D. Colloquium Presentations I	
Simulation Optimization with Sensitivity Information: An Application to Online-retail Inventory Replenishment Annie Chen	3654
Supermarket Optimization: Simulation Modeling and Analysis of a Grocery Store Layout	3656

Jessica Dorismond

Simulation Optimization for a Large-scale Bike-sharing System

Nanjing Jian A Modeling and Simulation Platform for Evaluating Optimization Methods in Container 3658 **Terminals** Mariam Kotachi The Role of Comorbidity: A Framework for Personalizing Interventions for Patients 3660 with Sepsis Nisha Nataraj 3662 Modeling and Analyzing the Breakdown Process Shu Pan **Blending Spatial Modeling and Probabilistic Bisection** 3664 Sergio Rodriguez ASTRO-DF: Adaptive Sampling Trust-region Optimization Algorithms, see page 554 Heuristics, and Numerical Experience Sara Shashaani Input-output Uncertainty Comparisons for Optimization via Simulation 3666 Eunhye Song **Outpatient Clinic Layout Design Accounting for Flexible Policies** 3668 Vahab Vahdatzad **Ph.D. Colloquium Presentations II** A Framework and Language for Complex Adaptive System Modeling and Simulation 3670 Lachlan Birdsey High Level Architecture (HLA) Compliant Distributed Simulation Platform for Disaster 3365 **Preparedness and Response in Facility Management** Minji Choi A Ship Block Logistics Support System Based on the Shipyard Simulation Framework 3672 Yong-Kuk Jeong Effective Visual Surveillance of Human Crowds using Cooperative Unmanned Vehicles 3674 Sara Minaeian Betting and Belief: Prediction Markets and Attribution of Climate Change see page 1666 John J. Nay Towards the Validation of a Simulation Environment 3676 **Bill Roungas** A Hybrid Approach to Study Communication in Emergency Plans see page 1376 Cristina Ruiz-Martín 3678 A DSL for Continuous-Time Agent-Based Modeling and Simulation Tom Warnke

#### **General and Ph.D. Poster Session**

# **Poster Briefings**

### **Poster Briefing**

Assessment of Patient-Physician Assignment Criteria in Emergency Department by using Discrete Event Simulation Marta Cildoz	3680
A Simulation-Based Model of Technology Localization in Developing Countries Babak Barazandeh	3682
Challenges in Applying Ranking and Selection after Search David J. Eckman	3684
Improving Fire Station Turn-Out-Time Using Discrete-Event Simulation Keegan Vaira	3686
Proposal for Fully Sequential Multiarm Trials with Correlated Arms Ozge Yapar, Stephen E. Chick, Noah Gans	3688
Simulation-based Development of IoT Applications with Multi-Agent Technology - Current Problems and Future Research Directions Marco Lützenberger, Sahin Albayrak	N/A
Comparison Of Gaussian Process Modeling Software Collin B. Erickson, Susan M. Sanchez, Bruce E. Ankenman	3692
Behavioral Analysis Of Agent Based Service Channel Design Using Neural Networks Ralph Laite, Karthik Sankaranarayanan, Nataliya Portman	3694
Projecting the Population-level Impact of Pre-exposure Prophylaxis for Hiv among Men Who Have Sex with Men in Baltimore City Parastu Kasaie	N/A
A Bayesian Simulation Approach for Supply Chain Synchronization Joshua Goldstein, Bianica Pires	3698
<b>Combination of an Evolutionary Agent-Based Model of Transitions in Shipping</b> <b>Technologies with a System Dynamics Expectations Formulation</b> Florian Senger, Johannes Hartwig	3700
<b>Optimal execution of large scale simulations In the cloud. The case of ROUTE-TO-PA</b> <b>SIM online preference simulation</b> Przemyslaw Szufel, Bogumil Kaminski, Marcin Czupryna	3702
Simulation-based Framework For Teaching Methods In Logistics And Production Planning Alexander Hübl, Maximilian Gruber, Gudrun Fischer	N/A
Multiobjective Emergency Room Capacity Planning Using Simulation and Response Surface Methodology	N/A

Felipe Baesler

Simulation of Triaging Patients Into an Internal Medicine Department to Validate the Use of an Optimization Based Workload Score Joseph K. Agor	3708
A Simulation Based Cut Generation Approach to Improve DEO Efficiency: the Buffer Allocation Case Mengyi Zhang, Andrea Matta, Arianna Alfieri, Giulia Pedrielli	3710
Language-agnostic Simulation Model Management Platform Timothy Lortz, Eric Zatcoff, Thomas Hoffman, Genevieve Brown	3712
Simulation Model Cost Database Hae Young Lee, So Jin Lee, SeungHyun Byun, Hyung-Jong Kim	3714
Discrete-event Modeling and Simulation of Ubiquitous Systems with Devsimpy Environement and Devsimpy-mob Mobile Application Laurent Capocchi	3716
Optimization and Simulation Based Approach for an Arrival and Departure Manager Tool Paolo Scala, Miguel Mujica	3718
Agent-based Simulation Analysis for Security Planning Based on Structures of Urban Road Networks Akinobu Goto, Shingo Takahashi, Kotaro Ohori, Shohei Yamae, Hiroaki Iwashita, Hirokazu Anai	3720
Signal Phase Timing Impact on Traffic Delay and Queue Length-A Intersection Case Study Xiaobing Li	3722
Empty Container Stacking Operations: Case Study of an Empty Container Depot In Valparaiso Chile	3724

Jimena Pascual, Alice Smith