

# **Proceedings of the 2011 Winter Simulation Conference**

**(WSC 2011)**

**Phoenix, Arizona, USA  
11-14 December 2011**

**Pages 1-914**



**IEEE Catalog Number: CFP11WSC-PRT  
ISBN: 978-1-4577-2108-3**

# Table of Contents

## Preface

---

From the Editors

## About the Conference

---

About the Conference Sponsoring Organizations

WSC Board of Directors

WSC 2011 Conference Committee

WSC 2011 Program Structure and Track Coordinators

Referees

The WSC Conferences

## PhD Colloquium Keynote

---

**On Innovation, and Building and Sustaining a Successful Career in Research** 1  
Richard Fujimoto

## Vendor Tutorials

---

**ExtendSim Technology: Scenario Management** 12  
David Krahl

**Simulation Education - Seven Reasons for Change** 20  
Malcolm Beaverstock, Allen Greenwood

**Introduction to SIMIO** 29  
C. Dennis Pegden, David Sturrock

**AUTOMOD - Providing Simulation Solutions for over 25 Years** 39  
Daniel J. Muller

**Recent Innovations in SIMIO** 52  
David Sturrock, C. Dennis Pegden

**How the ExpertFit Distribution-Fitting Software Can Make Your Simulation Models More Valid** 63  
Averill M. Law

**Introduction to SAS Simulation Studio** 70  
Ed Hughes, Emily K. Lada

## Advanced Tutorials

---

*Inside Discrete Event Simulation Software*

**Inside Discrete-Event Simulation Software: How It Works and Why It Matters** 80  
Thomas J. Schriber, Daniel T. Brunner

<b><i>Estimating Value-at-Risk, cVAR, and Sensitivites</i></b>	
<b>Monte Carlo Estimation of Value-at-Risk, Conditional Value-at-Risk and Their Sensitivites</b>	<b>95</b>
Jeff Hong, Guangwu Liu	
<b><i>Simulation in Statistics</i></b>	
<b>Simulation in Statistics</b>	<b>108</b>
Christian P. Robert	
<b><i>Random Generation of Combinatorial Structures</i></b>	
<b>Random Generation of Combinatorial Structures: Boltzmann Samplers and Beyond</b>	<b>120</b>
Philippe Duchon	
<b><i>Catastrophe Modeling</i></b>	
<b>Correlation, Simulation and Uncertainty in Catastrophe Modeling</b>	<b>133</b>
Dag Lohmann, Feng Yue	
<b><i>Rare-event Simulation</i></b>	
<b>Rare Event Simulation Techniques</b>	<b>146</b>
Jose H. Blanchet, Henry Lam	
<b><i>Distributed Computing</i></b>	
<b>Distributed Computing and M&amp;S: Speeding up Simulation and Creating Large Models</b>	<b>161</b>
Simon Taylor, Mohammedmersin Ghorbani, Tamas Kiss, Daniel Farkas, Navonil Mustafee, Shane Kite, Stephen J. Turner, Steffen Strassburger	
<b><i>Large-Scale Modeling and Simulation</i></b>	
<b>How to Successfully Conduct Large-Scale Modeling and Simulation Projects</b>	<b>176</b>
Osman Balci	
<b><i>Verification and Validation</i></b>	
<b>Verification and Validation of Simulation Models</b>	<b>183</b>
Robert G. Sargent	
<b><u>Agent-based Simulation</u></b>	
<b><i>Evacuation and Flow Simulation</i></b>	
<b>Agent-based Discrete-event Hybrid Space Modeling Approach for Transportation Evacuation Simulation</b>	<b>199</b>
Bo Zhang, Wai Kin (Victor) Chan, Satish Ukkusuri	
<b>Including Airport Duty-Free Shopping in Arriving Passenger Simulation and the Opportunities this Presents</b>	<b>210</b>
Tristan Kleinschmidt, Xufeng Guo, Wenbo Ma, Prasad Yarlagadda	
<b>An Agent Based Model for Evacuation Traffic Management</b>	<b>222</b>
Manini Madireddy, Deborah Medeiros, Soundar Kumara	
<b><i>Traffic and Transportation</i></b>	
<b>A Multi-methodology Agent-based Approach for Container Loading</b>	<b>234</b>
Navonil Mustafee, Eberhard Bischoff	
<b>Strategic Behavior in a Living Environment</b>	<b>246</b>
Marco Luetzenberger, Sebastian Ahrndt, Benjamin Hirsch, Nils Masuch, Axel Hessler, Sahin Albayrak	

<b>Agent Based Simulation Design for Aggregation and Disaggregation</b>	<b>259</b>
Tiffany J. Harper, John O. Miller, Joseph R. Wirthlin, Raymond R. Hill	
<b>Agent-based Modeling Framework</b>	
<b>IMAGE-Scenarization: From Conceptual Models to Executable Simulation</b>	<b>271</b>
François Rioux, Michel Lizotte	
<b>Towards an Ontological Foundation of Agent-based Simulation</b>	<b>284</b>
Giancarlo Guizzardi, Gerd Wagner	
<b>A General-Purpose Graph Dynamical System Modeling Framework</b>	<b>296</b>
Chris Kuhlman, V. S. Kumar, Madhav Marathe, Henning Mortveit, Samarth Swarup, Gaurav Tuli, S. Ravi, Daniel Rosenkrantz	
<b>Model Theoretic Implications for Agent Languages in Support of Interoperability and Composability</b>	<b>309</b>
Andreas Tolk, Saikou Diallo, Jose Padilla, Heber Herencia-Zapana	
<b>Social and Behavioral Modeling</b>	
<b>Understanding the Impact of Communications Technologies on Virtual Team Performance: An Agent-based Simulation Model</b>	<b>321</b>
Vikas Sahasrabudhe, Shivraj Kanungo, Ramakrishna Iyer	
<b>Agentizing the Social Science of Crime</b>	<b>333</b>
Steven Wilcox	
<b>Integrating BDI Reasoning into Agent Based Modelling and Simulation</b>	<b>345</b>
Lin Padgham, David Scerri, Gaya Jayatilleke, Sarah Hickmott	
<b>Agent Behavior and Interaction</b>	
<b>Interaction Metric of Emergent Behaviors in Agent-based Simulation</b>	<b>357</b>
Wai Kin Victor Chan	
<b>Greedy Servers On a Torus</b>	<b>369</b>
Karl Stacey, Dirk Kroese	
<b>Informed Virtual Geographic Environments: A Geometrically-Precise and Semantically-Enriched Model for Multiagent Geosimulations</b>	<b>381</b>
Mehdi Mekni, Bernard Moulin	

## **Analysis Methodology**

---

### ***The Role of Probabilistic and Statistical Intuition in the Design and Analysis of Simulation Experiments***

<b>Thirty Years of "Batch Size Effects"</b>	<b>393</b>
Barry L. Nelson	
<b>Overlapping Batch Means: Something More for Nothing?</b>	<b>401</b>
Christos Alexopoulos, Dave Goldsman, James R. Wilson	
<b>An Introspective on the Retrospective-approximation Paradigm</b>	<b>412</b>
Raghu Pasupathy	
<b>Importance Sampling Analysis for Input Distributions</b>	
<b>Fitting Mixture Importance Sampling Distributions via Improved Cross-Entropy</b>	<b>422</b>
Tim Brereton, Joshua Chan, Dirk Kroese	
<b>Graph Reductions to Speed Up Importance Sampling-Based Static Reliability Estimation</b>	<b>429</b>

Pierre L'Ecuyer, Samira Saggadi, Bruno Tuffin

**A Cross-validation Approach to Bandwidth Selection for a Kernel-based Estimate of the Density of a Conditional Expectation** 439

Athanasios Avramidis

***Analysis for Input Distributions***

**Inverse Transform Method for Simulating Levy Processes and Discrete Asian Options Pricing** 444

Liming Feng, Zisheng Chen, Xiong Lin

**Using Pearson Type IV and Other Cinderella Distributions in Simulation** 457

Russell Cheng

**I-SMOOTH: Iteratively Smoothing Piecewise-Constant Poisson-Process Rate Functions** 469

Bruce Schmeiser, Huifen Chen

***Analysis Methods for Initialization Issues***

**Brownian bridge hypothesis testing for the initial transient problem** 481

Peter W. Glynn, Eunji Lim

**Interval estimation using replication/deletion and MSER truncation** 488

Paul J. Sanchez, K. Preston White

**Implementing MSER-5 in Commercial Simulation Software and its Wider Implications** 495

Katy Hoad, Stewart Robinson

***Rare Event Simulation***

**Rare Event Simulation for Rough Energy Landscapes** 504

Paul Dupuis, Konstantinos Spiliopoulos, Hui Wang

**Efficient Rare Event Simulation for Heavy-tailed Systems Via the Cross Entropy Method** 516

Jose Blanchet, Yixi Shi

**An Importance Sampling Method Based on a One-step Look-ahead Density From a Markov Chain** 528

Zdravko Botev, Pierre L'Ecuyer, Bruno Tuffin

***New Results in Simulation Output Analysis***

**Agent Based Output Analysis** 540

Lee Schruben, Dashi Singham

**On the Mean-Squared Error of Variance Estimators for Computer Simulations** 549

Tuba Aktaran-Kalayci, Christos Alexopoulos, David Goldsman, James R. Wilson

**Asymptotic Properties of Kernel Density Estimators When Applying Importance Sampling** 556

Marvin Nakayama

***Analysis Methodology Advances***

**Multiple Input and Multiple Output Simulation Metamodeling using Bayesian Networks** 569

Jirka Poropudas, Jouni Pousi, Kai Virtanen

**Towards a Measurement Tool for Verification and Validation of Simulation Models** 581

Zhongshi Wang

**Rethinking the Initialization Bias Problem in Steady-state Discrete Event Simulation** 593

Winfried Grassmann

***Real Time Decision Support***

<b>Simulation-based Real-time Performance Monitoring (SIMMON): a Platform for Manufacturing and Healthcare Systems</b>	<b>600</b>
Alireza Mousavi, Alexander Komashie, Siamak Tavakoli	
<b>Statistical Issues in Ad Hoc Distributed Simulations</b>	<b>612</b>
Ya-Lin Huang, Wonho Suh, Christos Alexopoulos, Richard Fujimoto, Michael Hunter	
<b>Real-time Data Assimilation</b>	<b>625</b>
Shoko Suzuki, Takayuki Osogami	

## **Business Process Modeling**

---

### ***Business Process Modeling of Manufacturing and Services***

<b>Rapid Modeling of Field Maintenance Using Discrete Event Simulation</b>	<b>637</b>
Abdullah Alabdulkarim, Peter Ball, Ashutosh Tiwari	
<b>Empirical Make or Buy Decision Making Model in The Japanese Automobile Industry</b>	<b>647</b>
Nguyen Minh	
<b>Assessing Inter-Organizational Dynamics of Manufacturing Service Supply Contracts</b>	<b>659</b>
Zbigniew J. Pasek	

### ***Business Process Modeling and Complex Systems***

<b>Agent-based Conceptual Model Representation Using BPMN</b>	<b>671</b>
Bhakti Stephan Onggo, Onder Karpaz	
<b>Modeling Human Behavior in Customer-based Processes: the Use of Scenario-based Surveys</b>	<b>683</b>
Alinda Kokkinou, David Cranage	
<b>Modeling A Complex Global Service Delivery System</b>	<b>690</b>
Yixin Diao, Aliza Heching, David Northcutt, George Stark	

### ***Simulating Information Flows and Workflows***

<b>Simulation Analysis of Multithreaded Programs under Deadlock-Avoidance Control</b>	<b>703</b>
Hongwei Liao, Hao Zhou, Stephane Lafortune	
<b>WORMS- A Framework to Support Workflows in M&amp;S</b>	<b>716</b>
Stefan Rybacki, Jan Himmelspach, Fiete Haack, Adelinde Uhrmacher	
<b>Maintenance Framework to Address the Interaction of Components Using Simulation</b>	<b>728</b>
Daniel Mota, Luiz Augusto Franzese, Marcelo Moretti Fioroni, Yuri Mourão, Douglas da Silva, Isac de Santana, Johanna Quevedo, Farley Ribeiro	

### ***Business Process Modeling Methodologies***

<b>Simulation Standard For Business Process Management</b>	<b>741</b>
John Januszczak, Geoff Hook	
<b>Modeling Server Usage for Online Ticket Sales</b>	<b>752</b>
Christine Currie, Lanting Lu	
<b>A Simulation-based Approach to Enhancing Project Schedules by the Inclusion of Remedial Action Scenarios</b>	<b>761</b>
Sanja Lazarova-Molnar, Rabeb Mizouni	

### ***Business Process Modeling and Simulation***

<b>Business Process Modelling and Simulation</b>	<b>773</b>
Geoffrey M. Hook	

<b>Simulation-based Evaluation of Dispatching Policies in Service Systems</b>	<b>779</b>
Dipyaman Banerjee, Gargi Dasgupta, Nirmitt Desai	
<b>Modeling and Managing Engineering Changes in a Complex Product Development Process</b>	<b>792</b>
Weilin Li, Young Moon	

## **Environmental and Sustainability Applications**

### ***Modeling and Simulation for Sustainable Infrastructure Construction and Operation***

<b>Using Schedule Simulation Approaches to Reduce Greenhouse Gas Emissions in Highway Construction Projects</b>	<b>805</b>
Pei Tang, Darrell Cass, Amlan Mukherjee	
<b>A Decision Framework for Energy Use Reduction Initiatives in Commercial Buildings</b>	<b>816</b>
Carol Menassa, Elie Azar	
<b>Collaborative Visualization of Simulated Processes Using Tabletop Fiducial Augmented Reality</b>	<b>828</b>
Suyang Dong, Vineet Kamat	

### ***Modeling and Simulation of Sustainable Development I***

<b>Development of Whole-building Energy Performance Models as Benchmarks for Retrofit Projects</b>	<b>838</b>
Omer T. Karaguzel, Khee Poh Lam	
<b>A Sustainability Toolkit for Simulaiton: Recent Developments and Future Capabilities</b>	<b>850</b>
Michael Kuhl, Xi Zhou	
<b>Combining Sustainability Criteria with Event Discrete Simulation</b>	<b>859</b>
Andi Widok, Volker Wohlgemuth, Bernd Page	

### ***Modeling and Simulation of Sustainable Development II***

<b>Simulation-based Utility Assessment of Real-time Information for Sustainable Mining Operations</b>	<b>871</b>
Sai Srinivas Nageshwaranier, Chao Meng, Young-Jun Son, Sean Dessureault	
<b>Toward a Building Occupant Network Agent-based Model to Simulate Peer-Induced Energy Conservation Behavior</b>	<b>883</b>
Jiayu Chen, John Taylor, Hsi Hsien Wei	
<b>Environmental Activity Based Cost using Discrete Event Simulation</b>	<b>891</b>
Jon Andersson, Anders Skoogh, Björn Johansson	

### ***Energy Efficient and Sustainable Buildings***

<b>Performance Modeling of Daylight Integrated Photosensor Controlled Lighting Systems</b>	<b>903</b>
Richard G. Mistrick, Craig A. Casey	
<b>Modeling and Simulation of Building Energy Performance for Portfolios of Public Buildings</b>	<b>915</b>
Young Lee	
<b>Conformal Adaptive Hexahedral Dominant Mesh Generation for CFD Simulation in Architectural Design Applications</b>	<b>928</b>
Rui Zhang, Khee Poh Lam, Yongjie Zhang	

### ***Waste Management and Utilities***

<b>A Generalized Simulation Framework to Manage Logistic Systems: A Case Study in Waste Management and Environmental Protection</b>	<b>943</b>
Roberto Revetria, Alessandro Testa, Lucia Cassettari	
<b>A Simulation-based Evaluation for a Strategic Residential Wastewater Network Master Plan</b>	<b>953</b>
Esra Aleisa, Osama Alkassar, Abrar Al-Jadi, Sarah Al-Sabah, Rana Hishmi	
<b>Utility Resource Planning using Modular Simulation and Optimization</b>	<b>963</b>
Juan Corredor, Nurcin Celik, Shihab Asfour, Young-Jun Son	
<b>GIS and Remote Applications</b>	
<b>Discrete Event Model of the Remotely-operable Tru Pipe Connector</b>	<b>976</b>
Reid Kress	
<b>Simulation in the Woods: From Remote Sensing based Data Acquisition and Processing to Various Simulation Applications</b>	<b>984</b>
Juergen Rossmann, Michael Schluse, Ralf Waspe, Ralf Moshhammer	
<b>Architecture for Integrated Modeling, Simulation and Visualization of Environmental Systems using GIS and CellDEVS</b>	<b>997</b>
Mariano Zapatero, Rodrigo Castro, Gabriel Wainer, Maysoun Houssein	
<b>Simulation of Natural Phenomena &amp; Man-Made Waste</b>	
<b>An Experimental Frame for the Simulation of Forest Fire Spread</b>	<b>1010</b>
Bahaa Nader	
<b>Natural Reforestation of Abandoned Eucalypt Plantations in the Brazilia National Forest</b>	<b>1023</b>
Charles Knadler, Jr., Georgia Sinimbu	
<b>A Methodological Approach to Manage WEEE Recovery Systems in a Push/Pull Logic</b>	<b>1035</b>
Mosè Gallo, Elpidio Romano, Liberatina Santillo	
<b>Modeling and Simulation of Environmental Processes and Technologies I</b>	
<b>RSB Tool: a Light-weight LCA Tool for the Assessment of Biofuels Sustainability</b>	<b>1048</b>
Jürgen Reinhard, Mireille Faist Emmenegger, Andi Widok, Tobias Ziep, Volker Wohlgemuth, Victoria Junquera	
<b>Energy Efficiency Analysis for a Casting Production System</b>	<b>1060</b>
Jonatan Berglund, John Michaloski, Jorge Arinez, Swee Leong, Guodong Shao, Frank Riddick, Stephan Biller	
<b>Impact of Hybrid and Electric Vehicles on the Automobile Recycling Infrastructure</b>	<b>1072</b>
Deogratias Kibira, Sanjay Jain	
<b>Modeling and Simulation of Environmental Processes and Technologies II</b>	
<b>Simulation Analysis for ERP Conducted in Japanese SMEs Using the Concept of MFCA</b>	<b>1084</b>
Xuzhong Tang, Soemon Takakuwa	
<b>Communicating Uncertainty Information Across Conceptual Boundaries</b>	<b>1096</b>
Paul Hyden, Elias Ioup, Stephen Russell	

## **Healthcare Applications**

---

### **Complex Systems Simulation in Healthcare**

<b>A Framework for Evidence-based Health Care Incentives Simulation</b>	<b>1103</b>
---	-------------



Ching-Hua Chen-Ritzo, Joseph Bigus, Robert Sorrentino	
<b>Estimation and Management of Pandemic Influenza Transmission Risk at Mass Immunization Clinics</b>	<b>1117</b>
Michael F. Beeler, Dionne M. Aleman, Michael W. Carter	
<b>Complex Systems Modeling for Supply and Demand in Health and Social Care</b>	<b>1125</b>
Sally C. Brailsford, Eric Silverman, Stuart Rossiter, Jakub Bijak, Richard J. Shaw, Joe Viana, Jason Noble, Sophia Efstathiou, Athina Vlachantoni	
<b><i>Simulation of Healthcare Systems I</i></b>	
<b>Why Doesn't Healthcare Embrace Simulation and Modeling; What Would It Take?</b>	<b>1137</b>
James Fackler, Michael Spaeder	
<b>Development and Validation of a Large Scale ICU Simulation Model with Blocking</b>	<b>1143</b>
Theologos Bountourelis, Louis Luangkesorn, Spencer Nabors, Gilles Clermont, Andrew Schaefer, Lisa Maillart	
<b>Using Simplified Discrete-event Simulation Models for Real World Health Care Applications</b>	<b>1154</b>
Anthony Virtue, Thierry Chausaulet, John Kelly	
<b><i>Simulation of Healthcare Systems II</i></b>	
<b>An Application of Discrete-Event Simulation to an Outpatient Healthcare Clinic with Batch Arrivals</b>	<b>1166</b>
Michael Findlay, Hank Grant	
<b>Simulation-based Study of Hematology Outpatient Clinics with Focus on Model Reusability</b>	<b>1178</b>
Navonil Mustafee, Fiona Hughes, Korina Katsaliaki, Michael Williams	
<b>A Simulation-based Modeling Framework to Deal with Clinical Pathways</b>	<b>1190</b>
Yasar Ozcan, Elena Tànfani, Angela Testi	
<b><i>Simulation of Emergency Services I</i></b>	
<b>A Better Approach to Modeling Emergency Care Service</b>	<b>1202</b>
Sankar Sengupta, Meredith Deneweth, Robert Van Til	
<b>Improving the Emergency Department Performance Using Simulation and MCDM Methods</b>	<b>1211</b>
Hamidreza Eskandari, Mohammadali Riyahifard, Shahrzad Khosravi, Christopher D. Geiger	
<b>Improving Simulation Results with Static Models</b>	<b>1223</b>
Martin Miller, Niloo Shahi, Ashley Dias	
<b><i>Simulation of Emergency Services II</i></b>	
<b>Simulation Optimization for Emergency Department Resources Allocation</b>	<b>1231</b>
Shao-Jen Weng, Bing-Chuin Chen, Ling-Ya Su, Shu-Ting Kwong, Lee-Min Wang, Chun-Yueh Chang	
<b>Using ABMS to Simulate Emergency Departments</b>	<b>1239</b>
Paula Escudero-Marin, Michael Pidd	
<b>Design of Centralized Ambulance Diversion Policies using Simulation-Optimization</b>	<b>1251</b>
Adrian Ramirez-Nafarrate, John Fowler, Teresa Wu	
<b><i>Simulation of Medical Systems</i></b>	
<b>Dynamic Mortality Simulation Model Incorporating Risk Indicators for Cardiovascular Diseases</b>	<b>1263</b>
Jocimara Ferranti, Paulo Freitas Filho	

<b>A Biologically Based Discrete-Event Simulation Model of Liver Transplantation in the United States for Pediatric and Adult Patients</b>	<b>1275</b>
Aditya Iyer, Gabriel Zenarosa, Andrew Schaefer, Chung-Chou Chang, Cindy Bryce, Mark Roberts	
<b>An Application of Factorial Design to Compare the Relative Effectiveness of Hospital Infection Control Measures</b>	<b>1283</b>
Sean Barnes, Bruce Golden, Edward Wasil, Jon Furuno, Anthony Harris	
<b>Healthcare Efficiency</b>	
<b>Using Simulation and Data Envelopment Analysis in Optimal Healthcare Efficiency Allocations</b>	<b>1295</b>
Shao-Jen Weng, Bo-Shiang Tsai, Yi-Lin Long, Lee-Min Wang, Chun-Yueh Chang, Donald Gotcher	
<b>A System Dynamics Model of Singapore Healthcare Affordability</b>	<b>B#5</b>
Adam Ng, Charlle Sy, Jie Li	
<b>Planning and Scheduling</b>	
<b>Managing Patient Backlog in a Surgical Suite that Uses a Block-Booking Scheduling System</b>	<b>1319</b>
Oleg Shylo, Louis Luangkesorn, Oleg Prokopyev, Jayant Rajgopal, Andrew Schaefer	
<b>Optimizing Surgery Start Times for a Single Operating Room via Simulation</b>	<b>1330</b>
Yang Sun, Xueping Li	
<b>A Simulation Tool to Support Recovery Bed Planning for Surgical Patients</b>	<b>1338</b>
Yariv Marmor, Thomas Rohleder, Todd Huschka, David Cook, Jeffrey Thompson	
<b>Disease Modeling</b>	
<b>Simulation of Mitigation Strategies for a Pandemic Influenza</b>	<b>1345</b>
Arsalan Paleshi, Gerald W. Evans, Sunderesh S. Heragu, Kamran S. Moghaddam	
<b>Efficient Implementation of Complex Interventions in Large Scale Epidemic Simulations</b>	<b>1354</b>
Yifei Ma, Keith Bisset, Jiangzhuo Chen, Suruchi Deodhar, Madhav Marathe	
<b>A System Dynamics Model of Tuberculosis Diffusion with Respect to Contact Tracing Investigation</b>	<b>1367</b>
Yuan Tian, Fatima Alawami, Assaad Al-Azem, Nathaniel Osgood, Vernon Hoepfner, Christopher Dutchyn	
<b>Introductory Tutorials</b>	
<hr/>	
<b>Introduction to Simulation</b>	
<b>Introduction To Simulation</b>	<b>1379</b>
Ricki G. Ingalls	
<b>Input Distributions</b>	
<b>How to Select Simulation Input Probability Distributions</b>	<b>1394</b>
Averill M. Law	
<b>Health Care Systems</b>	
<b>Simulation of Health Care Systems</b>	<b>1408</b>
Stephen D. Roberts	
<b>Tips for Successful Practice</b>	
<b>Tips for Successful Practice of Simulation</b>	<b>1420</b>

David Sturrock

***Conceptual Modeling***

- Choosing the Right Model: Conceptual Modeling for Simulation** 1428  
Stewart Robinson

***Design of Experiments***

- Better Than a Petaflop: the Power of Efficient Experimental Design** 1441  
Susan Sanchez, Hong Wan

***Agent Based Modeling***

- Introductory Tutorial on Agent-Based Modeling and Simulation** 1456  
Charles M. Macal, Michael J. North

***Successful Living as a Simulationist***

- Roadmap To Success: Your First Simulation Model** 1470  
Robin Clark, David Krahl

- Doing Simulation for a Living** 1481  
Mohamed Fayeze, Mansooreh Mollaghasemi, Fabio Zavagnini

***Integrating Data from Multiple Simulation Models of Different Fidelity***

- Panel Discussion: Integrating Data from Multiple Simulation Models of Different Fidelity** 1492  
Derek Bingham, Shane Reese, Brian Williams

## **Logistics, Transportation & SCM**

---

***Mesosopic and Perennial Approach to Traffic and Logistics Modeling***

- Anisotropic Mesoscopic Traffic Simulation Approach to Support Large-Scale Traffic and Logistic Modeling and Analysis** 1500  
Yi-Chang Chiu, Ye Tian

- A Mesoscopic Approach to Modeling and Simulation of Logistics Processes** 1513  
Tobias Reggelin, Juri Tolujew

- Perennial Simulation of a Legacy Traffic Model: Implementation, Considerations, and Ramifications** 1524  
Seth Hetu, Gary Tan

***Formal Modeling and Flexible Simulation***

- Formal Modeling of Global Supply Chains** 1536  
George Thiers, Leon McGinnis

- Use of IDEF-SIM to Document Simulation Models** 1547  
Joao Rangel, Alessandro Nunes

- Flexible Model for Analyzing Production Systems with Discrete Event Simulation** 1559  
Alexander Hübl, Klaus Altendorfer, Herbert Jodlbauer, Margaretha Gansterer, Richard Hartl

***RFID and Real-time Tracking Applications***

- RFID for Air Cargo Operations: Return On Investment Analysis through Process Modeling and Simulation** 1571  
Qing Cao, Brandon Good, Lynn DeRose

- A Simulation Approach To Evaluate The Impact Of RFID Technologies On A CTO** 1583

## **Environment**

Lobna Haouari, Nabil Absi, dominique Feillet

### **Modeling the Materials Handling in a Container Terminal Using Electronic Real-time Tracking Data** 1596

Yan Liu, Soemon Takakuwa

## ***Advances in Supply Chain Management***

### **Supply Chain Performance Sustainability Through Resilience Function** 1605

Elpidio Romano, Liberatina Santillo, Teresa Murino

### **Transparency, Consistency and Modularity of Strategic Reasoning: An Agent Architecture for Interactive Business Simulations** 1617

Rick van Krevelen, Martijn Warnier, Frances Brazier, Alexander Verbraeck, Thomas Corsi

## ***Advances in Inventory Control***

### **Evaluating Variance Reduction Techniques within an Sample Average Approximation Method for a Constrained Inventory Policy Optimization Problem** 1629

Yasin Unlu, Manuel Rossetti

### **Studying The Impact Of Various Inventory Policies On A Supply Chain With Intermittent Supply Disruptions** 1641

Avinash Samvedi, Vipul Jain

### **Analyzing a Stochastic Inventory System for Deteriorating Items with Stochastic Lead Time Using Simulation Modeling** 1650

Mohammadmahdi Alizadeh, Hamidreza Eskandari, Seyed Mehdi Sajadifar, Christopher D. Geiger

## ***Enhanced Efficiency in Material Handling Operations***

### **Impact of Different Unloading Zone Locations in Transshipment Terminals Under Various Forklift Dispatching Rules** 1663

Uwe Clausen, Jan Kaffka, Daniel Diekmann, Larissa Mest

### **Simulation Aided, Knowledge Based Routing for AGVs in a Distribution Warehouse** 1673

Alexander Klaas, Christoph Laroque, Matthias Fischer, Wilhelm Dangelmaier

### **Operations Modeling and Analysis of an Underground Coal Mine** 1685

Kanna Miwa, Soemon Takakuwa

## ***Risk Modeling, Assessment, and Applications***

### **Assessing Oil Spill Risk in Port Tanker Operations Using a Multiattribute Utility Approach to Ranking and Selection** 1696

John Butler, Jason R. W. Merrick, Douglas Morrice

### **Conditional Value-at-Risk Model in Hazardous Materials Transportation** 1708

Changhyun Kwon

### **Simulation-based Assessment of Change Propagation Effect in an Aircraft Design Process** 1715

Dong Xu, Sai Srinivas Nageshwaranier, Young-Jun Son, Shuguang Song

## ***Simulation Optimization Applications***

### **ENHANCING OPERATIONAL EFFICIENCY OF A CONTAINER OPERATOR: A SIMULATION OPTIMIZATION APPROACH** 1727

Santanu Sinha, Viswanath Ganesan

### **Optimization of Scenario Construction for Loss Estimation in Lifeline Networks** 1739

Nathanael Brown, Jared Gearhart, Dean Jones, Linda Nozick, Natalia Romero, Ningxiong Xu

**Coupling Reliability and Logistical Considerations for Complex System of Systems Using Stochastic Petri Nets** 1751  
Vitali Volovoi, David Peterson

***Service Systems Applications***

**EPFAST: a Model for Simulating Uncontrolled Islanding in Large Power Systems** 1763  
Edgar Portante, Brian Craig, Leah Malone, James Kavicky, Stewart Cedres, Stephen Folga

**Simulating Calls for Service for an Urban Police Department** 1775  
J. Brooks, David Edwards, Toni Sorrell, Sudharshana Srinivasan, Robyn Diehl

**Check-in Processing: Simulation of Passengers with Advanced Traits** 1783  
Wenbo Ma, Tristan Kleinschmidt, Clinton Fookes, Prasad Yarlagadda

**MASM**

---

***Equipment Modeling***

**Aggregate Modelling of Semiconductor Equipment Using Effective Process Times** 1795  
L.F.P. Etman, C.P.L. Veeger, E. Lefeber, I.J.B.F. Adan, J.E. Rooda

**Automated Generation of Analytical Process Time Models for Cluster Tools in Semiconductor Manufacturing** 1808  
Robert Kohn, Oliver Rose

**Simulation-Based Framework to Automated Wet-Etch Station Scheduling Problems in the Semiconductor Industry** 1821  
Adrián Aguirre, Vanina Cafaro, Carlos Alberto Mendez

***Fab Simulation I***

**Cluster-based Analytical Method for the Lot Delivery Forecast of a Semiconductor Fab with a Wide Product Range** 1834  
Marcin Mosinski, Daniel Noack, Oliver Rose, Wolfgang Scholl

**Challenges and Solution Approaches for the Online Simulation of Semiconductor Wafer Fabs** 1845  
Daniel Noack, Marcin Mosinski, Oliver Rose, Peter Lendermann, Boon Ping Gan, Wolfgang Scholl

**Simulation-Based Optimization for Groups of Cluster Tools in Semiconductor Manufacturing using Simulated Annealing** 1857  
Tobias Uhlig, Oliver Rose

***Fab Simulation II***

**Overview of Techniques for Model-driven Development of a Simulation Package** 1869  
Pascal Weyprecht, Oliver Rose

**Cluster Tool Design Comparisons Via Simulation** 1877  
Kyungsu Park, James Morrison

**A Virtual Equipment as a Test Bench for Evaluating Virtual Metrology Algorithms** 1888  
Andreas Mattes, Matthias Koitzsch, Dirk Lewke, Michael Müller-Zell, Martin Schellenberger

***Fab Modeling and Control***

**Manufacturing Intelligence for Determining Machine Subgroups to Enhance Yield in Semiconductor Manufacturing** 1898  
Chen-Fu Chien, Chia-Yu Hsu, Ying-Jen Chen, Yi-Hao Yeh

**A Smart Sampling Scheduling and Skipping Simulator and its Evaluation on Real Data** 1908

## **Sets**

Claude Yugma, Stéphane Dauzère-Pérès, Jean-Loup Rouveyrol, Philippe Vialletelle, Jacques Pinaton, Christophe Relliaud

### **Impact Of Control Plan Design On Tool Risk Management: A Simulation Study In Semiconductor Manufacturing 1918**

Gloria Luz Rodriguez Verjan, Stéphane Dauzère-Pérès, Jacques Pinaton

## ***Fab Modeling I***

### **Application of Tool Science Techniques to Improve Tool Efficiency for a Dry Etch Cluster Tool 1926**

Dongjin Kim, Lixin Wang, Robert Havey

### **Implementation of a Simulation Based Short-Term Lot Arrival Forecast in a 200mm Mature Semiconductor Fab 1932**

Wolfgang Scholl, Boon Ping Gan, Daniel Noack, Peter Lendermann, Patrick Preuss, Falk Pappert

### **Simulating Conveyor-Based AMHS Layout Configurations in Small Wafer Lot Manufacturing Environments 1944**

Leanna Miller, Alger Bradley, Ashley Tish, Tongdan Jin, Jesus Jimenez, Robert Wright

## ***Fab Modeling II***

### **A Detailed Model for a High-mix Low-Volume ASIC Fab 1953**

Mike Gissrau, Oliver Rose

### **Design of a Manufacturing Facility Layout with a Closed Loop Conveyor with Shortcuts Using Queueing Theory and Genetic Algorithms 1964**

Dima Nazzal, Vernet Lasrado

### **Effective Wip Dependent Lot Release Policies : a Discrete Event Simulation Approach 1976**

Raha Akhavan-Tabatabaei, Carlos Felipe Ruiz Salazar

## ***Fab Scheduling I***

### **An Optimization Approach for Parallel Machine Problems with Dedication Constraints: Combining Simulation and Capacity Planning 1986**

Andreas Klemmt, Gerald Weigert

### **Scheduling Job Families on non-identical Parallel Machines with Time Constraints 1999**

Ali Obeid, Stéphane Dauzère-Pérès, Claude Yugma

### **A Comparison of Heuristics To Solve a Single Machine Batching Problem with Unequal Ready Times of the Jobs 2011**

Oleh Sobeyko, Lars Moench

## ***Fab Modeling III***

### **Implementing Virtual Metrology Into Semiconductor Production Processes - An Investment Assessment 2022**

Matthias Koitzsch, Jochen Merhof, Markus Michl, Humbert Noll, Alexander Nemecek, Alfred Honold, Gerhard Kleineidam, Holger Lebrecht

### **On the Fidelity of the AX+B Equipment Model for Clustered Photolithography Scanners in Fab-level Simulation 2034**

James Morrison

### **Using Static Capacity Modeling and Queueing Theory Equations to Predict Cycle Time Performance in Semiconductor Manufacturing 2045**

Roland Schelasin

### ***Fab Scheduling II***

**Scheduling Policies in Multi-product Manufacturing Systems with Sequence-dependent Setup Times** 2055

Wei Feng, Li Zheng, Jingshan Li

**Real Time Dispatching - A Catalyst To Assembly Test Manufacturing Execution Automation** 2067

Bala Iyer, Binay Dash

**Cyclic Scheduling of Cluster Tools with Non-Identical Chamber Access Times** 2073

Dae-Kyu Kim, Chihyun Jung, Yu-Ju Jung, Tae-Eog Lee

### ***Fab Operations***

**A Composite Rule Combining Due Date Control and WIP Balance in a Wafer Fab** 2085

Zhugen Zhou, Oliver Rose

**Symbiotic Simulation for Optimisation of Tool Operations in Semiconductor Manufacturing** 2093

Heiko Aydt, Wentong Cai, Stephen Turner, Boon Ping Gan

**Optimized Management of Excursions in Semiconductor Manufacturing** 2105

Justin Nduhura Munga, Stéphane Dauzère-Pérès, Philippe Vialletelle, Claude Yugma

### ***Supply Chain***

**Modeling Supply Contracts in Semiconductor Supply Chains** 2113

Konstanze Knoblich, Hans Ehm, Cathal Heavey, Peter Williams

**Towards a Supply Chain Simulation Reference Model for the Semiconductor Industry** 2124

Hans Ehm, Hanna Wenke, Lars Moench, Thomas Ponsignon, Lisa Forstner

## **Manufacturing Applications**

---

### ***Sustainable Manufacturing***

**A Method for Determining the Environmental Footprint of Industrial Products Using Simulation** 2136

Erik Lindskog, Linus Lundh, Jonatan Berglund, Tina Lee, Anders Skoogh, Björn Johansson

**The Hanford Waste Feed Delivery Operations Research Model** 2148

Joanne Berry, Vishvas Patel, Karthik Vasudevan

**Simulation-aided Design and Evaluation of Flexible Working Times** 2159

Gert Zülch, Patricia Stock, Michael Leupold

### ***Self-generated Models***

**LEAN+ Manufacturing Process Analysis Simulation (LPAS+)** 2171

Michael L. Gregg, Steven E. Saylor, Sean Van Andel

**Factory Flow Design and Analysis Using Internet-enabled Simulation-based Optimization and Automatic Model Generation** 2181

Amos H.C. Ng, Jacob Bernedixen, Matias Urenda Moris, Mats Jägstam

**Generic Framework for Simulating Networks Using Rule-Based Queue and Resource-Task Network** 2194

Naoko Akyia, Scott J. Bury, John M. Wassick

### ***Standards and Interoperability***

**A General Model Description for Discrete Processes** 2206

Oliver Schönherr, Oliver Rose	
<b>Model Building With Core Manufacturing Simulation Data Translators</b>	<b>2219</b>
Jonathan Fournier	
<b>Initialization of Simulation Models Using CMSD</b>	<b>2228</b>
Soeren Bergmann, Soeren Stelzer, Steffen Strassburger	
<b><i>Decision Support</i></b>	
<b>Simulation Modeling of Tool Delivery System in a Machining Line</b>	<b>2240</b>
Benny Tjahjono, John Ladbrook	
<b>The Impact of Product Variety on Logistics Performance</b>	<b>2250</b>
Xavier De Groot, Enver Yucesan	
<b>Using Discrete-event Simulation for Evaluating Non-linear Supply Chain Phenomena</b>	<b>2260</b>
Xu Yang, Edgar Blanco, Erica Gralla, Gary Godding, Emily Rodriguez	
<b><i>Efficient Work-procedures</i></b>	
<b>Selecting Abstraction Levels in Simulation Models of Complex Manufacturing Systems</b>	<b>2273</b>
Karthik Vasudevan, Ashish Devikar	
<b>SakerGrid: Simulation Experimentation Using Grid Enabled Simulation Software</b>	<b>2283</b>
Shane Kite, Chris Wood, Simon Taylor, Navonil Mustafee	
<b>Developing a Web-enable HLA Federate Based on Portico RTI</b>	<b>2294</b>
Zhiying Tu, Gregory Zacharewicz, David Chen	
<b><i>Process Industries</i></b>	
<b>A New Dynamic Scheduling Approach for Batch Processing Systems Using Stochastic Utility Evaluation Function</b>	<b>2307</b>
Hongsuk Park, Andy Banerjee	
<b>Best Practices for Effective Application of Discrete Event Simulation in the Process Industries</b>	<b>2320</b>
Scott J. Bury, Bikram R. Sharda	
<b>Real Time Performance Measurement for Batch Chemical Plants</b>	<b>2330</b>
Pradeep Suresh Babu, John M. Wassick, Jeff Ferrio	
<b><i>Decision Support and Optimization</i></b>	
<b>Modeling PCB Assembly Lines in Ems Provider's Environment-integrating Product Design into Simulation Models</b>	<b>2341</b>
Jing Li, Nagen Nagarur, Krishnaswami Srihari	
<b>Simulation-based Optimization of Paint Shops</b>	<b>2351</b>
Marco Lemessi, Thomas Schulze, Simeon Rehbein	
<b>Performance Analysis of Commercial Simulation-based Optimization Packages: OPTQUEST AND WITNESS OPTIMIZER</b>	<b>2363</b>
Hamidreza Eskandari, Ehsan Mahmoodi, Hamed Fallah, Christopher D. Geiger Geiger	
<b><i>Simulation-based scheduling</i></b>	
<b>Simulation Optimization of Part Input Sequence in a Flexible Manufacturing System</b>	<b>2374</b>
Howe Chiat Cheng, David Chan	
<b>A Prototype Simulation Tool for a Framework For Simulation-based Optimization of Assembly Lines</b>	<b>2383</b>
Evangelos Angelidis, Falk Stefan Pappert, Oliver Rose	



### ***Optimization in Manufacturing***

- A Multicriteria Simulation Optimization Method For Injection Molding** 2395  
Maria G. Villarreal-Marroquin, Jose Castro, Mauricio Cabrera-Rios
- Simulation based Optimization Model for the Lean Assessment in SME: A Case Study** 2408  
Amr Mahfouz, John Shea, Amr Arisha
- Nonlinear Optimization to Generate Non-overlapping Random Dot Patterns** 2419  
Takashi Imamichi, Hidetoshi Numata, Hideyuki Mizuta, Tsuyoshi Ide

## **Military Applications**

---

### ***Simulation in Combat Models***

- The Effects of Time Advance Mechanism on Simple Agent Behaviors in Combat Simulations** 2431  
Ahmed Al Rowaei, Arnold Buss, Stephen Lieberman
- Applications of Flocking Algorithms to Input Modeling for Agent Movement** 2443  
Dashi I. Singham, Meredith A. Thompson, Lee W. Schruben
- Development and the Deployment of COSAGE 2.0** 2450  
Nathan Dietrich, David Smith, Miles (Doug) Edwards

### ***Simulation of Army Personnel Issues***

- Simulation of Personnel in ARFORGEN to Predict Effects of Structure, Policy, and Demand Changes** 2458  
David W. Hughes, Paul Kucik, Mark Zais
- Shaping Senior Leader Officer Talent: Using a Multi-dimensional Model of Talent to Analyze the Effect of Personnel Management Decisions and Attrition on the Flow of Army Officer Talent throughout the Officer Career Model.** 2471  
Paul Kucik, Samuel Huddleston, David Lyle, Matthew Dabkowski
- On the Estimation of Operations and Maintenance Costs for Defense Systems** 2483  
Jay Martin, Daniel Finke, Christopher Ligetti

### ***Use of Simulation in Canadian Forces***

- 1 Canadian Forces Flying Training School (1 CFFTS) Resource Allocation Simulation Tool** 2495  
René Séguin
- Modeling and Simulation of Military Tactical Logistics Distribution** 2507  
Samir Sebbah, Ahmed Ghanmi, Abdeslem Boukhtouta
- The Managed Readiness Simulator: A Force Readiness Model** 2519  
Christine Scales, Stephen Okazawa, Michael Ormrod

### ***Logistics and Mobility***

- An Analytical Approach to Low Observable Maintenance Practices Using Simulation and Marginal Analysis** 2530  
Stephanie Ysebaert, Alan Johnson, John Miller, Timothy Pettit
- Scheduling Fighter Aircraft Maintenance with Reinforcement Learning** 2540  
Ville Mattila, Kai Virtanen
- A Simulation Based Analysis of the B-1B'S AN/ALQ-161 Maintenance Process** 2552  
Raymond Hill, Ricardo Garza

### ***Support of Live-Virtual-Constructive Events***

**Transitioning to NextGen Defense Training Environment** 2564  
Warren Bizub Bizub, Julia Brandt

**Using the Levels of Conceptual Interoperability Model and Model-based Data Engineering to Develop a Modular Interoperability Framework** 2576  
Saikou Diallo, Andreas Tolk, Jason Graff, Anthony Barraco

**Application of Coalition Battle Management Language (C-BML) and C-BML Services to Live, Virtual, and Constructive (LVC) Simulation Environments** 2587  
Curtis Blais

### ***Navy and Marine Corps Counter-Mine and IED***

**System Performance and Layered Analysis Tool** 2600  
John C. Hyland, Cheryl M. Smith

**Enhanced Naval Mine Warfare Simulation Framework** 2612  
Timothy E. Floore, George H. Gilman

## **Homeland Security and Military Applications**

### ***Cyber Attacks and Interoperability Difficulties***

**An Event Buffer Flooding Attack in DNP3 Controlled SCADA Systems** 2619  
dong jin, David M. Nicol, Guanhua Yan

**Modeling Cyber Attacks and Their Effects on Decision Process** 2632  
Erdal Cayirci, Reyhaneh Ghergherehchi

**Difficulties With True Interoperability In Modeling & Simulation** 2642  
Scott Gallant, Chris Gaughan

## **Homeland Security/Aviation/Emergency Response**

### ***Humanitarian Operations***

**Representation of Humanitarian Aid / Disaster Relief Missions with an Agent Based Model to Analyze Optimal Resource Placement** 2654  
Andrew Turner, Santiago Balestrini-Robinson, Dimitri Mavris

**Using Discrete Event Simulation to Evaluate The Logistics of Medical Attention During The Relief Operations in An Earthquake in Bogota** 2666  
Diomar Noreña, Raha Akhavan-Tabatabaei, Luis Yamin, Wilfredo Ospina

**Generating and Managing Realistic Victims for Medical Disaster Simulations** 2679  
Filip Van Utterbeeck, Christophe Ullrich

## **Modeling Methodology**

### ***Simulation Strategies I***

**A General Model for Soft Body Simulation in Motion** 2690  
Jaruwan Mesit, Ratan Guha

**RMSim: A Java Library for Simulating Revenue Management Systems** 2703  
Marco Bijvank, Pierre L'Ecuyer, Patrice Marcotte

**Designs for the Complementary Use of System Dynamics and Discrete-Event Simulation** 2715

Jennifer Morgan, Susan Howick, Valerie Belton

***Distributed Simulation I***

**A Binary Partition-based Matching Algorithm for Data Distribution Management in the HLA/RTI** 2728

Junghyun Ahn, Changho Sung, Tag Gon Kim

**A Methodology for Managing Distributed Virtual Environment Scalability** 2740

Lally Singh, Denis Gracanin

**An Interest Management Scheme for Mobile Peer-to-Peer Systems** 2752

Ying Li, Richard Fujimoto

***Model Analysis & Cross-Paradigm Modeling***

**An Alternative Approach To Avoiding Overfit For Surrogate Models** 2765

Huu Minh Nguyen, Ivo Couckuyt, Dirk Gorissen, Yvan Saeys, Luc Knockaert, Tom Dhaene

**Multivariate Arrival Rate Estimation using Semidefinite Programming** 2777

David Papp, Farid Alizadeh

**Cross-Paradigm Simulation Modeling: Challenges and Successes [PANEL, 1 hour]** 2788

Susan K. Heath, Sally C. Brailsford, Arnold Buss, Charles M. Macal

***Simulation Strategies II***

**Applying Enhanced Fault Localization Technology to Monte Carlo Simulations** 2803

David Kamensky, Ross Gore, Paul Reynolds

**Advanced 3D Visualization for Simulation using Game Technology** 2815

Jonatan Leonard Bijl, Csaba Attila Boer

**Using Hybrid Process Simulation to Evaluate Manufacturing System Component Choices: Integrating a Virtual Robot with Physical System** 2827

Janani Viswanathan, William Harrison, Dawn Tilbury, Fangming Gu

***Optimization Methods in Modeling***

**The Simulation-based Multi-objective Evolutionary Optimization (SIMEON) Framework** 2839

Ronald Halim, Mamadou Seck

**A Robust Evolutionary Strategy for Generative Validation of Agent-based Models using Adaptive Simulation Ensembles** 2852

Levent Yilmaz, Osman Balci, Guangyu Zou

**Stochastic Policy Search For Variance-penalized Semi-Markov Control** 2865

Abhijit Gosavi, Mandar Purohit

***Simulation Strategies III***

**A Method for Simulation State Mapping between Discrete Event Material Flow Models of Different Level of Detail** 2877

Daniel Huber, Wilhelm Dangelmaier

**What is New with the Activity World View in Modeling and Simulation? Using Activity as a Unifying Guide for Modeling and Simulation** 2887

David R.C. Hill, Alexandre Muzy

**Self-Simulating Systems** 2900

Lee Schruben

***Web Simulation and Ontologies***

**Challenges for Web Simulation Science** 2909

Simon Taylor

**SoPT: Ontology for Simulation Optimization for Scientific Experiments** 2914

Jun Han, John A. Miller, Gregory A. Silver

**Linking Simulation and Visualization Construction through Interactions with an Ontology Visualization** 2926

Zach Ezzell, Paul A. Fishwick, Juan Cendan

### ***High Performance Modeling and Simulation***

**Interaction Based HPC Modeling of Social, Biological, and Economic Contagions Over Large Networks** 2938

Keith Bisset, Jiangzhuo Chen, Chris J. Kuhlman, V. S. Anil Kumar, Madhav Marathe

**Investigating the Memory Characteristics of a Massively Parallel Time Warp Kernel** 2953

Christopher D. Carothers, Akintayo Holder

**The Backstroke Framework for Source Level Reverse Computation Applied to Parallel Discrete Event Simulation** 2965

George Vulov, Cong Hou, Richard Vuduc, Daniel Quinlan, Richard Fujimoto, David Jefferson

### ***M&S Standards***

**Towards a Methodological Approach to Identify Future M&S Standard Needs** 2980

Andreas Tolk, Osman Balci, Saikou Diallo, Paul Fishwick, Xiaolin Hu, Margaret Loper, Mikel Petty, Paul Reynolds, Hessam Sarjoughian, Bernard Zeigler

### ***Distributed Simulation II***

**Traces Generation to Simulate Large-Scale Distributed Applications** 2998

Emilio Mancini, Olivier Dalle

**Modelling and Simulation-based Design of a Distributed DEVS Simulator** 3007

Eugene Syriani, Hans Vangheluwe

**On-the-fly Parallelization of Sequential Agent-Based Simulation Systems** 3022

Cole Sherer, George Vulov, Maria Hybinette

### ***Model-Driven Engineering***

**Experimenting with the Multiple Worlds Concept to Support the Design of Automated Container Terminals** 3030

Michele Fumarola, Gwendolyn Kolfschoten, Cornelis Versteegt, Alexander Verbraeck

**Integrated Care Development using Systems Modeling - a Case Study of Intermediate Care** 3037

Tillal Eldabi, Peter Lacey, Aisha Naseer, Mohsen Jahangirian

**Metamodeling and Model Transformations in Modeling and Simulation** 3048

Deniz Cetinkaya, Alexander Verbraeck

### ***Ontology and Pattern-Oriented Modeling***

**An Approach to Semantic-based Model Discovery and Selection** 3059

Claudia Szabo, Yong Meng Teo

**P4-SimSaaS: Policy Specification for Multi-tendency Simulation Software-as-a-Service Model** 3072

Wu Li, Wei-Tek Tsai, Xiaoying Bai, Jay Elston

**Product Design Patterns for Agent-based Modeling** 3087

Michael J. North, Charle M. Macal

### ***Social Simulation Methodologies***

- CPI MODELING: COLLABORATIVE, PARTICIPATIVE, INTERACTIVE MODELING** 3099  
Joseph Barjis
- Towards Simulation of Organizational Norms** 3109  
Oana Nicolae, Gerd Wagner
- Primer for Building Factor Trees To Represent Social-Science Knowledge** 3121  
Paul K. Davis

## **Networks**

---

### ***Sustainable Networks***

- Simulation of Wireless Sensor Networks Under Partial Coverage** 3136  
Ruth Lamprecht, Peter Kemper
- The Asymmetric Diffusion of Trust Between Communities: Simulations of Dynamic Social Networks** 3146  
Marco Cremonini, Luca Allodi, Luca Chiodi
- Using Approximate Dynamic Programming to Optimize Admission Control in Cloud Computing Environment** 3158  
Zohar Feldman, Michael Masin, Asser Tantau, Diana Arroyo, Malgorzata Steinder

### ***Virtual Networks***

- Modeling Cellular Network Traffic with Mobile Call Graph Constraints** 3170  
Junwhan Kim, Anil Vullikanti, Achla Marathe, Guan hong Pei, Sudip Saha, Balaaji Sunapanasubbiah
- A Case for Virtualization of Content Delivery Networks** 3183  
Andre Moreira, Josilene Moreira, Djamel Sadok, Arthur Callado, Moises Rodrigues, Marcio Neves, Victor Souza, Per Karlsson

### ***Vulnerability Analysis***

- Survivability of Dual Core Networks During Rare Events** 3195  
Steven Gordon, David Garbin
- Simulating Energy Efficient Wireless Sensor Networks Using Cellular Automata** 3207  
Xiaoyun Xu, Xi Zhang, Long Wang
- Simulating Network Cyber Attacks Using Splitting Techniques** 3217  
Denise M. Masi, Martin J. Fischer, John F. Shortle, Chun-Hung Chen

### ***Frameworks***

- A Framework for Modeling Stochastic Flow and Synchronization Networks** 3229  
Mengran Xue, Sandip Roy
- Comparison of the Experimental and Simulation Results for Distributed Virtual Environments Applications Framework** 3241  
Xiaoyu Zhang, Denis Gracanin
- A Simple Framework to Simulate the Mobility and Activity of Theme Park Visitors** 3253  
Vladimir Vukadinovic, Fabian Dreier, Stefan Mangold

### ***Architectures***

- Simulation Based Experiments Using EDNAS: The Event-Driven Network Architecture Simulator** 3266  
Sean Salmon, Hala ElAarag

<b>Identification and Approximations for Systems with Multi-Stage Workflows</b>	<b>3278</b>
Parijat Dube, Jian Tan, Li Zhang	
<b>S3F: The Scalable Simulation Framework Revisited</b>	<b>3288</b>
David Nicol, Dong Jin, Yuhao Zheng	
<b><i>Modeling and Simulation of Cloud Computing Environments</i></b>	
<b>Modular Performance Simulations of Clouds</b>	<b>3300</b>
Peter Altevogt, Tibor Kiss, Wolfgang Denzel	
<b>Optimizing Service Replications in Clouds</b>	<b>3312</b>
Mathias Bjorkqvist, Lydia Y. Chen, Walter Binder	
<b>Modeling Web Usage Profiles of Cloud Services for Utility Cost Analysis</b>	<b>3323</b>
Joseph R. Idziorek, Mark F. Tannian, Douglas Jacobson	
<b><i>Network Structures</i></b>	
<b>Extracting Hierarchies With Overlapping Structure From Network Data</b>	<b>3335</b>
Brian Cloteaux	
<b>Linear Algebra &amp; Sequential Importance Sampling for Network Reliability</b>	<b>3344</b>
David G. Harris, Francis Sullivan, Isabel Beichl	
<b>Directed 3-cycle Anchored Digraphs and Their Application in the Uniform Sampling of Realizations from a Fixed Degree Sequence</b>	<b>3353</b>
Michael D. LaMar	

## **Project Management & Construction**

---

<b><i>Energy Simulation and Building Information Modeling I</i></b>	
<b>Energy Balance Framework for Net Zero Energy Buildings</b>	<b>3365</b>
Ravi Srinivasan, Daniel Campbell, William Braham, Charlie Curcija	
<b>Simulating the Impact of Building Occupant Peer Networks on Inter-building Energy Consumption</b>	<b>3378</b>
Xiaoqi Xu, Anna Laura Pisello, John Taylor	
<b>Validation of Autodesk Ecotect Accuracy for Thermal and Daylighting Simulations</b>	<b>3388</b>
Prasanthi Vangimalla, Svetlana Olbina, Raymond Issa, Jimmie Hinze	
<b><i>Energy Simulation and Building Information Modeling II</i></b>	
<b>Building Code Compliance Checking Using BIM Technology</b>	<b>3400</b>
Tang-Hung Nguyen, Jin-Lee Kim	
<b>Defining Background Tasks in SIMFC</b>	<b>3406</b>
Jamal Siadat, Janaka Ruwanpura, Reza Dehghan	
<b>Sustainability and Socio-enviro-technical Systems: A Prototype Agent Based Model to Generate Inputs for Costing Capital Facilities</b>	<b>3417</b>
Kristen L. Sanford Bernhardt, Annie Pearce, Michael Garvin	
<b><i>Construction Project Process Modeling and Simulation I</i></b>	
<b>Simulation Projects Management Using Scrum</b>	<b>3426</b>
Eduardo Quaglia, Claudia Tocantins	
<b>Using Simulation to Study the Impact of Improving Lookahead Planning on the Reliability of Production Planning</b>	<b>3436</b>
Farook Hamzeh, Brandon Langerud	

<b>Integrating Realtime Project Progress Input into a Construction Simulation Model</b>	<b>3448</b>
Hua Xie, Simaan AbouRizk, Siri Fernando	
<b>Scheduling Simulation-based Techniques for Earned Value Management on Resource-constrained Schedules under Delayed Scenarios</b>	<b>3460</b>
Ming-Fung Siu, Ming Lu	
<b><i>Construction Project Process Modeling and Simulation II</i></b>	
<b>Foresight: a Graphically Based Approach to Modeling Construction Processes</b>	<b>3472</b>
Ian Flood	
<b>Development of Model of Workers' Mental Processes Related to Absence Norm as Behavior Rule in Agent-based Simulation</b>	<b>3484</b>
Seungjun Ahn, SangHyun Lee	
<b>Process-Based Simulation Library for Construction Project Planning</b>	<b>3493</b>
Raimar Scherer, Ali Ismail	
<b><i>Project Planning and Scheduling - Modeling, Simulation and Visualization</i></b>	
<b>Analyzing Transit Tunnel Construction Strategies using Discrete Event Simulation</b>	<b>3505</b>
Elmira Moghani, Hala AbouRizk, Simaan AbouRizk, Heiner Sander	
<b>Application of Integrated Construction Simulation and Traffic Simulation in Planning Pipe-jacking Operations in Urban Areas</b>	<b>3516</b>
Sze Chun Lau, Ming Lu, Chi Sun Poon	
<b>Server - Client Applications Aided By Generic Simulations Regarding Earthmoving Operations In Civil Engineering Projects</b>	<b>3526</b>
Daniel Sierra, Jose Guevara, Fidel Torres, Hernando Vargas, Ana Ozuna, Javier Prieto	
<b><i>Use of BIM for Construction Simulation</i></b>	
<b>Towards Real-time Simulation of Construction Activities Considering Spatio-temporal Resolution Requirements for Improving Safety and Productivity</b>	<b>3538</b>
Amin Hammad, Cheng Zhang	
<b>Analysis of the Differences in Energy Simulation Results between Building Information Modeling (BIM)-based Simulation Method and the Detailed Simulation Method</b>	<b>3550</b>
Seongchan Kim, Jeong H. Woo	
<b>A Robust Positioning Architecture for Construction Resources Localization Using Wireless Sensor Networks</b>	<b>3562</b>
Meimanat Soleimanifar, Ming Lu, Ioanis Nikolaidis, SangHyun Lee	
<b><i>Visualization in Construction Simulation</i></b>	
<b>A Collaborative Augmented Reality Based Modeling Environment For Construction Engineering And Management Education</b>	<b>3573</b>
Amir Behzadan, Asif Iqbal, Vineet Kamat	
<b>Loosely Coupled Visualization of Industrial Construction Simulation Using a Gaming Engine</b>	<b>3582</b>
Amr ElNimr, Yasser Mohamed	
<b>Generating the Sparse Point Cloud of a Civil Infrastructure Scene Using a Single Video Camera under Practical Constraints</b>	<b>3593</b>
Fei Dai, Abbas Rashidi, Ioannis Brilakis, Patricio Vela	

## **Quality, Statistics, Reliability**

### ***Design of Experiments and Optimization***

- Improved Efficient, Nearly Orthogonal, Nearly Balanced Mixed Designs** 3605  
Helcio Vieira Junior, Susan Sanchez, Karl Kienitz, Carmen Belderrain
- Production Planning for Semiconductor Manufacturing via Simulation Optimization** 3617  
Feng Yang, Jingang Liu, Chihui Li, Hong Wan, Reha Uzsoy
- Relative Error Stochastic Kriging** 3628  
Mustafa Tongarlak, Bruce Ankenman, Barry Nelson

### ***Validation, Interpretation, and Modeling Languages***

- Simulation Validation Using Causal Inference Theory with Morphological Constraints** 3641  
William Reynolds, Frank Wimberly
- The Consequences of How Subject Matter Expert Estimates Are Interpreted and Modelled, Demonstrated by an Emergency Department Des Model Comparing Triangular and Beta Distributions** 3654  
Lene Holm, Mathias Barra
- VeriTAS - A Versatile Modeling Environment for Test-driven Agile Simulation** 3662  
Anatoli Djanatliev, Winfried Dulz, Reinhard German, Vitali Schneider
- Shift, Narrow, and Chop to Improve Process Capability** 3672  
Alan Bowman, Josef Schmee

## **Railroad Applications**

### ***Railroad Network Simulation***

- Simulating the Effects of Higher Speed Passenger Trains in Single Track Freight Networks** 3684  
Samuel Sogin, Christopher P.L. Barkan, Mohd Rapik Saat
- Strategic Crew Planning Tool in Railroad: a Discrete Event Simulation** 3693  
Kiran Chahar, Clark Cheng, Yudi Pranoto
- Calibration of Urban Rail Simulation Models: A Methodology Using SPSA Algorithm** 3704  
Zhigao Wang, Haris N. Koutsopoulos

### ***Railroad Simulation Methodology***

- Simulation and Analysis of Railroad Hump Yards in North America** 3715  
Edward Lin, Clark Cheng
- From Data to Simulation Models: Component-based Model Generation with a Data-driven Approach** 3724  
Yilin Huang, Mamadou Seck, Alexander Verbraeck
- SIMARAIL: Simulation Based Optimization Software for Scheduling Railway Network** 3735  
Arman Sajedinejad, Soheil Mardani, Erfan Hassannayebi, S. Ahmad Reza Mohammadi K., Alireza Kabirian

## **Risk Analysis**

### ***Financial Security Valuation***

- Valuation of Collateralized Debt Obligations (CDOs) in a Multivariate Subordinator Model** 3747  
Yunpeng Sun, Rafael Mendoza-Arriaga, Vadim Linetsky



<b>Pricing American Options under Partial Observation of Stochastic Volatility</b>	<b>3760</b>
Fan Ye, Enlu Zhou	
<b>Simulation Valuation of Multiple Exercise Options</b>	<b>3772</b>
Mark Reesor, James Marshall, Matthew Cox	
<b><i>Rare Event Simulation I</i></b>	
<b>A Large Deviation and Computation Study of Material Failure Problem</b>	<b>3784</b>
Jingchen Liu, Xiang Zhou, Rohit Patra, Weinan E	
<b>A Reflection-Based Variance Reduction Technique for Sum of Random Variables</b>	<b>3795</b>
Guangwu Liu	
<b>Efficient Estimation of Density and Probability of Large Deviations of Sum of IID Random Variables</b>	<b>3805</b>
Sandeep K. Juneja, Santanu Dey	
<b><i>Rare Event Simulation II</i></b>	
<b>Importance Sampling for Actuarial Cost Analysis under a Heavy Traffic Model</b>	<b>3817</b>
Jose Blanchet, Henry Lam	
<b>Importance Sampling for Stochastic Recurrence Equations with Heavy Tailed Increments</b>	<b>3829</b>
Kevin Leder, Jose Blanchet, Henrik Hult	
<b>A Conditional Monte Carlo Method for Estimating the Failure Probability of a Distribution Network with Random Demands</b>	<b>3837</b>
Jose Blanchet, Juan Li, Marvin K. Nakayama	
<b><i>Risk Management</i></b>	
<b>Optimal Disease Outbreak Decisions using Stochastic Simulation</b>	<b>3849</b>
Michael Ludkovski, Jarad Niemi	
<b>Risk Estimation via Weighted Regression</b>	<b>3859</b>
Mark Broadie, Yiping Du, Ciamac Moallemi	
<b>Sensitivity Estimation of SABR Model Via Derivative of Random Variables</b>	<b>3871</b>
Nan Chen, Yanchu Liu	

## **Simulation Education**

---

### ***Simulation to Support Learning***

<b>Spreadsheet Based Experiential Learning Environment for Project Management</b>	<b>3882</b>
Wee-Leong Lee	
<b>Discrete Event Simulation as Didactic Support to the Teaching of Telecommunications Systems: Applications in Digital Telephony</b>	<b>3893</b>
Thiago Silva, Joao Rangel	
<b><i>Education Across the Life Cycle - From Model Development to Scenario Comparison</i></b>	
<b>A Note On The Use Of Multiple Comparison Scenario Techniques In Education And Practice</b>	<b>3904</b>
Kathryn Hoad, Thomas Monks	
<b>A Literature Review Conceptual Comparison Between Discrete Simulation And Continuous Simulation As Booster Of The Hybrid Simulation Methodology</b>	<b>3915</b>
Thiago Brito, Rui Botter, Edson Trevisan	

<b>Model Development in Discrete-event Simulation: Insights from Six Expert Modelers</b>	<b>3928</b>
Antuela Tako	
<b><i>Simulation Environments in Education - From Old to New</i></b>	
<b>Learning By Gaming: Supply Chain Application</b>	<b>3940</b>
Ayman Tobail, John Crowe, Amr Arisha	
<b>GPSS 50 Years Old, but Still Young</b>	<b>3952</b>
Ingolf Ståhl, James Henriksen, Richard Born, Henry Herper	
<b><i>Panel Discussion: Smackdown - Adventures in Standards and Interoperability</i></b>	
<b>Smackdown - Adventures in Simulation Standards and Interoperability</b>	<b>3963</b>
Priscilla Elfrey, Gregory Zacharewicz	
<b><i>Panel Discussion: Educating the Workforce - M&amp;S Professional Education</i></b>	
<b>Educating the Workforce: M&amp;S Professional Education</b>	<b>3968</b>
Margaret L. Loper, John W. Diem, Amy Henninger, Mikel D. Petty, Andreas Tolk	

## **Simulation Optimization**

---

### ***Advances in Traditional Ranking and Selection***

<b>Bayesian Optimization via Simulation with Correlated Sampling and Correlated Prior Beliefs</b>	<b>3979</b>
Peter Frazier, Jing Xie, Stephen E. Chick	
<b>Selecting the Best By Comparing Simulated Systems In a Group of Three</b>	<b>3992</b>
Seong-Hee Kim, A. B. Dieker	
<b>Combining Simulation Allocation and Optimal Splitting and for Rare-Event Simulation Optimization</b>	<b>4003</b>
Ben Crain, Chun-Hung Chen, John Shortle	

### ***Frontiers in Simulation Optimization I***

<b>Simulation-based Optimization over Discrete Sets with Noisy Constraints</b>	<b>4013</b>
Yao Luo, Eunji Lim	
<b>A Sample Average Approximation Method for Multi-Objective Stochastic Optimization</b>	<b>4026</b>
Sujin Kim, Jong-hyun Ryu	
<b>A Bayesian Approach to Stochastic Root Finding</b>	<b>4038</b>
Rolf Waeber, Peter I. Frazier, Shane G. Henderson	

### ***Frontiers in Simulation Optimization II***

<b>Large-Scale Ranking and Selection Using Cloud Computing</b>	<b>4051</b>
Jeff Hong, Jun Luo	
<b>Ordinal Optimization: A Nonparametric Framework</b>	<b>4062</b>
Sandeep Juneja, Peter Glynn	
<b>Multi-objective Compass for Discrete Optimization Via Simulation</b>	<b>4070</b>
Loo Hay Lee, Ek Peng Chew, Haobin Li	
<b>SimOpt : A Library of Simulation Optimization Problems</b>	<b>4080</b>
Shane Henderson, Raghu Pasupathy	

### ***Novel Contexts for Simulation Optimization***

<b>A Sampled Fictitious Play Based Learning Algorithm for Infinite Horizon Markov</b>	<b>4091</b>
---	-------------

<b>Decision Processes</b>	
Esra Sisikoglu, Marina A. Epelman, Robert L. Smith	
<b>Optimization Simulation: the Case of Multi-stage Stochastic Decision Models</b>	<b>4103</b>
Suvrajeet Sen, Zhihong Zhou	
<b>A Regularized Adaptive Steplength Stochastic Approximation Scheme for Monotone Stochastic Variational Inequalities</b>	<b>4115</b>
Farzad Yousefian, Angelia Nedich, Uday Shanbhag	
<b>Global Simulation Optimization</b>	
<b>Combining STRONG and Screening Designs for Large-Scale Simulation Optimization</b>	<b>4127</b>
Kuo-Hao Chang, Ming-Kai Li, Hong Wan	
<b>Optimization via Simulation Using Gaussian Process-based Search</b>	<b>4139</b>
Lihua Sun, Zhaolin Hu, Jeff Hong	
<b>Adaptive Probabilistic Branch and Bound for Level Set Approximation</b>	<b>4151</b>
Zelda B. Zabinsky, Wei Wang, Yanto Prasetio, Archis Ghate, Joyce W. Yen	
<b>Simulation Optimization and Stochastic Programming</b>	
<b>On Interior-Point Based Retrospective Approximation Methods for Solving Two-Stage Stochastic Linear Programs</b>	<b>4163</b>
Soumyadip Ghosh, Raghu Pasupathy	
<b>A Combined Deterministic and Sampling-Based Sequential Bounding Method for Stochastic Programming</b>	<b>4172</b>
Peguy Pierre-Louis, Guzin Bayraksan, David Morton	
<b>Overlapping Batches for the Assessment of Solution Quality in Stochastic Programs</b>	<b>4184</b>
David Love, Guzin Bayraksan	
<b>Simulation Optimization on Discrete Sets</b>	
<b>Discrete-Valued, Stochastic-Constrained Simulation Optimization with Compass</b>	<b>4196</b>
Helcio Vieira Junior, Karl Kienitz, Mischel Belderrain	
<b>Discrete Optimization via Approximate Annealing Adaptive Search with Stochastic Averaging</b>	<b>4206</b>
Jiaqiao Hu, Chen Wang	
<b>Handling Stochastic Constraints in Discrete Optimization via Simulation</b>	<b>4217</b>
Chuljin Park, Seong-Hee Kim	
<b>Simulation Optimization Applications</b>	
<b>A Two-stage Non-linear Program for Optimal Electrical Grid Power Balance under Uncertainty</b>	<b>4227</b>
Dzung Phan, Soumyadip Ghosh	
<b>May The Best Man Win: Simulation Optimization For Match-Making In E-Sports</b>	<b>4239</b>
Ilya Ryzhov, Awais Tariq, Warren Powell	
<b>Optimizing Local Pickup and Delivery with Uncertain Loads</b>	<b>4251</b>
Weiwei Chen, Jie Song, Leyuan Shi	
<b>Simulation Optimization Applications II</b>	
<b>Simulation-Optimization of Flow Lines: an LP-based Bounding Approach</b>	<b>4262</b>
Arianna Alfieri, Andrea Matta	
<b>Automatic Surrogate Model Type Selection During The Optimization of Expensive</b>	<b>4274</b>

**Black-box Problems**

Ivo Couckuyt, Dirk Gorissen, Filip De Turck, Tom Dhaene

**Selecting the Best Supplier Based on a Multi-criteria Tagushi Loss Function: a Simulation Optimization Approach** 4285

Tamara Jaber, Rana Nazzal, Alaa Horani, Sameh Al-Shihabi

***Simulation Optimization on Finite Sets*****Optimal Sampling Laws for Constrained Simulation Optimization on Finite Sets: The Bivariate Normal Case** 4294

Susan Hunter, Nugroho Pujowidianto, Chun-Hung Chen, Loo Hay Lee, Raghu Pasupathy, Chee Meng Yap

**Simulation Optimization Using the Particle Swarm Optimization with Optimal Computing Budget Allocation** 4303

Si Zhang, Pan Chen, Loo Hay Lee, Peng Chew, Chun-Hung Chen

**Best-Subset Selection Procedure** 4315

Yu Wang, Louis Luangkesorn, Larry Shuman

**Guessing Preferences: A New Approach to Multi-Attribute Ranking and Selection** 4324

Peter I. Frazier, Aleksandr M. Kazachkov