2011 Spring Simulation Multiconference

SpringSim'11

PROGRAM BOOK

3-7 April 2011

Boston, MA, USA

Boston Marriott Long Wharf Hotel

SIMULATE CREATE SERVE

SCS

Society for Modeling & Simulation International (SCS)

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GENERAL INFORMATION

FOR SPRINGSIM ATTENDEES

Registration

Your registration for SCS's 2011 Spring Simulation Multiconferenc (SpringSim'11) includes morning and afternoon breaks each day, the Monday evening reception in the Palm Garden and access to all sessions, tutorials and special presentations (unless otherwise noted). SpringSim'11 is also co-located with the Simulation Interoperability Standards Organization (SISO) Spring Interoperability Workshop (SIW). Attendees of both conferences are welcome to attend any SCS or SISO session. An overview of SISO's schedule is included in this booklet for your reference.

- **Registration Hours** (*Foyer of the Grand Ballroom*):
  - **Sunday**, April 3rd – 3-6pm
  - **Monday**, April 4th – 7am–5pm
  - **Tuesday**, April 5th – 7am–5pm
  - **Wednesday**, April 6th – 7am–5pm
- **Contact Information:** If you have questions during the event, feel free to stop by the Registration Desk or e-mail the SCS staff at scs@scs.org.

Breaks

- **Breaks (***Palm Garden***):**
  - **Monday**, April 4th – 10–10:30am | 3-3:30pm
  - **Tuesday**, April 5th – 10–10:30am | 3-3:30pm
  - **Wednesday**, April 6th – 10–10:30am | 3-3:30pm

Spouses & Newcomers Get-Togethers

- **Spouses & Guests Get-Together**
  - **When:** Monday, April 4th, 10-10:30am (during the morning break)
  - **Where:** Quincy Room
  - **Who should attend?** Any spouse or guest of a SpringSim'11 attendee. Family members, children, etc. are all welcome.
  - **What is it?** This meeting will act as an informal place for spouses/guests to interact and introduce themselves to one another. We'll have Boston area information available. Been to Boston before? Share your tips and recommendations! First time to the area? Make a new friend and discover the city together. The sky's the limit!

- **SpringSim'11 Newcomers Get-Together/Meeting**:
  - **When:** Monday, April 4th, 3-3:30pm (during the afternoon break)
  - **Where:** Quincy Room
  - **Who should attend?** Any first-time SpringSim attendee.
  - **What is it?** We'll have SpringSim "veterans" on hand to answer any and all conference-related questions. This meeting is also a great opportunity for first-timers to get to know and network with one another. Think of it as SpringSim orientation.

Conference Organizers' Meetings

- **SpringSim'11 Pre-conference Meeting**: Sunday, April 3rd, from 4-5pm. We'll go over any last minute program changes and address any last minute questions / issues any symposia may have.

- **SpringSim'12 Planning Meeting**: Sunday, April 3rd, from 5-6pm. We'll do the initial stages of planning for SpringSim 2012. All symposia that plan on being part of SpringSim'12 should send a representative to this meeting (preferably any/all of the general chair, vice general chair & program chair). Anyone wanting to help in the planning of SpringSim'12, even if you're not associated with a specific symposium, is welcome to attend. If you want to help but can't make this meeting, contact the SpringSim'12 General Chair, Dr. Hala ElAarag.

- **SpringSim'12 Symposia Planning Meetings**: All SpringSim'12 symposia planning meetings will be held during lunch. If you are interested in helping with next year's event, please contact one of the symposia chairs for SpringSim'11. Seating is very limited at these events and attendance is by invitation only. Your invitation/ticket will tell you where the meeting will be held.

Monday Evening Reception

- There will be a reception in the Palm Garden exhibit area, open to all SpringSim'121 attendees, on Monday, April 4th, from 5-7pm.

Speakers' Breakfasts

- Speakers' breakfasts will be held Monday – Wednesday from 7am – 8am. The presenters for each day are invited to join their session chairs at a breakfast on the morning of their presentation. Each paper's presenter should receive a ticket with their registration material indicating the time, day and room for the breakfast they may attend.

Best Paper Award

- The Award for the Best Paper of SpringSim'11 will be presented at the start of the Opening Session before the keynote addresses in the Grand Ballroom on Monday April 4th at 8:30.

Keynote Presentations

Monday April 4th from 8:45-10:00

Prof. Alex Pentland
MIT Human Dynamics Lab
Massachusetts Institute of Technology

Alex `Sandy' Pentland directs MIT's Human Dynamics Laboratory and the MIT Media Lab Entrepreneurship Program, and advises the World Economic Forum, Nissan Motor Corporation, and a variety of start-up firms. He has previously helped create and direct MIT's Media Laboratory, the Media Lab Asia laboratories at the Indian Institutes of Technology, and Strong Hospital's Center for Future Health. Profiles of Sandy have appeared in many publications, including the New York Times, Forbes, and Harvard Business Review.

Sandy is among the most-cited computational scientists in the world, and a pioneer in computational social science, organizational engineering, mobile computing, image understanding, and modern biometrics. His research has been featured in Nature, Science, the World Economic Forum, and Harvard Business Review, as well as being the focus of TV features including Nova and Scientific American Frontiers. His most recent book is `Honest Signals,' published by MIT Press.

"Simulation of Directed Self Assembly at the Nanoscale"

Monday April 4th from 10:30 - 11:15

Dr. Paul Barton
Lammot du Pont Professor of Chemical Engineering
Department of Chemical Engineering
Massachusetts Institute of Technology

Paul Barton is the Lammot du Pont Professor of Chemical Engineering at MIT, where he has been since 1992. He received his Ph.D. from the Centre for Process Systems Engineering at Imperial College, London University in 1992. He has held Visiting Professor appointments at CNRS-ENSIC, Nancy, France and EPFL, Lausanne, Switzerland. He has industrial experience with BP and Air Products, and has consulted for major corporations including Dow Chemical, Alstom Power and Aspen Technology. In 2004 he was awarded the Outstanding Young Researcher Award by AIChE's CAST Division. Barton's research interests include hybrid discrete/continuous dynamic systems; numerical analysis of ordinary differential, differential-algebraic and partial differential-algebraic equations; sensitivity analysis and automatic differentiation; global, mixed-integer and dynamic optimization theory and algorithms; and open process modeling software. Some of the applications his group is currently focusing on include energy systems engineering, continuous pharmaceutical manufacturing and nano-scale systems engineering. He served as Director for AIChE's CAST Division from 2001-2004 and is currently a subject editor for Optimal Control Applications and Methods and associate editor for Journal of Global Optimization. He is author or co-author of over 100 articles in refereed journals. He has been very active in the design and the development of process modeling software, having been the original author of gPROMS, and having led the development of ABACUSS/JACOBIAN and DAEPACK at MIT, all of which are now commercial products widely used in industry.

Embracing Opportunity in Imperfection: Is simulation the real thing?

Monday April 4th from 11:15 - 12:00

Dr. Pieter Mosterman
Senior Research Scientist
The MathWorks, Inc.

PIETER J. MOSTERMAN is a Senior Research Scientist at MathWorks in Natick, MA where he works on core Simulink(r) simulation and code generation technologies. He also holds an Adjunct Professor position at the School of Computer Science of McGill University. Before, he was a Research Associate at the German Aerospace Center (DLR) in Oberpfaffenhofen. He has a Ph.D. degree in Electrical and Computer Engineering from Vanderbilt University in Nashville, TN, and a M.Sc. degree in Electrical Engineering from the University of Twente, Netherlands. His primary research interests are in Computer Automated Multiparadigm Modeling (CAMPaM) with principal applications in design automation, training systems, and fault detection, isolation, and reconfiguration. He designed the Electronics Laboratory Simulator that was nominated for The Computerworld Smithsonian Award by Microsoft Corporation in 1994. In 2003, he was awarded the IMechE Donald Julius Groen Prize for his paper on the hybrid bond graph modeling and simulation environment HYBRSIM. In 2009, he received the Distinguished Service Award of The Society for Modeling and Simulation International (SCS) for his services as Editor-in-Chief of SIMULATION: Transactions of SCS. Dr. Mosterman was Guest Editor for special issues on CAMPaM of SIMULATION, IEEE Transactions on Control Systems Technology (TCST), and ACM Transactions on Modeling and Computer Simulation. He is on the Editorial Advisory Board of SIMULATION and a CRC Press Series Editor for books on Computational Analysis, Synthesis, and Design of Dynamic Systems. He has chaired over thirty scientific events, served on over eighty International Program Committees, published over a hundred peer reviewed papers, is inventor on over fifteen awarded patents, and is Editor of books on Model-Based Design for Embedded Systems, Discrete-Event Modeling and Simulation: Theory and Applications, Model-Based Testing for Embedded Systems, and Real-time Simulation Technologies: Principles, Methodologies, and Applications.

Tuesday April 5th from 08:30 - 10:00

Dr. Jacqueline R. Henningsen
Director for Studies & Analysis, Assessments and Lessons Learned
Headquarters U.S. Air Force
Washington, D.C.

Dr. Jacqueline R. Henningsen, a member of the Senior Executive Service, is the Director for Studies & Analyses, Assessments and Lessons Learned, Headquarters U.S. Air Force, Washington, D.C. She is responsible to the Secretary and Chief of Staff of the Air Force for analytic and Air Force Lessons Learned policy oversight and implementation. She ensures comprehensive, defendable and time-sensitive processes underpin Air Force warfighting and force structure capability and sufficiency assessments; informs and illuminates leadership on emerging issues; fireproofs resource investment decisions; and rapidly collects, disseminates, implements and tracks lessons learned.Dr. Henningsen began her Air Force career in 1985. She served as the final Assessments Division Chief for Strategic Air Command and the first Chief of Assessments for U.S. Strategic Command. In these positions, she led strategic deterrence and conventional war-fighting capability assessments, and provided wargaming oversight during the transition period at the end of the Cold War. In 1992, she joined the Office of the Secretary of Defense, assuming oversight of strategic and space launch programs in the Program Analysis and Evaluation Directorate's Cost Analysis Improvement Group. Later, as an analyst in the Regional Assessments and Modeling Division, she was responsible for the Secretary of Defense-initiated Joint Analytic Model Improvement Program and country teams for the Partnership for Peace Resource Management Program. She was also responsible for Joint Staff program reviews, evaluation of Joint Forces Command establishment initiatives, and Quadrennial Defense Review assessments. In 1998, she became a member of the Senior Executive Service as Associate Director for Modeling, Simulation and Analysis with the Directorate for Command and Control in the Office of the Deputy Chief of Staff for Air and Space Operations. In that role, she provided corporate oversight of Air Force modeling, simulation and analysis. Prior to assuming her current position, Dr. Henningsen served as the Director of the Air Force Studies and Analyses Agency, a direct reporting unit to the Vice Chief of Staff of the Air Force. Dr. Henningsen has contributed analytic leadership during all of the Department of Defense's Quadrennial and other major defense reviews from the end of the Cold War to the present. She received the 2005 Presidential Meritorious Executive Rank Award for her analytic leadership in the Department of Defense. She also received a Department of Defense Distinguished Civilian Service Award in 2001 and 2009. Previously she was recognized with the Air Force's Meritorious Civilian Service Award for her role in supporting Strategic Air Command during operations Desert Shield and Desert Storm.

Special Tutorial – For Students in all Career Paths

Sunday, April 3rd, from 3-5pm – Faneuil Room

SCS & **SpringSim'11** are proud to announce a special tutorial at this year's conference on "***A Career in Modeling and Simulation***" by **Dr. Tim Cooley**, President and Founder of **DynamX Consulting**, a veteran owned consulting firm located in Larkspur, Colorado.

Dr Tim Cooley
President and Founder of DynamX Consulting

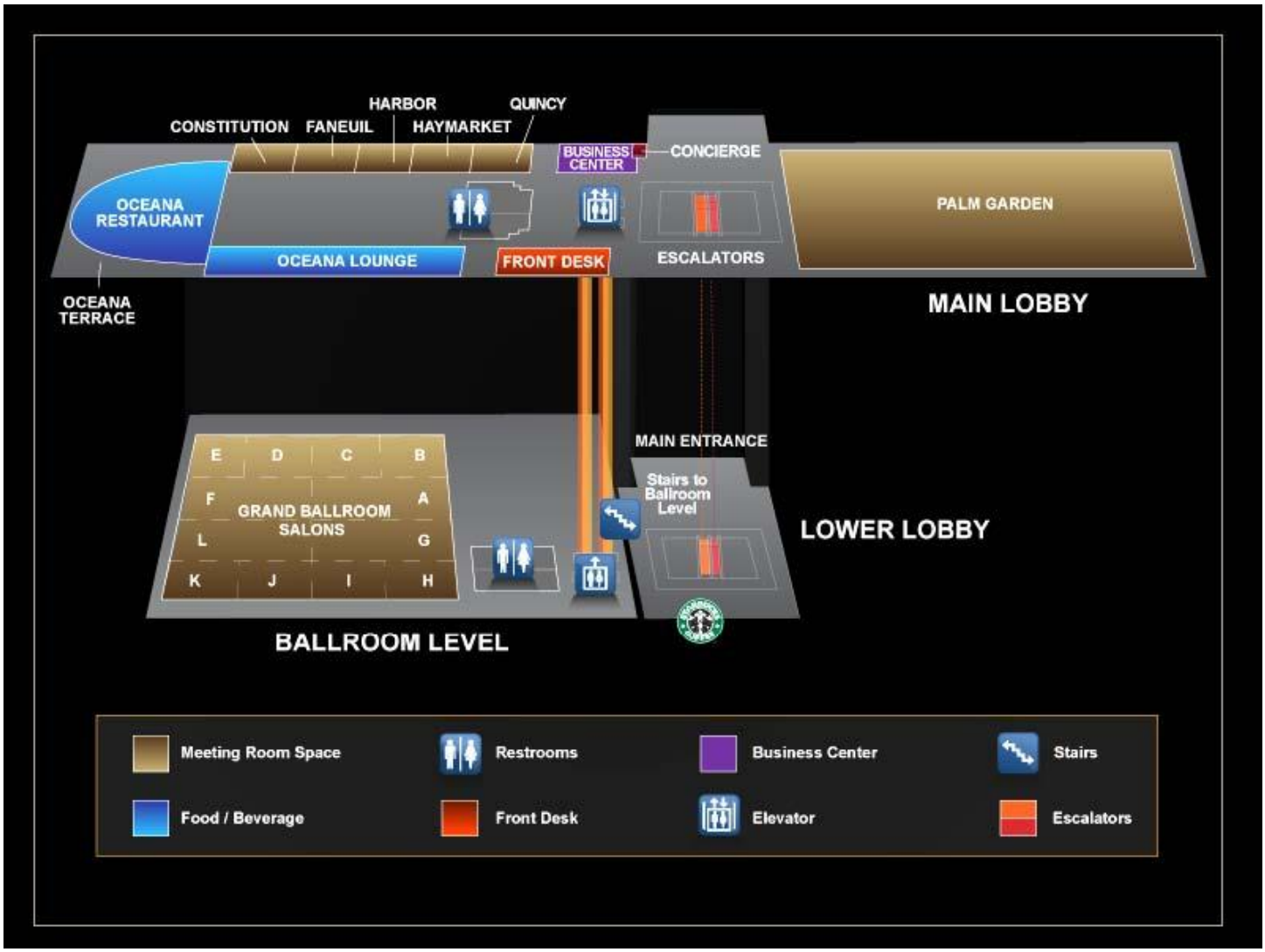
Dr Cooley spent 16 years on the United States Air Force Academy faculty, both in uniform and as a civilian, holding numerous positions to include Modeling and Simulation Chair, Deputy Department Head, and Senior Researcher. His previous military assignments included Squadron Commander of the 1987th Communications Squadron at Lowry AFB and Land Mobile Radio Manager for CINCNORAD. Currently, Dr Cooley is researching terrorist and criminal network modeling as well as the modeling of industrial supply chains. He developed and teaches the Air Force Combat Analysis Class and has performed detailed research on methodology for determining return on investment for modeling and simulation. He is co-author of the 2011 Defense Acquisition University Research Paper of the Year and 2011 Hirsch Prize recipient. Dr Cooley received his PhD in Computer Science/Biomedical Engineering from Rutgers University in 1996. He was inducted into Phi Beta Kappa in 1982 and is a lifetime member of Sigma XI, the Scientific Research Society.

- **Why would someone want to work in the field of Modeling and Simulation?**
- **What kind of skills are required for this field?**
- **What is it all about anyway?**

Have you ever wondered about the answers to these questions? Or, maybe you just are unsure of what you want to do for or with your career. This tutorial will give a brief overview of the field of Modeling and Simulation, present why it is a growing discipline with an appetite for many jobs over the next decade, and discuss some of the skills required to succeed in the field. The emphasis will be on college students but those contemplating a career change may benefit as well.

Hotel Map

Here is a map of the hotel's meeting facilities. If you have additional questions, please see the registration desk or hotel staff.



Exhibits

- **Exhibit Hours (*Palm Garden*):**
  - **Monday**, April 4th – 10–10:30am | 3-3:30pm | 5-7pm
  - **Tuesday**, April 5th – 10–10:30am | 3-3:30pm
  - **Wednesday**, April 6th – 10–10:30am | 3-3:30pm

List of Exhibitors

- ForwardSim – www.forwardsim.com
- VT Mak – www.mak.com

Poster Session

- **Poster Hours:**
  - Set-Up – Monday (between 8am-3pm)
  - **Poster Presenters should be Available for Q&A:**
    - **Monday**, April 4th – 3-3:30pm | 5-7pm
    - **Tuesday**, April 5th – 10–10:30am | 3-3:30pm
  - **Posters will be available for viewing Monday afternoon and evening and all day Tuesday**

SCS SpringSim 2011

At-A-Glance Agenda

Sunday April 3

Room	Faneuil	Constitution	Harbor
8:00-12:00		SCS Board of Director's Meeting	
12:00-3:00			
3:00-5:00	Student's Tutorial: A Career in the M&S Field		2011 SCS Pre-Conference Meeting 2012 SCS Organizers' Planning Meeting

Monday April 4

Track	ADS	ANSS	ANSS	CNS	HPC	MMS	TMS/DEVS	SimAUD
Room	Quincy	Salon K	Salon J	Haymarket	Faneuil	Salon I	Constitution	Harbor
8:30-10:00				**Opening Session** **Keynote Presentations - Prof. Alex Pentland** **Room: Grand Ballroom (Salons A, G, F, L)**				
10:00-10:30	AM BREAK - Palm Garden Exhibits Area & Spouses/Guests Meeting - Quincy Room							
10:30-12:00				**Keynote Presentations:** **Dr. Paul Barton** **Dr. Pieter Mosterman** **Room: Grand Ballroom (Salons A, G, F, L)**				
12:00-1:30	LUNCH BREAK - Lunch not provided							

Monday April 4

Track	ADS	ANSS	ANSS	CNS	HPC	MMS	TMS/DEVS	SimAUD
Room	Quincy	Salon K	Salon J	Haymarket	Faneuil	Salon I	Constitution	Harbor
1:30-3:00	ADS1 Chair: Greg Madey **-Dynamic Adaptive Disaster Simulation: Developing a Predictive Model of Emergency Behavior Using Cell Phone and GIS Data** *Francis Chen, Zhi Zhai, Greg Madey* **-The effects of different interaction protocols in agent-based simulation of social activities** *Nicole Ronald, Theo Arentze, Harry Timmermans* **-Identifying Norms of Behavior in Open Multi-agent Societies** *Wagdi Alrawagfeh, Edward Brown, Manrique Mata-Mantero*	Wireless Networks: Scheduling & Performance **-An Energy-Balanced Coding Redundancy Scheduling Approach to Support Quality of Service in Battery-Powered Multi-Hop Wireless Networks** *Lin Xing, Wei Wang, Shaoen Wu, Kun Hua, Honggang Wang* **-Performance Analysis and Simulation of Packet Scheduling Algorithms in Femtocell Environment** *Volkan Sevindik, Oguz Bayat, Jay Weitzen* **-TapRouter: An Emulating Framework to Run Real Applica-tions on Simulated Mobile Ad hoc Network** *Jinxue Zhang, Zheng Qi*	Networking Systems **-Denoising of Time Domain Responses in Wireless Sensor Network for the Structural Health Monitoring of Transportation Infrastructure** *Tzu-Yang Yu, Hong-gang Wang, Hong Liu* **-Enhancement of 802.11 Modules in ns-2 for Wireless Access on Vehicular Environ-ments & Performance Evaluation** *Kyohong Jin, Sungjin Lee, Daehoon Kang, Sangjun An, Jihyun Cha* **-Latency Modeling & Minimization for Large-scale Scientific Workflows in Dist. Network Environments** *Qishi Wu, Yi Gu, Yuchen Liao, Xukang Lu, Yunyue Lin, Nageswara Rao*	Network Performance Chair: Dr. Aftab Ahmad **-Puzzle Solving-based Authentication Method for Enhanced Security in SPINS and Its Performance Evaluation** *Sanjay Dhurandher, Mohammad S. Obaidat, Ankit Mahendru, Lakshaya Agnani* **-Modeling the Energy Consumption for Concurrent Executions of Parallel Tasks** *Thomas Rauber, Gudula Rünger* **-How Secure is WiFi MAC Layer in Comparison with IPsec for Classified Environments?** *Stanley Cebula III, Aftab Ahmad*	HPC'11 Best Paper I & Invited Speaker I **-A Multi-Core Numerical Framework for Characterizing Flow in Oil Reservoirs** *Christopher Leonardi, David Holmes, John Williams, Peter Tilke* **-Marketplace and the HPC Innovation** *-Niraj Srivastava*	MMS-C Chair: Karen Cooper **-Command and Control: A low cost framework to remotely monitor military training** *Roberto de Beauclair Seixas, Daniel de Vasconcelos Campos* **-Organizational Adoption of Innovation - Background, Programs & a Descriptive Modeling Approach** *Jerry Couretas, Mehmet Ucal* **-Fuzzy Logic Injruy Design for Crowd Modeling** *Emin Kugu, Jiang Li, Frederic D. McKenzie, Ozgur Koray Sahingoz*	Formalisms **-Developing Discrete Event Simulations from Rigorous Process Definitions** *Mohammad Raunak, Leon Osterweil, Alexander Wise* **-A BPMN Extension for Modeling Non Functional Properties of Business Processes** *Paolo Bocciarelli, Andrea D'Ambrogio* **-Extended Coloured Petri Nets with Structured Tokens - Formal Method for Distributed Systems** *Khaoula Al Ali, Wolfgang Fengler, Bernd Däne, Alexander Pacholik*	Welcome **-Designing with Deformation - Sketching Material and Aggregate Behaviour** *Anders Holden Deleuran* **-Analysis of Sustainable Manufacturing Using Simulation for Integration of Production and Building Service of Actively Deforming Material Systems** *John Michaloski, Jorge Arinez, Guodong Shao, Swee Leong, Kevin Lyons, Frank Riddick*
3:00-3:30	PM BREAK - Palm Garden Exhibits Area & SpringSim Newcomers Meeting - Quincy Room							
3:30-5:00	ADS2 Chair: Anthony Hunt **-Agent-Based Analysis of Asset Pricing under Ambiguous Information** *Ben-Alexander Cassell, Michael Wellman* **-An Architecture to Tame Simulation Time Tardiness in ADS** *Pier Taranti, Ricardo Choren, Carlos Lucena* **-Initial Formulation (proposal) of an Optimization Method Based on Stigmergic Construction** *Aditya Velivelli, Kenneth (Mark) Bryden*	Complex System **-Statistical Modeling of Optical Neural Transduction** *Jennifer Byrne* **-A Game Theoretical Approach to Broadcast Information Diffusion in Social Networks** *Dmitry Zinoviev, Vy Duong* **-Feasibility Study for Automatic Calibration of Transportation Simulation Models** *Hong Liu, Qian Yu, Wei Ding, Daiheng Ni, Honggang Wang, Stephen Shannon*	Environmental Systems **-Towards Parameter Estimation in Wildfire Spread Simulation Based on Sequential Monte Carlo Methods** *Fan Bai, Song Guo, Xiaolin Hu* **-A System Dynamics Model to Evaluate Sustainability of Water Supply in a Watershed** *Roberto DeLaLlata* **-Estimation of New Ignited Fires Using Particle Filters in Wildfire Spread Simulation** *Haidong Xue, Xiaolin Hu*	Network M&S Tools Chair: Dr. Hassan Rajaei **-HMNToolSuite: Tool Support for Mobility Management of Mobile Devices in Heterogeneous Mobile Networks** *Joon-Myung Kang, Sin-seok Seo, John Strassner, James Won-Ki Hong* **-JSimPlus: A Tool for Teaching Simulation Techniques** *Hassan Rajaei, Erick Eid, Divy Kanungo, Jordan Ringenberg* **-Mobile Medical Application Model for Heterogeneous Networks** *Salah Sharieh*	HPC'11 Best Paper II & Tutorial **-An SMP Soft Classification Algorithm for Remote Sensing** *Rhonda Phillips, Layne Watson, Randolph Wynne* **-Intro to Parallel Computing with MATLAB** *Jiro Doke*	MMS-B Chair: Toni Scribner **-Using a Constructive Simulation to Select a Camouflage Pattern for Use in OEF** *Joseph Venezia, Adam Peloquin* **-Task Degradation in Agent-based Simulation** *Daniel Rice, Mitha Andra* **-The Modeling & Simulation of Non-lethal Weapons in Constructive Simulation** *Mitha Andra, Nazli Elsamaloty, Lew Farkas*	Validation & Verification Chair: Hans Vangelhuwe **-Graded CTL Model Checking for Test Generation** *Margherita Napoli, Mimmo Parente* **-On-The-Fly Verification of Discrete Event Systems by Means of Simulation Purposes** *Paulo Salem da Silva, Ana Cristina Vieria de Melo* **-A Formal Approach to the Quantification of Sustainability and Dependability Metrics on Data Center Infrastructures** *Gustavo Callou, Erica Sousa, Paulo Maciel, Eduardo Tavares, Bruno Silva, Jair Figueirêdo, Carlos Araujo, Fabio Magnani, Francisco Neves*	Data Sensing **-Real-Time Occupancy Detection Using Decision Trees with Multiple Sensor Types** *Ebenezer Hailemariam, Rhys Goldstein, Ramtin Attar, Azam Khan* **-Sensor Placement Tool for Rapid Development of Video Sensor Layouts** *Tyler Garaas* **-A New System Dynamics Framework for Modeling Behavior of Vehicle Sharing Systems** *Dimitris Papanikolaou* ***SimAUD Authors & Chairs Only:* Tour of MIT Media Lab; gather at 5pm**

Tuesday April 5

Track	ANSS	ADS	CNS	HPC	MMS	TMS/DEVS	TMS/DEVS	SimAUD
Room	Quincy			Grand Ballroom (Salons GHI)				
8:30-10:00	Wireless Networks: Routing **-A Symbolic Model to Traffic Engineering in Wireless Mesh Networks** *Edgard Jamhour* **-A Bottleneck Aware Routing Metric for Wireless Mesh Networks** *Bing Qi* **-Study of the Impact of Link Availability on the Performance of DTN Routing Protocols** *Fuad Alnajjar*			**KEYNOTE PRESENTATION:** **Dr. Jacqueline R. Henningsen**				
10:00-10:30	AM BREAK - Palm Garden Exhibits Area							
Room	Salon I	Quincy	Haymarket	Faneuil	Salon I	Constitution	Harbor	Harbor
10:30-12:00	Multimedia and QoS **-Controlled Stochastic Petri Net Model for End-to-End Network QoS Provisioning in Middleware-based Multimedia and Real-Time Systems** *Hakiri Akram, Berthou Pascal, Gayraud Thierry* **-Cognitive Cross-layer Design with QoS Provisioning for Cooperative Wireless Networking** *Kun Hua, Shaoen Wu, Honggang Wang, Wei Wang* **-On Traffic Locality and QoE in Hybrid CDN-P2P Networks** *Moisés Rodrigues, Josilene Moreira, Arthur Callado, Márcio Neves, Djamel Sadok, Per Karlsson, Victor Souza*	ADS3 Chair: Joe Barjis **-A Proposed Method for Dynamic Knowledge Representation via Agent-directed Composition from Biomedical and Simulation Ontologies: An Example Using Gut Mucus Layer Dynamics** *Scott Christley, Gary An* **-Composite Cell Agent Model of Epithelial Culture in Vitro** *Sean H.J. Kim, C. Anthony Hunt* **-A Robust in Silico Analogue of MDCK Cystogenesis Mimics Growth in Multiple Culture Conditions** *Jesse Engelberg*	Wireless/Mobile Network Chair: Dr. Mohiuddin Ahmed **-Framework for the Integration of Body Sensor Networks and Social Networks to Improve Healthcare** *David Bauschlicher, Steven Bauschlicher, Hala ElAarag* **-An Energy Aware Routing Protocol for Mixed Static and Mobile Nodes in Wireless Sensor Networks** *Adel Gaafar A. Elrahim, Hussein A. Elsayed, Salwa El Ramly, Magdy M. Ibrahim* **-Performance Analysis of a Highly Available Home Agent in Mobile Networks** *Abdelgadir Abdelgadir, Mohiuddin Ahmed, Al-Sakib Pathan, Ariff Abdullah, Shariq Haseeb, Omar Al-Mushayt*	Biology Applications & Invited Speaker II **-The Virtual Parasite Project: in silico HPC Simulation of Trypanasoma cruzi Host-Parasite Dynamics to Model Chagas Disease** *Tarynn Witten, Samuel Sieg, Patricio Manque* **-Microsoft Technical Computing: Modeling the world with greater fidelity** *Dr. Ronnie Hoogerwerf*		Mod4Sim - Tools Chair: Andrea D'Ambrogio **-Simulating Layered Queueing Networks with Passive Resources** *Greg Franks* **-A Model-Driven Software Environment for Modeling, Simulation and Analysis of Complex Systems** *Luc Touraille, Mamadou Kaba Traoré, David Hill*	Joint Session - SimAUD and TMS/DEVS Workshop **-Introducing DEVS for Collaborative Building Simulation Development** *Rhys Goldstein* **-System Entity Structure and DEVS for Collaborative Building Simulation Development** *Bernard P. Zeigler* **-DEVS Standardization: Introduction and Current Status** *Gabriel Wainer*	
12:00-1:30	LUNCH BREAK - Box Lunch Option Available in Exhibit Area							

Tuesday April 5

Track	ANSS	ADS	CNS	HPC	MMS	TMS/DEVS	TMS/DEVS	SimAUD
Room	Salon I	Quincy	Haymarket	Faneuil	Salon I	Constitution	Salon G	Harbor
1:30-3:00		ADS4 Chair: Anthony Hunt **-The Observation of Tolerance in a Social Network Model** *Kristen Lund, Yu Zhang* **-An Agent-Based Genetically-Aware Entomological Model** *Regina McCormack, James E. Gentile, Samuel S.C. Rund* **-Survival of Altruistic Preferences in the Ultimatum Game** *Zsombor Z. Meder*	Network Performance Chair: Dr. Yelena Rykalova **-Latency and Saturation in Networks with Finite Buffers** *Yelena Rykalova, Lev B. Levitin* **-Evaluating Network Simulators as Extensions of Real Network Testbeds** *Daniel Günther, Michel Steichen, Nathan Kerr, Paul Müller* **-Multi Standard System Level Simulation Framework for Evaluation of Mobile Broadband Networks** *Alexey Khoryaev, Andrey Chervyakov, Mikhail Shilov, Sergey Panteleev, Apostolos Papathanassiou, Alexander Maltsev*	Numerical Methods **-FATODE: A Library for Forward, Adjoint, and Tangent Linear Integration of Stiff Systems** *Hong Zhang, Adrian Sandu* **-Shared Memory "Wide or Tall" and Sparse Matrix Dense Matrix Multiplications** *Gary Howell* **-Fully Implicit Tau-Leaping Methods for the Stochastic Simulation of Chemical Kinetics** *Tae-Hyuk Ahn, Adrian Sandu*	MMS-A Chair: Andrew Stricker **-Third-space Architec-ture for Learning in 3D** *Andrew Stricker, John Cook, Kimberly Combs-Hardy, Cynthia Calongne, Elizabeth Stricker, Kathryn Flitter, Toni Scribner, Fil Arenas* **-A Methodology for Evaluating Shared Leadership in a Game Simulation Kit** *Linda Hamons, Cynthia Calongne, Andrew Stricker, Anne-Marie Armstrong* **-Virtual Reality as a Theme-Based Game Tool for Homeland Security Applications** *Sharad Sharma, Stephen Otunba*	Mod4Sim - Domain-Specific Languages Chair: Hans Vangheluwe **-The SimTG Simulation Modeling Framework a domain specific language for space simulation** *Olivier Zanon* **-From Domain Specific Languages to DEVS Components: Application to Cognitive M&S** *Saurabh Mittal, Scott A. Douglass* **-Using Specification and Description Language to represent users' profiles in OMNET++ simulations** *Pau Fonseca i Casas, Miquel Ramo Niñerola, Angel A. Juan*	Formalisms (DEVS) Chair: Hessam Sarjoughian **-Obervations in DEVS Framework** *Gauthier Quesnel, Ronan Trépos, Patrick Chabrier, Jennifer Baudet, Raphael Duboz, Eric Ramat* **-Transforming UML2.0 Class Diagrams and Statecharts to Atomic DEVS** *Reehan Shaikh, Hans Vangheluwe* **-I-DEVS: Imprecise Real-Time and Embedded DEVS Modeling** *Mohammad Moallemi, Gabriel Wainer*	Implementation **-Grape: A Parametric Shape Grammar Implementation** *Thomas Grasl, Athanassios Economou* **-Automated Energy Model Creation for Conceptual Design** *Lillian Smith, Kyle Bernhardt, Matt Jezyk* **-An Integrated Approach to Algorithmic Design and Environmental Analysis** *Robert Aish, Andrew Marsh*
3:00-3:30	**PM BREAK - Palm Garden Exhibits Area**							
3:30-5:00		ADS5 Chair: Greg Madey **-Medieval Military Logistics: An Agent-based Simulation of a Byzantine Army on the March** *Bart Craenen, Georgios Theodoropoulos, Vincent Gaffney, Philip Murgatroyd, John Haldon* **-Price Rigidity and Strategic Uncertainty - An Agent-based Approach** *Robert Somogyi, James Vincze* **-Informing Malaria Control Policy Using ABMS** *Gregory Davis, Geralyn Janke*	Network Simulation Chair: Dr. Hassan Rajaei **-Advances in Virtual Learning Environments and Classrooms** *Hassan Rajaei, Arwa Aldhalaan* **-An Application of High Performance Computing to Improve Linear Acoustic Simulation** *Fouad Butt, Abdolreza Abhari, Jahan Tavakkoli* **-A Generic Optimized Time Management Algorithms (OTMA) Framework for Simulating Large-Scale Overlay Networks** *Syed Rizvi*	GPU and Multicore **-Accelerating the Smoldyn Spatial Stochastic Bio-chemical Reaction Network Simulator Using GPUs** *Denis Gladkov, Samuel Alberts, Steven Andrews, Roshan D'Souza* **-Lattice Boltzmann Methods Simulations on Massively Parallel Multi-core Architectures** *Luca Biferale, Mauro Sbragaglia, Andrea Scagliarini, Filippo Mantovani, Marcello Pivanti, Fabio Pozzati, Sebastiano Fabrio Schifano, Raffaele Tripiccione, Federico Toschi* **-Parallel GMRES Implementation for Solving Sparse Linear Systems on GPU Clusters** *Jacques Bahi, Raphaël Couturier, Lilia Ziane Khodja* **-Implementing Random Indexing on GPU** *Lukas Polok*	MMS-E Chair: Curtis Blais **-The Application of MTWS in the Simulation of Non-Kinetic Environment** *Donald Herod, John LaCrosse* **-Using a text analysis and categorization tool to generate Bayesian belief networks for use in cognitive social simulation from a document corpus** *Daniel McKaughan* **-Manual Wargaming as a Method for Training: An Analysis of the Commercial Wargame "Battle for Baghdad"** *Mike Stinchfield, Jason Caldwell*	Mod4Sim - Model-Driven Development Chair: Greg Franks **-Harmonized and Reversible development framework for HLA based interoperable application** *Zhiying Tu, Gregory Zacharewicz, David Chen* **-HiLeS2: Model Driven Embedded System Virtual Prototype generation** *Horacio Hoyes, Rubby Casallas, Fernando Jiménez, Darío Correal* **-Model-driven Development of Simulation Solution based on SysML starting with the Simulation Core** *Pascal Weyprecht, Oliver Rose*	Short - Applications Chair: Xiaolin Hu **-Constructing DEVS Models Based on Experts' Knowledge: Application to STM-icroelectronics' Large Scale Manufacturing Processes** *Pamela Viale, Claudia Frydman, Jacques Pinaton* **-Interfacing DEVS and Visualization Models for Emergency Management** *Mohammad Moallemi, Shafagh Jafer, Ahmed Sayed Ahmed, Gabriel Wainer* **-NoC Simulation Mod-eling in DEVS-Suite** *Hoda Ahmadinejad, Fatemeh Refan, Hessam Sarjoughian* **6:00pm DEVS Award** Chair: Doohwan Kim	Generative Design **-Generative Fluid Dynamics: Integration of Fast Fluid Dynamics and Genetic Algorithms for Wind Loading Optimization of a Free Form Surface** *Angelos Chronis, Alasdair Turner* **-Use of Sub-Division Surfaces Architectural Form-Finding and Procedural Modelling** *Shajay Bhooshan, Mostafa El Sayed* **-Leveraging Cloud Computing and High Performance Comuting Advances for Next-Generation Architecture and Urban Design Projects** *Francesco Iorio, Jane L. Snowdon*

Wednesday April 6

Track	ADS	ANSS	EAIA	CNS	HPC	MMS	TMS/DEVS	TMS/DEVS	SimAUD
Room	Salon I	Salon J	Quincy	Haymarket	Salon K	Salon I	Faneuil	Constitution	Harbor
8:30-10:00		Wireless II: Physical Layer Modeling **-A Correlation Model for Shadow Fading in Multi-hop Wireless Networks** *Wen Qin, Bo Yang* **-Towards Realistic Mobility Modeling for Vehicular Ad Hoc Networks** *Aifeng Wu, Jianqing Ma, Shiyong Zhang* **-Simulations of a New MIMO Zero-Forcing Detector for Correlated and Estimated Rician Fading** *Xiaonan Shi*	Business & Industry Simulation I Chair: Agostino Bruzzone **-Energy Portfolio Simulation Considering Environmental and Public Health Impacts** *Rafael Diaz, Joshua Behr, Mandar Tulpule* **-Modeling and Simulating the Economic and Demographic Impact of Transport Infrastructure Investment** *Joshua Behr, Rafael Diaz, Mandar Tulpule, Francesco Longo, Antonio Cimino*	Network Security Chair: Dr. Hala ElAarag **-Security in Wireless Sensor Networks: Key Intrusion Detection Module in SOOAWSN** *Mohammad Abuhelaleh, Khaled Elleithy* **-Enhancing Broadcast Authentication in Sensor Networks** *Arayeh Norouzi, Abdolreza Abhari, Truman Yang* **-Location-Based Security for ID Document and ID Card Enrollment Stations** *Eugene Gerety, Khaled Elleithy*	Invited Speaker II & Component Based Programming **-Convey ThreadSim: A Simulation Framework for Latency-Tolerant Architectures** *John Leidel* **-Component-Based Programming Techniques for Coarse-grained Parallelism** *Jörg Dümmler, Thomas Rauber, Gudula Rünger*	MMS-D Chair: Cynthia Calongne **-Taxonomy of Cyber Attacks and Simulation of Their Effects** *Ian M. Chapman, Sylvain P. Leblanc, Andrew Partington* **-Development of a Training Effects Algorithm for Modeling the Impact of Training in IMPRINT for 21st Century Air Force Needs** *Tristan Johnson, Rinat Rosenberg-Kima* **-An Overview of Cyber Attack and Computer Network Operations Simulation** *Sylvain Leblanc, Ian Chapman, Andrew Partington, Mélanie Bernier*	Software & Performance Chair: Jan Himmelspach **-GATLAS: Google Earth Visualization for ATLAS** *Gabriel Wainer, Ken Edwards* **-Performance of a Multi-Agent System over a Multi-Core Cluster managed by Terracotta** *Franco Cicirelli, Angelo Furfaro, Andrea Giordano, Libero Nigro* **-A Performance Evaluation of the Conservative DEVS Protocol in Parallel Simulation of DEVS-based Models** *Shafagh Jafer, Gabriel Wainer*		Education **-SimAUD Invited Talk 1** *Christoph Reinhart* **-SimAUD Invited Talk 2** *Christoph Reinhart* **-Solar Zoning and Energy in Detached Residential Dwellings** *Jeffrey Niemasz, Jon Sargent, Christoph Reinhart*
10:00-10:30	AM BREAK - Palm Garden Exhibits Area								
10:30-12:00	ADS6 Chair: Joe Barjis **-Modeling Space in an Agent-based Model of Malaria: Comparison between Non-Spatial and Spatial Models** *S.M. Niaz Arifin, Gregory J. Davis, Ying Zhou* **-Animation of Open Multi-Agent Systems** *Jeremy Pitt, Brendan Neville, Sam Macbeth, Hugo Carr*	Simulation Methods **-A (lumped) Markov process for a class of dynamic Petri nets** *Lorenzo Capra* **-Simulation of Routing in Nano-manipulation for creating pattern with Atomic Force Microscopy using hybrid PSO-AS** *Ahmad Naebi* **-Component-Oriented Interoperation of Real-Time DEVS Engines** *Mohammad Moallemi, Gabriel Wainer, Federico Bergero, Rodrigo Castro*	Business andIndustry Simulation II Chair: Francesco Longo **-Intelligent Agents for Pandemic Modeling** *Agostino Bruzzone, Marina Massei, Francesca Madeo, Federico Tarone, Julija Petuhova* **-A Component-based Approach for Manufacturing Simulation** *Frank Riddick, Deogratis Kibira, Y. Tina Lee, Stephen Balakirsky* **-An Effect of Failure Distribution of Machine to the Manufacturing System Performance of Engine Shop** *Dug Hee Moon, Guan Wang, Yang Woo Shin*	Grid and Clouds Computing Chair: Dr. Abdolreza Abhari **-Resource Management on Clouds and Grids: Challenges and Answers** *Shikharesh Majumdar* **-Clouds & Grids: A Network and Simulation Perspective** *Hassan Rajaei* **-Discussion**	HPC Applications **-Asynchronous Invocation of Adaptations in Electronic Structure Calculations** *Sai Kiran Talamudupula, Masha Sosonkina, Mike Schmidt* **-Direct Search Versus Simulated Annealing on Two High Dimensional Problems** *David Easterling, Layne Watson, Michael Madigan* **-A Highly Parallel Implementation of K-Means for Multithreaded Architecture** *Patrick Mackey, John Feo, Pak Chung Wong, Yousu Chen* **-Fault-tolerant Data Aggregation Scheme for Monitoring of Critical Events in Grid based Healthcare Sensor Networks** *Ather Saeed, Andrew Stanieri, Richard Dazeley*		Applications **-Common simulation methods for heat conduction from the perspective of Cellular Automata** *Michael Mueller, Georg-Peter Ostermeyer* **-Net-centric ACT-R Based Cognitive Architecture with DEVS Unified Process** *Saurabh Mittal, Scott Douglass* **-DEVS for AUTOSAR platform modeling** *Joachim Denil, Hans Vangheluwe, Pieter Ramaekers, Paul De Meulenaere, Serge Demeyer*	DEVS - Standardization Chair: Xiaolin Hu **-Taxonomy of DEVS Subclasses for DEVS Standardization** *Moon Ho Hwang* **-Some Desired Features for the DEVS Architecture Description Language** *Olivier Dalle, Judicael Ribault* **-Standardizing DEVS Models: An Endogenous Standpoint** *Hessam Sarjoughian, Yu Chen*	Design & Analysis **-A Simple Method to Consider Energy Data in the Architectural Conception of Dwelling Buildings** *Laëtitia Arantes, Olivier Baverel, Pascal Rollet, Daniel Quenard* **-Integrating Daylight and Thermal Performance Across the Urban and Building Scales. A Methodological Study of Environmental Simulation in Architecture & Engineering** *Peter Andreas Sattrup, Jakob Strømann-Andersen* **-Design & Simulation for Architectural Geometry** *Yoshishiro Kobayashi, Peter Wonka*
12:00-1:30	LUNCH BREAK - Lunch not provided								

Wednesday April 6

Track	ADS	ANSS	EAIA	EAIA	HPC	MMS	TMS/DEVS	TMS/DEVS	SimAUD
Room	Salon I	Salon J	Quincy	Haymarket	Salon K	Salon I	Faneuil	Constitution	Harbor
1:30-3:00		Computer Architectures **-A Latency Simulator for Many-core Systems** *Sunil Kumar, Tommaso Cucinotta, Giuseppe Lipari* **-Comparative Analysis of OpenMP and MPI on Multi-Core Architecture** *Michael Chan, Lan Yang* **-Stationary Solution Approximation using a Memory-Efficient Perfect Sampling Technique** *Ricardo M. Czekster, Paulo Fernandes, Afonso Sales, Thais Webber*	Emerging Applications I Chair: Rafael Diaz **-A Model for Simulating Impacts of Seismic Events on Large Power Systems** *Edgar Portante, Brian Craig, Leah Malone, James Kavicky, Stewart Cedres, Stephen Folga* **-A DEVS Library for Rail Operations Simulation** *Yilin Huang, Mamadou Seck, Alexander Verbraeck* **-KoProV - A Learning Approach for Coordinated Learning of Modeling and Simulation Based on Knowledge Modules** *Christoph Laroque, Jonas Schulte*	M&S in Engineering - Chair: Patrick Hester **-Modeling & Simulation Driven Software Development** *Joseph Barjis, Irina Rychkova, Levent Yilmaz* **-Wave-Pattern Processing Towards Inverse Reliability Problems** *Jan Podrouzek* **-Short Term Wind Power Forecasting Using Time Series Neural Networks** *Mohammadsaleh Zakerinia, Seyed Farid Ghaderi*	Scheduling & Performance **-Fast Approximation Algorithms for Scheduling Independent Multiprocessor Tasks** *Kai Baumgarten, Thomas Rauber* **-Communication with Spawned Processes** *Nicholas Radcliffe, Masha Sosonkina, Layne Watson* **Corrected Model for "Predicting the Relative Performance of CPU"** *Jayanta Choudhury*	MMS-F Chair: Dan Novak **-Balancing Exploration and Expoitation Ratio in Reinforcement Learning** *Ozkan Ozcan, Claudio Coreixas de Moraes, Jonathan Alt* **-Coalition Battle Management Language Extensions for Simulation Interoperability** *Robert Kewley, Samy Chatelet, Antione Helio* **-Measuring the Performance of Network Virtualization Tool N2N in the Design of a Cyber Warfare Training and Education Platform** *Kyle Stewart, Todd Andel, Jeffrey Humphries*	WIP - Software Chair: Jan Himmelspach **-ScipySim: Towards Distributed Hetergen-eous System Simulation for the SciPy Platform** *Allan McInnes, Brian Thorne* **-The Simulation-based Multi-objective Evolu-tionary Optimization (SIMEON) Framework** *Ronald Apriliyanto Halim, Mamadou Diouf Seck* **-Automating DEVS over Data Distribution Service for High Performance and Interoperability** *Ki-Jeong Kwon, Chungman Seo, Bernard P. Zeigler* **-Towards a Testing Framework for DEVS Formalism Implementation** *Xiaobo Li, Hans Vangheluwe, Yonglin Lei, Hongyan Song, Weiping Wang*	DEVS - Standardization - Standardizing DEVS Models Chair: Hessam Sarjoughian	Augmented Reality **-Lifecycle Building Card Towards Paperless and Visual Lifecycle Management Tools** *Holger Graf, Souheil Soubra, Guillaume Picinbono, Ian Keough, Alex Tessier, Azam Khan* **-3D Scans of As-Built Street Scenes for Virtual Environments** *Naai-Jung Shih, Chia-Yu Lee, Tzu-Ying Chan* **-Urban Affects: Urban Systems and Social Ecologies** *Chris Kroner, Phu Duong, Liz Barry, Mike Szivos*
3:00-3:30	PM BREAK - Palm Garden Exhibits Area								
3:30-5:00	**END**	Simulation and Software **-SimSaaS: Simulation Software as a Service** *Wei-Tek Tsai, Wu Li, Hessam Sarjoughian, Qihong Shao* **-Mapping of Software Model to Simulation Model for Performance Requirement Verification** *Ronaldo Arias, Celso Massaki Hirata* **-Developing High-Speed Real-Time Simulations** *Roy Crosbie, John Zenor, Richard Bednar, Dale Word, Narain Hingorani*	Emerging Applications II Chair: Andreas Tolk **-Understanding Interoperability** *Saiko Diallo, Heber Herencia-Zapana, Jose Padilla, Andreas Tolk* **-Emerging M&S Application in Risk Management** *C. Ariel Pinto, Andreas Tolk, Michael McShane*	END	Software & Environments **-A Data Management System for Ab-Initio Nuclear Physics Applications** *Fang Liu, Ritu Mundhe, Masha Sosonkina, Chase Cockrell, Miles Aronnax, Pieter Maris, James Vary* **-PetClaw: A Scalable Parallel Nonlinear Wave Propagation Solver for Python** *Amal Alghamdi, Aron Ahmadia, David Ketcheson, Matthew Knepley, Kyle Mandli, Lisandro Dalcin* **-Adaptive Runtime Selection of Parallel Schedules in the Polytope Model** *Benoît Pradelle, Philippe Clauss, Vincent Loechner* **-A Framework for an Automatic Hybrid MPI+ OpenMP code generation** *Khaled Hamidouche, Joel Falcou, Daniel Etiemble*	END	WIP/Short - Modeling & Computation Chair: Andrea D'Ambrogio **-Synchronizing Sequences On Not Strongly Connected Petri Nets** *Marco Pocci, Isabel Demongodin, Norbert Giambiasi, Alessandro Giua* **-The Rationale for Shaped Simulation** *Jeff Buzen* **-Clocked Transition System as an OPM Formalism with Application to Systems Biology** *Valeria Perelman, Dov Dori, Judith Somekh* **-ISTSM: Incompletely Specified Timed Sequential Machines** *Norbert Giambiasi*	DEVS - Standardization - Standardizing DEVS Simulator Interoperability Chair: Gabriel Wainer 6:30pm: Model Competition Chair: Hessam Sarjoughian	Parametric Urbanism **-City of Love and Hate** *Adnan Ihsan, Amirali Merati, Eva Poulopoulou, Foteinos Soulos* **-Components for Parametric Urban Design in Grasshopper. From Street Network to Building Geometry** *Christian Schneider, Anastasia Koltsova* **-Multi-Objective Optimization in Urban Design** *Michele Bruno, Kerri Henderson, Hong Min Kim*

Dynamic Adaptive Disaster Simulation: Developing a Predictive Model of Emergency Behavior Using Cell Phone and GIS Data

Francis Chen, Zhi Zhai and Greg Madey

Room: Quincy

Time: April 4th at 1:30

This paper presents our approach to developing a proof-of-concept Dynamic Adaptive Disaster Simulation (DADS), a system capable of predicting population movements in large-scale disasters by analyzing real-time cell phone data. It has been difficult for existing computer models to accomplish such tasks--they are often too inflexible to make realistic forecasts in complex scenarios. This has led to reactive, uninformed emergency response tactics with disastrous consequences. DADS resolves these issues by continuously updating simulations with real-time data. It accomplishes this by tracing movements of cell phone users on a GIS space, then using geospatial simulation algorithms to infer regional preferences. Inferences are incorporated into agent-based simulations which model future population movements through fluid dynamics principles. Due to privacy concerns, this research utilized synthetic data that were generated to mimic the cell phone location data associated with a recent disaster. Validation techniques such as Manhattan distance show that the simulation is both internally and predictively valid. DADS can adaptively generate accurate movement predictions in disaster situations, demonstrating a modeling paradigm that is highly applicable to population modeling and to other disciplines of computer simulation.

The effects of different interaction protocols in agent-based simulation of social activities

Nicole Ronald, Theo Arentze and Harry Timmermans

Room: Quincy

Time: April 4th at 1:30

Decision making in models of activity and travel behavior is usually individual-based and focuses on outcomes rather than the decision process. Using agent-based modeling techniques and incorporating interaction protocols into the model can assist in modeling decision making in more detail. We describe an agent-based model of social activity generation and scheduling, in which utility-based agents interact with each other to schedule activities. Six different protocols are tested. We show that the model outcomes reflect minor changes in the protocol, while changing the order of the protocol leads to significantly different outcomes; hence the protocol plays a large role in the simulation results and should be studied in more detail in real-life.

Identifying Norms of Behavior in Open Multi-agent Societies

Wagdi Alrawagfeh, Edward Brwon and Manrique Mata-Mantero

Room: Quincy

Time: April 4th at 1:30

Norms have an obvious role in the coordinating, regulating, controlling and predicting agents' behaviors in software agents' societies. Most researchers assume that agents in their societies already know the norms as protocols or some other form. Some researchers take into account the acquisition of societies' norms through inference. Most of this works applies to closed multiagent societies where the agents have similar internal architecture. In this paper, we will present a modification of a verification component that was used in inferring norms in closed multiagent systems. By this modification of the verification component, agents can dynamically infer norms in open multiagent systems, even if the agents do not have the concept of norm in their internal architecture. Using the JADE software framework, we build a restaurant interaction scenario as an example (where restaurants usually host heterogeneous agents), and demonstrate how dynamic permission and prohibition norms can be identified.

Agent-Based Analysis of Asset Pricing under Ambiguous Information

Ben-Alexander Cassell and Michael Wellman

Room: Quincy

Time: April 4th at 3:30

In a representative agent model, the behavior of a social system is described in terms of a single aggregate decision maker. Such models are popular in economic and finance research, largely due to their analytic tractability, but fail to account for real-world agent heterogeneity. Agent-based simulation models naturally incorporate such heterogeneity, and we exploit this capability to investigate a recent model from the finance literature proposed by Epstein and Schneider (ES), and its ability to explain the classic equity premium puzzle in risky asset pricing. In addition to the ambiguity-averse trading strategy adopted by the representative agent in the ES model, we consider simple Bayesian strategies. Rather than impose a particular strategy profile, we employ an empirical game-theoretic approach to derive stable market com- positions among the set of candidate strategies. For most market configurations that we examined, ambiguity-averse pricing was not present in equilibrium support. We do, however, find ambiguity-averse pricing in equilibrium support for a market configuration analogous to an illiquid asset. For none of the market configurations that we examined were we able to find significant equity premia. Both our use of strategic equilibrium as a market composition concept, and the actions of our simulated market microstructure contribute to removing any equity premium. These findings underscore the need to verify that results from abstract representative-agent models are supportable in a higher-fidelity model where heterogeneity and strategic interactions are taken into account.

An Architecture to Tame Simulation Time Tardiness in ADS

Pier Taranti, Ricardo Choren and Carlos Lucena

Room: Quincy

Time: April 4th at 3:30

Time advance control in simulations is usually performed in two different ways: next-event and time-step. Time-step advance is challenging when combined with an agent-centered simulation design

approach. In such approach, each agent can control the execution of its actions, according to its perception of the simulation time advance. In this situation, the tardiness in computing new states can lead the overall simulation to an inconsistent state. This paper presents an architecture that provides a distributed time-step control approach for action execution in agent-centered simulations. The approach provides a central simulation clock and a mechanism to tame tardiness at run-time. This paper discusses the implementation of the proposed architecture and shows simple examples of its application.

Initial Formulation (proposal) of an Optimization Method Based on Stigmergic Construction

Aditya Velivelli and Kenneth (Mark) Bryden

Room: Quincy

Time: April 4th at 3:30

Sign-based stigmergy methods such as the ant colony optimization algorithm have been used to solve network optimization, scheduling problems and other optimization problems that can be visualized as (directed) graphs. However, there has been no use of optimization methods based on sematectonic stigmergy (such as coordination through collective construction). This paper proposes an approach where the process of agent-directed stigmergic construction can be used as a general optimization tool similar to simulated annealing. To do so the authors adopt the previous work on stigmergic construction to a virtual space and propose applying statistical mechanics based techniques on data pertinent to collective construction.

A Proposed Method for Dynamic Knowledge Representation via Agent-directed Composition from Biomedical and Simulation Ontologies: An Example Using Gut Mucus Layer Dynamics

Scott Christley and Gary An

Room: Quincy

Time: April 5th at 10:30

The translational challenge in biomedical research lies in the effective and efficient transfer of mechanistic knowledge from one biological context to another. Implicit in this process is the establishment of causality from correlation in the form of mechanistic hypotheses. Effectively addressing the translational challenge requires the use of automated methods, including the ability to computationally capture the dynamic aspect of putative hypotheses such that they can be evaluated in a high throughput fashion. Ontologies provide structure and organization to biomedical knowledge; converting these representations into executables/simulations is the next necessary step. Researchers need the ability to map their conceptual models into a model specification that can be transformed into an executable simulation program. We suggest this composition function can be expressed as a set of logical rules, which an intelligent computational agent, a Composing Agent (CompAgt), performs reasoning upon to develop a plan to achieve that composition. Presented herein is a description for a composition operation between biomedical and simulation ontologies that can be performed by a CompAgt to produce executable code for dynamic knowledge representation.

Composite Cell Agent Model of Epithelial Culture in Vitro

Sean H. J. Kim and C. Anthony Hunt

Room: Quincy

Time: April 5th at 10:30

An advantage of synthetic, agent-oriented, modeling and simulation methods is the ease with which components can be refined or replaced with components having additional mechanisms and details. We present an agent-based model of epithelial cell culture, and describe revisions made to include subcellular details. Specifically, we developed new components inside cell agents, thereby evolving atomic cell agents into composite counterparts. The new components mapped abstractly to subcellular features involved in cell surface differentiation, which replaced agent rules governing simulated cell polarization and depolarization. Cross-model validation results under normal conditions demonstrated that the revisions did not measurably alter the earlier model phenotype. However, cross-model validation results under dysregulated conditions uncovered discrepancies. Their elimination required reengineering the composite. We expect the approach and methods developed will facilitate and accelerate acquisition of deeper mechanistic insight into tissue biology.

A Robust in Silico Analogue of MDCK Cystogenesis Mimics Growth in Multiple Culture Conditions

Jesse Engelberg

Room: Quincy

Time: April 5th at 10:30

Madin-Darby canine kidney (MDCK) cells undergoing cystogenesis in vitro is a scientifically useful model of epithelial morphogenesis. The cysts formed in collagen and Matrigel are qualitatively similar, consisting of a single layer of epithelial cells surrounding a hollow lumen. How-ever, differences in key quantitative measures of cyst growth, including cell number and cyst and lumen size, in-dicate that some cell behaviors are different within the two culture systems. We recently described an agent-oriented, agent-directed analogue of MDCK cystogenesis in Matrigel. It utilized a cellular Potts model and achieved qualitative and quantitative validation targets using empirical parame-ter tuning. Within this report we highlight steps taken to convert the cellular Potts model framework to one based upon an agent-oriented approach. If measures of cell death are ignored, the only parameters that required adjustment to allow the analogue of cystogenesis in Matrigel to mimic MDCK cystogenesis in collagen were those controlling cell division and polarization. These data indicate that in addition to delayed cell polarization, cell division in collagen is likely slower than in Matrigel. The reported results strongly support the hypothesis that MDCK cells use the same basic operating principles to create cysts when cultured in Matrigel or collagen.

The Observation of Tolerance in a Social Network Model

Kristen Lund and Yu Zhang

Room: Quincy

Time: April 5th at 1:30

In dynamic social networks, agents are able to make and break connections with neighbors to improve their payoffs. Rules have recently developed which help agents evaluate their neighbors and decide whether to break a connection. These rules have introduced the

idea of tolerance in dynamic networks by allowing an agent to maintain a relationship with a bad neighbor for some time. In this research, we investigate and define the phenomenon of tolerance in dynamic social networks, particularly with the Highest Weighted Reward rule. We define a mathematical model to predict an agent's tolerance of a bad neighbor and determine the factors that affect it. Tolerance of other agents is an intuitive human behavior, and its presence in social network models suggests that the development of social interaction rules among agents shows qualities of human interactions that exist in real life.

An Agent-Based Genetically-Aware Entomological Model

Regina McCormack, James E. Gentile and Samuel S.C. Rund

Room: Quincy

Time: April 5th at 1:30

There are multiple agent-based simulations investigating population and behavior dynamics of mosquito vectors. Some of these simulations model intervention pressures on the mosquito population to predict the impact of vector control strategies. These are complex models that can accurately characterize mosquitoes and simulate the effects of various interventions. One class of intervention methods involves the injection of altered genotypes into the vector population. The gene interrupts development and is inherited through the paternal line. Simulating these interventions requires an entomological model to be genetically-aware. We extend an existing model to capture genetic and heredity dynamics in a vector population. We show that it is possible to model heredity and simulate the effects of these intricate interventions through agent-based modeling. As a proof-of-concept, we simulate a method for insect control known as sterile insect technique (SIT). With our simulation, we show that introducing a female-specific lethal gene within the mosquito population greatly reduces the mosquito vector's ability to transmit malaria.

Survival of Altruistic Preferences in the Ultimatum Game

Zsombor Z. Meder

Room: Quincy

Time: April 5th at 1:30

We examine the survivability of altruistic preferences in the Ultimatum Game through two sets of agent-based simulations. We find that a self-centered, memory-based strategy updating provides a more plausible basis for altruism than classic imitate-your-neighbor learning. If memory of second-player acceptance thresholds is longer than memory of first-player offers, then our model behavior is consistent with the results of human experiments.

Medieval Military Logistics: An Agent-based Simulation of a Byzantine Army on the March

Bart Craenen, Georgios Theodoropoulos, Vincent Gaffney, Philip Murgatroyd and John Haldon

Room: Quincy

Time: April 5th at 3:30

Although historical studies are frequently perceived as clear narratives defined by a series of fixed events; in reality, even where critical historical events may be identified, historic documentation frequently lacks corroborative detail to support verifiable interpretation. Consequently, interpretation rarely rises above the level of unproven assertion and is rarely tested against a range of evidence. Agent-based simulation can provide an opportunity to break these cycles of academic claim and counter-claim. This paper discusses the development of an agent-based simulation designed to investigate medieval military logistics so that new evidence may be generated to supplement existing historical analysis. It uses as a use-case the Byzantine army's march to the battle of Manzikert (AD 1071), a key event in medieval history. The paper focuses primarily on the design of the agents and the environment they interact with, as well as how the agent-based simulation as a whole can be used to generate new parameters with which historical evidence can be situated.

Price Rigidity and Strategic Uncertainty - An Agent-based Approach

Robert Somogyi and Janos Vincze

Room: Quincy

Time: April 5th at 3:30

The phenomenon of infrequent price changes has troubled economists for decades. Intuitively one feels that for most price-setters there exists a range of inaction, i.e. a substantial measure of the states of the world, within which they do not wish to modify prevailing prices. However, basic economics tells us that when marginal costs change it is rational to change prices, too. Economists wishing to maintain rationality of price-setters resorted to fixed price adjustment costs as an explanation for price rigidity. In this paper we propose an alternative explanation, without recourse to any sort of physical adjustment cost, by putting strategic interaction into the center-stage of our analysis. Price-making is treated as a repeated oligopoly game. The traditional analysis of these games cannot pinpoint any equilibrium as a reasonable "solution" of the strategic situation. Thus there is genuine strategic uncertainty, a situation where decision-makers are uncertain of the strategies of other decision-makers. Hesitation may lead to inaction. To model this situation we follow the style of agent-based models, by modeling firms that change their pricing strategies following an evolutionary algorithm. Our results are promising. In addition to reproducing the known negative relationship between price rigidity and the level of general inflation, our model exhibits several features observed in real data. Moreover, most prices fall into the theoretical "range" without explicitly building this property into strategies.

Informing Malaria Control Policy Using ABMS

Gregory Davis and Geralyn Jank

Room: Quincy

Time: April 5th at 3:30

Malaria is a vector-borne illness affecting millions of lives annually, and it imposes a heavy financial burden felt worldwide. Moreover, there is growing concern that global climate change, in particular, rising temperature, will increase this burden. As such, policy makers are in need of tools capable of informing them about the potential strengths and weaknesses of intervention and control strategies. We extend a previously developed agent-based model of the Anopheles gambiae mosquito, one of the primary vectors of malaria, to investigate how changes in temperature influence the dynamics of malaria transmission and the effectiveness of intervention methods. Our results suggest that temperature increase can both potentially lead to higher malaria transmission rates and alter the effectiveness of a common intervention method. The implications and limitations of these findings are discussed.

Modeling Space in an Agent-based Model of Malaria: Comparison between Non-Spatial and Spatial Models

S. M. Niaz Arifin, Gregory J. Davis and Ying Zhou

Room: Salon I

Time: April 6th at 10:30

In agent-based modeling (ABM), an explicit spatial representation may be required in some cases for certain aspects of the system to be modeled more realistically. In this paper, we describe modeling space in a previous agent-based model of malaria. In the new spatial model, all agents (mosquitoes and aquatic habitats) possess explicit spatial information. The habitat locations of mosquitoes are specified according to different spatial patterns, or landscapes. We use three types of landscapes: regular, random, and hybrid. In the spatial context, we describe the modeling aspects of mosquito agents' movement, the event of oviposition (the process of laying eggs), and compare results between the two models (non-spatial and spatial). Ensuring oviposition is modeled accurately; we show that both models are docked. For both models, we investigate the effect of relative sizes of the aquatic habitats. Using different landscapes, we show that vector abundance (VA) remain unchanged. We also show that with same combined carrying capacity, varying the density of habitats in a landscape does not affect the mean population significantly. Finally, we show that when the density of aquatic habitats is constant, the combined carrying capacity drives VA.

Animation of Open Multi-Agent Systems

Jeremy Pitt, Brendan Neville, Sam Macbeth and Hugo Carr

Room: Salon I

Time: April 6th at 10:30

This paper presents applications of the system PreSage, an animator and simulator for open multi-agent systems and networks, with the computational intelligence of agents encapsulated in the network nodes. We briefly describe the architecture of the system and review its primary components, and then survey a number of experiments undertaken with the system. This includes: decision-making, cluster aggregation and fragmentation in mobile ad hoc networks; accuracy vs.\ longevity trade-offs in sensor networks; management of common pool resources; compliance pervasion in copyright games; and organized adaptation for run-time system modification. The range of applications and their varying characteristics demonstrate that PreSage is a versatile and re-configurable tool for the animation of networked intelligence.

Denoising of Time Domain Responses in Wireless Sensor Network for the Structural Health Monitoring of Transportation Infrastructure

Tzu-Yang Yu, Honggang Wang and Hong Liu

Room: Salon J

Time: April 4th at 1:30

Wireless sensor networks can collect real-time structure health information and perform a set of activities on transportation infrastructure (e.g., bridge and road) to predict their end-of-life and maintain it in operable conditions. However, before wireless sensors are deployed in the field, it is important to test the sensing and communication performance through the simulation. In this paper, propagation and scattering of wireless signals of WSN are simulated in the space-time domain by the finite-difference time-domain (FDTD) methods. Artificial noises are simulated by additive white Gaussian noise (AWGN) and introduced to the clean signal. Our simulation method can help designing an optimized deployment strategy of sensor networks for structure health monitoring.

Enhancement of 802.11 Modules in ns-2 for Wireless Access on Vehicular Environments and Performance Evaluation

Kyohong Jin, Sungjin Lee, Daehoon Kang, Sangjun An and Jihyun Cha

Room: Salon J

Time: April 4th at 1:30

This paper designs and develops the simulation program based on ns-2 for the multi-channel operation of the WAVE mode which is defined to enable communication among high-speed vehicles or between a vehicle and a roadside infrastructure network. The ns-2, the most popular simulation tool for networking research, supports the original 802.11 MAC and PHY, and some researchers contribute 802.11e, 802.11-extension modules to ns-2. However, the wireless MAC module utilizing the multi-channel operation for the WAVE has not been included until now. In this paper, we explain the newly-designed multi-channel simulation program based on ns-2 and show the verification and performance results.

Latency Modeling and Minimization for Large-scale Scientific Workflows in Distributed Network Environments

Qishi Wu, Yi Gu, Yuchen Liao, Xukang Lu, Yunyue Lin and Nageswara Rao

Room: Salon J

Time: April 4th at 1:30

Large-scale e-science applications feature complex workflows consisting of many computing modules. Mapping such workflows in distributed network environments and minimizing their latency are crucial to those applications that require fast system response and prompt user interaction. We model the time cost of each workflow component and design an efficient algorithm to compute the exact end-to-end delay of the entire workflow by explicitly accounting for the resource sharing dynamics. We further propose a workflow mapping approach to minimize the workflow latency using a recursive optimization procedure. The validity of the cost models and the accuracy of the latency computing algorithm are verified in comparison with an approximate solution, a dynamic system simulation program, and a workflow engine deployed in a real network. The performance superiority of the proposed mapping approach is illustrated by extensive simulation-based comparisons with existing algorithms.

An Energy-Balanced Coding Redundancy Scheduling Approach to Support Quality of Service in Battery-Powered Multi-Hop Wireless Networks

Lin Xing, Wei Wang, Shaoen Wu, Kun Hua and Honggang Wang

Room: Salon K

Time: April 4th at 1:30

Lifetime is a crucial issue for Multi-hop wireless network powered by size-limited batteries. There have been few algorithms proposed to solve such network lifetime challenge. Furthermore, the application of flexible channel coding redundancy scheduling to improve energy-balancing and energy-efficiency has seldom been reported in literature. In this paper, we propose a new approach to achieve energy-balancing of Multi-hop wireless networks while meeting the requirement of Quality of Service (QoS) by optimizing channel coding rates. In the proposed approach, we develop a scheme to select the optimal channel coding rate on each hop to approach a lower bound of quality requirement while achieving the best effort energy-balancing. Given a certain channel situation, a higher channel coding rate is assigned to reduce the error rate with a higher energy cost; or a lower channel coding rate is assigned to improve energy efficiency and energy-balancing at the cost of reduced QoS. The simulation results have shown that the proposed approach can significantly improve energy-balancing and prolong network lifetime of Multi-hop wireless networks within the QoS requirements.

Performance Analysis and Simulation of Packet Scheduling Algorithms in Femtocell Environment

Volkan Sevindik, Oguz Bayat and Jay Weitzen

Room: Salon K

Time: April 4th at 1:30

This article analyzes the performance of state-of-art macrocell scheduling algorithms in femtocell environment. Real data rate control (DRC) values collected through real femtocell experiments are used in computer simulations to calculate average sector throughput and fairness for best effort (BE) traffic users. Computer simulations are performed in order to model scheduling techniques, BE and VoIP users in femtocell environment. Scheduling algorithms simulated and analyzed are Round Robin (RR), maximum DRC (maxDRC), proportional fairness (PF), exponent DRC (expDRCe), average DRC (aveDRC) and maxDRC-PF. The performance of these schedulers are investigated in femtocell environment, and their sector throughput, throughput fairness performances are presented. As a result of computer simulations, expDRC^0.5, maxDRC-PF^0.1 or maxDRC-PF^0.5 scheduler is recommended to be used in femtocell environment.

TapRouter: An Emulating Framework to Run Real Applications on Simulated Mobile Ad hoc Network

Jinxue Zhang and Zheng Qi

Room: Salon K

Time: April 4th at 1:30

Developing usable and specific applications for users is critical for the success of Mobile Ad hoc Network (MANET). However applications on MANET are difficult to design because of the high dynamics of underlying network. Thus the prior evaluation and simulation are needed. Typical approaches to evaluate applications on MANET are network simulation and testbed deployment. Network simulation uses virtual networks and usually needs to re-write the applications to match the simulator's particular APIs or framework, which brings out with additional works and low credibility. On the other hand, applications on testbed will obtain reliable results but with high cost on deployment. Network emulation is an attractive tradeoff for

these two extremes to evaluate applications. In this paper, we propose TapRouter, an application-emulating framework for MANETs with high performance and usability by integrating the sophisticated ns-3 simulator and lightweight virtualization technology. Moreover, in order to improve efficiency, we design MAC binding mode and IP binding mode according to whether the application includes routing function. Our experimental evaluation shows that time overhead of TapRouter is trivial while memory occupation are scalable to the number of assigned nodes.

Towards Parameter Estimation in Wildfire Spread Simulation Based on Sequential Monte Carlo Methods

Fan Bai, Song Guo and Xiaolin Hu

Room: Salon J

Time: April 4th at 3:30

A vehicular ad hoc network (VANET) is distinct from most existing ad hoc networks in that the movements of vehi- cles are constrained by road, thus a realistic mobility model is vital for correctly evaluating protocol's performance in VANET. We analyze mobility models in vehicular ad hoc networks and identify key components that significantly im- pact the performance of protocols, involving vehicular move- ment pattern, map layout, trip selection scheme, destination selection mechanism, traffic light model. A realistic mobility model(REMM) is proposed based on the analysis results. We evaluate the model from two aspects: the degree of realism and the way it influences the performance of routing proto- cols. Simulation shows that our model has advantages over existing mobility models, including commonly used random way point model and existing mobility models STRAW. Our work improves the understanding of mobility modeling and REMM can be a reference for simulation of VANET proto- cols.

A System Dynamics Model to Evaluate Sustainability of Water Supply in a Watershed.

Roberto de la Llata

Room: Salon J

Time: April 4th at 3:30

A system dynamics model is developed with the purpose of analyzing scenarios of supply and demand of water in the hydrological basin around the city of Queretaro, Mexico. The model takes into account the main components of the social environment, together with their relations with the hydrological cycle. Population was estimated with the Cohort-Component method, domestic, industrial and livestock use was calculated with standard coefficients, while agricultural use was estimated with the Blaney-Criddle method. The hydrological model involved estimating monthly runoff with the Curve Number method. Precipitation was modeled in a disaggregate manner, first annual rainfall was modeled with spatially correlated lognormal random variables and conditional to them; monthly precipitations were obtained with the fragments method. Percolation coefficients were used to estimate aquifer's recharge. Water supply took into account the main reservoirs and aquifers in the region, together with water treatment and reuse. In the scenario construction phase, ten critical variables were selected and integrated in three basic scenarios. Results showed that in spite of a recent major inter-basin transfer, overexploitation of the main aquifer will continue in two of those scenarios, reinforcing the idea that demand administration measures are necessary to complement future supplies of water.

Estimation of New Ignited Fires Using Particle Filters in Wildfire Spread Simulation

Haidong Xue and Xiaolin Hu

Room: Salon J

Time: April 4th at 3:30

Assimilating real time data into wildfire spread simulations has the potential to improve simulation results of wildfires, which are complex and dynamic in nature. Our previous work developed a data assimilation method based on particle filters (PF) to estimate the state of a wildfire. This method, however, does not work effectively when there are significant events, such as new ignited fires, that change the fire spread behavior. This paper proposes a new method to estimate new ignited fires based on PF. The developed data assimilation method uses prior knowledge to design the proposal distribution for PF. Experiment results of this method, compared with those from several other proposal distributions, indicate that the developed method can effectively improve simulation results.

Statistical Modeling of Optical Neural Transduction

Jennifer Byrne

Room: Salon K

Time: April 4th at 3:30

This paper presents a model for photon absorption due to laser stimulation of the spiral ganglion cells in the basilar membrane of the inner ear. The system is modeled in three dimensions as four stacked semi-infinite homogeneous slabs, each with its own particular optical properties which drive the stochastic behavior of the system. The first slab is the ambient medium, perilymph, in the scala tympani. The second slab is the perilymph ambient medium with the optical laser fiber tip embedded in it. The optical fiber laser tip serves as the transducer for the auditory nerve cells. Setting up a separate slab for the tip allows us to examine the relationship between distance of the tip from the target tissue and attenuation of the photon absorption in the tissue. The third slab is the basilar membrane wherein lie the spiral ganglion cells. The fourth slab is the ambient medium in the scala vestibuli, perilymph. The model tracks the path and energy deposition of a single photon as it scatters, reflects, transmits, and is absorbed through the various slab layers. A large number of photons were run through the slab model. The absorption and path of each photon was tracked in three dimensions and then averaged to determine the three dimensional expected value for photon absorption and path (monte carlo technique). In this fashion, a three dimensional Green's function of absorption was obtained for the tissue. In this paper, we convolve that Green's function with a pulsed laser diode profile to obtain the predicted tissue absorption response and compare the analytic results to the experimental results presented in Izzo (1).

A Game Theoretical Approach to Broadcast Information Diffusion in Social Networks

Dmitry Zinoviev and Vy Duong

Room: Salon K

Time: April 4th at 3:30

One major function of social networks (e.g., massive online social networks) is the dissemination of information, such as scientific knowledge, news, and rumors. Information can be propagated by the users of the network via natural connections in written, oral or electronic form. The information passing from a sender to receivers and back (in the form of comments) involves all of the actors considering their knowledge, trust, and popularity, which shape their publishing and commenting strategies. To understand such human aspects of the information dissemination, we propose a game theoretical model of a one-way information forwarding and feedback mechanism in a star-

shaped social network that takes into account the personalities of the communicating actors.

Feasibility Study for Automatic Calibration of Transportation Simulation Models

Hong Liu, Qian Yu, Wei Ding, Daiheng Ni, Honggang Wang and Stephen Shannon

Room: Salon K

Time: April 4th at 3:30

This paper presents a high-tech solution to meet the challenges in calibrating transportation simulation models. Like any simulation software, model calibration prior to its application plays a crucial role in producing reliable results. However, transportation professionals face difficulties in performing the daunting tasks of calibrating a model for each transportation network design to satisfy the targeted traffic flow demand, especially during data collection and distillation. Our innovative approach utilizes sensor and geography networking technology to seamlessly collect data about real world network, traffic, and driver behavior. This data is then distilled as needed by data mining before feeding the data to a simulation model. The data is validated automatically to instantaneously reflect the real world and to avoid typographical errors often involved with human intervention, resulting in a more accurate model.

We conduct a feasibility study for our vision of model calibration automation. The research flexes multidisciplinary expertise in traffic flow simulation, geosciences, sensing/networking, and knowledge discovery. As a proof of concept, we implement a prototype that demonstrates how to convert sensor data about traffic flow collected by a state department of transportation into a format taken by CORSIM, a popular traffic simulation model. A running example shows encouraging results.

A Symbolic Model to Traffic Engineering in Wireless Mesh Networks

Edgard Jamhour

Room: Quincy

Time: April 5th at 8:30

Traditionally, routes in mesh networks are defined using the shortest path approach. Using only the shortest paths can lead to sub-optimal results, because bottlenecks can be formed, while parts of the network remain underused. Alternatively, traffic engineering methods can consider other routes to improve the use of network resources, and it is a common approach in wired backbone networks. Applying the same concept in a wireless mesh network (WMN) is a complicated problem, because the channel capacity depends on the amount of traffic transmitted by a node and its neighbors, and the traffic planning can significantly affect the overall network capacity. To address this problem, this paper defines a symbolic model that permits to determine the WMN capacity for a given traffic route scenario and a given network topology. The model can be solved in symbolic computation environments, such as Wolfram Mathematica. To illustrate its application, we define a traffic engineering method that employs an optimization approach to determine the best routes to be used in order to maximize the capacity of a WMN. The proposed method also permits to distribute the traffic among multiple paths, which can lead to improved results depending on the network topology.

A Bottleneck Aware Routing Metric for Wireless Mesh Networks

Bing Qi

Room: Quincy

Time: April 5th at 8:30

Outing metrics are critical for selecting a path with maximum throughput in wireless multi-radio multi-hop mesh networks. Due to the unique characteristics of wireless mesh networks, such as various wireless losses, data transmission rates and transmission channels. the traditional minimum hop count metric does not perform well. To address this diversity, we propose a new routing metric called Bottleneck Aware Transmission Delay (BATD). For EACH channel on a path, the {\em BATD} metric accumulates the total transmission time on the links within the same carrier sense range, and assigns a weight to the path based on the transmission delay of the channel that yields the maximal sum. The path with the least weight is preferred. As a consequence, {\em BATD} not only takes into account the diverse channel distribution when there are multiple non-overlapping channels within one path, but also considers that links on different channels can transmit data packets simultaneously.

This study extensively evaluates the effectiveness of the {\em BATD} routing metric along with other popular metrics via ns-2 simulations. The experiments are performed on a controlled chain topology as well as on a randomly generated topology. The results show that the novel {\em BATD} metric outperforms other routing metrics, especially for scenarios when more than two radios are configured within each node. It achieves up to 35\% throughput improvement over the current known metrics.

Study of the Impact of Link Availability on the Performance of DTN Routing Protocols

Fuad Alnajjar

Room: Quincy

Time: April 5th at 8:30

Routing in Delay/Disruption Tolerant Networks (DTN) acquires the attention and interest of researchers as being the most adequate solution for the problem of intermittently connection in Mobile Ad hoc Networks (MANET). Available simulation tools in DTN focus on evaluating performance of protocols in terms of network and application layers parameters. Unfortunately, implementation of physical layer parameters such as noise, fading, interference, link availability is not incorporated in those simulators. Our aim in this work is to study the impact of link interference as a parameter of the physical layer environment on the performance of DTN routing protocols. We demonstrate through the simulation how those protocols act against changes in network environment.

Controlled Stochastic Petri Net Model for End-to-End Network QoS Provisioning in Middleware-based Multimedia and Real-Time Systems

Hakiri Akram, Berthou Pascal and Gayraud Thierry

Room: Salon I

Time: April 5th at 10:30

End-to-end quality of service (QoS) is central to the objectives of the today's networks requirements of middleware based distributed real-time and embedded (DRE) systems. Any middleware based QoS system should be totally oriented to this goal, and in the scope of this purpose several mechanisms, components and approaches were, are being and will be developed in order to achieve it. In this paper, we show how controlled behavior of such QoS-aware systems can be developed based on stochastic Petri Nets. Afterwards,

We show how to obtain, using such an interpreted formal model, powerful numerical analysis for the management of the network QoS.

Cognitive Cross-layer Design with QoS Provisioning for Cooperative Wireless Networking

Kun Hua, Shaoen Wu, Honggang Wang and Wei Wang

Room: Salon I

Time: April 5th at 10:30

Various forms of cooperation occurred in wireless networks though multiple layers including physical, MAC and routing layers have broaden traditional cooperative communications concepts. Although several research have been successfully proposed to design efficient MAC and routing protocols for wireless cooperative networks, the individual cannot guarantee the overall network performance. The cross-layer design is being investigated as a promising approach for QoS provisioning for cooperative wireless networks. However, the cooperation may not be always the best choice when some situations are given, and there is a tradeoff between the cooperative and non-cooperative operations. In addition, the complexity of cross-layer control has also been remained as a challenge to hinder the cooperative cross-layer into real practice. In this paper, we proposed a novel cross-layer architecture with QoS Provisioning for Cooperative Wireless Networking, which can efficiently decide the cooperative operation and choose appropriate cross-layer parameters through sensitive analysis. Our contribution includes two folders: (1) Proposed a novel cross-layer framework for cooperative wireless networks (2) Proposed decision methods for cooperation choice and cross-layer parameter selection.

On Traffic Locality and QoE in Hybrid CDN-P2P Networks

Moisés Rodrigues, Josilene Moreira, Arthur Callado, Márcio Neves, Djamel Sadok, Per Karlsson and Victor Souza

Room: Salon I

Time: April 5th at 10:30

Hybrid CDN-P2P applications, such as P2P applications, tend to sometimes ignore traffic costs at ISPs and generate large amounts of undesirable cross-ISP traffic. As blocking the traffic does not seem to solve the problem, some simple cooperation between the neighboring peers will be beneficial. In this case, some biased neighbor selection helps peers connecting to others within the same Autonomous System, hence keeping communication local. We developed a detailed simulation model to evaluate the problem and discovered that using a biased neighborhood selection in a hybrid CDN-P2P content network can even enhance user's quality of experience (QoE) and fundamentally reduce the cross-ISP traffic even with the presence of a transit ISP making de-localization decisions.

A Correlation Model for Shadow Fading in Multi-hop Wireless Networks

Wen Qin and Bo Yang

Room: Salon J

Time: April 6th at 8:30

The Network shadowing (NeSH) model is accurate in approximating the correlations between links in wireless networks, but the computational complexity is high. Based on the NeSH model, this paper proposes an elliptical overlap (EO) model. The shadowing region of each link is modeled as an ellipse, and the correlation coefficient of two links is computed by approximating the area of the intersection of the two corresponding ellipses. EO model decreases the time cost greatly, while improves the precision.

Towards Realistic Mobility Modeling for Vehicular Ad Hoc Networks

Aifeng Wu, Jianqing Ma and Shiyong Zhang

Room: Salon J

Time: April 6th at 8:30

A vehicular ad hoc network (VANET) is distinct from most existing ad hoc networks in that the movements of vehicles are constrained by road, thus a realistic mobility model is vital for correctly evaluating protocol's performance in VANET. We analyze mobility models in vehicular ad hoc networks and identify key components that significantly impact the performance of protocols, involving vehicular movement pattern, map layout, trip selection scheme, destination selection mechanism, traffic light model. A realistic mobility model (REMM) is proposed based on the analysis results. We evaluate the model from two aspects: the degree of realism and the way it influences the performance of routing proto- cols. Simulation shows that our model has advantages over existing mobility models, including commonly used random way point model and existing mobility models STRAW. Our work improves the understanding of mobility modeling and REMM can be a reference for simulation of VANET proto-cols.

Simulations of a New MIMO Zero-Forcing Detector for Correlated and Estimated Rician Fading

Xiaonan Shi

Room: Salon J

Time: April 6th at 8:30

Among symbol-detection techniques for multiple-input multiple-output (MIMO) wireless communications systems deploying spatial multiplexing, zero-forcing (ZF) is the low-complexity choice. However, ZF is also known to offer fairly low symbol-detection performance. Herein, simulations show that ZF performance can be improved dramatically with a new approach that exploits not only the channel matrix estimate, as the conventional approach, but also the channel and noise statistics. These performance gains are demonstrated for various assumptions about the channel fading type (Rayleigh and Rician) and about the azimuth spread and the K-factor.

A (lumped) Markov process for a class of dynamic Petri nets

Lorenzo Capra

Room: Salon J

Time: April 6th at 10:30

A Petri net-based reflective layout (called Reflective Petri nets) based on classical (high-level) Petri nets and consolidated reflection concepts has been recently proposed as a formal model for evolving discrete-event systems. The basic idea behind that approach is keeping functional aspects separated from evolutionary ones. This way the ability of verifying properties typical of classical Petri nets is retained. As a first step toward discrete-event simulation, Reflective Petri nets have been recently provided with a with a state-transition semantics. In this paper a (lumped) Markov process is formally defined for Reflective Petri nets, having as support structure a symbolic state-transition graph.

Simulation of Routing in Nano-manipulation for creating pattern with Atomic Force Microscopy using hybrid PSO-AS

Ahmad Naebi

Room: Salon J

Time: April 6th at 10:30

Any collision nano-particles during manipulation operations and selecting the best route and lowest AFM movement are one of the most commonly used areas in nano-space. To apply the lowest force on the cantilever from the fluid environment forces, we try to minimize AFM movements. Our proposed method is movement of routing of AFM probe with nanoparticles transmission using particle swarm optimization algorithm is performed in type of medium. We considered minor barriers and deal with their collision. The purpose of minimization of AFM path is minimizing nano-particles manipulation time handling. So AFM will use less energy to manipulation process. For nano-particles transfer, we can produce a pattern. The second goal is to transfer the nanoparticles along the environment without any collision. So, AFM will use less energy in manipulation process. Routing method increases speed of process. For simulation we have utilized Mathematics and Matlab software.

Component-Oriented Interoperation of Real-Time DEVS Engines

Mohammad Moallemi, Gabriel Wainer, Federico Bergero and Rodrigo Castro

Room: Salon J

Time: April 6th at 10:30

Model reuse and interoperability are cost and effort saving solutions for the simulation-driven development of embedded real-time systems. Different embedded systems share the same components (e.g. motors, sensors, actuators, controllers, etc), and remodeling them is costly in terms of time and effort. Instead, by combining different existing models, developers can improve productivity. To do so, we here pre-sent a generic lightweight interface for message transfers between DEVS models running on different DEVS-based tools. The idea is to allow defining component-based models to be deployed on different tools collaborating in real-time. The components work autonomously as separate DEVS models, and exchange messages at the input-output level over a network infrastructure. We present a proof of concept implementation in which we interfaced ECD++ and PowerDEVS, to DEVS-based tools.

A Latency Simulator for Many-core Systems

Sunil Kumar, Tommaso Cucinotta and Giuseppe Lipari

Room: Salon J

Time: April 6th at 1:30

In this paper we present MCoreSim, an open-source simulation framework for massively parallel and many-core computing systems based on OMNeT++. The simulator supports tile-based architectures with distributed memory and mesh-based interconnects. Its primary purpose is to allow for investigations on the impact of the heterogeneous in-chip communication latencies, as arising due to the network-on-a-chip structure of future and emerging many-core processors, on the performance of the hosted applications. We plan to use MCoreSim to study the variety of possible choices in realizing a suitable software stack for these systems, especially in terms of the choices at the kernel design level.

Comparative Analysis of OpenMP and MPI on Multi-Core Architecture

Michael Chan and Lan Yang

Room: Salon J

Time: April 6th at 1:30

The trend of processors today is with the use of multi-core processors. The benefit of having many cores in one processor is a huge performance gain with parallel computing. However, programmers are faced with a difficult decision on which programming model to use. Two major models are commonly used, OpenMP and MPI. The two models have its advantages and disadvantages with different system configurations. Comparisons have been done in the past with single shared memory systems, shared memory clusters, and distributed memory clusters. MPI can be more favorable with the scalability of clusters but OpenMP can favor the speed of shared memory. Performance can also be affect by the type of problem that is being solved and the size. In this research comparisons were performed with a variety set of application problems from the NAS Parallel Benchmark specifications on systems of multi-core architecture. The performance is evaluated by investigating the execution times of computation and the effects of communication on a single multi-core processor. In comparing pure MPI to OpenMP, OpenMP outperformed MPI in most cases in execution time. The scalability was also better from expanding the problem across more cores. The effect of communication for MPI shows the main weakness of this programming model.

Stationary Solution Approximation using a Memory-Efficient Perfect Sampling Technique

Ricardo M. Czekster, Paulo Fernandes, Afonso Sales and Thais Webber

Room: Salon J

Time: April 6th at 1:30

The analytical solution of large Markovian models is one of the major challenges in performance evaluation. Structured formalisms provide a modular description to tackle state space explosion by presenting memory-efficient solutions based on tensor algebra and specific software tools implement such solutions using iterative methods. However, even these numerical methods become unsuitable when massively large models are considered, i.e., models with more than 100 million states. To deal with such classes of models is possible to find approximations of the stationary solution using simulation of long-run trajectories with perfect sampling methods. The use of these methods prevents usual simulation problems such as initial state setup and burn-in time. Unfortunately, the number of produced samples to establish statistically significant solution remains an open problem. This paper analyzes the sampling process in its extent, proposing a memory-efficient stopping criteria based on a numerical tolerance of the measures of interest. Moreover, we present some memory cost estimations for a classical Markovian model in order to demonstrate the gains of the proposed method.

SimSaaS: Simulation Software as a Service

Wei-Tek Tsai, Wu Li, Hessam Sarjoughian and Qihong Shao

Room: Salon J

Time: April 6th at 3:30

Simulation can benefit from cloud computing that often come with thousands of processors and its software is structured as Software-as-a-Service (SaaS) with its multi-tenancy architecture (MTA). This paper proposes Simulation Software-as-a-Service (SimSaaS) with a MTA configuration model and a cloud-based runtime to support rapid simulation development to be run in an elastic cloud environment.

Mapping of Software Model to Simulation Model for Performance Requirement Verification

Ronaldo Arias and Celso Massaki Hirata

Room: Salon J

Time: April 6th at 3:30

This paper describes the mapping of a software model to a simulation model in order to support the performance requirement verification. More specifically, we describe a mapping of a software model, based on UML Deployment, and State Machine diagrams annotated with performance information, to a simulation model that is specified in Activity Cycle Diagrams. The simulation model is translated to a simulation program so that verification of performance requirements can be made. The mapping is part of a framework based on the UML Profile for MARTE (Modeling and Analysis of Real-Time and Embedded Systems) employed for performance requirement verification of real time computers systems. An example is presented to show the feasibility of the mapping.

Developing High-Speed Real-Time Simulations

Roy Crosbie, John Zenor, Richard Bednar, Dale Word and Narain Hingorani

Room: Salon J

Time: April 6th at 3:30

In recent years applications of real-time simulation have emerged that require shorter frame times than can be achieved by conventional systems. This has led to research on new techniques for achieving high-speed real-time simulation with frame-times as low as 1 µS or even less. Special techniques have been developed for such applications that involve the use of digital signal processors (DSPs) or field programmable gate arrays (FPGAs). Other factors include the selection of numerical integration algorithm, careful coding techniques, programming tools, the use of multi-rate methods, and high-speed interfacing, all of which are considered.

Puzzle Solving- Based Authentication Method for Enhanced Security in SPINS and Its Performance Evaluation

Sanjay Dhurandher, Mohammad S. Obaidat, Ankit Mahendru, Lakshaya Agnani

Room: Haymarket

Time: April 4th at 1:30

The design of the protocol is motivated by the observation that a single-fold security mechanism is usually not sufficient for the prevention of network attacks such as Denial of service (Dos) attacks, Sybil attacks and cannot prevent the leakage of information through covert channels; one such example being the SPINS protocol. The protocol has been designed such that major attacks are prevented and the level of data security and integrity is increased for the complete lifetime of the network. The proposed design achieves three main objectives. One being the authentication mechanism by which the malicious nodes present in the network is identified. Secondly, it takes measures to oust the identified malicious node from the network. Thirdly, it provides the transmission of the encrypted data to the base station (BS), which is collected by the deployed sensor nodes.

Modeling the Energy Consumption for Concurrent Executions of Parallel Tasks

Thomas Rauber and Gudula Rünger

Room: Haymarket

Time: April 4th at 1:30

Parallel programming models using parallel tasks, also called parallel modules, multiprocessor tasks or malleable tasks, provide portable performance and scalability for modular applications on many high-performance systems. This is achieved by the flexibility of a two-level programming structure supporting mixed task and data parallelism and a large variety of support tools exploiting a parallel specification to obtain the best parallel performance for a specific hardware platform. Due to the emerging importance of energy efficiency in high-performance computing, programming models with parallel tasks should be extended to be able to include energy concerns.

Based on a well-accepted analytical energy model for a processor's energy consumption, this article explores the energy consumption of parallel tasks with communication that are executed concurrently with other tasks. Simulations show the different energy consumption scenarios for different task cooperations and demonstrate the potential for a flexible energy usage on varying parallel platforms.

How Secure is WiFi MAC Layer in Comparison with IPsec for Classified Environments?

Stanley Cebula III and Aftab Ahmad

Room: Haymarket

Time: April 4th at 1:30

Due to the simplicity and convenience of wireless local area networks (WLANs), they have become more popular among many different environments. WLANs are being used in businesses, schools, and government organizations. As a result of the rise in use of WLANs, security has become more important. Specifically, this research work will focus on the security of WLANs in a classified environment. We will give an overview of the security of WLANs, and discuss different attacks that the IEEE (Institute of Electrical and Electronics Engineers) 802.11 protocol defends against including: session hijacking, denial-of-service attacks, man-in-the-middle attacks, forgery attacks, and other simple attacks. We then analyze the security of the IPsec protocol suite and examine different attacks that can occur including two denial-of-service attacks and one attack against an encryption key. Next, we compare the security of IPsec to the 802.11 protocol in order to improve the security of WLANs. We find that the security of the 802.11 protocol is sufficient, but it can be improved with the help of IPsec. IPsec is less susceptible to denial-of-service attacks, and WLANs are easier to attack.

HMNToolSuite: Tool Support for Mobility Management of Mobile Devices in Heterogeneous Mobile Networks

Joon-Myung Kang, Sin-seok Seo, John Strassner, James Won-Ki Hong

Room: Haymarket

Time: April 4th at 3:30

This paper presents tool support for testing mobility of mobile devices in heterogeneous mobile networks. As mobile devices are growing and networks are becoming heterogeneous, their mobility management in heterogeneous mobile networks has become important. Nonetheless, previous network simulators have focused on handover protocols at layer 2 or layer 3, but have not focused on handover decisions at layer 7. This tool suite allows the user to create multiple types of mobile networks, mobile nodes, and network servers for testing mobility of mobile devices. Moreover, it also allows the user to create simulation scenarios and generates testing results based on users' demands. This paper presents the requirements, design, and implementation of the tool suite. We show the feasibility of our tool using a case study of context-aware handover decision management.

JSimPlus: a Tool for Teaching Simulation Techniques

Hassan Rajaei, Erick Eid, Divy Kanungo, Jordan Ringenberg

Room: Haymarket

Time: April 4th at 3:30

Plethora of simulation tools exists today covering most simulation needs of both academia and industry. Despite this rich collection, it can be hard to get hold of a simulation tool to teach not only modeling and analysis of certain applications, but also to teach how such tool is designed, developed, constructed, and improved. JSimPlus is the result of striving after such need. It has evolved and re-engineered in years from adding simple features to a simple tool, Simlib, to a fully pledged instrument to teach students the nuts and bolts of simulation. Simlib, a simple simulation library provided in the A. Law textbook, has good ability to demonstrate how a simple engine is constructed upon which complex models could be built. Clearly this tool has number of limitations. With some efforts it is possible to significantly improve this software towards a much practical and professional one. This paper describes the efforts of several groups of students who in a series of steps evolved the software from simple to a very advanced instrument, and changed its programming language from C to C++, Java, and to Web-Based Simulation platform with several repositories, graphical interfaces, and displays. JSimPlus has a discrete event simulation engine and supports applications using queuing networks simulation modeling.

Mobile Medical Application Model for Heterogeneous Networks

Salah Sharieh

Room: Haymarket

Time: April 4th at 3:30

This paper presents a model for mobile medical applications for a near –real-time binary data exchange over heterogeneous networks. The model was tested with a software simulation and a real fully mobile system which monitors oxygenated hemoglobin (HBO) and deoxygenated hemoglobin (HB) concentration changes in the brain and tissues. The system used global system for mobile communications (GSM) Bluetooth networks and the internet. The application used the proposed model. The model consists of four processing nodes: the first node collect data from the brain and send it to the second node over a short range network; the second node act as a intermediate mobile server that holds capture data and transmit it over a long range networks; the third node act a remote server that store data for long term, the fourth ac as a monitoring station that monitor test subjects in near-real-time.

Framework for the Integration of Body Sensor Networks and Social Networks to Improve Healthcare

David Bauschlicher, Steven Bauschlicher, Hala ElAarag

Room: Haymarket

Time: April 5th at 10:30

Over the last decade, the demand for efficient healthcare monitoring has increased and forced the health and wellness industry to embrace modern technological advances. Body Sensor Networks, or BSNs, can remotely collect patient data and upload vital statistics to servers over the Internet. Advances in wireless technologies such as cellular devices and Bluetooth increase the mobility patients experience while wearing a body sensor network. When connected by the proper framework, BSNs can efficiently monitor and record data while minimizing the energy expenditure of nodes in the BSN. Social networking sites play a large role in the aggregation and sharing of data between many users. Connecting a BSN to a social network creates the unique ability to share health related data with other users through social interaction. In this paper, we propose to integrate social networks and BSNs to establish a community promoting wellbeing and great social awareness.

An Energy Aware Routing Protocol for Mixed Static and Mobile Nodes in Wireless Sensor Networks

Adel Gaafar A.Elrahim, Hussein A.Elsayed, Salwa El Ramly, Magdy M. Ibrahim

Room: Haymarket

Time: April 5th at 10:30

Wireless sensor networks, a distributed network of sensor nodes perform critical tasks in many application areas such as target tracking in military applications, detection of catastrophic events, environment monitoring, health applications etc. The routing protocols developed for these distributed sensor networks need to be energy efficient and scalable. In this paper, we propose an energy efficient data forwarding protocol called Energy Aware Geographic Routing Protocol (EAGRP) for wireless sensor networks to extend the life time of the network. In EAGRP, both position information and energy are available at nodes used to route packets from sources to destination. The proposed protocol is an efficient and energy conservative routing technique for multi-hop wireless sensor networks. The significance of this study is that there has been a very limited investigation of the effect of mobility models on routing protocol performance such as packet delivery ratio, throughput, energy consumption, routing overhead, and delay in Wireless Sensor Network. We have considered the influence random way point mobility models on the performance of EAGRP routing protocol. The performance measures have been analyzed with variable number of nodes. Our simulation results indicate that the proposed algorithm gives better performance in terms of higher packet delivery ratio, throughput, energy consumption, routing overhead, and delay.

Performance Analysis of a Highly Available Home Agent in Mobile Networks

Abdelgadir Abdelgadir, Mohiuddin Ahmed, Al-Sakib Pathan, Ariff Abdullah, Shariq Haseeb, Omar Al-Mushayt

Room: Haymarket

Time: April 5th at 10:30

Network Mobility as a service is provided by the NEMO protocol in IPv6 environment. NEMO is an extension to MIPv6, and thus inherits the same reliability problems of MIPv6. MIPv6 is not reliable because the Home Agent (HA) is a single point of failure. In order to provide real-time services for MIPv6 networks, reliability should be considered as part of any high availability solution used to deploy Mobile IPv6 networks. Many approaches have been taken to solve the problem of HA as a single point of failure. In our proposed solution, failure detection and recovery is handled by the home agent. Therefore, recovery is transparent to the mobile network. In this work we opted for using HA redundancy to provide a highly available home agent solution which achieves recovery times suitable for real-time applications.

Latency and Saturation in Networks with Finite Buffers

Yelena Rykalova and Lev B. Levitin

Room: Haymarket

Time: April 5th at 1:30

This paper is devoted to networks with different size of buffers (from 5 to 50). The ring and the two-dimension torus topology networks are considered, and the results are compared with these for networks with infinite buffers. The network behavior in terms of the average number of messages and the latency has been studied. Both second-order and first-order transitions to the saturation state have been observed. The results show that the model of independent queues, which is valid for networks with infinite buffers, is still applicable for the load values outside of the critical region, but breaks down, which violates the Jackson theorem.

Evaluating Network Simulators as extensions of real network testbeds

Daniel Günther, Michel Steichen, Nathan Kerr, Paul Müller

Room: Haymarket

Time: April 5th at 1:30

Network testbeds are limited and often hard to configure. One method of overcoming these limitations is to use network simulators for extending a testbed. This paper aims to find out which network simulator is best able to extend a network testbed. Simulators are compared by their ability to provide a proposed environment in a network testbed. Both objective and subjective criteria are used in the comparison. The evaluated simulators are the well-known tools ns-3 and OMNeT++.

Multi Standard System Level Simulation Framework for Evaluation of Mobile Broadband Networks

Alexey Khoryaev, Andrey Chervyakov, Mikhail Shilov, Sergey Panteleev, Apostolos Papathanassiou, Alexander Maltsev

Room: Haymarket

Time: April 5th at 1:30

IEEE 802.16m and 3GPP LTE-Advanced mobile broadband communication systems represent the most promising technologies for providing high speed mobile broadband access to the Internet in the years to come. Many research groups, communication equipment vendors, and standardization bodies work on optimization and enhancements of the performance characteristics of 3GPP LTE-Advanced and IEEE 802.16m. The research and development efforts of academia and industry are mainly focused on the system level analysis of these mobile broadband networks. This paper provides an overview of multi-cell radio network system level modeling and presents the architecture of a multi-standard system level simulation software platform. The platform was designed for the evaluation of candidate IMT-Advanced radio interface technologies and can be used for the analysis and simulation of potential physical and medium access control enhancements for the IEEE 802.16m and 3GPP LTE-Advanced systems.

Advances in Virtual Learning Environments and Classrooms

Hassan Rajaei and Arwa Aldhalaan

Room: Haymarket

Time: April 5th at 3:30

Classrooms and laboratories of tomorrow are most likely enhanced with virtual presents in cyberspace allowing students and instructors to participate in the learning sessions using advanced Virtual Leaning Environments (VLE). These settings let difficult courses of science and engineering to be available for larger student audiences. Despite vast technological advances in recent years, there are significant challenges suggesting further research and developments that ensure virtual classrooms to be as good as or even better than what we have now in our physical lecture halls. This paper provides a state-of-the-art survey on a number of existing VLE solutions pinpointing their strengths and limitations. We distinguish between asynchronous distance learning and the synchronous settings whose model allows live participation of the learners as well as collaboration possibilities between them. Furthermore, we examine whether the selected VLEs maintain any virtual presents of the participants and scalability of the platform. Other comparison criteria include user interface, gesture & facial recognition, availability, affordability, compatibility and social awareness. As the virtual world moves closer to represent the real world, how these environments might facilitate different types of interactions inherent in a real classroom will largely dictate their future usefulness.

An Application of High Performance Computing to Improve Linear Acoustic Simulation

Fouad Butt, Abdolreza Abhari, Jahan Tavakkoli

Room: Haymarket

Time: April 5th at 3:30

A model describing the acoustic field resulting from an acoustic source vibrating in a rigid planar baffle is found to be computationally intensive if the field values are computed sequentially. The temporal complexity of the model is firstly due to the large number of computations required to integrate over the surface area of an arbitrarily-shaped source and secondly, due to the volume of the acoustic field itself. Thus, the model is assessed and it's workload characterization derives directly from the data-level parallelism inherent in the computation of the acoustic field. Two high performance computing approaches are developed and lead to improvements in both the precision and efficiency of the model with computation speedups that are beyond theoretical expectations. A further reduction in temporal complexity is introduced as a result of the axial-symmetric properties of the acoustic fields. The result is a particularly useful tool for high performance simulation of 3-dimensional ultrasound fields generated by realistic sources in various fluid media.

A Generic Optimized Time Management Algorithms (OTMA) Framework for Simulating Large-Scale Overlay Networks

Syed Rizvi

Room: Haymarket

Time: April 5th at 3:30

Recent evolutions in wireless networks will require more efficient use of the underlying parallel discrete-event simulation (PDES) synchronization protocols to accommodate the demand for large-scale network simulation. In this paper, we investigate underlying synchronization protocols to improve the performance of large-scale network simulators operating over PDES systems. We begin by proposing a generic optimized time management algorithms (OTMA) framework that combines the improved forms of synchronization protocols on a single platform. Particularly, for the proposed OTMA framework, we use the layered architecture approach to combine the optimized forms of conservative and optimistic time management algorithms. To support the implementation of the OTMA framework, a new m-LP (logical process) simulation model is proposed along with the varying parameters network topology that can show the implementation of different components of discrete-event simulation (DES).

Security in Wireless Sensor Networks: Key Intrusion Detection Module in SOOAWSN

Mohammed Abuhelaleh and Khaled Elleithy

Room: Haymarket

Time: April 6th at 8:30

Due to high restrictions in wireless sensor networks, where the resources are limited, clustering protocols for routing organization have been proposed in much research for increasing system throughput, decreasing system delay and saving energy. Even these algorithms have proposed some levels of security, but because of their dynamic nature of communication, most of their security solutions are not suitable. Some other researches proposed key management solutions which are to be used during network communication. Others proposed intrusion detection and recovery techniques to detect any attack that may appear in such kind of networks. In this paper we proposed two methods of intrusion detection techniques that can be used during wireless sensor networks communications. Our Solution perfectly fit all kinds of wireless sensor networks that follow the clustering hierarchy distribution. In addition it may fit many other distribution techniques. This solution is a part of a complete solution for wireless sensor network that covers all the network lifecycle from the time it deployed. We called this solution a

Secure Object Oriented Architecture for Wireless Sensor Networks (SOOAWSN).

Enhancing Broadcast Authentication in Sensor Networks

Arayeh Norouzi, Abdolreza Abhari, Truman Yang

Room: Haymarket

Time: April 6th at 8:30

Due to the nature of wireless sensor networks, security is a critical problem since resource constrained and usually unattended sensors are much vulnerable to malicious attackers that may impersonate the sender. Therefore authenticating received messages is a crucial matter to protect the system integrity. Generally used TESLA (Timed Efficient Stream Loss-tolerant Authentication) based authentication techniques involve consecutive delays for decryption purposes. These delays render the network vulnerable to different malicious attacks such as Denial of Service attack. As several techniques try to achieve immediate authentication to alleviate these threats, other factors such as reliability and buffer requirements may have been compromised. This paper proposes an integration of Low Buffer µTESLA protocol and an immediate authentication protocol to achieve a new refined scheme in broadcast authentication in sensor networks. Performance analysis and simulation results demonstrate that the proposed method succeeds to achieve immediate authentication while preserving desired security and low memory requirements in sensor nodes.

Location-Based Security for ID Document and ID Card Enrollment Stations

Eugene Gerety and Khaled Elleithy

Room: Haymarket

Time: April 6th at 8:30

Much of today's security for financial assets, services, facilities, personal information, immigration, employment and travel is provided in the form of a variety of ID instruments such as passports, credit cards, ID badges, access cards, and other similar forms of identification. Staggering costs associated with rampant identity theft are driving ongoing efforts to produce stronger, positive-ID documents and cards through the application of a wide variety of security enhancing techniques such as biometrics, embedded chips, encryption and specialized materials with security features. Each new generation of ID documents and cards becomes more technologically sophisticated and difficult to forge, forcing criminals to resort to increasingly complex and sophisticated forms of attack to circumvent their security mechanisms. Against this backdrop, ID Enrollment systems become particularly enticing targets for theft and unauthorized use, because with their use of authentic security materials, algorithms and production mechanisms, these systems are capable of producing truly undetectable fraudulent ID instruments capable of passing any and all security tests performed by even the most sophisticated ID verification terminals. This paper proposes and presents a practical location-based security framework designed to protect against any attempt to operate an ID production/enrollment system away from its authorized operating location.

Clouds & Grids: A Network and Simulation Perspective

Hassan Rajaei

Room: Haymarket

Time: April 6th at 10:30

Cloud Computing (CC) is coined as the paradigm shift of Information Technology (IT), as compared with the Packet Switching of Networking Technology. Experts in Communications and Networking fields recall remarkable changes that digital communications brought to the industry, academia, military, and thus our daily life. While discussions about Clouds and Grids are on the boiling points in the Cloudy community, this paper looks at the Clouds and Grids from networking standpoints as well as simulation opportunities that Cloud Networking (CN) provides. We look at some key issues like Quality of Services (QoS), Service Level Agreement (SLA), interoperability, migration between cloud networks, and network traffics. In addition, this paper compares clouds and grids and examines potential simulation needs.

Resource Management on Clouds and Grids: Challenges and Answers

Shikharesh Majumdar

Room: Haymarket

Time: April 6th at 10:30

Grids and more recently clouds are distributed system infrastructures that are rapidly gaining popularity among researchers and users. By providing the ability to acquire resources on demand these systems provide elasticity in resource usage as well as a pay-as-you-go opportunity, both of which can lead to a substantial savings for the system users. Appropriate management of resources by the middleware used by service providers is required however for effectively harnessing the power of the underlying distributed resource infrastructure. The problems range from handling resource heterogeneity, providing adequate security during resource access, allocating resources to user requests efficiently as well as effectively scheduling the requests that are mapped to a given resource. This talk will focus on the challenges associated with resource management on grids and clouds and discuss solutions to some of these problems. Particular attention will be paid to resource allocation and scheduling. Existing literature on resource management on grids and clouds describe techniques that are based on the detailed knowledge of local resource management policies as well as user estimates of resource demands for their requests. It is often impractical to assume such a detailed a priroi knowledge of management policies for all the resources will be available to resource brokers in a large and dynamic heterogeneous environment. Moreover, user estimates of resource demands are often error prone. Performing effective resource management "in the dark" and handling such uncertainties associated with the local resource management policies and user estimated resource demands will be discussed. Techniques for providing both user satisfaction by improving the fastness of responses as well as service provider benefits through generation of high revenue will be described.

Developing Discrete Event Simulations From Rigorous Process Definitions

Mohammad Raunak, Leon Osterweil, Alexander Wise

Room: Constitution

Time: April 4th at 1:30

We believe there is considerable value in creating a discrete-event simulation infrastructure based on rigorous and executable process definitions that is accessible to non-technical domain experts. The formal semantics of such process modeling languages would also allow one to perform different kinds of static analysis of processes. In this paper we have presented such a process definition language - Little-JIL, its runtime environment - Juliette, and a discrete event simulation framework that we have developed on top of them called JSim. One important component of JSim is its rich resource management component, ROMEO, which is capable of modeling dynamic agent behavior that is dependent on the state of the system. Using this infrastructure, we have successfully simulated some intricate variations of how patient care is provided in a hospital ED. We have also performed case studies to evaluate the versatility and usability of our simulation framework.

A BPMN Extension for Modeling Non Functional Properties of Business Processes

Paolo Bocciarelli and Andrea D'Ambrogio

Room: Constitution

Time: April 4th at 1:30

Business Process Management (BPM) is an holistic approach for describing, analyzing, executing, managing and improving large enterprise business processes, which can be seen as collections of related tasks executed to accomplish well-defined goals. This paper introduces a notation for the description of a business process in terms of both functional and non-functional properties, specifically addressing the performance and reliability characterization of a business process. In the BPM context, the Business Process Modeling Notation (BPMN) is the de-facto standard for the high-level description of business processes. Unfortunately BPMN does not support the characterization of the business process in terms of non-functional properties such as performance and reliability. To overcome such limitation, this paper introduces PyBPMN (Performability-enabled BPMN), a lightweight BPMN extension for the specification of properties that address both performance and reliability. The proposed extension is based on an approach that exploits principles and standards introduced by MDA (Model Driven Architecture), thus obtaining significant advantages in terms of easy customization and improve automation. The paper also presents an example application of the proposed extension to show how it enables the automated transformation of a business process model into a parameterized performance model whose execution gives insights about the behavior of a business process.

Extended Coloured Petri Nets with Structured Tokens - Formal Method for Distributed Systems

Khaoula Al Ali, Wolfgang Fengler, Bernd Däne, Alexander Pacholik

Room: Constitution

Time: April 4th at 1:30

Abstract Demands for clarity, reliability, productivity and the increasing complexity of communication software, protocols and algorithms require development of methods to ensure consistent, unambiguous, formal and accurate representation. In this article, a formal method is developed based on coloured Petri nets (CPN). This method represents an extended class of Petri nets; it is named 'High Coloured Petri Nets with Structured Tokens' (HCPN-ST). CPN are extended with structured tokens, which contain an ordered sequence of colors and carry additional information like events, operations, network nodes, etc. Furthermore the firing condition includes logical expressions. A formal definition of these nets is introduced, including its token structures and firing rules, which allow checking single token elements, parts of the token sequences or Boolean conditions between them. As an example, an algorithm that operates on P2P networks is modeled with the developed method. This example demonstrates analysis of such nets. It is transformed into CPN, in order to simulate, analyze and verify it with software tools. Then CPN model is simulated and analyzed with a tool named PENECA Chromos. In order to verify some properties this tool interoperates with the well known INA tool. So this formal method is demonstrated as an effective method to model and analyze distributed systems.

Graded CTL Model Checking for Test Generation

Margherita Napoli and Mimmo Parente

Room: Constitution

Time: April 4th at 3:30

Recently there has been a great attention from the scientific community towards the use of the model-checking technique as a tool for test generation in the simulation field. This paper aims to provide a useful mean to get more insights along these lines. By applying recent results in the field of graded temporal logics, we present a new efficient model-checking algorithm for Hierarchical Finite State Machines (HSM), a well established symbolism long and widely used for representing hierarchical models of discrete systems. Performing model-checking against specifications expressed using graded temporal logics has the peculiarity of returning more counterexamples within a unique run. We think that this can greatly improve the efficacy of automatically getting test cases. In particular we verify two different models of HSM against branching time temporal properties.

On-The-Fly Verification of Discrete Event Simulations by Means of Simulation Purposes

Paulo Salem da Silva and Ana Cristina Vieria de Melo

Room: Constitution

Time: April 4th at 3:30

Discrete event simulations can be used to analyse natural and artificial phenomena. To this end, one provides models whose behaviours are characterized by discrete events in a discrete timeline. By running such a simulation, one can then observe its properties. This suggests the possibility of applying on-the-fly verification procedures during simulations. In this work we propose a method by which this can be accomplished. It consists in modelling the simulation as a a transition system (implicitly), and the property to be verified as another transition system (explicitly). The latter we call a simulation purpose and it is used both to verify the success of the property and to guide the simulation. Algorithmically, this corresponds to building a synchronous product of these two transitions systems on-the-fly and using it to operate a simulator. The precise nature of simulation purposes, as well as the corresponding verification algorithm, are largely determined by methodological considerations important for simulations.

A Formal Approach to the Quantification of Sustainability and Dependability Metrics on Data Center Infrastructures

G. Callou, E. Sousa, P. Maciel, E. Tavares, B. Silva, J. Figueirˆedo, C. Araujo, F. Magnani and F. Neves

Room: Constitution

Time: April 4th at 3:30

Sustainability has received great attention by the scientific community, due to concerns for meeting current needs of energy

without compromising, for instance, non-renewable resources for future generations. In addition, as a result of stringent availability constraints, dependability plays an prominent role in the infrastructure that supports business service through the Internet, particularly, the growth of cloud computing paradigm. In this context, tools are important to support data center designers to estimate the environmental impact, dependability as well as the cost associated to the infrastructure before implementing it. This paper presents a methodology for estimating sustainability impact and dependability metrics, supported by an integrated environment, namely, ASTRO, which considers the advantage of both Reliability Block Diagrams (RBD) and Stochastic Petri Nets(SPN). ASTRO has been developed to evaluate data center infrastructures, but the environment is generic enough to evaluate general systems. Besides, real-world case studies considering 5 different data center power infrastructures are provided to demonstrate the applicability of the proposed methodology as well as the environment.

Simulating Layered Queueing Networks with Passive Resources

Greg Franks

Room: Constitution

Time: April 5th at 10:30

This paper describes an extension to Layered Queueing Networks (LQN), a form of an extended queueing network used to investigate performance problems, to model passive resources such as counting semaphores and buffers. Layered queueing networks can be constructed directly, or from UML design models which incorporate the MARTE profile, either directly or via the Core Scenario Model. Layered Queueing Networks scale well and can solve analytically systems with nested resource requests to active resources. However, passive resources cause problems which force the use of simulation. The layered queueing network simulator, lqsim, is also described here. Simulations are created by reading in an LQN model, constructing objects from pre-existing templates, then solving. The semaphore task extension was incorporated by modifying the existing template used to model multi-server tasks. Finally, the semaphore extension was used to solve a model of a building security system which has a pool of buffers to capture video images. The results here show that a lack of buffers is indeed a bottleneck, but other parts of the system ultimately limit the capacity of the system.

A Model-Driven Software Environment for Modeling, Simulation and Analysis of Complex Systems

Luc Touraille, Mamadou Kaba Traoré, David Hill

Room: Constitution

Time: April 5th at 10:30

Today's market is filled with a variety of simulation solutions for discrete-event simulation, but each has its own meta-model. A conversion between these meta-models is hard or even impossible. In some cases this is intended by the vendor of the simulation solution, in other cases it results from missing standards during development time. We propose SysML as a standardized simulation language and achieve this we develop a simulation solution with SysML as meta-model. For that purpose model-driven methods are used for a decreased development time and increased stability and maintainability compared to traditional development techniques. In this paper we present the design of the simulation core, and how model-driven techniques can be used for the development of a discrete-event simulation solution. We are starting with SysML as the meta-model, followed by an execution engine based on fUML and create a SysML based simulation core. Furthermore we will give a brief introduction to the Eclipse Modeling Framework (EMF), the Java Emitter Templates (JET) and eJava, a tool developed by the Software Technology Group at the Dresden University of Technology.

The SimTG Simulation Modeling Framework a domain specific language for space simulation

Olivier Zanon

Room: Constitution

Time: April 5th at 1:30

Astrium Satellites has developed a simulation infrastructure called SimTG. A modeling language was to be chosen to ease the development of simulation models running on SimTG. Thus a domain specific language dedicated to space simulation has been defined. The article will present its main features and the workbench support that has been developed around it.

From Domain Specific Languages to DEVS Components: Application to Cognitive M&S

Saurabh Mittal and Scott A. Douglass

Room: Constitution

Time: April 5th at 1:30

Air Force Research Lab (AFRL) research efforts to transition cognitive modeling from the laboratory to operational environments are finding that available architectures and tools are difficult to extend, lack support for interoperability standards, and struggle to scale. This paper describes a component-based modeling and simulation framework that exploits the Discrete Event System Specification (DEVS) formalism to eliminate these impediments. It extends the earlier DEVS Modeling Language (DEVSML) architecture and integrates Domain specific languages (DSLs). The paper discusses the framework and the transformation processes with a DSL tailored to the needs of cognitive modeling.

Using Specification and Description Language to represent users' profiles in OMNET++ simulations

Pau Fonsecai Casas, Miquel Ramo Niñerola, Angel A. Juan

Room: Constitution

Time: April 5th at 1:30

Omnet++ is a powerful and open-source simulation tool which is basically intended to model discrete-event systems. In particular, Omnet++ is extensively used to model and simulate computer networks. Typically, when a Wide Area Network needs to be modeled, different assumptions are made in order to simplify the complexity associated with human behavior. Nevertheless, human behavior can also be modeled, at least to some extent, by using Multi Agent Systems (MAS). This paper presents a methodology that allows connecting a MAS model –which accounts for human behavior–, with a standard Omnet++ model – which represents the behavior of a computer network. The approach presented here can be useful to obtain a better representation of the human behavior through a MAS model when using Omnet++. Furthermore, our approach simplifies the modeling process by splitting the complexity of a real system into two different parts. Therefore, on the one hand computer scientists can focus on the Omnet++ model while, on the other hand, specialists in human behavior can focus on the MAS model. Finally, our approach also facilitates the distribution of the models among different computers.

Observations in DEVS framework

Gauthier Quesnel, Ronan Trépos, Patrick Chabrier, Jennifer Baudet, Raphael Duboz, Eric Ramat

Room: Salon G

Time: April 5th at 1:30

The observation of a model is a necessary process in the context of modeling and simulation as it offers to modelers the results of their simulations. In this paper, we focus our works on the observation mechanism which is generally not explicit nor clearly specified. This is generally not an issue unless we want to use our model in experimental frames or to avoid the observation mechanism to interfere with the simulation. In this paper, we introduce an extension to the Parallel Discrete Event System Specification (PDEVS) formalism, to observe models in various ways, by event (at each state transition of a model), at the end of the simulation or by a time step. Thus, we define a formal specification of this extension and its abstract simulators algorithms. Finally, we present an implementation in the DEVS framework VLE.

Transforming UML2.0 Class Diagrams and Statecharts to Atomic DEVS

Reehan Shaikh and Hans Vangheluwe

Room: Salon G

Time: April 5th at 1:30

We propose a translation process by which a UML2.0 Class Diagram model, along with Statechart models used to describe the behavior of each of the instances of the classes in the Class Diagram is transformed into a single, behaviorally equivalent Atomic DEVS model. Statecharts language features such as hierarchical and orthogonal states allow for intuitive modeling of reactive, timed behavior. Variable structure and modularity are the prominent features of UML2.0 Class Diagrams.

DEVS is a highly modular, hierarchical formalism that can be used as a semantic domain for a variety of modeling languages such as discrete-event formalisms, timed model transformations, Ordinary Differential Equations,... This allows for true multi-formalism modeling and simulation as models in all these formalisms, including Class Diagrams + Statecharts, can be mapped onto DEVS and subsequently composed in the form of a Coupled DEVS model. Furthermore, our transformation brings the elegant Statechart notation as well as variable structure of Class Diagrams to Classical DEVS.

We validate our approach using a concrete example. We transform the UML2.0 Class Diagram + Statechart model of a digital watch to its Atomic DEVS equivalent and subsequently couple it with a model of a user (the “environment”) modelled as an Atomic DEVS.

I-DEVS: Imprecise Real-Time and Embedded DEVS Modeling

Mohammad Moallemi and Gabriel Wainer

Room: Salon G

Time: April 5th at 1:30

The problem of over-running in hard real-time systems pos-es critical risks to the hardware under control. The imprecise computation technique offers an effective way of resource utilization in these cases. We introduce Imprecise-DEVS (I-DEVS), a model-driven approach to develop real-time and embedded applications based on the DEVS (Discrete Event Systems Specification) formalism. This approach combines the dynamic advantages of the imprecise computation tech-nique with the rigor of a formal modeling methodology. This framework can be used to develop embedded applica-tions incrementally, integrating imprecise models with hardware components seamlessly. We have defined struc-tural modifications to DEVS in order to allow imprecise model definition.

Harmonized and Reversible development framework for HLA based interoperable application

Zhiying Tu, Gregory Zacharewicz, David Chen

Room: Constitution

Time: April 5th at 3:30

This paper aims at improving the re-implementation of existing information systems when they are reused in a system of systems, i.e. a federation of enterprise information systems that interoperate. The idea is adapting the local experiences, coming from the development of the original information system, to be part of a HLA process, thanks to Model Discovery and Ontological approach. This paper will propose a new bi directional development life cycle. In the first way, MDA and HLA FEDEP will be harmonized to implement distributed information systems from enterprise models. In the opposite way, model discovery will be used to help re-implement existing systems, in order to be interoperable without being fully reconstructed. Then, according to HLA 1516 evolved new feature, this paper will propose a solution based on an open source RTI, PORTICO, to implement web enable federates.

HiLeS2: Model Driven Embedded System Virtual Prototype generation

Horacio Hoyos, Rubby Casallas, Fernando Jiménez, Darío Correal

Room: Constitution

Time: April 5th at 3:30

Embedded system virtual prototyping allows exploration of solutions in system architecture and hardware specification, prior to real prototype construction, resulting in higher quality products, shorter time to market and cost reduction. Virtual prototypes allow simulation of the system so designers can analyze and evaluate their design decisions against system response. However, benefits in costs, shorter developing times and simulation capabilities can be affected by Virtual Prototype (VP) construction and modification, especially if done directly in Hardware Description Languages (HDL). The reasons are associated with being a manual error prone activity, the difficulty on keeping the VP in conformance to design requirements and the risk of simulations being hard to analyze. We propose a Model-Driven approach to generate automatically from a SysML high-level specification, structure and behavior, a VP in a HDL. Our proposal aims at providing a design methodology, significantly reducing the amount of manual code to diminish errors and increase simulation to design traceability. In our approach, we use a pivot language called HiLeS which is based on a Petri Net formalism facilitating the transformation into the HDL and allowing behavior verification. The paper presents the methodology and the model transformations done, specifically, to obtain from SysML sequence diagrams Petri Net models.

Model-driven Development of Simulation Solution based on SysML starting with the Simulation Core

Pascal Weyprecht and Oliver Rose

Room: Constitution

Time: April 5th at 3:30

Today’s market is filled with a variety of simulation solutions for discrete-event simulation, but each has its own meta-model. A conversion between these meta-models is hard or even impossible. In some cases this is intended by the vendor of the simulation solution, in other cases it results from missing standards during development time. We propose SysML as a standardized simulation language and achieve this we develop a simulation solution with SysML as meta-model. For that purpose model-driven methods are used for a decreased development time and increased stability and maintainability compared to traditional development techniques. In this paper we present the

design of the simulation core, and how model-driven techniques can be used for the development of a discrete-event simulation solution. We are starting with SysML as the meta-model, followed by an execution engine based on fUML and create a SysML based simulation core. Furthermore we will give a brief introduction to the Eclipse Modeling Framework (EMF), the Java Emitter Templates (JET) and eJava, a tool developed by the Software Technology Group at the Dresden University of Technology.

Constructing DEVS Models Based on Experts' Knowledge: Application to STMicroelectronics' Large Scale Manufacturing Processes

Pamela Viale, Claudia Frydman, Jacques Pinaton

Room: Salon G

Time: April 5th at 3:30

STMicroelectronics has a spirit of innovation in the development of chips, continuously modifying its production processes for improving performance. This is why it is interested in creating 'generic models' of their manufacturing processes and keeping them updated in spite of the high number of modifications demanded. It is specially interested in capitalizing experts' knowledge. In this article we explain ideas for constructing models for STMicroelectronics manufacturing processes using experts' definitions. The importance of our approach resides in the construction of models that constitute a step forwards to the implementation of an alarm control system over processes modifications.

Interfacing DEVS and Visualization Models for Emergency Management

Mohammad Moallemi, Shafagh Jafer, Ahmed Sayed Ahmed, Gabriel Wainer

Room: Salon G

Time: April 5th at 3:30

We introduce a method to integrate Cell-DEVS models with DEVS-based robotic agents and an advanced Immersive en-vironment for Emergency Management. The emergency is handled by an autonomous robot controlled by a real-time DEVS model. The model controlling the robot interacts with a simulation for emergencies, receiving real-time data about its location on a cell space. The immersive environ-ment is used to visualize the emergency and its manage-ment. The simulation results of both the cell-DEVS emer-gency model and the DEVS-based robotic first responder are visualized dynamically at real-time. The goal is to show how to integrate cellular modeling in a real-time platform and the DEVS formal framework as a collaboration mecha-nism. The real-time visualization allows for supervisory control of the emergency and first responders activities.

NoC Simulation Modeling in DEVS-Suite

Hoda Ahmadinejad, Fatemeh Refan, Hessam Sarjoughian

Room: Salon G

Time: April 5th at 3:30

Study of Network-on-Chip (NoC) systems requires simulators capable of handling their unique characteristics. Toward this objective, a set of simulation models are developed based on NoC first principles and the DEVS framework. The components necessary to build simulation models for NoC are developed using Parallel DEVS and implemented in NoC-DEVS which extends the general-purpose DEVS-Suite simulator. An example mesh-based NoC model synthesized from processing elements, network interfaces, switches, and links is experimented with and analyzed. The same example is also studied in Noxim which is an extension of the SystemC simulator. The NoC-DEVS simulator is evaluated and compared against the Noxim simulator. The comparison focuses on their modeling capabilities and considers delay and throughput performance metrics as well as capabilities expected from advanced simulation tools. Related and future research directions are briefly discussed.

GATLAS: Google Earth Visualization for ATLAS

Gabriel Wainer and Ken Edwards

Room: Faneuil

Time: April 6th at 8:30

ATLAS is a modeling language that allows one to define a static view of a city section for simulating traffic in an area. By using ATLAS TSC, an intermediary compiler, and CD++, a Cell-DEVS system, traffic simulations may be run. The outputs of the simulation are a collection of individual cell-space simulation results that are difficult to analyze as a whole. This problem is solved by using GATLAS ((ATLAS in Google Earth) to generate KML files from the CD++ outputs so that the simulation results may be examined as a whole in Google Earth.

Performance of a Multi-Agent System over a Multi-Core Cluster managed by Terracotta

Franco Cicirelli, Angelo Furfaro, Andrea Giordano, Libero Nigro

Room: Faneuil

Time: April 6th at 8:30

This paper describes a modelling and simulation experience using a scalable predator/prey model based on agents (actors), over a multi-core cluster managed by Terracotta. Terracotta was chosen for its ability of transparently clustering the Java Virtual Machine (JVM). Multiple executing JVMs can communicate to one another through global shared yet locked heap objects. The actor-based approach allows an exploitation of the computing power of modern multi-core machines. A key factor is the combined use of three levels of concurrency: (a) cooperative concurrency among non pre-emptive light-weight actors local to a same JVM, (b) pre-emptive concurrency among actors' executive thread and JVM i/o interface threads, and (c) truly parallelism among JVMs executing on distinct cores of (possibly) distinct physical machines. The paper summarizes the design rationale of the actor kernel over Terracotta, describes the predator/prey model where predators coordinate their behaviour by a minority game, then reports observed performance when executing the model under various distributed/parallel computing scenarios of a multi-core cluster. Finally, conclusions are drawn with an indication of on-going and future work.

A Performance Evaluation of the Conservative DEVS Protocol in Parallel Simulation of DEVS-based Models

Shafagh Jafer and Gabriel Wainer

Room: Faneuil

Time: April 6th at 8:30

We present the performance evaluation of the Conservative DEVS protocol. This conservative algorithm is based on the classical Chandy-Misra-Bryant (CMB) synchronization mechanism, and extends the DEVS abstract simulator by providing means for lookahead computation and null message distribution. The protocol is integrated into the CD++ simulation toolkit, providing a conservative simulator (named CCD++) for running large-scale DEVS and Cell-DEVS models in parallel and distributed fashion. Throughout the experiments, we analyze four types of metrics, the total execution time, the average blocked time per node, the average number of positive events executed on each node, and the average number of null messages per node. We show a study on three environmental Cell-DEVS models, which shows that CCD++ provides con-siderable speedups, showing its ability for simulating large and complex DEVS-based models.

Common simulation methods for heat conduction from the perspective of Cellular Automata

Michael Mueller and Georg-Peter Ostermeyer

Room: Faneuil

Time: April 6th at 10:30

In the field of engineering the modeling with Cellular Automata has achieved a higher popularity over the last decades. The reason for this lies in its rather simple architecture which allows one to investigate systems of high complexity. For a tribological problem, dealing with the growth and destruction of characteristic surface structures in automotive brake systems, which determine friction and wear of the system, such a model could have been introduced successfully. In tribology in general and for the brake system in particular heat generation and heat conduction play an important role either. So the authors were confronted with the task to integrate the respective partial differential equation into the model. Different common simulation methods – Finite Elements, Finite Differences and a new sophisticated Finite Volume model – have been tested with identical meshes. Therefore in this paper a general investigation of these three methods is carried out. With the help of a unit cube the matrices governing the equations of motion (conductivity matrix, capacity matrix) are analyzed with respect to the question which nodes interact with each other. This information can be interpreted as a type of neighborhood which crucially characterizes the respective method. In this context the methods are compared with each other and the correlation towards the results is pointed out. It can be seen that for this problem Finite Elements generate results clearly worse than Finite Differences and Finite Volumes. Reasons for that can be found in the neighborhood within the Finite Element model, the consequences are exposed. Finally the paper dedicates to the question of the correlation between Cellular Automata and these methods within the frame of system theory.

Net-centric ACT-R Based Cognitive Architecture with DEVS Unified Process

Saurabh Mittal and Scott Douglass

Room: Faneuil

Time: April 6th at 10:30

Air Force Research Lab (AFRL) research efforts employing cognitive and behavioral modeling are growing in scope and complexity as they work to integrate models into larger systems as cognitive agents, synthetic teammates or human operator surrogates. Efforts to transition cognitive modeling from the laboratory to operational environments are stymied by the isolated nature of current cognitive modeling software tools that are not readily extensible, interoperable or scalable e.g. ACT-R. In this paper, we describe an attempt to build a component-based architecture using the Discrete Event Systems Unified Process (DUNIP) that eliminates these impediments. We show how the ACT-R architecture is extensible and can serve as a component in larger systems of systems frameworks such as Department of Defense Architecture Framework. We will also address the issue of platform independent modeling and how Domain Specific Languages (DSLs) can be integrated within DUNIP. We then demonstrate how developing the architecture and related software infrastructure in DUNIP gives it net-centric capabilities that support large-scale integration.

DEVS for AUTOSAR platform modeling

Joachim Denil, Hans Vangheluwe, Pieter Ramaekers, Paul De Meulenaere, Serge Demeyer

Room: Faneuil

Time: April 6th at 10:30

AUTOSAR (AUTomotive Open System ARchitecture) is an open and standardized automotive software architecture, jointly developed by automobile manufacturers, suppliers and tool developers. Its design is a direct consequence of the increasingly important role software plays in vehicles. As design choices during the software deployment phase may have a large impact on the real-time properties of the system, designers need a method to explore various trade-offs. In this paper we evaluate the appropriateness of DEVS, the Discrete-Event system Specification, for modelling and subsequent performance evaluation of AUTOSAR-based systems. We demonstrate and validate our work by means of a power window and ABS case study.

Taxonomy of DEVS Subclasses for DEVS Standardization

Moon Ho Hwang

Room: Constitution

Time: April 6th at 10:30

This paper clarifies the class hierarchy among DEVS subclasses in terms of their expressiveness. We define the expressiveness of a given formalism as the scope of accepting event segments by the formalism. In this paper, we interpret that DEVS formalism can be nondeterministic as well as deterministic. Based on this interpretation, inclusion relationship between several different formalisms including Timed Automaton are shown. As a consequence, this paper contributes to \emph{DEVS standardization} at a level of formalism. The classes clarify the power of DEVS and enable the development of powerful sub-languages that make it easier to work in particular domains - and to teach the basics of DEVS - as we do with a subclass, called FDDEVS.

Some Desired Features for the DEVS Architecture Description Language

Olivier Dalle and Judicael Ribault

Room: Constitution

Time: April 6th at 10:30

ADL are particularly well suited for component-based model frameworks that support hierarchical composition, such as DEVS with coupled models. In this paper we present some features found in the ADL of another hierarchical component model, namely the Fractal Component Model (FCM). To our best knowledge, these features are not yet available in most of the current DEVS implementations. Using a few examples coming from our experience, we demonstrate the usefulness of these features for Modeling & Simulation and their potential relevance for inclusion in a future DEVS implementation standard.

Standardizing DEVS Models: An Endogenous Standpoint

Hessam Sarjoughian and Yu Chen

Room: Constitution

Time: April 6th at 10:30

Standardization is a term commonly used in modeling and simulation community. Although it invokes different ideas, its basic goal is to institute order from the modeling, interoperability, and lifecycle aspects. Our attempt in this article is to articulate some details on the model standardization. The idea of model standard is described, XML Schema is proposed for DEVS model standardization as offered as a basis toward a standard.

ScipySim: Towards Distributed Heterogeneous System Simulation for the SciPy Platform

Allan McInnes and Brian Thorne

Room: Faneuil

Time: April 6th at 1:30

The goal of the ScipySim project is to develop a distributed heterogeneous system simulation capability for the SciPy scientific computing platform. It began as an experiment in implementing Caspi et al.'s generalized Kahn theory for executable heterogeneous system semantics. Instead of using a centralized simulation engine, ScipySim simulations are composed of autonomous actors that interact by passing tagged events through first-in/first-out queues. The resulting decentralized simulation system is, in principle, well-suited to distributed execution. However, in practice, simultaneously achieving efficiency and liveness proves to be difficult. We describe the current design of ScipySim, some of the difficulties we have encountered in implementing a simulator using the generalized Kahn approach, and plans for the future.

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

Ronald Apriliyanto Halim and Mamadou Diouf Seck

Room: Faneuil

Time: April 6th at 1:30

The combination of simulation and optimization has been successfully applied to solve real-world decision making problems. However, many of the frameworks used to define the integration between simulation and optimization lack of transparent and coherent structure. This consequently deters the effective use of powerful features the simulation technique by optimization practitioners and vice versa. Furthermore, it also hinders the development of simulation-based optimization methods that have a proper balance between the desired features (i.e. generality, efficiency, high-dimensionality and transparency). This research provides the design of the framework that addresses the knowledge gap above and facilitates the fulfillment of the aforementioned features. The proposed framework is developed based on Zeigler's modeling and simulation framework and the phases of an optimization study in operations research. Finally, the test and evaluation on the framework implementation show that the framework successfully meets the desired features.

Automating DEVS over Data Distribution Service for High Performance and Interoperability

Ki-Jeong Kwon, Chungman Seo, Bernard P. Zeigler

Room: Faneuil

Time: April 6th at 1:30

System complexity in military applications requires interoperation between Live and Virtual models. The network middleware enables heterogeneous systems to exchange information. Data Distribution Service (DDS) is a network middleware that uses the publish/subscribe communication paradigm standardized for distributed real-time and embedded systems by OMG (Object Management Group). The DEVS modeling and simulation (M&S) framework separates models from simulators. This separation gives DEVS-based M&S the flexibility to interoperate heterogeneous systems and to utilize distributed network systems. A DEVS simulator is easily adapted to network middleware to implement distributed simulation and interoperable systems with the DEVS simulation protocol. This paper describes how DDS is integrated with the DEVS protocol to achieve distributed simulation of DEVS models. The new DEVS/DDS environment provides a specification to standardize a data-centric publish/subscribe programming model for distributed systems, as well as common protocols between Live, Virtual and Constructive models for high performance simulation.

Towards a Testing Framework for DEVS Formalism implementation

Xiaobo Li, Hans Vangheluwe, Yonglin Lei, Hongyan Song, Weiping Wang

Room: Faneuil

Time: April 6th at 1:30

Abstract: The Discrete-Event system Specification (DEVS) is a widely accepted formalism for discrete-event modelling and simulation. A variety of DEVS modelling and simulation tools have been implemented.Diverse implementations with platform-specific characteristics and often tailored to specific problem domains need to be tested to ensure their compliance with the DEVS formalism. Such compliance allows for meaningful exchange and re-use of models. It also allows for the correct comparison of simulator implementation performance and hence of specific implementation optimizations. In this paper, we focus on testing "correctness" and "preciseness" of DEVS implementations and propose a testing framework. Our testing framework combines black-box and white-box testing approaches.We start with the proposal of a standard XML representation for event and state traces (also known as segments).We then systematically derive a suite of concrete test cases covering all possible DEVS constructs and their combinations. We apply our testing framework to PythonDEVS and DEVS++, two concrete implementations of the Classic DEVS formalism. Analysis of the test results reveals candidate items for improvement of the two tools. Finally, insights gained into DEVS standardization are discussed.

Synchronizing Sequences On Not Strongly Connected Petri Nets

Marco Pocci, Isabel Demongodin, Norbert Giambiasi, Alessandro Giua

Room: Faneuil

Time: April 6th at 3:30

In testing Discrete Event System, an important topic is determining the final state of the machine after the application of a test. Synchronizing and Homing sequences have been proposed in the sixties to solve the problem using Mealy machine. In the synchronizing sequences problem we want to drive an implementation of a given model, seen as a black box, to a known state regardless of its initial state and the outputs. In this paper, we investigate how to determine synchronizing sequences using systems represented by a class of synchronized Petri nets. We propose an approach such that even for not strongly connected -but still connected- net, regardless of the number of tokens that the net contains, a synchronizing sequence may be computed in terms of the net structure, thus avoiding the state explosion problem.

The Rationale for Shaped Simulation

Jeff Buzen

Room: Faneuil

Time: April 6th at 3:30

Monte Carlo simulations are, in a sense, overly detailed when the objective of an analysis is to evaluate the steady state distribution of an underlying stochastic process. This paper describes an alternative simulation methodology – shaped simulation - that provides improved speed and accuracy, but limits the level of detail that can be extracted from the output of the simulation. The rationale for shaped simulation is presented for both discrete and continuous time Markov processes, as well as semi-Markov processes that can be analyzed using embedded Markov chains.

Clocked Transition System as an OPM Formalism with Application to Systems Biology

Valeria Perelman, Dov Dori, Judith Somekh

Room: Faneuil

Time: April 6th at 3:30

A myriad of detailed pieces of knowledge regarding the structure and function of the living cell have been accumulating at an alarmingly increasing rate. Emphasis is shifting from the study of a single molecular process to cellular pathways, cycles, and the entire cell as a system. A framework for supporting the biological researcher for hypotheses verification is proposed. The framework includes molecular biological systems modeling and verification against pertinent literature. Object-Process Methodology (OPM) is a holistic modeling language which is proposed to represent complex biological systems intuitively yet formally. A Clocked Transition System (CTS) is also part of the framework, as is a set of translation rules from OPM to CTS. We apply the translation rules for verification of OPM models. An example from the mRNA transcription subsystem of gene expression demonstrates the value of our system to filling knowledge gap and assessing the feasibility of given conjectures.

ISTSM: Incompletely Specified Timed Sequential Machines

Norbert Giambiasi

Room: Faneuil

Time: April 6th at 3:30

In this paper, after the definition of incompletely specified Timed Sequential Machines (ISTSM), we present a method to reduce the number of states of this sub-class class of Timed Sequential Machines. For this purpose, we define the relations of coverage and compatibility between two states of an ISTSM, and we show how these relations can be used to reduce the number of states of an ISTSM

Energy Portfolio Simulation Considering Environmental and Public Health Impacts

Rafael Diaz, Joshua Behr and Mandar Tulpule

Room: Quincy

Time: April 6th at 8:30

Traditional thermal electricity production is associated with undesirable public health and environment consequences. There is growing interest in the production of electricity from renewable sources such as wind, solar, and biomass. Not unlike traditional power generation, renewable electricity production also must strike a balance among cost, reliability, and compatibility. Certainly the economic and health benefits make renewables a consideration for regions endowed with natural resources that facilitate such enterprises. The 'business' of electricity generation may also be a stimulus for job and wealth creation in a region. A portfolio mix of production methods that maximizes the economic benefits while minimizing the negative health and environmental impacts is attractive. This paper utilizes a system dynamics approach to model the dynamics and effects associated with various energy portfolios mixes. This research introduces a model that can be used to assess complex electricity portfolios, ones that quantify environmental and public health impacts for a region. To demonstrate its functionality, the model is both calibrated and simulated on the U.S. Hampton Roads - Peninsula Region for the years 1996 through 2002.

Modeling and Simulating the Economic and Demographic Impact of Transport Infrastructure Investment

Joshua Behr, Rafael Diaz, Mandar Tulpule, Francesco Longo and Antonio Cimino

Room: Quincy

Time: April 6th at 8:30

Investment in transportation infrastructure has been widely utilized as an instrument for inducing economic growth in a country or region. Such investment usually leads to job creation and an increase in per capita income that, in turn, encourages an increase in population through migration. The increased spending potential of these new populations leads to secondary job creation and further economic development. However, this increased economic activity corresponds with increased utilization of the transport infrastructure resulting in high levels of congestion. The congestion may negatively impact the attractiveness of the region for new investment since the level of congestion in a transportation network is known to affect the productivity of the workforce. Thus, congestion has a direct impact on the region's GRP (Gross Regional Product). Often calls are made to alleviate this congestion through added investment in the transport infrastructure that again spurs economic activity, migration, and congestion. The present study employs a system dynamics approach for modeling the cyclic relationships observed between the economic impact of transportation infrastructure and regional development. Our approach uses a common platform wherein the interconnected factors of demography, transportation infrastructure, and economic activity are jointly modeled and simulated. This model aspires to be utilized as a decision support and consensus building tool in the process of better understanding the impact of investment in transport infrastructure.

Intelligent Agents for Pandemic Modeling

Agostino Bruzzone, Marina Massei, Francesca Madeo, Federico Tarone and Julija Petuhova

Room: Quincy

Time: April 6th at 10:30

Pandemic scenarios are very complex due to the wide number of variables and critical aspects which have to be considered. In fact these phenomena evolve quickly with strong inertia and influence of stochastic components (i.e. mutation, human decisions, etc.). Therefore, Modeling & Simulation is often the only approach able to reproduce effectively pandemic dynamics in a realistic way. A methodology for developing such types of models, taking into consideration open-issues generated by pandemic threats is proposed in the paper and human factors are consider as critical element to mode. A methodology that supports quick development of models and fast result achievement is elaborated and described; at the same time, particular attention is given to validation and verification of models.

A Component-based Approach for Manufacturing Simulation

Frank Riddick, Deogratis Kibira, Y.Tina Lee and Stephen Balakirsky

Room: Quincy

Time: April 6th at 10:30

Manufacturing systems can be very complex and are often costly to develop and operate. Simulation technology has been shown to be an effective tool for optimizing manufacturing system design, operations, and maintenance procedures. However, each manufacturing simulation is usually developed to address a specific set of industrial issues, and may only apply to a small portion of a complex manufacturing system. To enable manufacturers to more easily use simulation technology to solve complex manufacturing issues, this paper defines a reference architecture for component-based simulation (RACS). With the architecture, complex manufacturing systems are functionally partitioned into smaller interacting subsystems, and simulations of those subsystems are combined to form a federated simulation of the overall manufacturing system. This enables the simultaneous analysis of different aspects of each of the simulated subsystems and the overall manufacturing system.

An Effect of Failure Distribution of Machine to the Manufacturing System Performance of Engine Shop

Dug Hee Moon, Guan Wang and Yang Woo Shin

Room: Quincy

Time: April 6th at 10:30

Manufacturing system design is a hard job when a new factory is built. Although some factories produce the same product, the layouts of the factories may be different. The machining line of engine shop in an automotive factory is a typical flow line, but the layout concept of the line is different among factories. In this paper, a simulation study on the design concept of the manufacturing system for automotive engine is discussed. For the comparison, three types of real engine block lines in different factories are analyzed, and three structures of parallel lines were extracted. The effects of failure distribution on the performance measures of three types of parallel line structures were investigated, and some insights of the layout concept ware suggested.

A Model for Simulating Impacts of Seismic Events on Large Power Systems

Edgar Portante, Brian Craig, Leah Malone, James Kavicky, Stewart Cedres and Stephen Folga

Room: Quincy

Time: April 6th at 1:30

This paper describes the capabilities and calculation logic of EPfast, a new simulation and impact analysis tool developed by Argonne National Laboratory. The tool represents an emerging set of simulation models focusing on evaluating the vulnerability of energy infrastructures to simultaneous disruption of a large set (or "cluster") of system components. The problem goes beyond the traditional N-1 or N-2 scenarios covered in most standard power system reliability studies.

Specifically, for EPfast, the purpose is to explore the tendency of power systems to spiral into uncontrolled islanding triggered by either man-made or natural disturbances. This paper describes a recent application of the model to examine the effects of a high-intensity New Madrid seismic event on the U.S. Eastern Interconnection (USEI). The model's most recent upgrade and subsequent application to the USEI were made possible by funding from the U.S. Department of Energy's Office of Infrastructure Security and Energy

A DEVS Library for Rail Operations Simulation

Yilin Huang, Mamadou Seck and Alexander Verbraeck
Room: Quincy
Time: April 6th at 1:30

Detailed yet computationally efficient simulation models are needed to support the design and operation of modern rail infrastructure systems. LIBROS-II is a model component library for microscopic rail operations simulation. Basic rail elements are modeled as atomic DEVS models which are further aggregated into more elaborate rail component models. The latter can in turn be used modularly for the composition of rail network systems of arbitrary complexity in a detailed, efficient, and rigorous way. This paper explains the communication principles in the model and gives an overview of vehicle detection and control system simulation. To enhance its usability, LIBROS-II is augmented with CRMB, a model generator capable of inferring structural and behavioral features of a rail network from standard CAD data.

KoProV- A learning Approach for Coordinated Learning of Modeling and Simulation Based on Knowledge Modules

Christoph Laroque and Jonas Schulte
Room: Quincy
Time: April 6th at 1:30

In university teaching the motif of a skill-oriented education is changing to a competency-based. Competency can be roughly divided into technical and interdisciplinary competences. In particular, the transfer of key qualifications has received in the teaching of natural sciences inadequate collection. While the classic teaching aims for acquisition of professional competence, just project-oriented approaches quickly reach their limits according to participant size or scope of the learning content. To enable the acquisition of interdisciplinary competences in an appropriate way, new teaching concepts are required, which provide a closer link between traditional lectures and project-based learning. The outlined approach of the "coordinated project course" (KoProV: Koordinierte ProjektVorlesung) tries to link knowledge transfer in the context of lectures with coordinated practical phases in subgroups. For a successful implementation and development of the accompanying practice project by several subgroups, organizational and technical conditions must be observed. This paper describes the concept of KoProV as well as its application in a modeling and simulation course at the University of Paderborn.

Modeling and Simulation Driven Software Development

Joseph Barjis, Irina Rychkova and Levent Yilmaz
Room: Haymarket
Time: April 6th at 1:30

Modeling and simulation takes significant efforts and the results of these efforts are often underutilized in the subsequent phases of software development. In particular, the code generated in the simulation model can be a basis for further software development. In this paper, we discuss a theoretical and conceptual framework for software development based on the codes generated in a simulation environment. As business process modeling plays a departure role, in this paper, we pay attention to both conventional process modeling, i.e., imperative modeling based on explicit control flow, and unstructured process handling. i.e., declarative modeling based on circumstantial information. Since a simulation environment has the advantage of conducting experiments in regard to certain aspects or characteristics of a system, we also discus robustness and resilience of system performance in relation to fluctuating input, utilization of resources, and environmental uncertainties. A robust system is one that can withstand environmental disturbance without substantially losing ability to perform its operational mission, while a resilient system has the capability to rapidly recover its optimal performance.

Wave-Pattern Processing Towards Inverse Reliability Problems

Jan Podrouzek
Room: Haymarket
Time: April 6th at 1:30

Ultrasonic wave propagation simulation serves in this paper as a conceptual approach to nondestructive testing of inherent material properties. The suggested method attempts to identify possible defects and to reduce the uncertainty of the system and thus contribute to the safety. The nontraditional Cellular Automata computational scheme was adopted for both the wave propagation solution and pattern processing.

Short Term Wind Power Forecasting Using Time Series Neural Networks

Mohammadsaleh Zakerinia and Seyed Farid Ghaderi
Room: Haymarket
Time: April 6th at 1:30

Forecasting wind power energy is very important issue in a liberalized market and the prediction tools can make wind energy be competitive in these kinds of markets. This paper will study an application of time-series and neural network for predicting wind energy production in a short time 1h ahead. Several types of typical neural networks like adaptive linear element and black propagation (BP) are used. Moreover, the performance of different methods is assessed based on mean absolute error, root mean square error and mean absolute percentage error. The data that has been used in this paper is obtained from Renewable Energy Organization of Iran and applied in the site of Shiraz.

Understanding Interoperability

Saikou Diallo, Heber Herencia-Zapana, Jose Padilla and Andreas Tolk
Room: Quincy
Time: April 6th at 3:30

In this paper, we seek to understand and explain what interoperability is, how it works and make a case for a formal theory of interoperability. Based on the study of existing definitions and approaches, we establish the necessary and sufficient conditions under which systems are interoperable and show that current approaches are semantically equivalent. Finally, we propose a set of objectives that a formal theory of interoperability should meet in order to be useful.

Emerging M&S Application in Risk Management

C. Ariel Pinto, Andreas Tolk and Michael McShane
Room: Quincy
Time: April 6th at 3:30

There has been compelling signs of the great potential of building further synergy with academics, researchers, and industry practitioners from the areas of Modeling and Simulation (M&S)

managing risk events. M&S's potential goes far beyond its power to tell us how systems may, would, and should work. And for this same reason, M&S also has a great and still untapped power to tell us how complex systems may fail and to enable specialists from various field of discipline to interact. Nonetheless, there needs to be the conscious and deliberate attempt to harness this power by bringing together current knowledge and game-changing ideas from the best academics, researchers, and industry practitioners in M&S and risk management.

A Multi-Core Numerical Framework For Characterizing Flow in Oil Reservoirs

Christopher Leonardi, David Holmes, John Williams and Peter Tilke

Room: Faneuil

Time: April 4th at 1:30

This paper presents a numerical framework that enables scalable, parallel execution of engineering simulations on multi-core, shared memory architectures. Distribution of the simulations is done by selective hash-tabling of the model domain which spatially decomposes it into a number of orthogonal computational tasks. These tasks, the size of which is critical to optimal cache blocking and consequently performance, are then distributed for execution to multiple threads using the previously presented task management algorithm, H-Dispatch. Two numerical methods, smoothed particle hydrodynamics (SPH) and the lattice Boltzmann method (LBM), are discussed in the present work, although the framework is general enough to be used with any explicit time integration scheme. The implementation of both SPH and the LBM within the parallel framework is outlined, and the performance of each is presented in terms of speed-up and efficiency. On the 24-core server employed in this research, near linear scalability was achieved for both numerical methods with a utilization efficiency of approximately 90%. To close, the framework is applied in the simulation of fluid flow in a porous rock specimen, which is a problem of broad geophysical significance and in particular in enhanced oil recovery.

Marketplace and the HPC Innovation

Niraj Srivastava

Room: Faneuil

Time: April 4th at 1:30

Invited Presentation

An SMP Soft Classification Algorithm for Remote Sensing

Rhonda Phillips, Layne Watson and Randolph Wynne

Room: Faneuil

Time: April 4th at 3:30

This work introduces a parallel version of the continuous iterative guided spectral class rejection (CIGSCR) algorithm, a semi-automated classification algorithm for remote sensing (multispectral) images. The algorithm uses soft clusters to produce a soft classification containing inherently more information than a comparable hard classification at an increased computational cost. Previous work suggests that similar algorithms achieve good parallel scalability, motivating the parallel algorithm development work here. Experimental results of applying parallel CIGSCR to an image with approximately 10^8 pixels and six bands demonstrate superlinear speedup. A soft two-class classification is generated in just over four minutes using 32 processors.

Introduction to Parallel Computing with MATLAB

Jiro Doke

Room: Faneuil

Time: April 4th at 3:30

Invited Presentation

The Virtual Parasite Project: in silico HPC Simulation of Trypanasoma cruzi Host-Parasite Dynamics to Model Chagas Disease

Tarynn Witten, Samuel Sieg and Patricio Manque

Room: Faneuil

Time: April 5th at 10:30

Infectious diseases remain one of the biggest medical problems to date. Many examples of such infectious disease host-parasite systems exist and have debilitating and/or fatal consequences for humans all over the planet. Because of its complex life-cycle, {\it Trypanosoma cruzi} provides one of the most fascinating and complex, yet sophisticated host-parasite model systems for investigation. Our methodology is based upon an integrated mathematical, {\it in silico} multi-scale modeling approach. The long-term goal of this project is to apply novel mathematical and computational modeling technologies, well informed by biological experimentation, to specific host-parasite systems in order to develop new paradigms for understanding the infectious disease process, for the purpose of developing new therapeutic and public health interventions and strategies. We are developing and will make available to the scientific community an extensible, portable, {\it in silico}, multi-scale, high performance computational model of parasite-host dynamics.

Microsoft Technical Computing: Modeling the world With Greater Fidelity

Dr. Ronnie Hoogerwerf

Room: Faneuil

Time: April 5th at 10:30

Invited Presentation

FATODE: A Library for Forward, Adjoint, and Tangent Linear Integration of Stiff Systems

Hong Zhang and Adrian Sandu

Room: Faneuil

Time: April 5th at 1:30

This paper presents FATODE, a Fortran package for the Forward, Adjoint, and Tangent linear integration of stiff ODE systems. This package generalizes the KPP numerical library. FATODE contains three families of methods – fully implicit Runge-Kutta, singly diagonally implicit Runge-Kutta, and Rosenbrock. For each family, forward, discrete adjoint, and discrete tangent linear models are implemented, in support of both direct and adjoint sensitivity analyses. It incorporates a set of direct linear solvers suitable for full and sparse systems, and allows users to provide application specific linear solvers as well. Implementation aspects of the package, code organization, and usability are discussed. The use of FATODE is demonstrated on a small chemical mechanism.

Shared Memory "Wide or Tall" and Sparse Matrix Dense Matrix Multiplications

Gary Howell

Room: Faneuil

Time: April 5th at 1:30

This note shows some tuning techniques for sparse matrix dense matrix (called USMM in Blast Forum documentation) multiplications and dense "wide or tall" matrix multiplications. "Wide and tall" and USMM mulitiplications are the predominant calculations in block Krylov and Lanczos methods. The main attraction of a “block” as opposed to a vector based algorithm is the potential for better computational speed. The available tuned BLAS libraries do not tune

the _gemm operator for this case. Similarly, users of USMM operations cannot rely on the available BLAS libraries for efficient tuning. In the ``wide or tall" case, we get highly efficient OpenMP parallelization on a NUMA multi-core AMD blade.

Fully Implicit Tau-Leaping Methods for the Stochastic Simulation of Chemical Kinetics

Tae-Hyuk Ahn and Adrian Sandu

Room: Faneuil

Time: April 5th at 1:30

The stochastic simulation algorithm (SSA), proposed by Gillespie, is a cardinal simulation method for the chemical kinetics. Because the SSA simulates every reaction event, the amount of the computational time is huge when models have many reaction channels and species. This drawback motivates many attempts to improve the efficiency with the accuracy. The existing "implicit tau-leaping" procedure attempts to accelerate the exact SSA especially for stiff systems. The implicit tau-leaping method uses an implicit discretization for the mean, together with an explicit discretization of the Poisson "noise". It is therefore a partially implicit method.

In this paper we propose three fully implicit tau-leaping methods that treat implicitly both the mean part and the variance of the Poisson variables. The three methods considered below are the backward Euler for the mean and backward Euler for the variance of the Poisson variables, trapezoidal for both the mean and the variance of the Poisson variables, and backward Euler for the mean and trapezoidal for the variance of the Poisson variables. These methods are motivated by the theory of weakly convergent discretizations of stochastic differential equations. Numerical results demonstrate the performance of the new fully implicit methods.

Accelerating the Smoldyn Spatial Stochastic Biochemical Reaction Network Simulator Using GPUs

Denis Gladkov, Samuel Alberts, Steven Andrews and Roshan D'Souza

Room: Faneuil

Time: April 5th at 3:30

Smoldyn is a spatio-temporal biochemical reaction network simulator. It belongs to class of methods called particle-based methods and is capable of handling effects such as molecu- lar crowding. Individual molecules are modelled as point ob- jects that can diffuse and react in a control volume. Since each molecule has to be simulated individually, the computational complexity of the simulator is quite high. Efficiently execut- ing high fidelity (> 106 molecules) is not feasible with tradi- tional serial computing on central processing units (CPUs). In this paper we present novel data-parallel algorithms designed to execute on graphics processing units (GPUs) to handle the computational complexity. Our preliminary implementa- tion can handle diffusion, zero-order, first-order, and second- order reactions. It also able to handle complex mesh geometry in the simulation. Our preliminary results show performance gain of over 200x over the original implementation without loss of accuracy.

Lattice Boltzmann Methods Simulations on Massively Parallel Multi-core Architectures

Luca Biferale, Mauro Sbragaglia, Andrea Scagliarini, Filippo Mantovani, Marcello Pivanti, Fabio Pozzati, Sebastiano Fabio Schifano, Raffaele Tripiccione and Federico Toschi

Room: Faneuil

Time: April 5th at 3:30

We describe the implementation and optimization of a state-of-the-art Lattice Boltzmann code for computational fluid-dynamics for massively parallel systems using multi-core processors. We consider a code describing 2D compressible fluid flows, including thermal and combustion effects. We carefully match and balance the large degree of parallelism of the underlying algorithm with the diverse available parallel resources (inter-node, intra-node, SIMD). We test our code on the prototype of the application-driven AuroraScience machine, but our results can be readily ported to virtually any large scale system. We obtain a sustained performance for this ready-for-physics code that is a large fraction of peak performance.

Parallel GMRES implementation for solving sparse linear systems on GPU clusters

Jacques Bahi, Raphaël Couturier and Lilia Ziane Khodja

Room: Faneuil

Time: April 5th at 3:30

In this paper, we propose an efficient parallel implementation of the GMRES method for GPU clusters. This implementation requires us to parallelize the GMRES algorithm between CPUs of the cluster. Hence, all parallel and intensive computations on local data are performed on GPUs and reduction operations to compute global results are carried out by CPUs. The performances of our parallel GMRES solver are evaluated on test matrices of sizes exceeding 10^7 rows. They show that solving large and sparse linear systems on a cluster of 12 GPUs is about 8 times faster than that performed on cluster of 12 CPU cores.

Implementing Random Indexing on GPU

Lukas Polok

Room: Faneuil

Time: April 5th at 3:30

Vector space models (also word space models or term space models) are algebraic models, used for representing text documents as vectors of terms. They have received much attention recently as they have wide spectrum of applications, including information filtering, information retrieval, indexing and relevancy ranking. They can be advantageous over the other representations because vector spaces are mathematically well defined and there's large set of tools for manipulating them. Random Indexing is one of methods used for calculating vector space models from set of documents, based on distributional statistics of term co-occurrences. To produce useful results it may therefore require large amounts of data and significant computational power. We present an efficient implementation of Random Indexing on GPU, allowing fast training even on large datasets. It is only limited by amount of memory available on GPU, some techniques to overcome this limitation are suggested. Speedups in magnitude of tens are achieved for training from random seed vectors, and even much higher for retraining. Implementation scales well with both term vector dimension and seed length.

Convey ThreadSim: A Simulation Framework for Latency-Tolerant Architectures

John Leidel, Convey Computer Corporation

Room: Salon K

Time: April 6th at 8:30

Invited Presentation

Component-Based Programming Techniques for Coarse-grained Parallelism

Jörg Dümmler, Thomas Rauber and Gudula Rünger
Room: Salon K
Time: April 6th at 8:30

Coarse-grained parallelism can be used to define components for large parallel programs from scientific computing. A (parallel) component is a piece of parallel code that can be executed in parallel on a set of processors or cores and has a predefined interface to be coupled with other components. Depending on the internal programming and memory model, a component may consist of computation and communication phases or, alternatively, of shared memory code. The interfaces are usually responsible for data exchanges. Parallel components can be used to build up more complex parallel programs with a flexible component interaction structure.

In this article, we discuss the programming with parallel components for designing efficient parallel programs for massively parallel execution platforms. We present a mechanism for the specification of parallel components with communication interfaces. The execution of these components can be adapted to the architectural characteristics of multicore clusters with a hierarchical communication structure. The usefulness of the approach is demonstrated by application programs for the solution of large systems of differential equations.

Asynchronous Invocation of Adaptations in Electronic Structure Calculations

Sai Kiran Talamudupula , Masha Sosonkina and Mike Schmidt
Room: Salon K
Time: April 6th at 10:30

Modern quantum chemistry deals with electronic structure calculations of unprecedented complexity and accuracy. They demand full power of high-performance computing and must be in tune with the given architecture for superior efficiency. To make such applications resource-aware, it is desirable to enable their static and dynamic adaptations using some external software (middleware), which may monitor both system availability and application needs, rather than mix science with system-related calls inside the application.

This paper investigates models of application integration with middleware based on the example of the computational chemistry package GAMESS and middleware NICAN. The existing synchronous integration model is limited by the possible delays due to the middleware processing time under the sustainable runtime system conditions. Proposed asynchronous and hybrid integration models aim at overcoming this limitation. The experiments contribute to gaining an insight into a choice of integration model.

Direct Search Versus Simulated Annealing on Two High Dimensional Problems

David Easterling, Layne Watson and Michael Madigan
Room: Salon K
Time: April 6th at 10:30

Two global optimization problems with high dimensionality and many local minima are investigated with two different optimization algorithms: DIRECT and simulated annealing. The problems include a difficult biomechanics problem with a great deal of experimental noise and a deterministic integer programming problem with a known global minimum.

A Highly Parallel Implementation of K-Means for Multithreaded Architecture

Patrick Mackey, John Feo, Pak Chung Wong and Yousu Chen
Room: Salon K
Time: April 6th at 10:30

We present a parallel implementation of the popular k-means clustering algorithm for massively multithreaded computer systems, as well as a parallelized version of the KKZ seed selection algorithm. We demonstrate that as system size increases, sequential seed selection can become a bottleneck. We also present an early attempt at parallelizing k-means that highlights critical performance issues when programming massively multithreaded systems. For our case studies, we used data collected from electric power simulations and run on the Cray XMT.

Fault-tolerant Data Aggregation Scheme for Monitoring of Critical Events in Grid based Healthcare Sensor Networks

Ather Saeed, Andrew Stranieri and Richard Dazeley
Room: Salon K
Time: April 6th at 10:30

Wireless sensor devices are used for monitoring patients with serious medical conditions. Communication of content-sensitive and context sensitive datasets is crucial for the survival of patients so that informed decisions can be made. The main limitation of sensor devices is that they work on a fixed threshold to notify the relevant Healthcare Professional (GP) about the seriousness of a patient's current state. Further, these sensor devices have limited processor, memory capabilities and battery. A new grid-based information monitoring architecture is proposed to address the issues of data loss and timely dissemination of critical information to the relevant GP. The proposed approach provides an opportunity to efficiently aggregate datasets of interest by reducing network overhead and minimizing data latency. To narrow down the problem domain, in-network processing of datasets with Grid monitoring capabilities is proposed for the efficient execution of the computational, resource and data intensive tasks. Interactive wireless sensor networks do not guarantee that data gathered from the heterogeneous sources will always arrive at the sink (base) node, but the proposed aggregation technique will provide a fault tolerant solution to the timely notification of a patient's critical state. Experimental results received are encouraging and clearly show a reduction in the network latency rate.

Fast Approximation Algorithms for Scheduling Independent Multiprocessor Tasks

Kai Baumgarten and Thomas Rauber
Room: Salon K
Time: April 6th at 1:30

In this paper we present different approximation algorithms for the scheduling of parallel modules. Each module can be executed on an arbitrary number of processors such that its execution time depends on the number of processors assigned to it. The scheduling algorithms assume that there is no dependence between the modules. In the first part we present algorithms that are based on results for the classical rectangle filling problem. Afterwards we modify an approximation algorithm for the shop scheduling problem. The resulting algorithms are simple, but efficient and guarantee tight worst-case bounds on the suboptimality of the solution. We test the quality of the generated schedules by applying the scheduling algorithm to randomly generated problem instances.

Communication with Spawned Processes

Nicholas Radcliffe, Masha Sosonkina and Layne Watson

Room: Salon K

Time: April 6th at 1:30

Motivated by prior work with the global optimization algorithm pVTDIRECT95, this paper considers two methods for simplifying communication with spawned processes. Tests are performed for each method, and runtimes for the two methods are compared. In general, the performance of the two methods is quite similar, although other aspects of each method set the methods apart. In particular, restrictions on how the spawning has to be done determines the practicality of the method.

Corrected Model for "Predicting the Relative Performance of CPU"

Jayanta Choudhury

Room: Salon K

Time: April 6th at 1:30

In the era of cloud computing and virtualization it is ever more important to model performance of computing systems. An algorithm for finding functions to describe relative performance using sample CPU rating system from www.spec.org was proposed by Debbie Sheetz, Lying Song and Anatoliy Rikun. A major error in the primary model equation of the algorithm, proposed by Sheetz and group is reported here. The fundamental cause of the error and its implication is explained. The validity of the data presented in several tables were analyzed against the error in the main theory. Correct form of the equation is presented. The corrected model is applied to a new set of performance data and the results are validated by comparing some predictions with measured data.

A Data Management System for Ab-Initio Nuclear Physics Applications

Fang Liu, Ritu Mundhe, Masha Sosonkina, Chase Cockrell, Miles Aronnax, Pieter Maris and James Vary

Room: Salon K

Time: April 6th at 3:30

Reproducible Research in the computational science domain is an emerging concept in computational sciences, and reproducibility lies at the very core of the scientific method: an experiment is reproducible if it can be replicated by researchers independent from those that conducted it in the first place. In this work, we introduce reproducible research to another scientific domain - ab initio nuclear physics calculations. Through a data management system, the provenance information is consistently recorded for post-processing, validation, and education purposes. Due to the large volume of data generated through each experimental run, data management system needs to address the high performance computing needs compared with a traditional database management system.

PetClaw: A Scalable Parallel Nonlinear Wave Propagation Solver for Python

Amal Alghamdi, Aron Ahmadia, David Ketcheson, Matthew Knepley, Kyle Mandli and Lisandro Dalcin

Room: Salon K

Time: April 6th at 3:30

We present PetClaw, a scalable distributed-memory solver for time-dependent nonlinear wave propagation. PetClaw unifies two well-known scientific computing packages, Claw- pack and PETSc, using Python interfaces into both. We rely on Clawpack to provide the infrastructure and kernels for time-dependent nonlinear wave propagation. Similarly, we rely on PETSc to manage distributed data arrays and the com- munication between them. We describe both the implementa- tion and performance of PetClaw as well as our challenges and accomplishments in scaling a Python-based code to tens of thousands of cores on the BlueGene/P architecture. The capabilities of PetClaw are demonstrated through application to a novel problem involving elastic waves in a heterogeneous medium. Very finely resolved simulations are used to demonstrate the suppression of shock formation in this system.

Adaptive Runtime Selection of Parallel Schedules in the Polytope Model

Benoît Pradelle, Philippe Clauss and Vincent Loechner

Room: Salon K

Time: April 6th at 3:30

Static compilers are unable to choose which optimizing and parallelizing transformations will perform the best on any architecture and for any execution context. Further, there is often no unique optimized version that provides the best performance in all circumstances. Hence compilers should rely on an adaptive runtime decision. Our framework aims to solve two drawbacks of existing adaptive methods: they require many function calls in order to detect the best version; it is difficult to handle varying input data, since even small variations of the input data shape or size may have a strong influence on execution times.

In our proposal, different code versions of parallel loop nests are statically generated by the compiler. At install time, each version is profiled in different execution contexts. At runtime, the execution time of each code version is predicted using the profiling results, the current input data shape and the number of available processor cores. The version that has been predicted as the most performing is then actually run.

Our framework handles several versions of possibly tiled parallel loops, using the polytope model for both the profiling and the dynamic selection phases. We show on several benchmark programs that our runtime system almost always succeeds in selecting the most efficient version with a very low runtime overhead, and selects another well performing version in the other cases. This quick and efficient selection leads to speedups compared to the usage of a unique version in every execution context.

A Framework for an Automatic Hybrid MPI+ OpenMP code generation

Khaled Hamidouche, Joel Falcou and Daniel Etiemble

Room: Salon K

Time: April 6th at 3:30

Cluster symmetric Multiprocessors (SMP) are perceived as one of the most cost-effective solution for large scale application and the combination of MPI and OpenMP models is regarded as a suitable programming model for such architecture. But writing efficient MPI+OpenMP programs requires expertise and performance analysis to determine the best number of processes and threads for the optimal execution for a given application on a given platform.

To solve these problems, we propose a framework for the development of hybrid MPI+OpenMP programs. This paper makes the following contributions: (i) A compiler analyzer that estimates the computing time of a sequential function. (ii) A code generator tool for hybrid code generation based on (i) and a simple analytical parallel performance prediction model to estimate the execution time of an hybrid program. (iii) Assessing the accuracy of the framework and the easy of use on several benchmarks.

Command and Control: A low cost framework to remotely monitor military training

Roberto de Beauclair Seixas and Daniel de Vasconcelos Campos
Room: Salon I
Time: April 4th at 1:30

The Command and Control theory of John Boyd, a 20th century military strategist, allow us to intro- duce computing techniques that are able to speed up the OODA loop (Observe–Orient–Decide–Act), especially on observing and orienteering steps. This paper introduces a low cost framework capable of monitoring people, vehicles, boats, or any other elements of interest, almost in real time. The goal of this design is to gather and present the best possible information for decision makers in a Theater of Operations.

Organizational Adoption of Innovation - Background, Programs & a Descriptive Modeling Approach

Jerry Couretas and Mehmet Ucal
Room: Salon I
Time: April 4th at 1:30

Adoption of innovation, the transfer of new technology from developers to adopters, has a unique history that alternates between Government and Industry sponsors. In reviewing this history of programs and approaches for technology migration, we leverage well-known technology refresh rates for mediums that span from information technology (IT) to large capital equipment (e.g., shipbuilding) projects. Using these known technology refresh periods as examples, we approximate an organization's technology adoption / procurement time via a set of novel structural constraints first proposed in this paper.

Fuzzy Logic Injury Design for Crowd Modeling

Emin Kugu, Jiang Li, Frederic D. McKenzie and Ozgur Koray Sahingoz
Room: Salon I
Time: April 4th at 1:30

A crowd is a group of people attending a public event such as protesting the government. In case a violence event, military or police forces try to manage of the crowd to save the public peace. Often, police or military forces use non-lethal weapons (NLWs), such as plastic bullets or clubs, to accomplish their job [1]. In order to simulate this kind of event in the computer we need to solve a problem: The determination of physical effects of NLWs over the crowd individuals based on a model. It is not easy to acquire a mathematical model for these kinds of problems. Here, fuzzy logic design may be an option. In this paper we designed a fuzzy logic model to determine the physical effects of NLWs. Fuzzy logic concepts can be applied on a problem domain by using linguistic variables. The key point is the experience on the problem domain. The inputs and the outputs of the fuzzy system must be determined clearly by the problem domain experts. Here, police or military officers are domain experts. We have defined fuzzy logic injury model rules by working together with military security officers. We have implemented our model using the Repast Symphony agent based simulation toolkit as a proof of concept.

Using a Constructive Simulation to Select a Camouflage Pattern for Use in OEF

Joseph Venezia and Adam Peloquin
Room: Salon I
Time: April 4th at 3:30

The Natick Soldier Research, Development, and Engineering Center (NSRDEC) is involved in research to objectively select an alternative camouflage pattern to the Universal Camouflage Pattern (UCP) for use in Operation Enduring Freedom (OEF). The UCP is the current pattern used in the Army Combat Uniform (ACU).

The main hypothesis of this study investigated possible increases in survivability in a constructive simulation when using one of five camouflage uniforms in lieu of the UCP. To assess the operational effectiveness of these uniform patterns in a combat environment, this analysis used the Infantry Warrior Simulation (IWARS) constructive simulation. Field test data collected in OEF was used as an input to IWARS. Survivability, detectability, and overall mission effectiveness were three metrics used in concert to determine whether one camouflage was more effective than another.

Task Degradation in Agent-based Simulation

Daniel Rice and Mitha Andra
Room: Salon I
Time: April 4th at 3:30

During emergency operations for the response and recovery to events, such as terrorist attacks and natural disasters, issues related to human resource and equipment allocation can have a large impact on the effectiveness of operations. The unexpected degradation of first responders' task performance under multiple attack vectors (e.g., threat of smoke, gunfire, bomb threats, chemical and biological agents) that are expected to be used in coordinated attacks such as the Mumbai attacks of 2008 can exacerbate negative impacts on responder performance. Constructive simulation provides the context for the investigation of multiple scenarios with varied environmental, materiel, strategic, personnel and task factors that impact task performance and overall mission effectiveness. Modeling and simulation tools are being leveraged by the US Armed forces to study these impacts, the role of resource allocation, and the overall performance of these forces in challenging asymmetric warfare contexts that have many similarities to coordinated terrorist attacks. This paper investigates the role of constructive simulation in studying the impact of the above factors on homeland security missions involving emergency response and disaster recovery personnel. A set of potentially useful scenarios are suggested to help study these factors and resource allocation decisions, (e.g., determining the type and number of first responders and their required equipment necessary for response to hypothetical attacks). Modeling and simulation tools are suggested for use in providing the tools needed to study the impact of these factors and decisions on emergency response, preparedness, and recovery operations. More specifically, this research suggests the exploration of modeling and simulation for use in studying various course of actions (COAs) with an eye on creating optimal policies that can be put in place to optimize emergency response and disaster recovery performance in complex environments involving unique combination of factors ultimately impacting responder task performance and mission effectiveness.

The Modeling and Simulation of Non-lethal Weapons in Constructive Simulation

Mitha Andra, Nazli Elsamaloty and Lew Farkas
Room: Salon I
Time: April 4th at 3:30

The capability to evaluate Nonlethal Weapons (NLWs) and their effects on operations in an urban environment for combat as well as stability and support operations is increasing in importance. This research investigates the modeling and simulation (M&S) of NLWs and their effects on task performance in an operational environment. Most NLWs are not well represented in Army simulations and there is a need for important elements that support requirements definition, training, development of tactics and analysis. The lack of NLW representation in constructive simulations leads to a deficiency in operational assessment of materiel and tactics of NLWs in urban environment. The paper describes current and ongoing research regarding representing NLWs in

constructive simulations based on documented data structures that identify key inputs and outputs for NLWs and methodology development that have been documented in a manner similar to the Physical Knowledge Acquisition Documents (PKAD) used by Army Materiel Systems Analysis Activity (AMSAA) and the simulation model developers. The paper also discusses the capability for an initial NLW distributed simulation capability within the RDECOM Modeling Architecture for Technology, Research, and Experimentation (MATREX) environment. An effective representation of NLWs in constructive simulations such as the Infantry Warrior Simulation (IWARS) model, Combat XXI and OneSAF will enable a distributed simulation NLW M&S capability that addresses multiple needs in integrated events and experiments as well as addresses the limited capability to assess potential NLW technology material solutions and support training.

Third-space Architecture for Learning in 3D

Andrew Stricker, John Cook, Kimberly-Combs Hardy, Cynthia Calongne, Elizabeth Stricker, Kathryn Flitter, Toni Scribner and Fil Arenas

Room: Salon I

Time: April 5th at 1:30

Learning is increasingly untethered to home, work or school spaces by means of mobile, collaboratively-driven use of digital "third space." A 3rd-space, portable and modular design is described and demonstrated for use in administering and delivering scenario-based learning games across levels of difficulty in a 3D world. 3rd-space learning designs support multi-purpose, multifunctional devices and tools for learner-centered design and collaboration in support of social learning. The framework offered in this paper supports multiple delivery options involving offline and online access to an OpenSim platform for delivering 3D world scenario-based learning games and the use of Drupal modules for administering and supporting collaborative peer-based social learning among game community members. The presentation will include a demonstration and lessons learned from a prototype learning game employing the framework. Evaluation of framework design features, modeling strategies, and delivery options will be discussed and recommendations offered for scaling the design.

A Methodology for Evaluating Shared Leadership in a Game Simulation Kit

Linda Hamons, Cynthia Calongne D.CS., Andrew Stricker Ph.D. and Anne-Marie Armstrong Ph.D.

Room: Salon I

Time: April 5th at 1:30

This research examines the effectiveness of shared leadership in virtual teams.

This paper presents an experimental design for assessing the effectiveness of shared leadership among a team of players in a game set in a virtual environment. The four-member teams comprised of randomly selected members are observed from afar as they participate in a game simulation that models a hostage rescue mission. The Game Simulation Kit was developed by the Air University (AU) Innovations and Integrations Division. AU hosts the game and their research examines teamwork, interdependent group responses and leadership set within the virtual world of Second Life. This research analyzes team effectiveness through qualitative assessment and empirical testing as players progress through a series of objectives, and anchors the results to the interdependent leadership model from the Center for Creative Leadership at the US Air Force Academy.

Virtual Reality as a Theme-Based Game Tool for Homeland Security Applications

Sharad Sharma and Stephen Otunba

Room: Salon I

Time: April 5th at 1:30

Human behavior can sometimes be predictable and this provides a context for different behaviors that would work in crowd simulations. Gaming industry has been extensively incorporating these behaviors. Various human behavioral aspects can be observed in places like subway stations, sporting events, or gatherings. In this paper, we propose a theme-based game approach to study the human behaviors in different emergency situations which can be used to collect data needed for simulating crowd behaviors, control the generated traffic conditions, and pedestrian movements. This paper describes the two developed theme-based game applications in virtual reality for emergency behavior analysis. The applications are virtual city and virtual airport environments. We propose virtual reality as a tool for conducting controlled experiments of human behaviors in response to emergencies. The results of these experiments can be used to test decision making strategies for homeland security applications.

The Application of MTWS in the Simulation of Non-Kinetic Environment

Donald Herod and John LaCrosse

Room: Salon I

Time: April 5th at 3:30

This paper discusses proposed enhancements to the Marine Air-Ground Task Force (MAGTF) Tactical Warfare Simulation (MTWS) to support the U.S. Marine Corps Training Modeling and Simulation Master Plan requirement for injections of non-kinetic PMESII (Political, Military, Economic, Social, Infrastructure, and Informational) effects into operational level staff simulation training.

Successful simulation of non-kinetic effects requires both simulation enhancements and changes to how simulation training exercises are planned, conducted, and executed.

The proposed simulation enhancements capitalize on many of the currently existing capabilities in MTWS, and provide the best short-to-mid term solution to simulating non-kinetic PMESII actions pending the development of next generation simulation systems.

Using a text analysis and categorization tool to generate Bayesian belief networks for use in cognitive social simulation from a document corpus

Daniel McKaughan

Room: Salon I

Time: April 5th at 3:30

Cognitive social simulation provides a promising means of gaining insight into a particular area of interest for a given population, but the data to instantiate these models must be gleaned from disparate data sources. Methods and tools to efficiently leverage information regarding a population of interest from a document corpus are required. This paper provides an overview of the use of Sandia National Laboratory's Text Analysis Extensible Library (STANLEY) to categorize a body of documents to create Bayesian belief networks that can be used as cognitive models within social simulation.

Manual Wargaming as a Method for Training: An Analysis of the Commercial Wargame "Battle for Baghdad"

Mike Stinchfield and Jason Caldwell
Room: Salon I
Time: April 5th at 3:30

Wargames have a history as long as war itself. Although used by militaries throughout history to train, the relatively recent development of computers and operational analysis have redefined the wargame significantly for professional use. A new, commercial, manual wargame, "Battle for Baghdad" , attempts to model the political, civil, and military dimensions of the war in Baghdad from 2004-2009. Through several play sessions, we analyzed the game as a potential training tool for commands and staffs seeking to improve decision making during stability operations.

Taxonomy of Cyber Attacks and Simulation of Their Effects

Ian M. Chapman, Sylvain P. Leblanc and Andrew Partington
Room: Salon I
Time: April 6th at 8:30

Due to an increasing level of reliance on computer network technology, military organizations are increasingly vulnerable to cyber attacks. Cyber attacks take a variety of forms and have a broad spectrum of effects. In order to facilitate military cyber operators' and defenders' understanding of the threats they face, we propose a taxonomy of cyber attacks based on the level of access required by the attacker to launch the attack. We also discuss a number of methods used to deliver cyber attacks to target systems. Finally, we propose methods to simulate the effects of several cyber attack types for use in simulation in support of training and experimentation.

Development of a Training Effects Algorithm for Modeling the Impact of Training in IMPRINT for 21st Century Air Force Needs

Tristan Johnson and Rinat Rosenberg-Kima
Room: Salon I
Time: April 6th at 8:30

The general aim of this project was to employ a model-based approach for aligning instructional strategies with technical task performance. The modeling system used in this effort was the Improved Performance Research Integration Tool (IMPRINT). IMPRINT has been used successfully by the United States Military to predict human performance in complex and dynamic operational environments. At the outset of this project, however, IMPRINT did not include a training component to determine the effects of instructional approaches on task performance within various learning taxonomic domains. In order to achieve the project goal, the project team carried out an extensive literature review on the effects of training on technical task performance and developed a training effects algorithm based on the meta-analysis of relevant studies. The training effects algorithm acts as a plug-in to the IMPRINT system and has been shown to effectively model training effects in a technical mission.

An Overview of Cyber Attack and Computer Network Operations Simulation

Sylvain Leblanc, Ian Chapman, Andrew Partington and Mélanie Bernier
Room: Salon I
Time: April 6th at 8:30

This paper represents a snapshot of the current state of the art in the simulation and modeling of cyber attacks and defensive responses to those. It discusses a number of simulations of cyber warfare, including live, virtual, and constructive simulations. The simulations discussed in this paper were found in the open literature and were conducted in the private sector, academia, and government. Each simulation is briefly described, including goals, methodology, and a brief discussion of its accomplishments. These modeling and simulation efforts are of particular interest to the military modeling and simulation community, as it is likely that military forces will continue to rely ever more heavily on computer and communication networks.

Balancing Exploration and Exploitation Ratio in Reinforcement Learning

Ozkan Ozcan, Claudio Coreixas de Moraes and Jonathan Alt
Room: Salon I
Time: April 6th at 1:30

The issue of controlling the ratio of exploration and exploitation in agent learning in dynamic environments provides a continuing challenge in the application of agent learning techniques. Methods to control this ratio in a manner that mimics human behavior are required for use in the representation of human behavior, which seek to constrain agent learning mechanisms in a manner similar to that observed in human cognition. This paper describes the use of two novel methods for adjusting the exploration and exploitation ratio of agents using a simple grid-world example and two armed bandit example.

Coalition Battle Management Language Extensions for Simulation Interoperability

Robert Kewley, Samy Chatelet and Antione Helio
Room: Salon I
Time: April 6th at 1:30

This paper addresses the challenge of simulation and command and control interoperability for coalition forces. The Coalition Battle Management Language (CBML) is extended and harmonized with a simulation command and control data model, Primitives of Meaning (POM), using a Model Based Data Engineering Approach (MBDE). This yields a series of extensions to CBML. The first group of extensions allows execution of low-level tactical tasks such as mount a vehicle or orient in a particular direction. Additional extensions allow the specification of detailed execution instructions such as the speed and formation for movement or the posture (kneeling, prone, standing, etc.) for dismounted forces. The last extension allowed CBML orders to be executed by a person or a unit, as opposed to only by a unit. Using these extensions, a data translator developed in this work is able to receive a CBML order and issue it as a POM order. Using the US Army's Modeling Architecture for Testing, Research, and Experimentation (MATREX), the POM order was autonomously issued as a high level architecture (HLA) interaction for execution in the Army's One Semi-Automated Forces (OneSAF) combat simulation. In this manner, the simulation executed the CBML order issued by the command and control system directly, without any additional human interaction.

Measuring the Performance of Network Virtualization Tool N2N in the Design of a Cyber Warfare Training and Education Platform

Kyle Stewart, Todd Andel and Jeffrey Humphries
Room: Salon I
Time: April 6th at 1:30

Developing realistic cyber warfare training environments enables individualized hands-on training of cyber security topics without using operational networks. Cost, space, time, and

reproducibility are major factors that prevent large-scale network replications for individual training purposes. Network virtualization provides an alternative training approach. Network virtualization is an important component in building a decentralized cyber warfare education platform. It allows for software defined, virtual network topologies that are independent of the underlying physical network topology. This creates an environment where students have increased flexibility over the creation and connections of their individual virtual networks. However, there is overhead associated with the virtualization of the network layer. Additional software drivers must encrypt and repackage inbound and outbound packets destined for the virtual network. This research presents a set of experiments that characterize this virtualization performance overhead relative to direct physical connections. Results indicate two to four times reduction in performance with respect to both latency and bandwidth when the network is virtualized relative to direct network connections. The benefit to this cost in performance is the ability to create scalable, flexible network topologies that can be used to create a robust, isolated cyber training environment.

Designing With Deformation - Sketching Material and Aggregate Behavior

Anders Holden Deleuran
Room: Harbor
Time: April 4th at 1:30

The recent development of material performance as a key driver of architectural design is currently challenging the role of representation and prototyping. This paper shares findings from a research project exploring the potential of a digital-material prototype capable of addressing this challenge. The project examines the possibility of incorporating material properties into digital models using respectively an analytical and a dynamics-based approach. The paper will present three design experiments with different material properties all attempting to deliberately embrace deformation as a key principle of design. This exploration of actively deforming structures is carried out using light weight dynamics simulation producing flexible and intuitive models for sketching material behavior in the early design stages.

Analysis of Sustainable Manufacturing Using Simulation for Integration of Production and Building Service of Actively Deforming Material Systems

John Michaloski, Jorge Arinez, Guodong Shao, Swee Leong, Kevin Lyons and Frank Riddick
Room: Harbor
Time: April 4th at 1:30

The desire to be environmentally sustainable gives manufacturers the necessary impetus to implement "green" technology that previously may have been regarded as less important. Traditionally, Energy Management Systems (EMS), which handle energy-related activities within building services, and Manufacturing Execution Systems (MES), which handle production activities, have been isolated from one another. Clearly, the integration of EMS-MES offers a compelling opportunity to make important energy-efficient contributions toward manufacturing sustainability. Discrete Event Simulation (DES) has been very valuable for manufacturing applications as an efficient analysis tool to aid problem solving and decision-making. This paper analyzes the requirements of EMS-MES system integration within the framework of DES. A case study of the EMS-MES system integration for precision sand casting production will be explored.

Real-Time Occupancy Detection Using Decision Trees With Multiple Sensor Types

Ebenezer Hailemariam, Rhys Goldstein, Ramtin Attar and Azam Khan
Room: Harbor
Time: April 4th at 3:30

The ability to accurately determine localized building occupancy in real time enables several compelling applications, including intelligent control of building systems to minimize energy use and real-time building visualization. Having equipped an office workspace with a heterogeneous sensor array, our goal was to use the sensors in tandem to produce a real-time occupancy detector. We used Decision Trees to perform the classification and to explore the relationship between different types of sensors, features derived from sensor data, and occupancy. We found that the individual feature which best distinguished presence from absence was the root mean square error of a passive infrared motion sensor, calculated over a two-minute period. When used with a simple threshold, this individual feature detected occupancy with 97.9% accuracy. Combining multiple motion sensor features with a decision tree, the accuracy improved to 98.4%. Counter intuitively, the addition of other types of sensors, such as sound, CO2, and power use, worsened the classification results. The implication is that, while Decision Trees may improve occupancy detection systems based on motion sensors alone, one.

Sensor Placement Tool for Rapid Development of Video Sensor Layouts

Tyler Garaas
Room: Harbor
Time: April 4th at 3:30

The arrangement of video sensors – in closed-circuit television (CCTV) systems, for instance – can have drastic effects on the efficiency and cost of the final system. In the present work, I describe a tool designed for rapid construction of simulated video sensor layouts that allows quantification of sensor coverage and cost estimation to be determined prior to installation; thus, avoiding costly changes during or after the installation. Most previous work in this area either considers sensor coverage only in a 2D space or requires significant preparation to achieve accurate results in 3D. In the present work, I describe an implementation of a novel coverage-analysis algorithm that uses the geometry of image formation to cast rays from simulated video sensors through the monitored area to estimate sensor coverage at every 3D location. Visualization techniques of the acquired sensor coverage data are additionally presented.

A New System Dynamics Framework for Modeling Behavior of Vehicle Sharing Systems

Dimitris Papanikolaou
Room: Harbor
Time: April 4th at 3:30

One-way vehicle sharing systems are convenient mobility systems consisting of parking stations and a fleet of shared vehicles. Users can pick up a vehicle from any station and drop it off to any other station. However, due to asymmetric demand patterns eventually all vehicles end up at the stations with no demand, decreasing throughput performance. This paper presents an ongoing research for a new computational framework in System Dynamics that describes distribution of resource allocation in a vehicle sharing system under non homogenous demand patterns by simulating the resource flow between areas of high density to areas of low density as demand pattern changes. The framework will be used as study tool to understand behavior and explore organizational solutions.

Introducing DEVS for Collaborative Building Simulation Development

Rhys Goldstein
Room: Harbor
Time: April 5th at 10:30

Invited Workshop Presentation

System Entity Structure and DEVS for Collaborative Building Simulation Development

Bernard P. Zeigler
Room: Harbor
Time: April 5th at 10:30

Invited Workshop Presentation

DEVS Standardization: Introduction and Current Status

Gabriel Wainer

Room: Harbor

Time: April 5th at 10:30

Invited Workshop Presentation

Grape: A Parametric Shape Grammar Implementation

Thomas Grasl and Athanassios Economou

Room: Harbor

Time: April 5th at 1:30

An implementation of a shape grammar interpreter is described. The underlying graph-theoretic framework is briefly discussed to show how alternative representations from graph theory including graphs, overcomplete graphs and hyperedge graphs can support some of the intuitions handled in shape grammars by direct visual computations with shapes. The resulting plugin implemented in Rhino, code-named GRAPE, is briefly described in the end.

Automated Energy Model Creation for Conceptual Design

Lillian Smith, Kyle Bernhardt and Matt Jezyk

Room: Harbor

Time: April 5th at 1:30

Architects today rarely use whole building energy analysis to inform their early design process. During this stage of design, the team is responsible for macro-level decisions (such as basic form and orientation) that can have the most significant effects on energy use. So why are so few architects using energy analysis tools at this stage? In many cases, this is because the tools available to perform energy analysis are too complex and time-consuming to learn and use during the fast-paced conceptual design phase because of the time needed to model and analyze the design. Often energy analysis tools are separate, standalone applications that require a separate thermal model to be authored. This adds more time and complexity and limits the number of professionals experienced with these tools. Understanding the results and using them in presentations is also quite difficult in current tools.

This paper describes a system that can alleviate these problems by automatically generating an energy model from an architect's basic massing model. Our approach allows an architect to focus on modeling the building form, rather than the thermal zones that are the focal point for most energy modeling software on the market today. The architect's massing model can then be modified and the energy model stays in sync, allowing comparative analyses to be made quickly and easily.

An Integrated Approach To Algorithmic Design and Environmental Analysis

Robert Aish and Andrew Marsh

Room: Harbor

Time: April 5th at 1:30

This paper describes the motivation and design of DesignScript, an end-user domain-specific programming language for algorithmic architectural and geometric design. Furthermore, the integration and use of DesignScript within the context of an environmental analysis software application is described that invokes a representative subset of analysis functionality.

Generative Fluid Dynamics: Integration of Fast Fluid Dynamics and Genetic Algorithms for Wind Loading Optimization of a Free Form Surface

Angelos Chronis and Alasdair Turner

Room: Harbor

Time: April 5th at 3:30

The integration of simulation environments in generative, performance-driven form-finding methods is expected to enable an exploration into performative solutions of unprecedented complexity in architectural design problems. Computational fluid dynamics simulations have a wide range of applications in architecture, yet they are mainly applied at final design stages for evaluation and validation of design intentions, due to their computational and expertise requirements. This paper investigates the potential of a fast fluid dynamics simulation scheme in a generative optimization process, through the use of a genetic algorithm, for wind loading optimization of a free form surface. A problem-specific optimization environment has been developed for experimentation. The optimization process has provided valuable insight on both the performance objectives and the representation of the problem. The manipulation of the parametric description of the problem has enabled control over the solution space highlighting the relation of the representation to the performance outcome of the problem.

Use of Sub-Division Surfaces Architectural Form-Finding and Procedural Modelling

Shajay Bhooshan and Mostafa El Sayed

Room: Harbor

Time: April 5th at 3:30

Growth in the role of simulation in conceptual design and evaluation of building performance is coupled with need for architects to manage the dichotomy between high resolution geometries used in simulation and lower resolution, free-form manipulation friendly, CAD geometries. This paper will argue for the benefits of Hierarchical Sub-division surfaces in this process, concentrating specifically on its uses in:

a. Design and approximate simulation of Shell structures using particle-spring methods and its correlation with FEA analysis.

b. Procedural modeling of large number of such shells.

c. Pre-engineering rationalization of such designs.

d. Preparation of such geometries for down-stream production, and its fabrication /construction.

The paper will present case studies for each, including details of customization of the Autodesk Maya Nucleus technology (using its C++ API) and it's linking to Autodesk Algor Simulation , design of architectural competition entries , and mock-ups of structures designed and fabricated using these methods.

Leveraging Cloud Computing and High Performance Computing Advances for Next-Generation Architecture and Urban Design Projects

Francesco Iorio and Jane L. Snowdon

Room: Harbor

Time: April 5th at 3:30

Architecture and urban design projects are constantly breaking barriers of scale and complexity and continuously seek improved efficiency, sustainability, building energy performance, and cost-effectiveness. Simulation and large-scale data processing are now fundamental elements of this process. Recent advances in algorithms and computational power offer the means to address the complex dynamics of an integrated whole building system. However, scalability is a significant barrier to the realization of whole building systems tools

for design, control and optimization. This position paper presents a set of techniques such as fast design parameter-space exploration, large-scale high-accuracy simulation, and integrated multi-disciplinary optimization for semi- or fully-automated designs. These techniques are extremely computing intensive, and have traditionally only been available to the research community. But, once enabled by advances in cloud computing and high performance computing, these techniques can facilitate the interactive design process resulting in improved outcomes and reduced development cycle times.

Solar Zoning and Energy in Detached Residential Dwellings

Jeffrey Niemasz, Jon Sargent and Christoph Reinhart
Room: Harbor
Time: April 6th at 8:30

The Solar Envelope is a three dimensional envelope on a site which ensures adjacent neighbors a specified minimum direct solar access time per day throughout the year. The solar envelope was developed as a tool to give buildings in an urban setting the mutual opportunity to employ passive and active solar design strategies. Parametric computer-aided-design (CAD) environments significantly ease the construction and visualization of solar envelopes across whole neighborhoods, facilitating its wider use as a prescriptive zoning tool. This study investigates the implications of a solar envelope zoning approach for the most common building type in the United States (US) with respect to energy use and developable density. The results indicate that solar zoning for this building type has a limited and sometimes negative effect on energy use as well as a larger negative impact on developable density.

A Simple Method To Consider Energy Data in the Architectural Conception of Dwelling Buildings

Laëtitia Arantes, Olivier Baverel, Pascal Rollet and Daniel Quenard
Room: Harbor
Time: April 6th at 10:30

The main contribution of our work is in combining the methods for parametric urban design of highly specialized software such as CityEngine and general-purpose parametric modeling platform such as Grasshopper. Our work facilitates and prompts the use of parametric tools by architects and planners for urban design. In this paper we present a custom grasshopper component for street network generation and block subdivision. The component was developed in C# using the RhinoCommon SDK. We used Grasshopper for the development of an urban design proposal at a teaching exercise. To meet the requirements of the urban design project, additional functionalities had to be added to the range of existing Grasshopper components. In particular, we needed components for street network generation and block subdivision. To develop the component we implemented the street expansion strategies described in (Weber et al., 2009) and the methods for block subdivision described in (Vanegas et al., 2009). Additionally, we adapted and enhanced the strategies to meet the NURBS modeling capabilities of Rhinoceros.

Integrating Daylight and Thermal Performance Across the Urban and Building Scales. A Methodological Study of Environmental Simulation in Architecture and Engineering

Peter Andreas Sattrup and Jakob Strømann-Andersen
Room: Harbor
Time: April 6th at 10:30

This study presents a methodological and conceptual framework that allows for the integration and creation of knowledge across professional borders in the field of environmental simulation. The framework has been developed on the basis of interviews with leading international practitioners, key theories of environmental performance in architecture and engineering, and a range of simulation experiments by the authors. The framework is an open structure, which can continuously be renewed and contributed to by any author. The value of the framework is demonstrated, using it to map a series of simulation studies, emphazising the multidimensionality of environmental performance optimization. Clarifying the conceptual interconnectivity between architecture and engineering, - agency and physics, - not only enhances communicative power and the dissemination of knowledge, but becomes instrumental in pointing out the need for improving metrics, software and not least the performance of the built environment itself.

Design and Simulation for Architectural Geometry

Yoshihiro Kobayashi and Peter Wonka
Room: Harbor
Time: April 6th at 10:30

This paper introduces an innovative computational design tool to edit architectural geometry interactively and demonstrates the process of designing geometry using this tool. The background, related work, implementation methods, system framework, and case studies are described. In addition, the designed geometry is evaluated using off-the-shelf structural analysis tools and construction simulation tools. The evaluation and future work are described at the end.

Lifecycle Building Card Towards Paperless and Visual Lifecycle Management Tools

Holger Graf, Souheil Soubra, Guillaume Picinbono, Ian Keough, Alex Tessier and Azam Khan
Room: Harbor
Time: April 6th at 1:30

This paper presents a novel vision of paperless and visual lifecycle building management tools based on the coupling between Building Information Models (BIM) and Augmented Reality (AR) called Lifecycle Building Card. As the use of BIM increases within the architecture, engineering, and construction industries, new opportunities emerge to help stakeholders and maintenance operators to leverage the BIM dataset for lifecycle issues using realtime environments and simulation. In particular, a tighter coupling of BIM with computer vision techniques could enable innovative lifecycle management tools based on AR concepts. In this context, this work explores the possibilities and derives theoretical and practical concepts for the use of BIM enhanced by AR for supporting maintenance activities in buildings. An implementation of a wireless spatially-aware display is presented as a first step toward the stated vision.

3D Scans of As-Built Street Scenes for Virtual Environments

Naai-Jung Shih, Chia-Yu Lee and Tzu-Ying Chan
Room: Harbor
Time: April 6th at 1:30

The purpose of this research is to build digital urban models by as-built environmental 3D scan data. Scans were made of a street and surrounding buildings for 5.5 km through the center of Taipei, Taiwan. A 3D long-range laser scanner was used to record buildings, landscapes, and open spaces. The scan tolerance was controlled in 4 mm/50 m. The final urban information creates a precise description of objects in a virtual environment with colors and textures feasible for internet browsing, infrastructure dimensioning, and construction monitoring. A 3D representation of scan noise, in terms of pedestrian

pattern in front of Taipei Metro, was conducted to illustrate the response of human flow to obstacles.

Urban Affects: Urban Systems and Social Ecologies

Chris Kroner, Phu Duong, Liz Barry and Mike Szivos

Room: Harbor

Time: April 6th at 1:30

Modeling urbanism affects urban understanding. This paper introduces a layered pedagogy focusing on urban design representation. It emphasizes the ephemeral and experiential dimensions of the contemporary metropolis. While this research-oriented coursework has targeted a visual study of infrastructural systems found in the New York-New Jersey metropolitan region, the topical nature of the urban discourse remains universal: urban systems and social production they elucidate transpire across the city at large. Beginning with geographic tools, initial mappings become subjective endeavors with specific intentions or empowered by a design agency (political). This information then is filtered through an algorithm oriented process to efficiently reconstitute 3d attributed data into modeling software for further interrogation and speculation (computation and visual). By running simulations driven by this data, urban systems reveal visible and invisible relationships upon urban space. Cinematic techniques are developed through film analysis studies which are then employed to integrate these animated models with live-action video footage. The resulting work of the lessons aims to produce short videos that animate, analyze and link disparate spatial qualities together. The videos make visible the various latent relationships of how infrastructural systems work and what they mean and do for people in cities.

City of Love and Hate

Adnan Ihsan, Amirali Merati, Eva Poulopoulou and Foteinos Soulos

Room: Harbor

Time: April 6th at 3:30

The rising complexity of 21st century cities demands a more rigorous and intense understanding of their inherently complex programs, which cannot be resolved by a conventional design methodology. This paper proposes a new design process using an automated workflow that incorporates the computational iterations and the design values of an architect in a unified process aiming to produce high performing optimized results. The procedure, that is described, uses CATIA for parametric simulation and modeFrontier for multi-criteria optimization. The “value meter”, a qualitative assessment, is used to grade the results according to subjective design criteria. The setup operates in two stages, Phase 1 [city scale] elaborates on broad urban land-use goals, whereas Phase 2 [neighborhood scale] explores detailed objectives such as density and infrastructure. The complete workflow operates under the realms of conventional urban design ideas, but produces exponentially large variety of design alternatives.

Components for Parametric Urban Design in Grasshopper. From Street Network To Building Geometry

Christian Schneider and Anastasia Koltsova

Room: Harbor

Time: April 6th at 3:30

The main contribution of our work is in combining the methods for parametric urban design of highly specialized software such as CityEngine and general-purpose parametric modeling platform such as Grasshopper. Our work facilitates and prompts the use of parametric tools by architects and planners for urban design. In this paper we present a custom grasshopper component for street network generation and block subdivision. The component was developed in C# using the RhinoCommon SDK. We used Grasshopper for the development of an urban design proposal at a teaching exercise. To meet the requirements of the urban design project, additional functionalities had to be added to the range of existing Grasshopper components. In particular, we needed components for street network generation and block subdivision. To develop the component we implemented the street expansion strategies described in (Weber et al., 2009) and the methods for block subdivision described in (Vanegas et al., 2009). Additionally, we adapted and enhanced the strategies to meet the NURBS modeling capabilities of Rhinoceros.

Multi-Objective Optimization in Urban Design

Michele Bruno, Kerri Henderson and Hong Min Kim

Room: Harbor

Time: April 6th at 3:30

Urban Design is a multi-objective task. Traditionally, urban spaces are designed hierarchically; organizational inputs are idealized uniquely, and negotiated through sequential overlay. In our investigation, parametric modeling (with the software application Catia) and evolutionary optimization employing genetic algorithms (with the software application Mode Frontier) enable the exploration of a non-linear design space whereby multiple objectives may be optimized concurrently. This paper describes an experiment that builds from prior research in multi-objective optimization of architectural design and applies that workflow to multi-objective optimization in urban design. The experiment employs given constraints, custom procedural algorithms and genetic algorithms to examine a wide design space and identify designs that perform well in multiple arenas. Design, data and latent influences are exposed and negotiated quantitatively to render topological variation through optimization. By using multi-objective optimization we define and apply quantitative metrics in order to examine the potential for a new workflow in urban design.

Posters/Works-In-Progress

A Proposal to Modify MASK Protocol for Anonymous Communication in MANETs

Avisa Tehrani, Hamid Shahnasser and Abdolreza Abhari
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

On one hand, the practical significance of Mobile ad hoc networks (MANETs) have been increasing in communication applications due to their ease of installations. On the other hand, security in this kind of network cannot be compromised because these applications are used by organizations like the military and the government. This paper discusses the MASK protocol, one of the solutions offering anonymity for MANETs in protect the network against traffic analysis, the most invisible and unsolved passive security attack. In addition a new revised MASK protocol is proposed in this paper to address an important drawback of this protocol.

Adaptive Clustering for Energy Optimization of Variant Base Station in Wireless Sensor Networks

Negin Behboudi and Abdolreza Abhari
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

This paper proposes an adaptive clustering method for energy optimization of wireless sensor networks. The approach takes into consideration the location of the base station with respect to the network and adjusts the cluster sizes using the analytical derivation of "optimum number of clusters". In our approach, the optimum number of clusters is interpreted as a factor defining the cluster size rather than the actual number of clusters. In the proposed clustering, the further away a cluster is from the base station, the larger it becomes, and the closer a cluster is to the base station, the smaller it becomes. The adaptive clustering regulates the network energy consumption in a more uniformly manner, optimizing the energy consumption while improving the overall system performance.

Automatic Performance Model Construction of a Parallel Distributed Software System

Ahmad Mizan and Greg Franks
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

Performance models are built throughout the software development-cycle to aid software designers to assess various design alternatives and find the best practice in a performance-oriented fashion. This work introduces a new automated performance model construction methodology which is independent of wall clock time and is suitable for distributed software applications. This methodology allows for concurrency in a node of a distributed application by using a new format for timestamp of recorded events which has resulted in a simple structure for execution-graph and straightforward analysis method to characterize a parallel distributed application. This approach has been used to construct the performance model of a distributed message passing application which is simulated by PARASOL.

Customer-Telecommunications Company's Relationship Simulation Model (RSM), Based on Non-Monotonic Business Rules Approach and Formal Concept Analysis Method

Victor Romanov, Roman Veynberg and Alina Polujektova
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

In this paper we study the interaction between telecommunications companies and consumers, in part of [if «description of the situation», then «the solution»]. «Description of the situation» suggests that there is a set of assertions of non-monotonic first-order logic, including the concepts and relations between concepts. Further Business rules management system opens opportunity to telecommunications companies in consolidation of essential strategic purposes based on business rules technology. This paper considers business rules approach and formal concept analysis method in the development of telecommunication industry, as one of the fast growing and most innovative. The aim of our research – business rules discovery by mean formal concept analysis (FCA) technology [1] from customer's data base. We assume that data may be incomplete or contradictory and therefore implication derived by Conexp [1] software should be considered within the frame of non-monotonic logic [1], and realized as defeasible theory [1] rules. Non-monotonic reasoning is an approach that allows reasoning process with incomplete or changing information. More specifically, it provides mechanisms for taking back conclusions that, in the presence of new information, turn out to be wrong and for deriving new, alternative conclusions instead.

Development of Scheduler Using Simulation in a Weapon Industry

Dug Hee Moon, Jun Seok Lee and Kyeong Wook Shin
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

Scheduling is difficult job in a manufacturing system when the structures of products and the manufacturing processes become complex. Many companies have installed Advanced Planning and Scheduling (APS) systems to ERP system for better production scheduling. This paper introduces a case study of developing a scheduler which is applied to a Korean military weapon industry. Simulation models are used as the engines of scheduler, and backward/forward algorithm is used.

SMDS: Simulation and Stimulation of Army Medical Business Systems

Ryan Johnson, William Young, Brian Baldwin, Sheilagh O'Hare, Aubrey White, Aaron Lawyer, John Gentle and John Duncanson
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

Addressing "Any Aspect of Modeling and Simulation related to the Military"
The Simulation Medical Data System (SMDS) is a Java-based probabilistic simulator of casualty encounters both battle and non-battle, in a theatre of operations. It provides a realistic training environment to Army medical commanders and staff by stimulating the Army's Joint Medical Workstation (JMeWS) medical command and control system. SMDS currently simulates casualties and medical functions in a standalone mode, and is being extended to function as a

High Level Architecture (HLA) simulation federate. In order to provide a realistic view of the medical situation and timeline in a battlefield, SMDS models characteristics of medical events, supply chains, and command structure. By communicating with existing Army battle simulators via the HLA link and supplementing the received data with synthesized patient and treatment information, SMDS will enable medical personnel to participate in large multi-echelon training exercises.

Toward a Hybrid Packet-Complex Systems Model of the Internet

Adam Cornachione, David Newman and Brian Hay
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

Complex Systems such as the power transmission grid and large communication networks have become an integral part of our society. These systems, due to economic and social pressures, often run near their operational limits, leaving them susceptible to cascading failures. The dynamics of a complex system are difficult to predict, and the increasing dependencies of these systems causes more need to for better understanding. It is difficult to create virtual networks that can display the dynamics of complex systems. This model is an attempt at using a packet model along with a complex systems model to capture such dynamics. It is important to study the different affects that the evolution of these systems have on the overall dynamics, especially at the susceptibility of the failures of such systems. Many of these systems have shown to exhibit similar intrinsic characteristics to one another. By learning more about how these complex systems evolve and function dynamically, we hope to learn how more resilient systems can be built.

Use of Model Sets with Differential Inputs for Chesapeake Bay Management

Ping Wang, Lewis Linker and Richard Batiuk
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

We use a set of model scenarios with differential inputs to obtain useful information for management applications. Three examples of the application of model scenario sets are presented. 1) Use scenarios with differential sediment and nutrient loads to establish relationship of light attenuation coefficient (Kd) improvement with sediment and nutrient load reduction. From that, we developed a method to quantify sediment and nutrient load reduction to achieve water clarity goals. 2) Use a set of scoping scenarios to establish relative importance of sediment source types for bay waters. 3) Use geographically isolated input scenarios to analyze relative effects of sediment and nutrient source.

Web Server Benchmark Tools for httperf

Samuel Fonseca and Juan Sola-Sloan
Room: Palm Garden/Exhibit Area
Time: April 4th (2:30-3:30 & 5:00-7:00) April 5th/6th (9:00-12:00 & 1:00-5:00)

The Internet traffic has substantially evolved in the last decade. The Internet is no longer a tool only managed by computer scientists, engineers or technicians. Abstracting features of the flow of Web traffic has been a continuous challenge due to this evolution since the Internet has become an unconditional source for users. Therefore simulating or even emulating the Web Traffic is a difficult task. Web server benchmarks have to evolve alongside the Web otherwise calculating performance of these web sites will not be precise. Classic Web server benchmarks like httperf, Webstone 2.5, Iperf were designed during the nighties when Social networks and Websites that provides audio/video streaming content for Web 2.0 applications were not in their original design scope. Our main target is focus in the research and development of the software necessary to upgrade the existing Web server benchmarks to reach this new design goals.

Our target Web server benchmark was created in Hewlett Packard Laboratories and is called httperf. Two different tools are been created in our starting phase. The first tool is called BenchGraph which is used to generate a better appreciation of the performance measurements produced by httperf. BenchGraph accepts txt, csv, and xml files as input. We have modified the httperf source already to produced this kind of output files. This tool uses Gnuplot to create visual plots of the performance measurements. Those results are going to make easier the process of analyzing how a web server responds to requests made by users browsing the Internet. BenchGraph is a different tool that is not tightly couple with httperf. This tool can be modified to produce similar results for other Web server benchmarks (i.e. Webstone 2.5). The second tool of our research goals is a file system generator for Web 2.0 content. Our team will be working on this tool, however, this initiative will be carried out mostly by a fellow graduate student.

A long term objective of our research is to use currently existing benchmarks as a stepping stone for the development of a new Web server benchmark. This new Web server benchmark will be able to measure most of the content found in today websites.

SISO PROGRAM AGENDA--

Please use this Agenda Handout to view this week's meetings "at a glance". For more detailed information about the schedule, please refer to the agenda book or USB drive provided to you at registration. This hand-out supplements the agenda book.

MONDAY

ROOM	Salon B	Salon D	Salon E	Salon H	Salon I
8:30 AM - 10:00 AM	(0700-0800) SISO Newcomers Orientation Breakfast	***Tutorial:** Introduction to High Level Architecture (HLA) (HLA 101)	***Tutorial:** High Level Architecture (HLA) – An Overview (HLA 201)	***Tutorial:** Employing Service Oriented Architecture for Live-Virtual-Constructive Multi-Architecture Distributed Simulations (SOA/LVC 101)	***Tutorial:** Verification, Validation & Accreditation (VV&A) (VV&A 101)

10:00-10:30 AM ***BREAK*

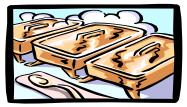
ROOM	JOINT SCS/SISO PLENARY	Ballroom
10:30 AM - 12:00 PM	Featured Speaker**: Gordon Gillerman**, Chief, Standards Services Division, National Institute of Standards and Technology (NIST) Featured Speaker: **Dr. Pieter J. Mosterman**, Senior Research Scientist, The MathWorks, Inc.	

12:00 PM – 1:30 PM ***LUNCH (lunch not provided)***

ROOM	SISO PLENARY SESSION		Ballroom
1:30 PM - 3:00 PM	1330-1340	Call to Order and Welcome: **Steve Swenson**, SISO Conference Committee Chair,	
	1340-1350	Conference Committee Report: **Steve Swenson**, SISO Conference Committee Chair	
	1350-1410	Featured Speaker: **Björn Möller** (Co-Author), SIWZie Awardee, **10F-SIW-031** - Processes and Tools for Management and Reuse of FOM Modules	
	1410-1430	State of SISO: **Dr. Katherine L. Morse**, SISO Executive Committee Chair	
	1430-1445	SISO Product Update: **Paul Lowe**, SISO Standards Activity Committee Chair	
	1445-1455	Awards: **Mikael Karlsson and Björn Möller -** For contributions to the Development of the HLA Standard, in particular the HLA EVOLVED	

3:00-3:30 PM ***BREAK*

ROOM	Salon B	Salon D	Salon E	Ballroom
3:30 PM - 5:00 PM	***Tutorial:** SISO Standards 101 *(no cost for this tutorial)*	***Tutorial:** Distributed Simulation Engineering & Execution Process (DSEEP) (DSEEP 101)	***Tutorial:** High Level Architecture (HLA) FOM Modules (HLA 202)	 **A-119 Panel Discussion**

ROOM	JOINT SISO/SCS RECEPTION	Palm Garden (Exhibit Area)
5:00 PM - 7:00 PM		**Please join us for this informal gathering!** Food and drink will be available courtesy of our Sponsors and Exhibitors

**** There is a cost of $75.00 (USD) for tutorial participation.***

TUESDAY

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon J&K
	RD&E/DSPT/SER FORUMS	**DDCP SG**	**VV&A FORUM**	**SIMSUMMIT**	**DMAO PDG**	**C2/M&S/ANL FORUMS**
	Intro (8:00-8:05 AM)					
8:00-8:30	11S-SIW-024	Starts (8:00 AM)	Into (8:30-8:35 AM)		Starts (8:00 AM)	Intro (8:15-8:30 AM)
8:30-9:00	11S-SIW-054		**Invited Presentation** [1]			11S-SIW-011 *(& TRAIN Forum)*
9:00-9:30	11S-SIW-025		**Invited Presentation** [2]	Starts (9:00 AM)		11S-SIW-065
9:30-10:00	11S-SIW-034		11S-SIW-039			11S-SIW-072

10:00-10:30 AM ***BREAK***

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon J&K
	RD&E/DSPT/SER FORUMS	**DDCP SG**	**VV&A FORUM**	**SIMSUMMIT**	**DMAO PDG**	**C2/M&S FORUM**
10:30-11:00	11S-SIW-008		11S-SIW-073 *(& TRAIN Forum)*			11S-SIW-047 *(& ANL Forum*)
11:00-11:30	11S-SIW-016		11S-SIW-031	Ends (11:00 AM)		11S-SIW-008
11:30-12:00	11S-SIW-069	Ends (12:00 PM)	11S-SIW-009 *(& ANL Forum)*		Adjourns until 7 PM	**Invited Presentation** [5]

12:00-1:30 PM ***LUNCH (lunch not provided)***

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon J&K
	RD&E FORUM	**ANL FORUM**	**VV&A/SPACE FORUMS**	**DSPT FORUM**	**SER FORUM**	**C2/M&S FORUM**
		Into (1:30-1:35 PM)		Into (1:30-1:35 PM)	Into (1:30-1:35 PM)	
1:30-2:00	11S-SIW-065	11S-SIW-049	11S-SIW-074	11S-SIW-020 *(& C2/MS Forum)*	11S-SIW-042	11S-SIW-020 *(Salon D)*
2:00-2:30	11S-SIW-019	11S-SIW-039	**Invited Presentation** [3]	11S-SIW-023	11S-SIW-029	11S-SIW-041
2:30-3:00	11S-SIW-028	11S-SIW-033	11S-SIW-017	11S-SIW-011	11S-SIW-038	11S-SIW-043

3:00-3:30 PM ***BREAK***

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon J&K
	RD&E FORUM	**ANL FORUM**	**VV&A FORUM**	**DSPT FORUM**	**SER FORUM**	**C2/M&S FORUM**
3:30-4:00	11S-SIW-049	11S-SIW-021	**Discussion** [4]	11S-SIW-044	11S-SIW-046	11S-SIW-061
4:00-4:30	11S-SIW-058	11S-SIW-052		11S-SIW-067	11S-SIW-039	11S-SIW-062
4:30-5:00	11S-SIW-012	Adjourn	Adjourn	11S-SIW-036 *(& ANL Forum)*	11S-SIW-060	Adjourn
	Adjourn			Adjourn	Adjourn	

5:00-7:00 PM ***DINNER BREAK***

ROOM	Salon D	Salon E
7:00-9:00PM -	**PDMS SSG**	**DMAO PDG** - *Continues*

Invited Presentations/Discussion Titles:

1. Invited Presentation: Government and Non-Government Voluntary Census VV&A Standards – Identifying Gaps & Needs
2. Invited Presentation: Ongoing Research: M&S Use Risk Methodology (MURM)
3. Invited Presentation: Guidance for the Use of NASA Standards for Models and Simulations
4. Discussion: Emerging VV&A Standards
5. Invited Presentation: Coalition Battle Management Language (C-BML) Phase 1 Specification: Road to Balloting

WEDNESDAY

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon G	Salon H
	TRAIN/T&E FORUM	**C2/MS FORUM**		**SPACE FORUM**	**CMSD PDG/PSG**	**HSCB-CMSS FORUM**	**SLC FORUM**
	Intro (8:00-8:05 AM)			Intro (8:00-8:05 AM)			
8:00-8:30	11S-SIW-019			**Invited Presentation** [1]	Starts (8:00 AM)	Intro (8:15-8:30 AM)	Intro (8:15-8:30 AM)
8:30-9:00	11S-SIW-029	Intro (9:00-9:05 AM)		11S-SIW-017		**Invited Presentation** [3]	11S-SIW-075
9:00-9:30	11S-SIW-034	11S-SIW-050		11S-SIW-052		11S-SIW-074	11S-SIW-032
9:30-10:00	11S-SIW-024	11S-SIW-073		11S-SIW-056	Ends (10:00 AM)	11S-SIW-014	11S-SIW-070
		Adjourn					

10:00-10:30 AM ***BREAK***

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon G	Salon H
	TRAIN FORUM	**T&E FORUM**		**SPACE FORUM**	**CFI FORUM**	**HSCB-CMSS /IO-ISR FORUMS**	**SLC FORUM**
		Intro (10:30-10:35 AM)			Intro (10:30-10:35 AM)		
10:30-11:00	11S-SIW-012 (*& C2/MS*)	11S-SIW-054		11S-SIW-075	11S-SIW-032	11S-SIW-033	**Panel Discussion** [4]
11:00-11:30	11S-SIW-021	11S-SIW-025		11S-SIW-072 *(& DSPT)*	11S-SIW-045	11S-SIW-048	
11:30-12:00	11S-SIW-060	11S-SIW-065		**Invited Presentation** [2]	11S-SIW-059	11S-SIW-027	Panel Discussion Ends
				Adjourn			

12:00-1:30 PM ***LUNCH (lunch not provided)***

ROOM	Salon A	Salon B	Salon C	Salon D	Salon E	Salon G	Salon H
	TRAIN FORUM	**T&E FORUM**	**IO-ISR FORUM**	**DIS PDG**	**CFI FORUM**	**HSCB-CMSS FORUM**	**SLC FORUM**
			Intro (1:30-1:35 PM)				
1:30-2:00	11S-SIW-050	11S-SIW-005 *(& C2/MS)*	11S-SIW-011	Starts (1:30 PM)	11S-SIW-043	11S-SIW-012	11S-SIW-058
2:00-2:30	11S-SIW-069	11S-SIW-026	11S-SIW-022		11S-SIW-049	11S-SIW-075	11S-SIW-042
2:30-3:00	11S-SIW-053	Adjourn	Adjourn		11S-SIW-069	11S-SIW-047 *(& IO-ISR*)	11S-SIW-052
	Adjourn				Adjourn		

3:00-3:30 PM ***BREAK***

ROOM	Salon	Salon B	Salon C	Salon D	Salon E	Salon G	Salon H
				DIS PDG	**PDMS SSG**	**HSCB-CMSS/IO-ISR FORUMs**	**SLC FORUM**
3:30-4:00					Starts	11S-SIW-037	11S-SIW-028
4:00-4:30						11S-SIW-038	SLC Forum Debrief
4:30-5:00				Ends (5:00 PM)		11S-SIW-060	Adjourn
						Adjourn	

5:00-7:00 PM ***DINNER BREAK***

ROOM	Salon D	Salon E	Salon G	Salon H	Palm Garden
7:00-9:00PM -	**DIS PSG**	**PDMS SSG** *(Continues)*	**HSCB SG**	**HLA-EVOLVED PSG**	**Interoperability Space Smackdown**

Invited Presentations/Panel Discussion Titles:

1. Invited Presentation: Update on NASA's Standard for Models and Simulation
2. Invited Presentation: Smackdown 2011
3. Invited Presentation: Human Social Cultural Behavior (HSCB) Modeling Standards Study Group Investigations: Objectives and Early Findings
4.  Panel Discussion: M&S for Acquisition

THURSDAY

ROOM	Salon A	Salon B	Salon C	Salon D-E-F	Salon G	Salon H	Constitution Room	Faneuil Room
8:00 AM-10:00 AM	**MSDL PDG**	**FEAT PDG**	**DIS PSG**		**REIDP SG**	**SCM PDG**	**GM-VV PDG** *(starts at 0830)*	**CIGI SG**

10:00-10:30 AM ***BREAK***

ROOM	Salon A	Salon B	Salon C	Salon D-E-F	Salon G	Salon H	Constitution Room	Faneuil Room
10:30 AM - 12:30 PM	**MSDL PDG**	**FEAT PDG**	**DIS PSG** 11S-SIW-026 (10:30)		**REIDP SG**	**SCM PDG**	**GM-VV PDG**	**CIGI SG**

12:00-1:30 PM ***LUNCH (lunch not provided)***

ROOM	Salon A	Salon B	Salon C	Salon D-E-F	Salon G	Salon H	Constitution Room	Faneuil Room
1:30 PM - 3:00 PM	**CBML PDG**		**DIS PSG** 11S-SIW-067 (13:30)	**SPECIAL WORKSHOP:** Challenges in Information Sharing – **Part 1**		**BOM PSG**	**GM-VV PDG**	

3:00-3:30 PM ***BREAK***

ROOM	Salon A	Salon B	Salon C	Salon D-E-F	Salon G	Salon H	Constitution Room	Faneuil Room
3:30 PM - 5:00 PM	**CBML PDG**	**EPLRS/ SADL PDG**	**DIS PSG**	**SPECIAL WORKSHOP:** Challenges in Information Sharing – **Part 1** 		**BOM PSG**	**GM-VV PDG**	

FRIDAY

ROOM	Salon D-E-F	Salon B	Salon C	Salon A
8:30 AM - 10:00 AM	**SPECIAL WORKSHOP:** Challenges in Information Sharing – **Part 2**	**TADIL TALES PSG**	**DIS PSG**	**BML Research Symposium**

10:00-10:30 AM ***BREAK***

ROOM	Salon D-E-F	Salon B	Salon C	Salon A
10:30 AM - 12:30 PM	**SPECIAL WORKSHOP:** Challenges in Information Sharing – **Part 2**	**LINK 11 A/B PDG**	**DIS PSG**	**BML Research Symposium** (*Session continues until 5:00PM*)

*BREAKS are scheduled from **1000-1030** and **1500-1530**. Below is the location of the BREAK area for each day*

		1000-1030 BREAK	1500-1530 BREAK
MONDAY	**04 APRIL 2011**	**Ballroom Foyer Area** (*Lower Level*)	**Palm Garden** *(Lobby Level)*
TUESDAY	**05 APRIL 2011**	**Palm Garden** *(Lobby Level)*	**Palm Garden** *(Lobby Level)*
WEDNESDAY	**06 APRIL 2011**	**Palm Garden** *(Lobby Level)*	**Palm Garden** *(Lobby Level)*
THURSDAY	**07 APRIL 2011**	**Salon J-K-L** *(Lower level)*	**Salon J-K-L** *(Lower level)*
FRIDAY	**08 APRIL 2011**	**Salon J-K-L** *(Lower level)*	**Salon J-K-L** *(Lower level)*

PAPER PRESENTATIONS SCHEDULE

Paper Number	Paper Title	Presentation Schedule
11S-SIW-005	APLET's lessons learnt on C4I-Simulation Interoperability	Wednesday, Salon B, 1330-1400, T&E/C2M&S Joint Session
 **11S-SIW-008**	How is M&S Interoperability Different from other Interoperability Domains?	Tuesday, Salon A, 1030-1100, DSPT/RD&E/SER Joint Session Tuesday, Salons J&K, 1100-1130, C2M&S Forum
 **11S-SIW-009**	Verifying Error Models Using the Pearson Chi-Square Test	Tuesday, Salon C, 1130-1200, ANL/VVA Joint Session
11S-SIW-011	Global Force Management Data Initiative - The Next GPS	Tuesday, Salons J&K, 0830-0900, ANL/C2/TRAIN Joint Session Tuesday, Salon D, 1430-1500, DSPT Forum Wednesday, Salon C, 1335-1400, IO-ISR Forum
11S-SIW-012	Serious Games: Fun vs. Reality	Tuesday, Salon A, 1630-1700, RD&E Forum Wednesday, Salon A, 1030-1100, TRAIN/C2/MS Joint Session Wednesday, Salon G, 1330-1400, HSCB-CMSS Forum
11S-SIW-014	Status Report: A Review of the Critical Needs for Interdisciplinary Standards within the HSCB User Community	Wednesday, Salon G, 0930-1000, HSCB-CMSS Forum
11S-SIW-016	Process Oriented Development for Effective Data Analysis of Military Distributed Simulation	Tuesday, Salon A, 1100-1130, DSPT/RD&E/SER Joint Session
11S-SIW-017	A Credibility Assessment Scoring (CAS) Process for Mission Risk Management	Tuesday, Salon C, 1430-1500, VV&A/SPACE Joint Session Wednesday, Salon D, 0830-0900, SPACE Forum
11S-SIW-019	OneSAF Implementation on High Performance Computing Systems	Tuesday, Salon A, 1400-1430, RD&E Forum Wednesday, Salon A, 0805-0830, TRAIN/T&E Joint Session
11S-SIW-020	LVC Architecture Study	Tuesday, Salon D, 1335-1400, DSPT/C2/MS Joint Session
 **11S-SIW-021**	Using Decision-Making Techniques in Support of Simulation Training Transfer	Tuesday, Salon B, 1530-1600, ANL Forum Wednesday, Salon A, 1100-1130, TRAIN Forum
11S-SIW-022	Symbiotic Simulation for Planning and Monitoring C2 Systems	Wednesday, Salon C, 1400-1430, IO-ISR Forum
11S-SIW-023	Interoperating Between Levels of Fidelity	Tuesday, Salon D, 1400-1430, DSPT Forum
11S-SIW-024	Gateway Concepts for Enhanced LVC Interoperability	Tuesday, Salon A, 0805-0830, DSPT/RD&E/SER Joint Session Wednesday, Salon A, 0930-1000, TRAIN/T&E Joint Session
11S-SIW-025	LVCAR Enhancements for Using Gateways	Tuesday, Salon A, 0900-0930, DSPT/RD&E/SER Joint Session Wednesday, Salon B, 1100-1130, T&E Forum
11S-SIW-026	Facilitating Interoperability and Standards for Healthcare Simulators	Wednesday, Salon B, 1400-1430, T&E Forum Thursday, Salon C, 1030-1000, DIS PSG Session
 **11S-SIW-027**	Toward Data Interoperability for HSCB Models	Wednesday, Salon G, 1130-1200, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-028	An HLA-Based Approach to Quantify Achievable Performance for Tactical Edge Applications	Tuesday, Salon A, 1430-1500, RD&E Forum Wednesday, Salon H, 1530-1600, SLC Forum
11S-SIW-029	An Emerging DoD M&S Enterprise Data Strategy	Tuesday, Salon E, 1400-1430, SER Forum Wednesday, Salon A, 0830-0900, TRAIN/T&E Joint Session
11S-SIW-031	Best Practices for Verification, Validation, and Accreditation of Legacy Modeling and Simulation	Tuesday, Salon C, 1100-1130, VV&A Forum

 *-2011 Spring "SIWzie" Recommended Reading List (RRL) Nominee*

Paper Number	Paper Title	Presentation Schedule
11S-SIW-032	Lessons Learned from the Pilot Development of a SOA-based LVC Interoperability Framework	Wednesday, Salon H, 0900-0930, SLC Forum Wednesday, Salon E, 1035-1100, CFI Forum
11S-SIW-033	How does the Black Swan Fly?: Considerations for an HSCB Metamodel	Tuesday, Salon B, 1430-1500, ANL Forum Wednesday, Salon G, 1030-1100, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-034	Emerging Solutions for LVC Asset Reuse	Tuesday, Salon A, 0930-1000, DSPT/RD&E/SER Joint Session Wednesday, Salon A, 0900-0930, TRAIN/T&E Joint Session
11S-SIW-036	Constructing Bridges between Mission Space Models and BOM	Tuesday, Salon D, 1630-1700, ANL/DSPT Joint Session
11S-SIW-037	Behavior Generation for Clutter and Scenarios	Wednesday, Salon G, 1530-1600, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-038	Critical Infrastructure Layers for Synthetic Environments	Tuesday, Salon E, 1430-1500, SER Forum Wednesday, Salon G, 1600-1630, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-039	A Taxonomy for Conceptual Models	Tuesday, Salon C, 0930-1000, VV&A Forum Tuesday, Salon B, 1400-1430, ANL Forum Tuesday, Salon E, 1600-1630, SER Forum
11S-SIW-041	A NATO OPORD Capability for BML	Tuesday, Salons J&K, 1400-1430, C2/MS Forum
11S-SIW-042	Software Reuse for Modeling and Simulation	Tuesday, Salon E, 1335-1400, SER Forum Wednesday, Salon H, 1400-1430, SLC Forum
11S-SIW-043	Dynamic Publish/Subscribe Topics in the Scripted BML Server	Tuesday, Salons J&K, 1430-1500, C2/MS Forum Wednesday, Salon E, 1330-1400, CFI Forum
 **011-SIW-044**	VEVA as German Approach Towards Operationalizing the DSEEP: Overview and First Experiences	Tuesday, Salon D, 1530-1600, DSPT Forum
11S-SIW-045	Design and Model-checking Techniques Applied to Real-time RTI Time Management.	Wednesday, Salon E, 1100-1130, CFI Forum
11S-SIW-046	Environment Data for a High Fidelity Fictitious Continent	Tuesday, Salon E, 1530-1600, SER Forum
11S-SIW-047	Operational environment Scenario Generation! Aligning MSDL for Planning in an IW Context	Tuesday, Salons J&K, 1030-1100, ANL/C2/MS Joint Session Wednesday, Salon G, 1430-1500, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-048	Developing Human Social Cultural and Behavioral (HSCB) Ontologies to Support Simulations	Wednesday, Salon G, 1100-1130, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-049	Time Representation and Interpretation in Simulation Interoperability - An Overview	Tuesday, Salon B, 1330-1400, ANL Forum Tuesday, Salon A, 1530-1600, RD&E Forum Wednesday, Salon E, 1400-1430, CFI Forum
11S-SIW-050	Cross-Domain Information Sharing in a Joint Training Environment (CDIS-JTE)	Wednesday, Salon B, 0905-0930, C2/MS Forum Wednesday, Salon A, 1330-1400, TRAIN Forum
11S-SIW-052	Developing Flexible Discrete Event Simulation Models in an Uncertain Policy Environment	Tuesday, Salon B, 1600-1630, ANL FORUM Wednesday, Salon D, 0900-0930, SPACE Forum Wednesday, Salon H, 1430-1500, SLC Forum
11S-SIW-053	Network Protocol Extensions for Automated Human Performance Assessment in Distributed Training Simulation	Wednesday, Salon A, 1430-1500, TRAIN Forum
11S-SIW-054	LVCAR Enhancements for Selecting Gateways	Tuesday, Salon A, 0830-0900, DSPT/RD&E/SER Joint Session Wednesday, Salon B, 1035-1100, T&E Forum
11S-SIW-056	Visualizing SRML simulations using X3D	Wednesday, Salon D, 0930-1000, SPACE Forum

 *-2011 Spring "SIWzie" Recommended Reading List (RRL) Nominee*

Paper Number	Paper Title	Presentation Schedule
11S-SIW-058	Understanding the Value of M&S	Tuesday, Salon A, 1600-1630, RD&E Forum Wednesday, Salon H, 1330-1400, SLC Forum
11S-SIW-059	Modeling Tools to Integrate of Structures Data Sources	Wednesday, Salon E, 1130-1200, CFI Forum
11S-SIW-060	Building an Angry Grandmother	Tuesday, Salon E, 1630-1700, SER Forum Wednesday, Salon A, 1130-1200, TRAIN Forum Wednesday, Salon G, 1630-1700, HSCB-CMSS/IO-ISR Joint Session
11S-SIW-061	Management of C4I and M&S Data Standards with Modular OWL Ontologies	Tuesday, Salons J&K, 1530-1600, C2/MS Forum
11S-SIW-062	Reuse of User Interface Components across M&S and C2 Systems	Tuesday, Salons J&K, 1600-1630, C2/MS Forum
 **11S-SIW-065**	Scalability of Parallel and Distributed Modeling and Simulation Architectures	Tuesday, Salon J&K, 0900-0930, ANL/C2 Joint Session Tuesday, Salon A, 1330-1400, RD&E Forum Wednesday, Salon B, 1130-1200, T&E Forum
11S-SIW-067	Schema of the Machine Readable Enumerations Document	Tuesday, Salon D, 1600-1630, DSPT Forum Thursday, Salon C, 1330-1400, DIS PSG
11S-SIW-069	Towards Multi Level Security for NATO Collective Mission Training!: A White Paper	Tuesday, Salon A, 1130-1200, DSPT/RD&E/SER Joint Session Wednesday, Salon A, 1400-1430, TRAIN Forum Wednesday, Salon E, 1430-1500, CFI Forum
11S-SIW-070	Future Technologies and Processes and their Impact in the Domain of Live-Virtual-Constructive Architectures	Wednesday, Salon H, 0930-1000, SLC Forum
11S-SIW-072	How to Develop True Distributed Real Time Simulations? Mixing IEEE HLA and OMG DDS Standards	Tuesday, Salons J&K, 0930-1000, ANL/C2/MS Joint Session Wednesday, Salon D, 1100-1130, DSPT/SPACE Forum
11S-SIW-073	Verification, Validation and Accreditation (VV&A) MAGTF Training Simulations Division Updated Process and Status for Training Simulations VV&A	Tuesday, Salon C, 1030-1100, VV&A/TRAIN Joint Session Wednesday, Salon B, 0930-1000, C2/MS Forum
11S-SIW-074	Towards a Foundational Theory for Validation of Models and Simulations	Tuesday, Salon C, 1330-1400, VV&A/SPACE Joint Session Wednesday, Salon G, 0900-0930, HSCB-CMSS Forum
11S-SIW-075	Interoperability of Multiple Autonomous Simulators in Integrated Simulation Environments	Wednesday, Salon H, 0830-0900, SLC Forum Wednesday, Salon D, 1030-1100, SPACE/VV&A Joint Session Wednesday, Salon G, 1400-1430, HSCB-CMSS Joint Session

 *-2011 Spring "SIWzie" Recommended Reading List (RRL) Nominee*

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