THE SOCIETY FOR
MODELING & SIMULATION
INTERNATIONAL

PROUDLY PRESENTS

SPRINGSIM

Spring Simulation Multi-Conference 2013

April 7 - 10, 2013

Bahia Hotel, San Diego, CA, United States

2013 SpringSim

PROGRAM BOOK

April 7—10, 2013
San Diego, CA, USA

Sponsored by SCS

General Chairs
Andreas Tolk
&
Mamadou Traoré

Scan The QR Code To View Our Mobile App

TABLE OF CONTENTS

Table of Contents

Brought to you by :
The Society for Modeling & Simulation International (SCS)

GENERAL INFO

General Information

Registration

Your registration for SCS's 2013 Spring Simulation Multi-conference (SpringSim'13) includes morning and afternoon breaks each day, the Monday evening reception on the William D. Evans boat and access to all sessions, tutorials and special presentations (unless otherwise noted).

SpringSim'13 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 will be available for your reference.

- **Registration Hours** (*Pavilion*):
  - ◊ **Sunday**, April 7th – 3:00pm-6:00pm
  - ◊ **Monday**, April 8th – 7:00am–5:00pm
  - ◊ **Tuesday**, April 9th – 7:00am–5:00pm
  - ◊ **Wednesday**, April 10th – 7:30am–3:00pm

Exhibits

- **Exhibit Hours** (*Pavilion*):
  - ◊ **Monday**, April 8th – 7:30am—5:00pm
  - ◊ **Tuesday**, April 9th – 7:30am—8:00pm
  - ◊ **Wednesday**, April 10th – 7:30am—1:00pm

Breaks

- **Coffee Breaks** (*Pavilion*):
  - ◊ **Monday**, April 8th – 10:00am–10:30am | 3:00pm-3:30pm
  - ◊ **Tuesday**, April 9th – 10:00am–10:30am | 3:00pm-3:30pm
  - ◊ **Wednesday**, April 10th – 10:00am–10:30am | 3:00pm-3:30pm

Poster Session

- **Poster Hours** (*Pavilion*):
  - ◊ **Monday** (April 8th) 8:00am-5:00pm, **Tuesday** (April 9th) 8:00am-5:00pm, and **Wednesday** (April 10th) - 8:00am-3:00pm

General Information

Conference Meetings

Sunday:

SCS Board Meeting (8:00am-12:00pm); Marina Room
SCS Board Members

SCS Ad Hoc Board Meeting (3:00pm-5:00pm); Marina Room
By Invitation

Tutorials (12:30pm-5:45pm); Del Mar Room and Ventana Room
All conference attendees invited (See agenda for details)

**Pre-Conference Meeting (5:30pm-6:00pm); Pavilion
Topic: Conference Orientation
All conference attendees invited

Monday:

Conference Organizers Planning Lunch (12pm); Pavilion
By Invitation

**Future Conference Planning Meeting (5:00pm-5:30pm); Pavilion
Topic: Future plans for 2014-2015 Conferences
All conference attendees and future volunteers invited

Body of Knowledge Session (3:30pm-5:00pm); Studio
All conference attendees invited

Reception (5:30-7:00pm); William D. Evans
All conference attendees invited

Tuesday:

Membership Meeting (12:30pm); Mission Ballroom
Topic: What's new for SCS MEMBERS?
SCS members and future SCS members invited (See agenda for details)

SimSmackdown Event (5:30pm-7:00pm); Pavilion
All conference attendees invited (See agenda for details)

Body of Knowledge Session (3:30pm-5:00pm); Studio
All conference attendees invited

Wednesday:

PDG-Task Group for M&S-VV&A (8:30am-5:00pm); By Invitation

**The Vice President of Conferences for SCS, invites all SpringSim attendees to the organization meeting for future conferences. In this meeting, we will discuss the overall organization of SCS conferences, plans for future meetings, and different opportunities for SpringSim members to participate in the decision-making processes, the scientific content of the programs, and the overall Symposia structure and organization.

General Information

Monday Evening Reception

There will be a reception on the William D. Evans, open to all SpringSim'13 attendees, on Monday, April 8th, from 5:30pm-7:00pm.

Speakers' Breakfasts

Speakers' breakfasts will be held Monday – Wednesday from 7am – 8:15am. 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'13 will be presented at the beginning of the SCS Plenary session.

Notes

Welcome to SpringSim'13

Welcome from the General Chair

Welcome to the Spring Simulation Multi-Conference 2013 (SpringSim'13) in San Diego, CA. As the General Chair of this year's SpringSim, it is an honor and privilege to be your host for these exciting four days of activities driven and organized by the various members of our society. Despite challenges in the worldwide economy and the overall decrease of funding for travel and conferences, the interest in Modeling and Simulation (M&S) and its applications is still high enough to ensure a challenging and interesting program. From the opening tutorial day where international experts are providing their knowledge to our community to the presentation of peer-reviewed papers, invited special topic presentations, and expert panel discussions the chairs of our symposia did their best to provide an outstanding choice. Without the work of these volunteers, SpringSim would not have been possible.

This year's SpringSim is again collocated with the Spring Simulation Interoperability Workshop organized by the Simulation Interoperability Standards Organization (SISO). We hope that you will find the time to visit some of their events as well. Of particular interest should be the NASA Smackdown event on Tuesday evening. During this event, students present their work on utilizing simulation interoperability solution to contribute to a bigger NASA effort. SCS encourages students to participate in this event and hopes to play a more active role in the future.

Before addressing the symposia in some more detail, please allow me to introduce the organization committee for this year's event:

Vice-General Chair:	Mamadou Traoré, Blaise Pascal University LIMOS
Program Chair:	Saikou Diallo, Old Dominion University
Proceedings Chair:	Andrea D'Ambrogio, University of Rome
Awards Chair:	Agostino Bruzzone, University of Genoa DIPTEM
Tutorial Chair:	Daniele Gianni, University of Rome
Poster Co-Chairs:	Shafagh Jafer, Milwaukee School of Engineering
	Mohammad Moallemi, Carleton University

Welcome to SpringSim'13

I wish to thank every one of these leaders in the M&S Community for giving their time and expertise to support the overall organization of SpringSim. Their tireless effort tied the individual efforts of the symposia together to become SpringSim, which makes this a leading event in the M&S community.

The living components of SpringSim, however, are our symposia. Each of them will address you in their own section as well, but I want to use the opportunity to thank all the co-chairs that organized outstanding programs within their domains, and who showed great team spirit in being flexible in the scheduling and very creative when it came to organizing shared sessions of common interest. Some of them even integrate SISO activities to overall serve our community better. The symposia organized under the roof of SpringSim are this year:

- Agent-Directed Simulation (ADS) Symposium, chaired by Levent Yilmaz, Auburn University and Tuncer Ören, University of Ottawa
- 46th Annual Simulation Symposium (ANSS), chaired by Eric Imsand, US Army SMDC SimCtr / GaN Corp, Dr. Qishi Wu, University of Memphis, and Shaoen Wu, University of Southern Mississippi
- 16th Communications and Networking Symposium (CNS), chaired by Hassan Rajaei, Bowling Green State University
- Symposium on Emerging M&S Applications in Industry and Academia (EAIA), chaired by Rafael Diaz, Old Dominion University, and Francesco Longo, University of Calabria
- 21th High Performance Computing Symposium (HPC), chaired by Fang (Cherry) Liu, Georgia Tech, and Karl Rupp, Technische Universität Wien / Argonne National Laboratory
- Symposium on Military Modeling & Simulation (MMS), chaired by Saikou Diallo, Old Dominion University, and Kevin Gupton, University of Texas at Austin
- Symposium on Simulation for Architecture and Urban Design (SimAUD), chaired by Liam O'Brian, Carleton University, and Azam Khan, Autodesk
- *New Mini-Symposium* on Modeling and the Humanities (MatH), chaired by Charles Turnitsa, Columbus State University, and Ted Carmichael, University of North Carolina

I am also very happy that the Conference on Theory of Modeling and Simulation (TMS'13), chaired by Gabriel A. Wainer, Carleton University, and Pieter Mosterman, McGill University, will be conducted as a sub-conference under the SpringSim roof.

Welcome to SpringSim'13

I hope that many of our symposia are continuing to grow and become sub-conferences following the example of TMS. I also hope that we will continue to attract new domains, such as MatH and the track on Philosophy of M&S in EAIA..

Finally, SpringSim would not have been made possible without the authors and presenters. Rigorous peer reviews added to the already high standards of this year's submissions that we received from all over the world. The academic program is rounded up perfectly by our industry sponsors. I encourage everybody to visit them during their exhibition.

My final thank you in this welcome note goes to the office of SCS. Oletha Darensburg and her team made sure that all deadlines were on schedule, production documents were in place, and that everyone continued to be in a cheerful mode while doing so.

I wish you a great time during the SpringSim 2013!

Andreas Tolk
General Chair SpringSim 2013
Professor Engineering Management and Systems Engineering
Professor Modeling, Simulation, and Visualization Engineering
Old Dominion University, Norfolk, VA

SimSmackDown

This unique intra-university multi-national event, in its 3rd year, allows student teams to learn simulation interoperability by gaining hands-on experience. SimSmackDown breaks down barriers to simulation employment as students learn to build and test models while working together across time zones on a simulated lunar mission. SimSmackDown is unfunded and volunteers-driven. It provides faculty and students with free industry software, standards, NASA content and conference registration. Simulation professionals from Aegis Technologies, ForwardSim, MAK, Pitch, BDMA, NASA, SISO and SCS serve as mentors. The 9 teams representing at this year's SimSmackdown are from France, Germany, Italy, South Korea, the UK and US (UAH , MIT, Nebraska, Penn State).

The goal is to create a distributed simulation of a lunar exploration mission. Students gain hands on experience with the High Level Architecture (HLA) standard IEEE-1516-2010, design system simulations, define data objects, and negotiate interactions with other teams, and demonstrate the simulation to an international audience of simulation professionals.

The realistic simulation of lunar exploration systems requires students to learn how to apply physics for trajectories, surface movement, docking, and exchanging payloads. An understanding of coordinate frames, 3D mesh formats, and computer graphics rendering technologies are requirements for depicting systems and activities.

SpringSim'13 encourages everyone, including potential employers, to meet and help the students as they set-up, test and configure technical equipment on April 8-9 in the Pavilion at the Bahia Hotel and to take part in the actual event on April 9 at 5:30-7 pm. Join us in this adventure of virtual simulation that is out of this world.

Notes

NOTES

TUTORIALS

Tutorials Information

Spring Sim 2013
Tutorial Schedule (Sun 7th April)

Tutorial Chair: Daniele Gianni (email: danielegmail-springsim@yahoo.it)

- 12:30pm-2:00pm Room: Del Mar — *Natural Computing Approaches for Simulations*; Dr Silja Meyer-Nieberg, University of the Federal Armed Forces Munich, Germany
- 2:15pm-3:45pm Room: Del Mar — *Introduction to Modeling and Simulation with DEVS and Cell-DEVS*; Prof Gabriel Wainer, Carleton University, Canada
- 2:15pm-3:45pm Room: Ventana — *Developing Domain Specific Languages for Modelling and Simulation*; Dr Steve McKeever, Uppsala University, Sweden
- 4:15pm-5:45pm Room: Del Mar — *MS4 Me – System Entity Structure based DEVS Modeling and Simulation environment*; Dr Bernard Ziegler, MS4 Systems, Inc. and RTSync Corp, USA
- 4:15pm-5:45pm Room: Ventana — *Model-driven Development of Distributed Simulation Systems*; Prof Andrea D'Ambrogio, University of Rome TorVergata, Italy

Tutorials Information (Cont.)

Title

Model-driven Development of Distributed Simulation Systems

Speaker

Andrea D'Ambrogio, University of Roma TorVergata (Roma, Italy)

Abstract

MDD (Model Driven Development) is finding increasing acceptance in the development of complex systems as enabler of significant reuse and higher degree of automation. Distributed simulation (DS) systems are inherently complex due to their intrinsic concurrency, the required interoperability and the intricacies of currently available DS platforms. MDD provides a promising approach for effectively supporting the development of DS systems of higher quality at largely reduced time, effort and cost.

The tutorial first introduces the MDD principles and standards, by highlighting the challenges and opportunities of applying a MDD process in the field of DS system development. Two approaches are then illustrated, the former carrying out a *conventional* MDD process based on MDA (Model Driven Architecture) standards and tools, the latter exploiting a *simulation-enabled* MDD process based on the SimArch layered architecture. The two presented approaches will be described by use of example applications and eventually compared to show the benefits of using the simulation-enabled approach with respect to the conventional one.

Speaker's Bio

Andrea D'Ambrogio is associate professor of computer science at the Faculty of Engineering of the University of Roma "Tor Vergata", Roma (Italy), where he teaches courses of software engineering and distributed simulation for graduate and PhD students in computer science and Internet engineering. He is Deputy Director of the post graduate one-year course in "Systems Engineering", recently established at the University of Roma TorVergata.

Andrea D'Ambrogio's research interests are in the software engineering field, specifically in the areas of engineering and validation of system performance and dependability, model-driven systems and software engineering, and distributed and web-based simulation.

In such areas he has authored several journal/conference papers and has served as member of the program committee of international conferences such as IEEE WETICE, ACM WOSP, ACM ICPE, SCS/ACM/IEEE TMS/DEVS, ACM PADS and SIMUTools. He has been general chair of IEEE WETICE 2008 and program chair of SCS/ACM/IEEE TMS/DEVS 2012. In 2010 he started the IEEE International Workshop on Collaborative Modeling and Simulation (CoMetS) and in 2011 the SCS/ACM/IEEE International Workshop on Model-driven Approaches for Simulation Engineering (Mod4Sim), which is now at its third edition. He is member of IEEE, IEEE Computer Society, ACM, SCS and INCOSE.

Tutorials Information (Cont.)

Title

Developing Domain Specific Languages for Modelling and Simulation

Speaker

Dr Steve McKeever, Uppsala University

Abstract

In this tutorial I'll motivate the need for domain specific languages in the field of modelling. I'll mention some common approaches such as discrete and continuum methods. I'll look at some success stories, namely CellML and SBML. The main trust of the presentation will be a demonstration of how to construct a domain specific language and corresponding tool support. Finally I'll summarise by showing how these descriptions enable interoperability through repositories, the construction of compound models and simulation environments.

Speaker's bio

Dr Steve McKeever has a background in computing science and formal methods in particular. He completed his doctorate at the University of Oxford on automatic compiler generation. He subsequently moved to the custom computing group at Imperial College London as a researcher. In 2002 he returned to Oxford as a lecturer on the Software Engineering programme where he developed courses on object oriented programming and XML. This is where he became interested in applying mark-up languages to physiological modelling. He has recently moved to Sweden to continue his academic career at Uppsala University in the Department of Informatics.

Title

Natural Computing Approaches for Simulations

Speaker:

Silja Meyer-Nieberg

Abstract

Natural computing considers approaches that adopt principles found in nature either by considering evolutionary processes, by implementing simple models of human brains or by mimicking swarm behaviour. The methods that belong to natural computing are therefore quite diverse ranging from evolutionary algorithms over swarm-based optimization to neural networks.

One of the earliest application areas is in simulations. Successful applications of natural computing include examples from the engineering or industrial domain over to computational red teaming and evolutionary data farming. The tutorial gives an overview over natural computation and illustrates the general working principles. Advantages and disadvantages are presented and discussed. Afterwards, exemplary applications of using natural computing for simulations are presented.

Tutorials Information (Cont.)

Speaker's bio

Silja Meyer-Nieberg studied applied system science (Angewandte Systemwissenschaften) with major in mathematics and minors in computer science and chemistry at the University of Osnabrück, Germany. She obtained her diploma degree in 2001.

After working at the University of Cologne at the Center for Applied Computer Science as a scientific employee, she moved to the Technical University of Dortmund, Germany where she worked in the Collaborative Research Center and Computational Intelligence. She obtained her PhD at the Technical University of Dortmund in the area of evolutionary algorithms in 2007. The thesis (supervisor: Hans-Georg Beyer) provided a analysis of the self-adaptation mechanism of evolution strategies.

At present she is working at the University of the Federal Armed Forces Munich, Germany. Her research focuses on natural computing methods under uncertainty. It comprises theoretical analyses as well as practical applications for instance the use of natural computing methods in games and simulations.

Title

Introduction to Modeling and Simulation with DEVS and Cell-DEVS (1.5 hours)

Speaker

Gabriel A. Wainer, Dept. of Systems & Computer Engineering, Carleton University
http://www.sce.carleton.ca/faculty/wainer

http://cell-devs.sce.carleton.ca/

Abstract

Recent advances in computer technology have influenced simulation techniques to become an effective approach to understand physical systems. In recent years, grid-shaped cellular models have gained popularity in this sense. In particular, Cellular Automata (CA) have been widely used with these purposes. CA have received much attention in the last decade, and it has received a tremendous impulse in the recent years. Despite their usefulness to describe complex behavior, it has been shown that CA usually require large amounts of compute time, mainly due to its synchronous nature. The use of a discrete time base also constrains the precision of the model. Besides this, CA do not describe adequately most of existing physical systems whose nature is asynchronous.

The Cell-DEVS formalism was defined in order to attack these problems. Cellular automata are defined using discrete variables for time, space and system states. Instead, Cell-DEVS is based on the DEVS formalism, a continuous time technique. The goal of Cell-DEVS is to build discrete-event cell spaces, improving their definition by making the timing specification more expressive. DEVS models are described using a hierarchical and modular specification, and different modeling formalisms were successfully mapped as DEVS (Petri Nets, Queuing Networks, Finite

Tutorials Information (Cont.)

State Machines, etc.). Therefore, we can now build cellular models that can interact with others described using different modeling techniques. DEVS and Cell-DEVS formalisms were implemented in a modeling and simulation tool (CD++), which was successfully used to develop different types of systems: biological (ecological models, heart tissue, ant foraging systems, fire spread, etc.), physical (diffusion, binary solidification, excitable media, surface tension, etc.), artificial (robot trajectories, traffic problems, heat seeking devices, etc.), and others. The independence of M&S tasks made possible to run DEVS models on different environments (personal computers, parallel computers, real-time equipment, and distributed simulators) and middleware (CORBA, MPI, HLA, RT-CORBA, RT-Linux, and a wide variety of Operating Systems and programming languages).

In this tutorial, we will introduce the main characteristics of the DEVS and Cell-DEVS formalisms, and will show how to model complex cell spaces in an asynchronous parallel environment. We will focus in showing how the application of these techniques can improve model definition, reducing the development times of software applications developed to study this kind of systems. We will also focus in describing how to create models that can be executed automatically in a parallel environment without any modifications to the original models, or user intervention. We will present different examples of application, and discuss open research issues in this area. We will then show some examples of the current use of DEVS, including applications in different fields (biology, physics, defense, industry, and embedded systems development). The course will finally discuss current open topics in the area, which include advanced methods for centralized, parallel or distributed simulation.

Speaker's Bio

GABRIEL A. WAINER, SMSCS, SMIEEE, received the M.Sc. (1993) at the University of Buenos Aires, Argentina, and the Ph.D. (1998, with highest honors) at the University of Buenos Aires, Argentina, and Université d'Aix-Marseille III, France. After being Assistant Professor at the Computer Science Department of UBA, in July 2000 he joined the Department of Systems and Computer Engineering at Carleton University (Ottawa, ON, Canada), where he is now Full Professor. He has held visiting positions in numerous places, including the University of Arizona, LSIS (CNRS), University of Nice and INRIA Sophia-Antipolis (France), UNPA, UNR and others. He is the author of three books and over 260 research articles; he edited four other books, and helped organizing over 120 conferences, including being one of the founders of SIMUTools and SimAUD. He was PI of different research projects (NSERC, Precarn, Usenix, CFI, CONICET, ANPCYT, CANARIE,). Prof. Wainer is the Vice-President Conferes, and was a Vice-President Publications and a member of the Board of Directors of the SCS. He is Special Issues Editor of SIMULATION, member of the Editorial Board of Wireless Networks (Elsevier), Journal of Defense Modeling and Simulation, and International Journal of Simulation and Process Modelling (Inderscience). He is also the Director of the Ottawa Center of The McLeod Institute of Simulation Sciences and chair of the Ottawa M&SNet, and one of the investigators in Carleton University Centre for advanced Simulation and Visualization (V-Sim). He is the head of the Advanced Real-Time Simulation lab, located at Carleton University's Centre for advanced Simulation and Visualization (V-Sim). He has been the recipient of various awards, including the IBM Eclipse Innovation Award, SCS Leadership Award, and various Best Paper awards. He has

Tutorials Information (Cont.)

been awarded Carleton University's Research Achievement Award (2005-2006), the First Bernard P. Zeigler DEVS Modeling and Simulation Award, and the SCS Outstanding Professional Award (2011). His current research interests are related with modelling methodologies and tools, parallel/distributed simulation and real-time systems. His e-mail and web addresses are <gwainer@sce.carleton.ca> and <www.sce.carleton.ca/faculty/wainer>.

Title

MS4 Me – System Entity Structure based DEVS Modeling and Simulation environment

Speaker

Dr. Bernard P. Ziegler, Chief Scientist, MS4 Systems, Inc. and RTSync Corp.

Abstract

MS4 Me is a new commercial Integrated Development Environment for DEVS, available for download from www.ms4systems.com. It features use of the System Entity Structure (SES) simulation modeling ontology in easy-to-use-form for model development and experimentation management. In this tutorial session, we will present a streamlined modeling and simulation process with MS4 Me environment using a variety of illustrative examples.

The two main pillars of DEVS and SES make the new environment a powerful and efficient platform to develop a virtual build and test of complex Systems of Systems.

Topics to be covered:

- DEVS Integrated Development Environments
- Finite Deterministic DEVS
- System Entity Structure (SES)
- Decomposition and Coupling
- Hierarchical Construction.
- DEVS Natural Language Models and Elaborations
- Dynamic Structure: Agent Modeling
- And more…

Through the cloud based model store, it is easy for teachers and students to exchange DEVS models within a course setting and for developers to collaborate across the web. More information can be found from the new book, Guide to Modeling and Simulation of Systems of Systems"

Notes

NOTES

KEYNOTES

Keynotes Information

Speaker's Bio

Dr. Rocky Reston currently serves as the Chief of Clinical Informatics and Requirements Research at DoD/VA Interagency Program Office. Dr. Reston previously has served as CMIO, MHS Cyberinfrastructure Services (MCiS) at Office of the Secretary of Defense, Chief Medical Technology Officer, OCIO at AF Surgeon General and Program Director, Anesthesiology at SAUSHEC. Dr. Reston's earned his Doctor of Medicine at F. Edward Hébert School of Medicine Uniformed Services University of the Health Sciences, Bethesda, Maryland. He received his Doctor of Philosophy in Solid State Physics and Electromagnetics and his Master of Science in Electrical Engineering in Electronic Devices and Very Large Scale Integration at the Air Force Institute of Technology. He received his Bachelor of Science in Electrical Engineering United States Air Force Academy Colorado Springs, Colorado. Dr. Retson has received numerous honors and awards and is the author of many published articles in his field.

CNS Keynotes Information

Putting Logic in Modeling of Biological Neuron – A New Framework

Aftab Ahmad[1], Richard Wells[2]
[1]Norfolk State University {aahmad@nsu.edu}
[2]University of Idaho {rwells@uidaho.edu}

Abstract

In this paper and the accompanying presentation, we discuss various frameworks used for modeling communications among biological neurons and their networks. Following the framework discussion, we highlight various modeling attempts made in the past, their strengths and limitations. Along the way, we present the role of technological advancements in making headways in quantitative modeling, and the state-of-the art in such techniques. We also present a novel framework in which a neural processing unit is viewed as a node in a heterogeneous network of clusters of neural processing units. Neural processing units are scalable as appropriate for various levels of modeling in the central nervous system (CNS). We believe this scalability is feasible from the neuron and sub-neuron level all the way up to major tissue systems encompassing millions of neurons. The approach has similarities to the one presented by Cohen and Grossberg (*Human Neurobiology* 1986 5:1-22) in explaining speech and Damasio (*Cognition* 33(1989) 25-62) in explaining neural basis of memory and recognition. In the proposed framework, we view a neural processing unit ("neuron") as consisting of interconnected smaller units ("organelles") that together generate a composite signal ("activity") consisting of physiological and logical groups of signals. These groups are responsible for specific tasks, such as physiological signaling, signal routing and mental function coding (*neural code*) with 'standard' interfaces between signal groups. We contend that despite the variety of signals processed in the CNS, the interfaces between same signal groups are in some sense "standardized" for all communications. In our framework, we define an organelle as source of a distinct signal group. Thus it does not have to be the sub-somal organelle delimited by its own membrane. The benefits of such a framework are that (i) it assumes that the mental function is topologically coded in only a subset of the neuronal signals that gives the possibility of restricting research on mental functions on certain parts of neuronal signals (Malsburg, *Handbook of Brain Theory and Neural Networks*, 2003, pp. 365-8), and (ii) it assume standardized interfaces between logical signal groups that makes it possible to have common models of different mental functions, such as cognition, memory, neuro-muscular and audio-visual functions. We will present various experimental set ups possible for deriving quantitative models under this framework.

Speaker's Bio

Dr. Aftab Ahmad (D.Sc. George Washington University) is an associate professor in the computer science department of Norfolk State University. He has been a Senior Member of IEEE from 2005-2011, is a Member ACM, and a member of New York Academy of Sciences. Dr. Ahmad's research interests are in modeling of biological neuron, resource management in wireless networks, and network security assessment. He holds Certified Ethical Hacking (CEHv6) certification for 2012. He also has certifications of Opnet modeler (advance level). He's authored two book, *Data Communications Principles: For Fixed and Wireless Networks* published by Springer-Verlag (2002) and *Wireless and Mobile Data Networks* published by John Wiley and Sons (2005). He has also authored a book chapter titled Security Assessment of

CNS Keynotes Information

Networked Systems iin *Network Security, Administration and Management: Advancing Technologies and Practice* published by IGI Global (2011). In this chapter, he has made original contribution on assessing security of a networked system according to the ITU X.805 framework. He's published over 50 peer reviewed papers in peer-reviewed professional journals and conferences. Dr. Ahmad has directed many theses and projects on networking, computer security and computer graphics. Before coming to Norfolk State University in 2003, he has held regular academic positions in DePaul University (2000-2003), Ole Miss (1998-2000), Gwangju Institute of Science and Technology, RoK (1996-1998) and National University of Sciences and Technology (NUST) in Pakistan (1994-1996).

Speaker's Bio

Dr. Richard B. Wells holds the rank of Professor at the University of Idaho in Moscow, ID, with appointments to the Department of Electrical and Computer Engineering, the Graduate Program in Neuroscience, the Materials Science and Engineering Program in the Department of Chemical Engineering and Materials Science, and the Department of Philosophy. He is also appointed affiliate to the Department of Physiology and Biophysics at the University of Washington School of Medicine. Dr. Wells received his Ph.D. degree from the University of Idaho in 1985, his Master of Science Degree in Electrical Engineering from Stanford University in 1979, and his Bachelor of Science Degree with Distinction in Electrical Engineering from Iowa State University in 1975. His teaching career began in 1974 at Iowa State. He was appointed affiliate to the Department of Electrical Engineering at the University of Idaho in 1981 and became a member of the regular faculty and the graduate faculty in 1993.

From 1975 to 1993 he was employed by the Hewlett Packard Company. There he held positions as Research & Development Engineer, Project Leader, Project Manager, and Production Engineering Manager. Since 1976 he has owned and operated his own private investment business. Prior to starting college he owned and operated a small private retail and trucking business dealing in fresh bakery goods.

Dr. Wells is a Registered Professional Engineer, registered in the State of Idaho, and is a Senior Member of the Institute of Electrical and Electronics Engineers. He holds four United States Patents and authored one textbook on Coding and Information Theory for Engineers as well as several on-line books and articles on the subjects of computational neuroscience, the Critical Philosophy, and mental physics. Some of his papers have been honored with "Best Paper" or "Editor's Choice" awards or recognitions by journals or at conferences. He has been honored with two "Best Teacher" awards by his students and one "Best Researcher" award by his peers. In 1999 he was honored by the Hewlett Packard Company by being designated a Hewlett Packard Master Researcher, one of only six such designees in the world at that time.

Dr. Wells is founder and director of the Wells Laboratory for Computational Neuroscience and Technology Research. He is past director of the Graduate Program in Neuroscience and past associate director of the Microelectronics Research and Communication Institute, both at the University of Idaho. He is currently associate chair of Electrical and Computer Engineering. Dr. Wells serves on the University Curriculum Committee, is chair of the College of Engineering Curriculum Committee, chair of the Electrical and Computer Engineering Curriculum Committee, and member of the Neuroscience Curriculum Committee. He has in the past served on the University of Idaho Research Council, the University Wide Programs Committee, and the

CNS Keynotes Information

University Selection Committee for the Department of Defense Experimental Program to Stimulate Competitive Research (DoD-EPSCoR). He has served as an External Reviewer for the National Science Foundation and as a National Science Foundation Review Panelist for the Professional Science Masters Program, a part of the American Recovery and Reinvestment Act.

He has served as Major Professor for more than fifty graduate students and as a member of more than seventy other graduate student committees for students studying in various disciplines. He annually serves as academic advisor for fifteen to twenty-five undergraduate students. His Laboratory Website, containing numerous electronic books, tutorial articles and papers, currently receives a quarter of a million hits per year coming from every continent except Antarctica.

Visions of the Future Aeronautical Data Network

Dr. Max Ehammer
Department of Computer Science
Salzburg University, Salzburg, Austria
mehammer@cosy.sbg.ac.at

Abstract

Operations relevant for air traffic management are based on procedures communicated through speech commands. These procedures are human centric, thus un-automated. Following predictions of air traffic growth forecasts, air traffic will increase no matter which forecast model is taken into account. High density air traffic areas become inefficient to handle through un-automated procedures. As a result air traffic management requires support of automated and consequently data based processes. Such processes could only be supported if data communication services are offered homogeneously in relevant areas. That is, data link and network services have to be interoperable on a worldwide basis. Currently large scale industry consortia in Europe and the United States are focusing on increasing efficiency of air traffic management through advanced concepts based on data communication applications. These activities demand a lot of coordination amongst participating organizations in order to achieve technical, economical, and political consensus amongst all partners. This talk will address the status quo of aeronautical data communication services, visions of possible emerging aeronautical data links, and the integration of these data links into an all IP based communication system relevant for air traffic management and operations, respectively. The presented topics are based on recent studies showing not only simulation results but also results from flight trials.

Speaker's Bio

Dr. Max Ehammaer studied computer science at Bowling Green State University, Ohio, USA, where he received his MSc in 2004. In 2005, he joined the Aeronautical Digital Communication (ADC) group of the University of Salzburg, Austria, where he received his Ph.D. degree in 2012. His main research interests are the implementation, evaluation, and interaction of communication protocols for data link, network, security, and transport services. He is involved in several research projects conducted for the European Commission, the European Space Agency, or the SESAR Joint Undertaking.

Notes

NOTES

EXHIBITORS

Exhibitors Information

AEgis Technologies

AEgis Technologies (www.aegistg.com), is a world leader in Modeling and Simulation Products and Solutions. AEgis is a privately held small business headquartered in Huntsville, Alabama, USA, that provides advanced technology and expert consulting services to industries throughout the world. AEgis specializes in modeling & simulation (M&S) and micro/nanoscale technology development. The company's M&S products and services include simulation software and training simulators; geospatial databases; 3D models; war fighter exercise support; systems engineering and analysis; verification, validation, and accreditation (VV&A); test and evaluation support; Hardware-in-the-Loop (HWIL) and Man-in-the-Loop (MIL) simulation. AEgis' Nanogenesis Division excels in advancing cutting edge micro and nanoscale technologies from concept to deployment with applications ranging from defense to energy to biotechnology.

AEgis Technologies is the North American distributor for Pitch Technologies' (www.pitch.se) Interoperability Products. Pitch offers Infrastructure, Development, Runtime and LVC products to support and enhance any enterprise simulation network.

VT MÄK

VT MÄK, a company of VT Systems, Inc., helps customers deliver simulation systems. Leveraging our strong foundation of COTS software products and custom developed system components, we work with our customers to build and populate compelling 3D simulated environments in which our users train, plan, analyze, experiment, prototype, and demonstrate.

MÄK Customers

MÄK's primary users are in the aerospace and defense industry, yet our products and services can be used anywhere modeling and simulation is needed to train, plan, analyze, experiment, prototype, and demonstrate. MÄK software has been used to develop solutions in the areas Air Traffic Management, Command and Control, Homeland Security, and Space. Thousands of customers worldwide use MÄK products, including the world's ten largest defense contractors.

MÄK Products

VT MÄK offers a complete line of software to address your simulation challenges. Whether you're developing a simple simulation scenario or dealing with complex program requirements, our products are easy to use and scale to meet the full range of simulation needs.

- Link - HLA-DIS Simulation Networking, HLA RTI - Run Time Infrastructure, Protocol Translation & Bridging, and Simulation Recording & Replay
- Simulate - Computer Generated Forces, Simulator Development, and Artificial Intelligence Behavior Modeling

Exhibitors Information (Cont.)

- Visualize - 3D Simulation Visualization, Tactical Map Display, and Visual & Sensor Image Generation
- Terrain - Streaming Terrain and Terain Interoperability
- Web - Interoperability for Web-based Federates and Web Applications to Observe, Control, and Participate in Your Distributed Simulations

We also offer a full line of System Components. These custom products are built to your specifications and help you build and deliver simulation systems. These are a higher level of product, more than just a toolkit; a larger component on which to build your simulation, like an After Action Review system. Used together, in a System Component or individually, as a stand-alone COTS product, MÄK products provide a strong foundation for your distributed simulation system.

MÄK Services

Sometimes customers need assistance that goes beyond technical support. MÄK offers a wide variety of engineering services, including training and consulting, product enhancements, on-site support, and project implementation. We put the experience of MÄK's engineers to work for you to help solve your unique technical challenges, from the mundane task to the most difficult requirements. We offer the following types of services:

- Simulation Content Creation
- Software Customization
- Interoperability
- Research and Development
- Training

MÄK Philosophy

MÄK is dedicated to your success; building solutions that help you win business and deliver on the business you win. With our growing partner ecosystem, we give you access to other industry-leading products to complement and enhance our offerings. Our dedication to open standards ensures that our technology can work together and interoperate with other systems. And by giving you direct access to our developers via technical support, you get answers from the people who developed your system. By combining our technology, talent, and expertise, MÄK can help you succeed.

Exhibitors Information (Cont.)

ForwardSim

ForwardSim Inc. is established in the High Tech Park of Québec city since 2005. Its experience and background in modeling and simulation, mathematics, computer sciences, and project management is used on a daily basis to support customers with high quality product and services. Providing a suite of tools, personalized training, consulting and programming services to the modeling and simulation community, ForwardSim improves customers' efficiency to generate results out of their simulations.

Pitch

Pitch Technologies (Pitch) is a leading provider of innovative state-of-the-art interoperability products, services and solutions for development of distributed systems. Their products and solutions are being used by some of the largest and most complex simulation programs in government and industry around the world.

AGI

AGI develops commercial modeling and analysis software for the space, defense and intelligence communities. Used by more than 40,000 engineers, operators and analysts worldwide, AGI software avoids the cost of reinvention, eliminates stovepipes and reduces risks associated with unproven tools. AGI products are used in the areas of space, cyberspace, aircraft, missile defense, C4ISR and electronic systems, and are available as ready-to-use applications, development tools or turnkey solutions. Learn more at agi.com.

Springer

Spring is the leading global scientific publisher, providing researchers in academia, scientific institutions and corporate R & D departments with quality content via innovative information products and services.

Trusted local-language publisher in Europe – especially in Germany and the Netherlands primarily for physicians and professionals working in the automotive, transport and healthcare sectors.

Some 2,000 journals and more than 7,000 new book titles published every year, in 6 main publishing fields: science, technology, medicine, business, transport and architecture

Springer eBook Collection with more than 55,000 titles available on www.springerlink.com; expected to be more than 110,000 (including the Springer Book Archives) by the end of 2012.

Exhibitors Information (Cont.)

Largest open access portfolio worldwide, with over 300 open access journals.

Springer presents attendees with a truly integrated array of publishing options, based on individual needs: books, journals, and even our new line of short books called Springer Briefs. With their new book series, and a very proactive and flexible approach to securing new journal ideas, they're ready to provide these services to potential authors and editors in your related communities.

Cradle

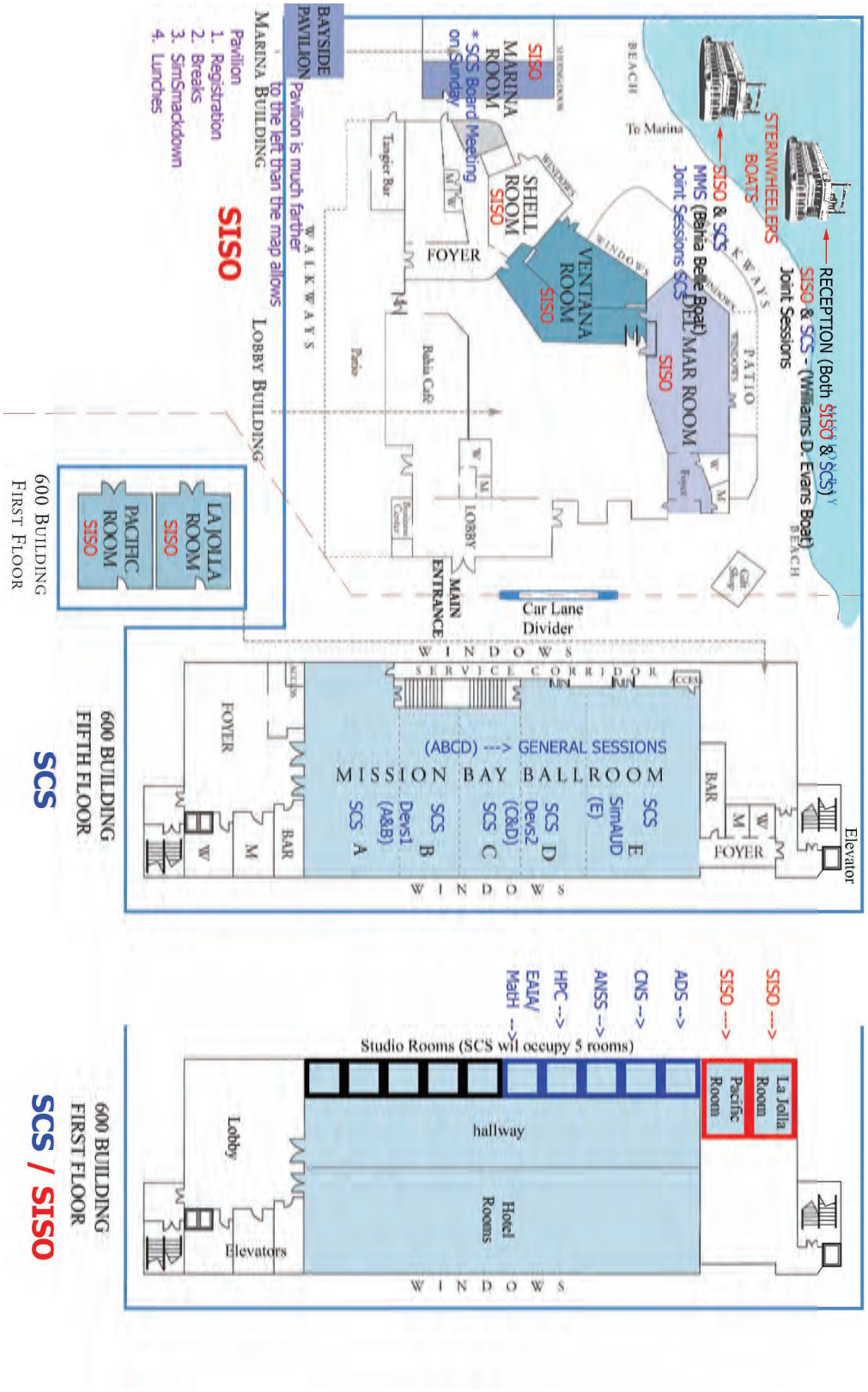
Software Cradle is a leading provider of Computational Fluid Dynamics (CFD) software including SC/Tetra (general purpose unstructured mesh), scSTREAM (general purpose Cartesian mesh), and HEAT Designer (Cartesian mesh for electronics). Since inception in 1984, Cradle has established itself as a major innovator that is advancing the role of simulation in engineering design. Our software products are well known for ease of use, exceptionally fast and powerful meshing, efficient solvers, sophisticated physical models, and professional post processing. Cradle's worldwide presence consists of offices in Japan and North America and a network of distributors servicing and supporting all parts of the globe.

Notes

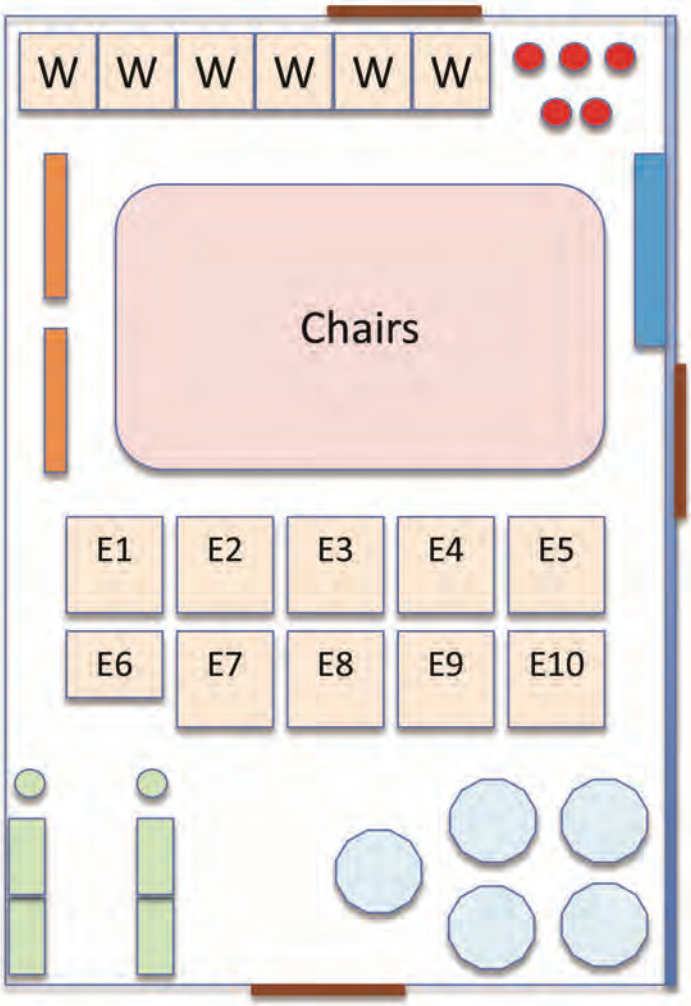
NOTES

MAPS

Hotel Map


RECEPTION (Both SISO & SCS)
SISO & SCS - (Williams D. Evans Boat)
Joint Sessions
STERNWHEELERS BOATS
SISO & SCS
MMS (Bahia Belle Boat)
Joint Sessions SCS
BEACH
To Marina
SISO
MARINA ROOM
* SCS Board Meeting on Sunday
SHELL ROOM SISO
FOYER
VENTANA ROOM SISO
DEL MAR ROOM SISO
PATIO
WINDOWS
WALKWAYS
Tangier Bar
Bahia Café
Patio
LOBBY
MAIN ENTRANCE
Car Lane Divider
BAYSIDE PAVILION
Pavilion is much farther to the left than the map allows
MARINA BUILDING
LOBBY BUILDING
Pavilion
1. Registration
2. Breaks
3. SimSmackdown
4. Lunches
SISO
600 BUILDING FIRST FLOOR
LA JOLLA ROOM SISO
PACIFIC ROOM SISO
600 BUILDING FIFTH FLOOR
SCS
SERVICE CORRIDOR
(ABCD) ---> GENERAL SESSIONS
MISSION BAY BALLROOM
SCS A
SCS B Devs1 (A&B)
SCS C SCS D Devs2 (C&D)
SCS E SimAUD (E)
FOYER
BAR
Elevator
SISO --->
SISO --->
ADS -->
CNS -->
ANSS -->
HPC -->
EA/IA/ MatH -->
Studio Rooms (SCS will occupy 5 rooms)
La Jolla Room
Pacific Room
hallway
Hotel Rooms
Lobby
Elevators
600 BUILDING FIRST FLOOR
SCS / SISO

Bayside Pavilion



Student Work Areas
6 Tables (18 Chairs)

Exhibitors
E1. Aegis & Pitch
E2. Mak
E3. FowardSim
E4. Cradle N. America
E5. AGI
E6. Springer (tabletop)
E7-E10 (Possible Additional Exhibitors)

Registration

Tables - Meals

Exhibits/Work Areas

Pavilion Exit/Door

Chairs – Tues Night

Projection Screen

Breaks Station

High Bar Tables

SpringSim'13 At A Glance Sessions

		ADS	ANSS	CNS	TMS/DEVS
Monday	**8-Apr-13**				
08:30 – 10:00	SCS Plenary				
10:00 – 10:30	Break		BREAK		BREAK
10:30 – 12:00	SCS/SISO Plenary				
12:00 – 13:30	Lunch (on your own)		LUNCH		LUNCH
13:30 – 15:00	Session Block I	Studio	Studio	Bahia Belle	Mission AB
15:00 – 15:30	Break		BREAK		BREAK
15:30 – 17:00	Session Block II	Studio	BOK	Studio	Mission AB
Tuesday	**9-Apr-13**				
08:00 – 10:00	Sessions		Studio; starts 8:30am		
10:00 – 10:30	Break		BREAK		BREAK
10:30 – 12:00	Session Block III	Studio	Studio	Studio	Mission AB
12:00 – 13:30	Lunch (on your own)		LUNCH		LUNCH
13:30 – 15:00	Session Block IV	Studio	WDE Boat	WDE Boat	Mission AB
15:00 – 15:30	Break		BREAK		BREAK
15:30 – 17:00	Session Block V	BOK	Studio	Studio	Mission AB
Wednesday	**10-Apr-13**				
08:30 – 10:00	Session Block VI	PDG Users	Studio	Studio	Mission AB; starts 9am
10:00 – 10:30	Break		BREAK		BREAK
10:30 – 12:00	Session Block VII	PDG Users	Studio	Studio	Mission AB
12:00 – 13:30	Lunch (on your own)		LUNCH		LUNCH
13:30 – 15:00	Session Block VIII	PDG Users			Mission AB
15:00 – 15:30	Break		BREAK		BREAK
15:30 – 17:00	Session Block IX	PDG Users			

*Posters will be presented during breaks Monday 8:00am – 5:00pm, Tuesday 8:00am – 5:00pm, a

SpringSim'13 At A Glance Sessions

TMS/DEVS 2	MMS	MatH	EAIA	HPC	SimAUD
BREAK	BREAK		BREAK		BREAK
LUNCH	LUNCH		LUNCH		LUNCH
Mission CD	Bahia Belle	Studio		Studio	Mission E; starts 1pm
BREAK	BREAK		BREAK		BREAK
Mission CD	Bahia Belle		Studio	Studio	Mission E
	Bahia Belle		Studio; starts 8:30am	Bahia Belle	Mission E; starts 8:30am
BREAK	BREAK		BREAK		BREAK
Mission CD	Bahia Belle		Studio	Studio	Mission E
LUNCH	LUNCH		LUNCH		LUNCH
Mission CD	WDE Boat		Studio	Studio	Mission E
BREAK	BREAK		BREAK		BREAK
	WDE Boat		Studio	Studio; Ends 5:30pm	Mission E
				Studio	Mission E; starts 8:30am
BREAK	BREAK		BREAK		BREAK
Mission CD				Studio	Mission E
LUNCH	LUNCH		LUNCH		LUNCH
Mission CD				Studio	Mission E
BREAK	BREAK		BREAK		BREAK
				Studio	Mission E

nd Wednesday, 8:00am – 3:00pm

Notes

NOTES

AGENDAS

Notes

Agent-Directed Simulation (ADS)

Agenda

Monday, 8 April 2013

Session I **13:30 – 15:00** **Room: Studio** **Session Chair: Levent Yilmaz**

- *Design and Evaluation of UAV Swarm Command and Control Strategies* (Alexander Madey and Gregory Madey)
- *Hierarchical Multi-Agent-Based Model for Simulating the Prevalence and Evolution of Influenza Virus* (Takahiro Sasaki)
- *Themis-1: An Agent-Based Model of a Modern Monetary Reserve System* (Sean Williams and Stephan Eidenbenz)

Session II **15:30 – 17:00** **Room: Studio** **Session Chair: Levent Yilmaz**

- *Multi-Hop Communications in a Swarm of UAVs* (Rachael Purta, Saurabh Nagrecha and Gregory Madey)
- *Examining The Dynamics Of Epithelial Metaplasia And Pouchitis In An Illeal Pouch With A Spatially-Explicit computational Multi-scale Gut Model (MSGM)* (Chase Cockrell, Scott Christley and Gary An)
- *Investigation of Normal Colonic Crypt Behaviors Through Agent-based Simulations* (Matthew Saponaro, Keith Decker, Bruce Boman and Gilberto Schleiniger)

Tuesday, 9 April 2013

Session III **10:30 – 12:00** **Room: Studio** **Session Chair: Levent Yilmaz**

- *Evolutionary Intelligent Agent Modeling for Emergent Warship Combat Simulation* (Chan-Ho Jung, Yong-Jun You, Sung-Do Chi, Jae-Ick Kim and Seung-Jin Han)
- *Agent-Based Simulation for UAV Swarm Mission Planning and Execution* (Yi Wei, Gregory R. Madey and M.Brian Blake)
- *Network-Based Trust Games: An Agent-Based Model (Shu-Heng Chen and Tong Zhang)*

Session IV **13:30 – 15:00** **Room: Studio** **Session Chair: Levent Yilmaz**

- *Agent-Based Simulation of Cooperative Hunting with UAVs* (Ryan McCune and Greg Madey)
- *Multi-Level Modeling As A Society Of Interacting Models* (Benjamin Camus, Christine Bourjot and Vincent Chevrier)
- *Impact of Population Relocation to City Commerce: Micro-Level Estimation with Agent-Based Model* (SeHoon Lee, JoonSoo Shin, GeunHo Lee and Il-Chul Moon)

46th Annual Simulation Symposium (ANSS)

Agenda

Monday, 8 April 2013

Session I **13:30 – 15:00** **Room: Studio** **Session Chair: Eric Imsand**

- *Implementing RSVP-Based Capacity Admission in OPNET Modeler* (Flavius Pana and Ferdi Put)
- *Wireless Sensor Network Simulation with Xen* (Paul Harvey and Joseph Sventek)
- *MobiSIM: A Simulation Library for Resource Prediction of Smartphones and Wireless Sensor Networks* (Markus Buschhoff, Jochen Streicher, Björn Dusza, Christian Wietfeld and Olaf Spinczyk)

Tuesday, 9 April 2013

Beginning Session **8:30 – 10:00** **Room: Studio** **Session Chair: Eric Imsand**

- *Performance Analysis of Sampling-based Turbo Coded NCQFSK for Image Data Transmission* (Junghwan Kim, Pooja Raorane, Mona Nasseri and Mansoor Alam)
- *Stochastic Agent-Based Simulations of Social Networks* (Garrett Bernstein and Kyle O'Brien)

Session III **10:30 – 12:00** **Room: Studio** **Session Chair: Eric Imsand**

- *On an Integrated Mapping and Scheduling Solution to Large-scale Scientific Workflows in Resource Sharing Environments* (Daqing Yun, Qishi Wu, Yi Gu and Xiyang Liu)
- *Integration of Test-Driven Agile Simulation Approach in Service-Oriented Tool Environment* (Vitali Schneider and Reinhard German)

Session IV **13:30 – 15:00** **Room: William D. Evans** **Session Chair: Eric Imsand**

- ANSS'13 and CNS'13 Joint Session
  Putting Logic in Modeling of Biological Neuron – A New Framework (Dr. Aftab Ahmad and Dr. Richard Wells)

Session V **15:30 – 17:00** **Room: Studio** **Session Chair: Eric Imsand**

- *Scalable And Transparent Approach To Media Archive Using Digital Object Architecture* (Tu Hoang and Lan Yang)
- Accurate and Efficient Algorithm *for Estimating the Reliability of Digital Combinational Circuits* (Walid Ibrahim)

Wednesday, 10 April 2013

Session VI **8:30 – 10:00** **Room: Studio** **Session Chair: Eric Imsand**

- *Parallel Microscopic Simulation of Metropolitan-scale Traffic* (Ricardo Fernandes, Fausto Vieira and Michel Ferreira)
- *Using Crowdsourced Geographic Information from OpenStreetMap for Discrete Event Simulation of Logistic Systems* (Torben Meyer, Matthias Trojahn and Steffen Strassburger)

Session VII **10:30 – 12:00** **Room: Studio** **Session Chair: Eric Imsand**

- *On Learning How to Plan Content Delivery Networks* (Moises Rodrigues, Andre Moreira, Arthur Callado, Ernani Azevedo, Marcio Neves, Josilene Moreira, Djamel Sadok and Victor Sousa)
- *Cost-Benefit Analysis of Digital Rights Management Products Using Stochastic Models* (Wen Zeng, Kaiyu Liu and Maciej Koutny)
- *Flow Count: A CDN Dynamic Replica Placement Algorithm for Cross Traffic Optimization* (Moises Rodrigues, Andre Moreira, Marcio Neves, Arthur Callado, Ernani Azevêdo, Djamel Sadok and Victor Souza)

16th Communications and Networking Symposium (CNS)

Agenda

Monday, 8 April 2013

Session I 13:30 – 15:00 Room: Bahia Belle Session Chair: Hassan Rajaei & Dialoo

- *Invited Talk I – CNS'13 and MMS'13 Joint Session*
  Visions of the Future Aeronautical Data Network (Dr. Max Ehammer)

Session II 15:30 – 17:00 Room: Studio Session Chair: Hala ElAarag

- *Event Detection and Trending in Multiple Social Networking Sites* (Shakira Banu Kaleel and Abdolreza Abhari)
- *Information Retrieval in Web 2.0- Role of Tagging and Folksonomies* (Poornima Prabhu and Dr. Abdolreza Abhari)
- *Toward Authorization as a Service: A Study of the XACML Standard* (Romain Laborde, François Barrère and Abdelmalek Benzekri)

Tuesday, 9 April 2013

Session III 10:30 – 12:00 Room: Studio Session Chair: Jin-Seek Choi

- *Multifaceted Modeling and Simulation Framework for System of Systems Using HLA/RTI* (Byeong Soo Kim, Chang Beom Choi and Tag Gon Kim)
- *P2P Grid Technology for Virtual Classrooms and Laboratories* (Hassan Rajaei and Nada Hakami)
- *BGSU Grid: An Experimental and Educational Grid Environment* (Hassan Rajaei, Amber Dhavale, Moheeb Alwarsh and Peter Dillon)

Session IV 13:30 – 15:00 Room: William D. Evans Session Chair: Hassan Rajaei & Eric Imsand

- *Invited Talk II – CNS'13 and ANSS'13 Joint Session*

  Putting Logic in Modeling of Biological Neuron – A New Framework (Dr. Aftab Ahmad and Dr. Richard Wells)

Session V 15:30 – 17:00 Room: Studio Session Chair: Dr. Aftab Ahmad

- *Simulation of Mobile Networks using Discrete Event System Specification Theory* (Mohammad Moallemi, Gabriel Wainer, Shafagh Jafer, Gary Boudreau and Ronald Casselman)
- *DEVS-based Modeling of Coordinated Multipoint Techniques for LTE-Advanced* (Misagh Tavanpour and Gabriel Wainer)
- *Using an Agent-Based Friend Circle Creator Model to Analyze Drivers of Consumer Choice: Network Effects Vs. Value Proposition* (Farhaan Mirza and Fernando Beltrán)

Wednesday, 10 April 2013

Session VI 8:30 – 10:00 Room: Studio Session Chair: Thouraya Tebibel

- *Accurate Heavy Tail Distribution Approximation for Multifractal Network Traffic (Jeferson Stenico and Lee Luan Ling)*
- *Modeling the Access Market of the Two-Sided Ultra Fast Broadband Platform in New Zealand* (Farhaan Mirza and Fernando Beltrán)
- *A Hybrid Topology Discovery Protocol for Mobile Backhaul (*Jin Seek Choi*)*

Session VII 10:30 – 12:00 Room: Studio Session Chair: Dr. Max Ehammer

- *Performance analysis of current data hiding algorithms for VoIP* (Harrison Neal and Hala ElAarag)
- *Secure Data Transmissions* (Thouraya Bouabana-Tebibel)
- *Hash Chain To Secure Proactive Protocols* (Thouraya Bouabana-Tebibel)
- *A Recommendation System for Twitter Users in The Same Neighborhood* (Meshary AlMeshary and Abdolreza Abhari)

Symposium on Theory of Modeling & Simulation - DEVS (TMS/DEVS)

Agenda

Monday, 8 April 2013

Session I 13:30 – 15:00 Room: Mission Ballroom AB Session Chair: Gabriel Wainer

- DEVS Keynote

Session II 15:30 – 17:00 Room: Mission Ballroom AB Session Chair: Gregory Zacharewicz & Fernando Barros

- *Towards a Theory of Interface-Based Design of Hierarchical Reactive Systems* (Herbert Praehofer)
- *Multiple Real-Time Semantics on top of Synchronous Block Diagrams* (Andreas Naderlinger)
- *Metamorphic Differential Simulation Using the Multi-Delay Timing Model* (Peter Maurer)

Tuesday, 9 April 2013

Session III 10:30 – 12:00 Room: Mission Ballroom AB Session Chair: Herbert Praheofer

- *Systematic Management of Simulation State for Multi-Branch Simulations in Simulink* (Zhi Han, Pieter Mosterman, Justyna Zander and Fu Zhang)
- *Creating Suites of Models with System Entity Structure: Global Warming Example* (Bernard P. Zeigler, Chungman Seo, Robert Coop and Doohwan Kim)
- *DEVS Modeling and Simulation Methodology with MS4Me Software Tool* (Chungman Seo, Bernard P. Zeigler, Robert Coop and Doohwan Kim)

Session IV 13:30 - 15:00 Room: Mission Ballroom AB Session Chair: Moon Hwang

- *Efficient Online Analysis of Accidental Fault Localization for Dynamic Systems using Hidden Markov Model* (Ning Ge, Shin Nakajima and Marc Pantel)
- *Enabling Formal Analysis of Energy-Aware Automotive Embedded Systems in EAST-ADL* (Eun-Young Kang and Pierre-Yves Schobbens)
- *Observations on Real-time Simulation Design and* Experimentation (Soroosh Gholami and Hessam Sarjoughian)

Session V 15:30 – 17:00 Room: Mission Ballroom AB Session Chair: Claudia Frydman

- PhD Presentations

Wednesday, 10 April 2013

Session VI 9:00 – 10:00 Room: Mission Ballroom AB Session Chair: Fernando Barros & Gregory Zacharewicz

- *Grand Challenges on the Theory of Modeling and Simulation* (Simon Taylor, Azam Khan, Katherine Morse, Andreas Tolk, Levent Yilmaz and Justyna Zander)

Session VII 10:30 – 12:00 Room: Mission Ballroom AB Session Chair: Gary Godding

- *The Impact of Operations Strategies for Emergency Room in Taiwan* (Shao-Jen Weng, Po-Yu Huang, Wei-Hsiu CHANG, Lee-Min Wang and Chun-Yueh Chang)
- *Occupancy Analysis using Building Information Modeling and Cell-DEVS Simulation* (Sixuan Wang, Gabriel Wainer, Vinu Subashini Rajus and Robert Woodbury)
- *NOISYSIM: exact simulation of stochastic chemically reacting systems with extrinsic bounded noises (WIP)* (Giulio Caravagna, Giancarlo Mauri and Alberto d'Onofrio)

Session VIII 13:30 – 15:00 Room: Mission Ballroom AB Session Chair: Justyna Zander

- *Agent-Oriented Approach Based on Discrete Event Systems (WIP)* (Paul-Antoine Bisgambiglia, Paul Antoine Bisgambiglia and Romain Franceschini)
- *Survival vs. Revenue: Modelling and Reasoning on Population Dynamics (WIP)* (Andrea Bracciali, Giulio Caravagna and Amjad Ullah)
- *A Cellular Automaton Model for Psoriasis Disease* (Morgan Germain, Christopher Banerji, Chrysanthi Ainali and Nour Shublaq)

Symposium on Theory of Modeling & Simulation - DEVS 2 (TMS/DEVS)

Agenda

Monday, 8 April 2013

Session I 13:30 – 15:00 Room: Mission Ballroom CD Session Chair: Andrea D'Ambrogio

- *Abstraction in Physiological Modelling Languages* (Steve McKeever, Mandeep Gill, Anthony Connor and David Johnson)
- *Model-based, Composable Simulation for the Development of Autonomous Miniature Vehicles* (Christian Berger, Olaf Landsiedel, Elad Schiller, Michel Chaudron and Rogardt Heldal)
- *Data and Behavior Decomposition for the Model-Driven Development of an Executable Simulation Model* (Gürkan Özhan and Halit Oğuztüzün)

Session II 15:30 – 17:00 Room: Mission Ballroom CD Session Chair: Halit Oguztuzun

- *Model Composability and Execution across Simulation, Optimization, and Forecast Models* (Hessam Sarjoughian, James Smith, Gary Godding, and Mohammed Muqsith)
- *On the Representation of Product Lines using Pluggable Software Units: Results from an Exploratory Study* (Fernando Barros)
- *4SEE: a Model-driven Simulation Engineering Framework for Business Processes Analysis in a SaaS paradigm* (Paolo Bocciarelli, Andrea D'Ambrogio and Daniele Gianni)

Tuesday, 9 April 2013

Session III 10:30 – 12:00 Room: Mission Ballroom CD Session Chair: Raphael Duboz

- *GAMETE: General Adaptable Metric Execution Tool and Environment (WIP)* (Kurt Rohloff, Kyle Usbeck and Joe Loyall)
- *A Metamodel-Based Approach For Generalizing Requirements In Database-Driven 3D Simulation (WIP)* (Martin Hoppen, Michael Schluse and Juergen Rossmann)
- *Model-based Animation of Micro-Traffic Simulation (WIP)* (Philip Guin and Eugene Syriani)
- *Principles for the Realization of an Open Simulation Framework Based on fUML (WIP)* (Jeremie Tatibouet, Arnaud Cuccuru, Sebastien Gerard and Francois Terrier)

Session IV 13:30 - 15:00 Room: Mission Ballroom CD Session Chair: Eugene Syriani

- *Transformation of Extended Actigram Star to BPMN2.0 in the frame of Model Driven Service Engineering Architecture* (Hassan BAZOUN, Gregory Zacharewicz, Yves Ducq and Hadrien Boye)
- *Hybrid Agent based Simulation with Adaptive Learning of Travel Mode Choices for University Commuters (WIP)* (Nagesh Shukla, Albert Munoz, Jun Ma and Nam Huynh)
- *Comparison Of Three Agent-Based Platforms On The Basis Of A Simple Epidemology Model (WIP)* (Kishoj Bajracharya and Raphael Duboz)

Wednesday, 10 April 2013

Session VII 10:30 – 12:00 Room: Mission Ballroom CD Session Chair: Rhys Goldstein

- *Semantics for an Interdisciplinary Computation (WIP)* (Justyna Zander and Pieter Mosterman)
- *Revisit of System Variable Trajectories (WIP)* (Moon Ho Hwang)
- *Hybrid Systems Modeling and Verification with DEVS (WIP)* (Hesham Saadawi and Gabriel Wainer)

Session VIII 13:30 – 15:00 Room: Mission Ballroom CD Session Chair: Saurabh Mittal

- *Informal DEVS Conventions Motivated by Practical Considerations (WIP)* (Rhys Goldstein, Simon Breslav and Azam Khan)
- *A Method for DEVS Simulation of E-Commerce Processes for Integrated Business and Technology Evaluation (WIP)* (Carlos María Chezzi, Ana Rosa Tymoschuk and Ricardo Lerman)
- *GAMME, a meta-model to unify data needs in simulation modeling (WIP)* (Judicaël Bedouet, Nicolas Huynh and Romain Kervarc)

Emerging M&S Applications in Industry and Academia Symposium (EAIA) and Modeling and Humanities (MatH)

Agenda

Monday, 8 April 2013

Modeling and Humanities

Session I **13:30 – 15:00** **Room: Studio** **Session Chair: Dr. Charles Turnista**

- *Conditions and Consequences of Language Choice: A linguistic inquiry on bilingualism using ABMs* (Jacob Rosen and Teresa Satterfield)

Emerging M&S Applications in Industry and Academia

Session II **15:30 – 17:00** **Room: Studio** **Session Chair: Andreas Tolk**

- *An Extended Research Framework for the Simulation Era* (Martin Ihrig and Klaus G. Troitzsch)
- *M&S Methodological Challenges* (Jose Padilla, Andreas Tolk and Saikou Y. Diallo)
- *On the Evolution of Agency and Implications for Comprehensively Modeling It* (Dante Suarez)

Tuesday, 9 April 2013

Emerging M&S Applications in Industry and Academia

Beginning Session 8:30 – 10:00 **Room: Studio** **Session Chair: Raphael Diaz**

- *Effective Simulation of Earth Moving Projects (Jamal Siadat)*
- *Perception of a Building Construction Schedule (Kais Samkari, Ralf Gnerlich and Volkhard Franz)*
- *Advanced Modeling & Simulation Based Tools for Supporting The Design and Management of A Job Order Manufacturing System (Agostino Bruzzone, Francesco Longo, Letizia Nicoletti, Alessandro Chiurco and Rafael Diaz)*

Tuesday, 9 April 2013

Session III 10:30 – 12:00 Room: Studio Session Chair: Raphael Diaz

- *Throughput Simulation of Port of Beirut* (Jean-Paul Arnaout, Samar Hallab and Caline El Khoury)
- *Electric Load Forecasting using Support Vector Machines for Robust Regression* (Sonia De Cosmis, Renato De Leone, Erik Kropat, Silja Meyer-Nieberg and Stefan Pickl)
- *Different Modeling and Simulation Approaches applied to Industrial Process Plants* (Agostino G. Bruzzone, Francesca Madeo, Margherita Dallorto, Davide Poggi and Angelo Ferrando)

Session IV 13:30 – 15:00 Room: Studio Session Chair: Raphael Diaz

- *Interdisciplinary Systems and Simulation Studies for an Innovative Undergraduate Program* (Anatoly Kurkovsky)
- *Integrating the Computer Science Curriculum by Using Robot Soccer Simulator* (Vadim Kyrylov)
- *Challenges with Simulator Development for Ultrasonography Training: Developing Hardware – Software Interface* (John Sokolowski, Catherine Banks, William Richards and Hector Garcia)

Session V 15:30 – 17:00 Room: Studio Session Chair: Raphael Diaz

- *Metamodeling by using Multiple Regression Integrated K-Means Clustering Algorithm* (Emre Irfanonglu, Ilker Akgun and Murat Gunal)
- *Integrating Fuzzy Expert System with Discrete Event Simulation to Determine Configuration of Resources Level for an Emergency Unit* (S. Mohsen Hosseini, Seratun Jannat and Abdullah Al-Khaled)

21st High Performance Computing Symposia (HPC)

Agenda

Monday, 8 April 2013

Session I **13:30 – 15:00** **Room: Studio** **Session Chair: Karl Rupp**

- *Exascale Workload Characterization and Architecture Implications* (Prasanna Balaprakash, Darius Buntinas, Anthony Chan, Apala Guha, Rinku Gupta, Sri Hari Krishna Narayanan, Andrew Chien, Paul Hovland and Boyana Norris)
- *Buffering IO for Data Management in Multi-physics Simulations* (William Dai)
- *SimMatrix: Simulator for Many-Task Computing Execution Fabric at Exascales* (Ke Wang, Kevin Brandstatter and Loan Raicu)

Session II **15:30 – 17:00** **Room: Studio** **Session Chair: Fang (Cherry) Liu**

- Invited Talk: *Computing at a Million* (Scott Baden)
- Invited Talk: (Scott Baden)
- Invited Talk: (Scott Baden)

Tuesday, 9 April 2013

Beginning Session 8:00 – 8:30 **Room: Bahia Belle** **Session Chair: William Thacker**

- *Introduction to Joint Sessions of the Spring Simulation Multi-Conference Military M&S Symposium and the Spring SIW Human Systems Modeling*
  Moderators: Saikou Diallo and Curtis Blais

Morning Session 8:30 – 10:00 **Room: Bahia Belle** **Session Chair: William Thacker**

- Joint Panel Session: *Human Social Culture Behavior (HSCB) Modeling: Past, Present, Future*
  Moderators: Saikou Diallo and Curtis Blais

Session III **10:30 – 12:00** **Room: Studio** **Session Chair: Fang (Cherry) Liu**

- *Exploring Reliability of Exascale Systems Through Simulations* (Dongfang Zhao, Da Zhang, Ke Wang and Loan Raicu)
- *Performance of an Intuitive Hash Table in Shared-Memory Parallel Programs* (Christopher Cischke)
- *Hybrid Parallel Algorithm For Simulation Of Seismic Wave Propagation In 3D Models Containing Intrusions With Complex Properties* (Viktor Kostin, Vadim Lisitsa, Galina Reshetova, Vladimir Tcheverda and Dmitry Vishnevsky)

Session IV **13:30 – 15:00** **Room: Studio** **Session Chair: Karl Rupp**

- *Simulating Resilience in Transaction-Oriented Networks* (Dmitry Zinoviev, Hamid Benbrahim, Greta Meszoely and Dan Stefanescu)
- *Storm Surge Simulation and Load Balancing in Azure Cloud* (Abhirup Chakraborty, Milinda Pathirage, Isuru Suriarachchi, Kavitha Chandrasekar, Craig Mattocks and Beth Plale)
- *Cloud MapReduce for Particle Filter-Based Data Assimilation for Wildfire Spread Simulation* (Fan Bai and Xiaolin Hu)

Session V **15:30 – 17:30** **Room: Studio** **Session Chair: William Thacker**

- *Multiple Objective Scheduling of HPC Workloads Through Dynamic Prioritization* (Tyler Simon, Phuong Nguyen and Milton Halem)
- *Arbiter Work Stealing for Parallelizing Games on Heterogeneous Computing Environments* (Wessam AlBahnassi, Dhrubajyoti Goswami and Sudhir P. Mudur)
- *Task Mapping in Rectangular Twisted Tori* (Cristóbal Camarero, Enrique Vallejo, Carmen Martínez, Miquel Moreto and Ramón Beivide)
- *High Performance Distributed Scheduling Algorithm* (Ankur Narang, Abhinav Srivastava and Rudrapatna Shyamasundar)

Wednesday, 10 April 2013

Session VI **8:30 – 10:00** **Room: Studio** **Session Chair: Fang (Cherry) Liu**

- Tutorial: *PETSc-Portable, Extensible Toolkit for Scientific Computation* (Karl Rupp)

Session VII **10:30 – 12:00** **Room: Studio** **Session Chair: Karl Rupp**

- Invited Talk II: *Niches, Long Tails, and Condos: Effectively Supporting Modest-Scale HPC Users* (Richard Wagner)
- Invited Talk II: *General Talk – HPC Experiment: Paving the Way* (Burak Yenier)

Session VIII **13:30 – 15:00** **Room: Studio** **Session Chair: William Thacker**

- *An Efficient Parallel Solution to the Wigner-Poisson Equations* (Anne Costolanski, C. Timothy Kelley, Gary Howell and Andrew Salinger)
- *Probability-One Homotopy Maps for Tracking Constrained Clustering Solutions* (David Easterling, Shahriar Hossain, Layne Watson and Naren Ramakrishnan)
- *Cache Efficient Implementation for Block Matrix Operations* (Lukas Polok, Viorela Ila and Pavel Smrz)

Session IX **15:30 – 17:00** **Room: Studio** **Session Chair: Fang (Cherry) Liu**

- *GPU-Based Monte Carlo Simulation for the Gibbs Ensemble* (Eyad Hailat, Kamel Rushaidat, Jason Mick, Loren Schwiebert and Jeffery Potoff)
- *GPU Accelerated Discontinuous Galerkin Methods for Euler Equations and Its Adjoint* (Martin Siebenborn and Volker Schulz)
- *An Efficient Implementation of Range-Doppler Algorithm on GPGPU* (Ramakrishna Reddy V, Tirupathi T, Anuradha R, Mahendra P, Pramod Kumar K and Geeta Varadan)

Symposium on Simulation for Architecture and Urban Design (SimAUD)

Agenda

Monday, 8 April 2013

Session I **13:00 – 15:00** **Room: Mission Ballroom E**

- *Simulating Nonlinear Nano-to-Micro Scaled Material Properties and Effects at the Architectural Scale* (Simin Wang, Andrew Lucia and Jenny Sabin)
- *The Faraday Pavilion: Activating Bending In The Design And Analysis Of An Elastic Gridshell* (Paul Nicholas, Elisa Lafuente Hernandez and Christoph Gengnagel)
- *Self-Learning Algorithm as a Tool to Perform Adaptive Behaviour in Unpredictable Changing Environments - A Case Study* (Elite Sher, Angelos Chronis and Ruairi Glynn)
- *Choreographic Architecture: Inscribing instructions in an Auxetic based material system* (Theodoros Themistocleous)

Session II **15:30 – 17:00** **Room: Mission Ballroom E**

- *Façade's Apertures Optimization. Integrating Cross Ventilation Performance Analysis In Fluid Dynamics Simulation* (Chrysanthi (Sandy) Karagkouni, Ava Fatah gen Schieck, Martha Tsigkari and Angelos Chronis)
- *A Review Of The Brazilian NBR 15575 Standard: Applying The Simulation And Simplified Methods For Evaluating A Social House Thermal Performance* (Tassia Helena Teixeira Marques and Karin Maria Soares Chvatal)
- *Thermal Reconstruction of a Crime Scene Using Calibrated Simulation* (Nathan Brown, Susan Ubbelohde, George Loisos, Santosh Philip and Ibone Santiago)

Symposium on Simulation for Architecture and Urban Design (SimAUD)

Agenda

Tuesday, 9 April 2013

Beginning Session 8:30 – 10:00 Room: Mission Ballroom E

- SimAUD Keynote Speaker: *Alvin Huang, Synthesis Design + Architecture/USC School of Architecture*
- *Modeling, Analysis and Simulation of a Form-Found Civic Sculpture for Lower Manhattan* (Zak Kostura, Erin Morrow and Ben Urick)
- *Visualization In 3ds Max For Cell-DEVS Models Based On Moving Entities* (Victor Freire, Sixuan Wang and Gabriel Wainer)

Session III 10:30 – 12:00 Room: Mission Ballroom E

- *Evaluating the Performance Robustness of Fixed and Movable Shading Devices Against Diverse Occupant Behaviours* (William O'Brien)
- *Simulating the Sensing of Building Occupancy* (Simon Breslav, Rhys Goldstein, Ben Doherty, Dan Rumery and Azam Khan)
- *Development of Discrete Event System Specification (DEVS) Building Performance Models for Building Energy Design* (H. Burak Gunay, Liam O'Brien, Rhys Goldstein, Simon Breslav and Azam Khan)

Session IV 13:30 – 15:00 Room: Mission Ballroom E

- *City Information Modeling (CIM) and Urbanism: Blocks, Connections, Territories, People and Situations* (Todor Stojanovski)
- *A Study of the Relationship Between Urban Form and Environmental Performance for Three Urban Block Typologies of Paris* (Ji Zhang)
- *End-node Approach for Street Network Simulation (Abstract)* (Hiroshi Ota)

Session V 15:30 – 17:00 Room: Mission Ballroom E

- *Designing-In Performance: Cloud based Simulation and Multidisciplinary Design Solution Space Search* (Shih-Hsin (Eve) Lin and David Gerber)
- *From Statistical to Diagrammatic Geo-Spatial & Time Based Data Visualization Through Parametric Modeling* (Ming Tang, Chris Auffery and Mingming Lu)
- *Integrated Design in the Simulation Process* (Martha Tsigkari, Angelos Chronis, Sam Conrad Joyce, Adam Davis, Shuai Feng and Francis Aish)

Symposium on Simulation for Architecture and Urban Design (SimAUD)

Agenda

Wednesday, 10 April 2013

Session VI **8:30 – 10:00** **Room: Mission Ballroom E**

- SimAUD Keynote Speaker: Anders Carlson, USC School of Architecture
- *Building Simulation Weather Forecast Files for Model-Based Predictive Control* (José A. Candanedo, Éric Paradis and Meli Stylianou)
- *How Hot Can the University Campus Get in 2050? Environmental Simulation of Climate Change Scenarios at an Urban Neighbourhood Scale* (Chengzhi Peng and Amr Elwan)

Session VII **10:30 – 12:00** **Room: Mission Ballroom E**

- *Improving Building Performance at Urban Scale with a Framework for Real-time Data Sharing* (Xiufeng Pang, Tianzhen Hong and Mary Ann Piette)
- *Isomorphic City: A Customizable Future Scenario* (Susannah Dickinson, David Gonzalez and Kyle Szostek)
- *A Collaborative Multi-Touch, Multi-Display, Urban Futures Tool* (Michael Van der Laan, Ronald Kellett, Cynthia Girling, Maged Senbel and Tao Su)

Session VIII **13:30 – 15:00** **Room: Mission Ballroom E**

- *Solutions for Scalability in Building Information Modeling and Simulation-Based Design* (Sixuan Wang, Gabriel Wainer, Rhys Goldstein and Azam Khan)
- *Evaluation of Indoor Climate in Low Energy Houses* (Liesbeth Staepels, Griet Verbeeck, Staf Roels, Liesje Van Gelder and Geert Bauwens)
- *HubPod: Integrating Acoustic Simulation In Architectural Design Workflows (*Brady Peters, Nicholas Williams, Jane Burry and Daniel Davis)

Session IX **15:30 – 17:00** **Room: Mission Ballroom E**

- *Data Mining Using ANN for Finding the Effects of Building Structure on Thermal Comfort* (Lubaid Ahmed and Abdolreza Abhari)
- *A Generalised Event Driven Framework For Building Occupancy* (Gandherva G and Aiswarya Prasannakumar)
- *Simulation for Planning Passenger and Freight Transportation System Projects* (Beth Kulick)
- *Preliminary Results of Model Predictive Control of Shading Systems* (Brent Huchuk, William O'Brien and Cynthia Cruickshank)
- Closing Remarks: Liam O'Brien and Azam Khan

Military Modeling & Simulation (MMS)

Agenda

Monday, 8 April 2013

Session I 13:30 – 15:00 Room: Bahia Belle Session Chair: Max Ehammar

- Invited Talk I – CNS'13 and MMS'13 Joint Session
  Visions of the Future Aeronautical Data Network (Dr. Max Ehammer)

Session II 15:30 – 17:00 Room: Bahia Belle Session Chair: Saikou Diallo

- *Introduction to knowledge management for military systems* (Kevin Gupton/ARL/UT)
- *Open Discussion on the future of MMS* (Saikou Diallo)

Tuesday, 9 April 2013

Beginning Session 8:00 – 8:30 Room: Bahia Belle Session Chair: William Thacker

- Introduction to Joint Sessions of the Spring Simulation Multi-Conference Military M&S Symposium and the Spring SIW Human Systems Modeling
  Moderators: Saikou Diallo and Curtis Blais

Morning Session 8:30 – 10:00 Room: Bahia Belle Session Chair: Saikou Diallo & Curtis Blais

- Joint Panel Session: *Human Social Culture Behavior (HSCB) Modeling: Past, Present, Future*
  Moderators: Saikou Diallo and Curtis Blais

Session III 10:30 – 12:00 Room: Bahia Belle Session Chair: Saikou Diallo & Curtis Blais

- *Modeling and Simulation for Improving Future Ambulance Patient compartments* (Deogratias Kibira)
- *Reasoning, Planning and Goal Seeking for Small Unit Combat Simulation* (Thomas Stanzione)
- *Low-Level Battle Management Language* (Anders Alstad)

Session IV 13:30 – 15:00 Room: William D. Evans Session Chair: Saikou Diallo

- *Collaborative Modeling & Tailored Simulation for COA Validation* (Mark Sumile)
- *A Realistic Implementation for Simulating Side-Channel in Mobile Ad Hoc Networks (Ming Li, Mazda Salmanian and Peter C. Mason)*
- *Representing the Ballistic Missile Defense System using Agent-based Modeling (Christopher Lynch, Saikou Diallo and Andreas Tolk)*

Session V 15:30 – 17:00 Room: William D. Evans Session Chair: Saikou Diallo

- *Evaluating the Applicability of Cloud Computing Enterprises in Support of the Next Generation of Modeling and Simulation Architectures* (Harry Johnson and Andreas Tolk)

Poster Track

Agenda

Posters will be presented during breaks Monday (8:00am – 5:00pm), Tuesday (8:00am – 5:00pm) and Wednesday (8:00am – 3:00pm)

- *DEV&DESS-Based Cyber-Physical Systems Modeling Language with Uncertainty Consideration* (Hae Young Lee, Ingeol Chun and Won-Tae Kim)
- *Discrete Event Simulator Benchmark Design* (Carl Hein and Jon Russo)
- *Simulation and Optimization of Systems With Delays (*John T. Betts, Stephen L Campbell and Karmethia C Thompson)
- *Transmitted Simulation from Vibrating Object Sound* (Yuta Kinoshita, Yuko Aoyama and Kazutaka Kitamori)

ABSTRACTS

Design and Evaluation of UAV Swarm Command and Control Strategies

Alexander Madey and Gregory Madey

Summary

We present an approach to developing unmanned aerial vehicle (UAV) swarming behaviors and command and control (C2) strategies to govern them. In recent years, the military has become increasingly interested in the development and applications of UAVs. Recent attention has shifted toward designing UAVs which are not only unmanned, but also autonomous or self-controlled. One possible method is to utilize a large number of small, autonomous UAVs which form a cohesive group or “swarm” to accomplish complex missions as a whole. Swarms offer numerous benefits over single UAVs which include higher coverage, redundancy in numbers and reduced long-range bandwidth requirements. A major challenge to engineering a swarm is not only designing the swarming behavior, but finding an effective way to control the behavior so that the swarm can be directed to complete the desired mission. In this paper, we used the agent-based modeling toolkit NetLogo to create two different mission types. We then created UAV swarming behaviors and ways in which those behaviors can be altered to accomplish each mission. Despite the fact that these models are still preliminary, and lacking in full realism, this work has demonstrated the potential usefulness of agent-based modeling in the engineering of UAV swarms.

Hierarchical Multi-Agent-Based Model for Simulating the Prevalence and Evolution of Influenza Virus

Takahiro Sasaki

Summary

To understand the fundamental behaviors of infectious diseases and to make effective plans for minimizing their negative impact, we need to simultaneously consider both the spatial spreading patterns of an infection among the host population and the temporal co-evolutionary dynamics between a pathogen and its hosts. In this paper, we focus on influenza, which has viruses as pathogens that are continuously changing, and propose a bi-layered, multi-agent-based simulation that combines two models: 1) an epidemic model, which describes how viruses are circulated among a host population, and 2) a virus evolution model, which describes how viruses change during a time course. The latter model includes genomic segments of the viruses whose evolutionary paths are guided by the composite selective pressures from the hosts' immunity and the intra-genomic constraints. By including a micro-level representation in the model, we show possible mechanisms that generate the limited diversity of viruses, which is one of the fundamental yet unexplained temporal characteristics observed in the evolution of influenza.

Themis-1: An Agent-Based Model of a Modern Monetary Reserve System

Sean Williams and Stephan Eidenbenz

Summary

We present Themis, an agent-based simulation of a modern reserve system, along with the financial components of the public sector, and a proxy for the nonbank members of the private sector. The simulation primarily revolves around the key interest rate that benchmarks private lending, which arises from agents' trading within a market for bonds and loans, along with the financial implications of that interest rate. Several tunable parameters allow a user to experiment with different policy configurations and levels of private demand for loans. We both validate the simulation against real-world data, and show the results of three unconventional policy settings: one in which the central bank "loses its appetite" for public debt, a second in which the treasury runs deficits without corresponding

debt issuance, and a third in which the central bank uses other policy tools to correct for some of the consequences of the second scenario.

Multi-hop Communications in a Swarm of UAVs

Rachael Purta, Saurabh Nagrecha and Gregory Madey

Summary

Unmanned Aerial Vehicles (UAVs) are of increasing interest to researchers because of their diverse applications, such as military operations and search and rescue. The problem we have chosen to focus on is using a swarm of small, inexpensive UAVs to discover static targets in a search space. Though many different swarm models have been used for similar problems, our proposed model, the Icosystem Swarm Game, to our knowledge has not been evaluated for this particular problem of target search.

Further, we propose to simulate the performance of this model in a semi-realistic communications environment. The challenge here is to find the optimal multi-hop configuration for the UAVs, so that they can find the most targets, avoid collision with each other as much as possible, and still communicate efficiently. We implement this through a weighted shortest-path problem using Dijkstra's algorithm, with the weights being the transmission cost over distance. Testing has shown that our multi-hop communications perform, in terms of target-finding and collision avoidance with other UAVs, as well as an idealized communications environment.

Examining the dynamics of epithelial metaplasia and pouchitis in an illeal pouch with a spatially-explicit computational multi-scale gut model (MSGM)

Chase Cockrell, Scott Christley and Gary An

Summary

In patients with a history of proctocolectomy with illeal pouch-anal reconstruction for ulcerative colitis (UC), epithelial metaplasia in the pouch, a conversion from the short crypts, high villi and few goblet cells of illeal mucosa to colonic-like mucosa with deeper and wider crypts, short villi and more goblet cells, appears to predispose to pouchitis. Inflammation is known to be associated with both pouch metaplasia and pouchitis, but the mechanisms by which the histological transformation occurs, and the functional consequences thereof, are unclear. We propose that appropriate contextualization of the role of inflammation on metaplasia requires understanding the cellular control system that determines the epithelial crypt-villus architecture. Towards this end we have developed spatially explicit computational model, the multi-scale gut model (MSGM), in order to dynamically represent existing knowledge concerning the behavior of gut epithelial tissue, and to help posit and visualize plausible mechanistic relationships between molecular and genetic entities of interest and provide predictions as to the most promising lines of future inquiry.

Investigation of Normal Colonic Crypt Behaviors Through Agent-based Simulations

Matthew Saponaro, Keith Decker, Bruce Boman and Gilberto Schleiniger

Summary

When studying colonic cancer, medical doctors can use simulations of parts of the colon, called crypts, to test hypotheses about system dynamics instead of testing live patients. Development of more accurate models can lead to better understanding about the processes involved in both normal and

cancerous crypt development. Researchers have gained valuable insight of the human colonic crypt over the past few years; however, much is not known which gives rise to the necessity of mathematical models to more fully understand crypt behaviors. Existing modeling methods, such as global stochastic or global deterministic models, fail to include accurate depictions at a crypt's cellular level—where cancer is suspected to develop. These features involve the physical state of the crypt, as well as chemical triggers that control cell behavior and signal cell mutations. To address this problem, we present the development of a simulation of a normal human colonic crypt using agent based modeling to more fully understand how crypt dynamics maintain the form and function of the colonic epithelium. Particularly, we focus on cell-matrix dynamics represented by linearly elastic spring connections to neighboring cells as well as linearly elastic spring connections to its own underlying basal layer. Furthermore, we regulate the physical movement of the cell through chemical feedback regulations of APC and WNT to regulate cell processes such cell division and cell adhesion to its surrounding environment. Choosing agent-based modeling to simulate this complex system allows researchers to succinctly describe human colonic crypts with both deterministic and stochastic behavior, and to formulate hypothesis about the effect of state changes—particularly in crypt formation, and to validate those hypotheses.

Evolutionary Intelligent Agent Modeling for Emergent Warship Combat Simulation

Chan-Ho Jung, Yong-Jun You, Sung-Do Chi, Jae-Ick Kim and Seung-Jin Han

Summary

Traditionally, national defense relies on human-based warfare simulations to assess risks, optimize missions, and make operational, tactical and strategic decisions. However, these approaches are extremely expensive and do not enable analysts to explore all aspects of any given problem nor create emergent behaviors. The major goal of this paper is to propose a methodology for designing an evolutionary intelligent agent system and then to introduce how to generate a wide array of possible simulation trajectories based to the evolution process for finding emergent tactical solutions. To do this, we have employed the model-based architecture concept for building the intelligent agent architecture as well as the genetic algorithm for developing the evolutionary simulation environment. Our approach is differentiated with others in that it (i) provides the evolutionary model-based agent modeling methodology, (ii) supports evolutionary simulation so as to automatically generate emergent behaviors, i.e., emergent tactics. Several simulation tests have been successfully performed to demonstrate the feasibility of proposed approach.

Agent-based Simulation for UAV Swarm Mission Planning and Execution

Yi Wei, Gregory R. Madey and M.Brian Blake

Summary

Swarms of Unmanned Aerial Vehicles (UAV) have been foreseen by multiple organizations to serve an important role in future air-based warfare and civilian operations. UAVs are less expensive than their piloted counterparts, provide greater flexibilities and remove the need for on-board pilot support. Efficient control of swarms opens a set of new challenges, such as automatic UAV coordination, efficient swarm monitoring and dynamic mission planning. In this paper, we investigate the problem of dynamic mission planning for a UAV swarm. An agent-based control framework is proposed, which employs a control agent for task assignment and multiple UAV agents for local task scheduling. A prototype simulation framework is implemented as a proof-of-concept. Experimentation with the framework suggests the effectiveness of swarm control for several mission planning mechanisms.

Agent-Directed Simulation (ADS)

Abstract

Network-Based Trust Games: An Agent-Based Model

Shu-Heng Chen and Tong Zhang

Summary

This paper presents an agent-based model of the network-based trust game by combing two essential ingredients, namely new economic geography and cooperative games. Through simulating this model, we would like to show the co-evolution of trusts, networks, economic growth and income distribution. Variations of the proposed design allow us to examine the role of social trust in economic growth and can allow us to further explore the effect of culture and personality in the trust-based growth theory.

Agent-Based Simulation of Cooperative Hunting with UAVs

Ryan McCune and Greg Madey

Summary

Methods to control agent swarms for intelligent behavior is an open problem. With enhanced UAV capabilities, more problems in American defense may be approached from an agent-based perspective. An agent swarm approach for dynamic cooperative cleaning is augmented with an additional behavior to form a distributed optimization problem. Agent behavior is simulated with an agent-based model.

Multi-level modeling as a society of interacting models

Benjamin CAMUS, Christine BOURJOT and Vincent CHEVRIER

Summary

We use the multi-agent paradigm to envisage multilevel modeling as a society of interacting models. We propose a framework to better specify what concepts are used in multilevel modeling and what are their relationships. This framework is implemented through the AA4MM metamodel which benefits of a middleware layer. We use it to implements some proofs of concept examples where we show the ability of this approach to rapidly change from one pattern of interaction to an another by reusing some of the components.

Impact of Population Relocation to City Commerce: Micro-Level Estimation with Agent-Based Model

SeHoon Lee, JoonSoo Shin, GeunHo Lee and Il-Chul Moon

Summary

To reduce overpopulation around Seoul, Korea, the government implemented a relocation policy of public officers by moving the government complex. This implies that there will be a negative impact to the suburban area that originally hosted the complex, but we do not know the magnitude of the impact. Therefore, this paper presents a micro-level estimation of the impact with an agent-based model. This model is calibrated using the micro-level population and time-use datasets. Agent behavior is formally specified to illustrate the model transparently so that other modelers can replicate the model. Our virtual experiment indicates that the city commerce will not be affected unless the public officers relocate with their families; if they relocate with the whole family, the impact will be significant. We provide this impact analysis at the building level to support further urban planning and public policy.

Implementing RSVP-Based Capacity Admission in OPNET Modeler

Flavius Pana and Ferdi Put

Summary

OPNET Modeler represents nowadays one of the most important simulation tools used by the research community in the area of Quality of Service (QoS). Because of the complexity and of the multitude of configurations that are possible in a network domain or in the Internet, a number of specific implementations of QoS mechanisms are not yet available in simulation tools. This paper presents a new type of queue configuration mechanism that enables the dynamic creation of Resource Reservation Protocol (RSVP) queues, while maintaining the properties of the Differentiated Service (DiffServ) queue scheduling discipline for a specific interface. Practical considerations for extending the queue management facilities and supported QoS abilities of OPNET Modeler are illustrated.

Wireless Sensor Network Simulation with Xen

Paul Harvey and Joseph Sventek

Summary

The large-scale and inaccessibility of deployed wireless sensor networks mandate that the code installed in sensor nodes be rigorously tested prior to deployment. Such testing is primarily done using software simulators. Discrete event simulators, by their very nature, mask race conditions in the code since simulated interrupts never interrupt running code; an additional limitation of most such simulators is that all simulated nodes execute the same application code, at variance with common practice in actual deployments. Java-based simulators often suffer from efficiency issues, which limits the scale and performance of the simulation. Since all of these problems reduce confidence in the deployed system, the focus of this work is to eliminate these problems via complete emulation of wireless sensor networks using virtualisation techniques in a scalable manner. This work describes the virtualisation of the Contiki, TinyOS, and InceOS wireless sensor network operating systems to execute as guest domains over the Xen hypervisor. In each case, the hardware virtualisation is performed at the lowest possible layer, maximising the amount of OS and application code which is executed during the emulation. This work also introduces a novel Xen-specific radio model mechanism, easing the introduction of different radio models for use during emulations.

MobiSIM: A Simulation Library for Resource Prediction of Smartphones and Wireless Sensor Networks

Markus Buschhoff, Jochen Streicher, Björn Dusza, Christian Wietfeld and Olaf Spinczyk

Summary

The prediction of resource consumption is an essential task in the development of heavily resource-constrained systems, like smartphones and wireless sensor networks. In particu- lar, good estimations on energy consumption are difficult to achieve, as they depend on the application's behavior, the used hardware and environment parameters. To address these issues we introduce MobiSIM, an open-source1 OMNeT++ simulation library. MobiSIM allows the modeling of embed- ded systems to gain valuable information on the system's dynamic characteristics of resource consumption. The ben- efit of MobiSIM over other simulation systems is the focus on resource usage. Most other simulators focus on highly detailed system models to allow for the execution of native program code. These simulators are highly platform specific and complex to handle. We decided to use a coarse-grained, event-driven and platform-independent system model while still using detailed resource models for various devices. We will show that for several simulation purposes the application code can be modeled by a behavioral description, rendering instruction-accurate code execution unnecessary.

Performance Analysis of Sampling-based Turbo Coded NCQFSK for Image Data Transmission

Junghwan Kim, Pooja Raorane, Mona Nasseri and Mansoor Alam

Summary

In this paper, we propose the efficient turbo code metric calculation methodology for noncoherent Quaternary Frequency Shift Keying (NCQFSK) which is suitable for sampling–based computer simulation. In its branch metric calculation for turbo coded NCQFSK under AWGN, four decision statistics having either Rician or Rayleigh probability density functions must be accounted for in the decoding process. In this regard, this paper clarifies the mathematical details of utilizing the four NCQFSK demodulator outputs so that sampling-based turbo decoding can be realized. Results of BER performances using the named waveform are shown for turbo code rates of 1/3, 1/2 and 2/3 under AWGN and a comparative assessment along with convolutional code is presented to check validity of the proposed metric calculation procedures. These results are further extended to include implementation of RS–turbo concatenated scheme for NCQFSK towards practical use with minimal number of decoding iteration. Finally the proposed turbo coded NCQFSK is applied to the image data (64x 64 pixels of Gray scale) transmission under AWGN to check the effectiveness in the multimedia data transmission.

Stochastic Agent-Based Simulations of Social Networks

Garrett Bernstein and Kyle O'Brien

Summary

The rapidly growing field of network analytics requires data sets for use in evaluation. Real world data often lack truth and simulated data lack narrative fidelity or statistical generality. This paper presents a novel, mixed-membership, agent-based simulation model to generate activity data with narrative power while providing statistical diversity through random draws. The model generalizes to a variety of network activity types such as Internet and cellular communications, human mobility, and social network interactions. The simulated actions over all agents can then drive an application specific observational model to render measurements as one would collect in real-world experiments. We apply this framework to human mobility and demonstrate its utility in generating high fidelity traffic data for network analytics.

On an Integrated Mapping and Scheduling Solution to Large-scale Scientific Workflows in Resource Sharing Environments

Daqing Yun, Qishi Wu, Yi Gu and Xiyang Liu

Summary

Next-generation e-science applications feature large-scale data-intensive workflows comprised of many interrelated computing modules. The end-to-end performance of such scientific workflows depends on both the mapping scheme, which determines module assignment, and the scheduling policy, which determines resource allocation if multiple modules are mapped to the same node. These two aspects of workflow optimization are traditionally treated as two separated topics, and the interactions between them have not been fully explored by any existing efforts. As the scale of scientific workflows and the complexity of network environments rapidly increase, each individual aspect of performance optimization alone can only meet with limited success. We conduct an in-depth investigation into workflow execution dynamics of both mapping and scheduling, and propose an integrated solution, referred to as Mapping and Scheduling Interaction (MSI), to achieve a higher level

of resource utilization and workflow performance. The efficacy of MSI is illustrated by extensive simulation-based workflow experiments.

Integration of Test-Driven Agile Simulation Approach in Service-Oriented Tool Environment

Vitali Schneider and Reinhard German

Summary

The approach of test-driven agile simulation combines model-based simulation and testing techniques to achieve an improved overall quality during the development process. It intends to provide a cheap and agile technique to validate the models in several iteration steps during early engineering phases. Designated phases of this process can be automated and supported by specialized tools. Originally, the suggested tools have been integrated in one framework, which was only accessible on a single machine. In this paper we show how this approach could be integrated in a distributed, service-oriented tool environment to profit by the advantages of the service-based architecture, such as higher accessibility, interoperability and extensibility. Towards this goal, we specify loosely coupled services for validation, transformation and simulation of models, which may exchange data through formally defined interfaces. Based on common technologies and standards these services are integrated in a heterogeneous development environment to support the whole development lifecycle.

Scalable And Transparent Approach To Media Archive Using Digital Object Architecture

Tu Hoang and Lan Yang

Summary

The blooming age of the Internet and technology advancements in hardware and software infrastructure have introduced a major shift from text-based to media-based information, from static web pages or small text files to interactive media-rich representation. The exploding number of media files yield a challenge in storage, management and ownership, the rapid technology advancements impose potential integration and scalability problems. This paper proposes an architecture for media archival that supports scalability and transparency by adopting the components of Digital Object Architecture, a powerful open-source architecture for information management developed by Corporation for National Research Initiative. We design and deploy a small-scaled system on Windows Azure Cloud Service and fork a client application to demonstrate the interaction between clients and the system. We also mount several tests against the system to verify its functionality and measure its performance under increasing load. Experimental results demonstrate the ability of our architecture to support transparent media storage, access and management over a very long time frame, and also the ability to scale to handle large load. However, our results also indicate that the storage component yields low utilization rate due to non-optimal load-balancing mechanism.

Accurate and Efficient Algorithm for Estimating the Reliability of Digital Combinational Circuits

Walid Ibrahim

Summary

As the size of CMOS devices is aggressively scaled deep into the nanometer range, the manufacture of future nano-circuits will become extremely complex and will inevitably introduce more defects, including more transient faults that appear during operation. For this reason, accurately calculating the reliability margins of future designs will become very critical for nano circuit designers as they investigate design alternatives to optimize the trade-offs between the conflicting metrics of area-power -delay versus reliability. However, accurately estimating the reliability margins of large and highly

connected circuits is a complex and very time consuming process. This paper presents an efficient and accurate solution for estimating the reliability of digital combinational circuits. The simulation results show that the solution is accurate and scales well with the circuit size and the length of the input vector.

Parallel Microscopic Simulation of Metropolitan-scale Traffic

Ricardo Fernandes, Fausto Vieira and Michel Ferreira

Summary

We present a scalable and high-performance microscopic simulator capable of simulating metropolitan-scale traffic. We analyze the requirements for a realistic level of detail and present techniques for optimizing the performance of the simulator and maintain coherence when scaling into parallel computing architectures. To demonstrate its capabilities, we simulate the San Francisco Bay Area road network. Finally, we provide a performance comparison with other free/open- source simulators and show that our simulator not only out- performs existing solutions but also scales well when running in multi-core environments.

Using Crowdsourced Geographic Information from OpenStreetMap for Discrete Event Simulation of Logistic Systems

Torben Meyer, Matthias Trojahn and Steffen Strassburger

Summary

This article investigates the usability of crowd sourced geographical information from systems such as OpenStreetMap (OSM) for logistic simulation. Our investigations are motivated by the need to efficiently and quickly build simulation models containing complex infrastructure elements such as streets, rails, waterways, and their junctions. We, therefore, discuss the representation of such data in geographical information systems as well as possible export and import mechanisms. We further suggest transformations of the exported data for facilitating its use for logistics simulation. We finally introduce a prototype based on OSM data of the Volkswagen plant in Wolfsburg (Germany) and report some performance results.

On Learning How to Plan Content Delivery Networks

Moises Rodrigues, Andre Moreira, Arthur Callado, Ernani Azevedo, Marcio Neves, Josilene Moreira, Djamel Sadok and Victor Sousa

Summary

There is a stringent lack of integrated CDN planning tools. P2PCDNSim, a comprehensive CDN simulator, is presented in this work. The result of a three-year project effort, it allows performance analysis of a wide range of CDN scenarios. The present simulator performs similarly to the ns-3 and CDNsim public simulators at the packet and CDN domains respectively. Using CDNP2Psim, highly detailed CDN scenarios can be built and analyzed by an ISP, including customer access such as ADSL link asymmetry and broadband technologies. Overall and cross ISP traffic metrics are captured and shown to the planner in real-time. CDN known metrics such as the cache hit ratio and startup delay are also portrayed in real-time. All these metrics are captured during simulation and shown in a multi-layer simulator that can be easily extended and its parts reused. With it, we learned that dynamically selecting a good location for the caches has a great deal of influence on the total network traffic and that traffic asymmetry has a great effect on cross traffic, especially on P2P-based or hybrid CDN-P2P

networks. We also learned that a proper evaluation of cache algorithms according to traffic profile can also improve Quality of Experience metrics through the selection of the most appropriate algorithm.

Cost-benefit analysis of Digital Rights Management products using stochastic models

Wen Zeng, Kaiyu Liu and Maciej Koutny

Summary

Digital Rights Management (DRM) has been proven effective and successful in protecting the confidentiality of sensitive documents by providing access control. However, the cost and benefit of these products have not been analyzed in a systematic and quantitative manner to date. As a result, companies do not have an established procedure to evaluate the cost and benefit of implementing these products. In this document, the benefits of implementing DRM products in enterprises are quantified using stochastic Petri-net models and are compared with the security needs of a corporation and potential costs incurred by the implementation process. An evaluating procedure for implementing DRM products is established. This procedure has the potential to be used to improve the ability of a corporation to make sensible security investment decisions.

The implementation of MS IRM (Microsoft Information Rights Management), one of the DRM products, was studied as a type case. In this case study, the MS IRM system was analyzed; a group of security metrics were developed for measuring and evaluating the effectiveness of the MS IRM system, in terms of increased security provided. Stochastic models are a core part of the process. It was found that the business process is a critical factor in determining document security. Although DRM products improve security, they typically increase the cost to the company and potentially reduce the productivity of staff. Therefore, for a successful deployment of the DRM system, it is recommended that a company evaluate the benefit and cost of DRM systems quantitatively using the procedures described in this document.

Flow Count: A CDN Dynamic Replica Placement Algorithm for Cross Traffic Optimization

Moises Rodrigues, Andre Moreira, Marcio Neves, Arthur Callado, Ernani Azevêdo, Djamel Sadok and Victor Souza

Summary

Content Distribution Networks (CDN) are a popular technology to deliver content and have attracted great interest in recent years. CDNs main idea is to place content replicas closer to the end user by geographically distributing replica servers. One important research point concerning the CDN universe is how to decide where replica servers will be placed. Algorithms that try to tackle this problem are Replica Placement Algorithms (RPA). In this paper we propose a new dynamic RPA strategy, very similar to the Greedy strategy, based on the count of data flows through network nodes. Our experiments show better results using the proposed Flow Count Strategy than using Greedy or Hotspot algorithms when considering cross traffic with similar quality of experience. Also, the obtained results show that Flow Count seems to place replica servers more efficiently during local flash crowd events.

Invited Paper: Visions of the Future Aeronautical Data Network

Max Ehammer

Summary

Abstract: Operations relevant for air traffic management are based on procedures communicated through speech commands. These procedures are human centric, thus un-automated. Following predictions of air traffic growth forecasts, air traffic will increase no matter which forecast model is taken into account. High density air traffic areas become inefficient to handle through un-automated procedures. As a result air traffic management requires support of automated and consequently data based processes. Such processes could only be supported if data communication services are offered homogeneously in relevant areas. That is, data link and network services have to be interoperable on a worldwide basis. Currently large scale industry consortia in Europe and the United States are focusing on increasing efficiency of air traffic management through advanced concepts based on data communication applications. These activities demand a lot of coordination amongst participating organizations in order to achieve technical, economical, and political consensus amongst all partners. This talk will address the status quo of aeronautical data communication services, visions of possible emerging aeronautical data links, and the integration of these data links into an all IP based communication system relevant for air traffic management and operations, respectively. The presented topics are based on recent studies showing not only simulation results but also results from flight trials.

Event Detection and Trending in Multiple Social Networking Sites (Extended Abstract)

Shakira Banu Kaleel and Abdolreza Abhari

Summary

A continues rise in popularity of social media motivates many people to express their opinions and news on the real-time basis. In this paper, the social networking sites such as Twitter and Facebook are considered as a platform for event detection. Since social information streams are sparse and continuous, the processing time and speed are vital while detecting events. We suggest a novel approach of discovering events from multiple social streams using widely used Euclidean realization of locality sensitive hashing (LSH) algorithm. In our proposed method, the LSH is used twice in event detection. Firstly, it is used to obtain the events independently from both social streams. The cross-over events between social networks are detected by applying the algorithm one more time. The detected events can be trended to show its activeness on different networks. We explore a theoretical approach on design of event detection and trending in multiple social sites.

Information Retrieval in Web 2.0- Role of Tagging and Folksonomies

Poornima Prabhu and Dr. Abdolreza Abhari

Summary

The present paper proposes the concept of folksonomies and tagging in a professional networking site LinkedIn with justification that the existence of tagging and folksonomies, enhance the information retrieval in Web 2.0. In recent years, Web 2.0 has become so popular where more and more people are collaborating over the internet .Folksonomies are the characteristics of web 2.0 which are user generated tagging services. Literature shows that folksonomies enhance the information retrieval in web 2.0 to greater extent. In this paper we study the role of tagging and folksonomies in social information retrieval, types of Folksonomies and related algorithm taking Bibsonomy, a social bookmarking system into consideration. Further, a case study has been discussed about, advantages

of tagging over the traditional file search systems. The relation between the users, tagged documents and tags has been summarized in this paper. Even though tagging plays a major role in enhancing the information retrieval, literature shows uncontrolled vocabulary hinders the potential of tagging process. Objective: The concept of tagging and folksonomies doesn't exist yet in a professional fast growing networking site LinkedIn. In this paper we propose a concept of folksonomy in LinkedIn website to perform the information retrieval efficient and making LinkedIn superior.

Toward Authorization as a Service A study of the XACML standard

Romain Laborde, François Barrère and Abdelmalek Benzekri

Summary

Cloud computing has promoted the notion of service as the leading way to deliver and consume computing resources. Today, security is going down that road and the term security as a service is emerging. Authorization that consists in managing permissions is one of the main classic security services. We propose in this article to study how authorization could be delivered/consume as a Service. We focus on the XACML standard that has been adopted by the cloud security community because of its native flexibility and adaptability properties. Although XACML seems to fulfill the requirements of authorization as a Service in theory, it is very complex to realize it in practice. We propose a service oriented component architecture together with the concept self-contained policy to cope with this issue. This approach allows both the cloud consumers to adapt the authorization system to its authorization policy and the cloud provider to minimize the cost of providing a flexible authorization service.

Multifaceted Modeling and Simulation Framework for System of Systems Using HLA/RTI

Byeong Soo Kim, Chang Beom Choi and Tag Gon Kim

Summary

The multifaceted system modeling method represents all the components and alternatives of a system. As one of these methods, the System Entity Structure/Model Base (SES/MB) enhances the organization of model families as well as, storing and reusing model components. However, the real world can be described not only as an individual system but also as a collection of those systems, which is called a system of systems. Because SES/MB is limited in simulating the system of systems using HLA/RTI, an extended framework is required to simulate the system of systems. This paper proposes a System of Systems Entity Structure/Federate Base (SoSES/FB) framework for simulation in a distributed environment. The proposed framework provides a library of simulators (FB) and SoSES formalism, which represents structural knowledge of a collection of simulators. It also provides a new federation synthesis process. The paper introduces a simulation of a warship's anti-missile defense system using the proposed SoSES/FB framework.

P2P Grid Technology for Virtual Classrooms and Laboratories

Hassan Rajaei and Nada Hakami

Summary

Computing technologies can play important role in Virtual Classrooms and Laboratories (VCL) and e-learning settings. In these systems, the underlying computing platforms enable large number of students across the globe to collaborate and interact with each other as well as with the learning components. A typical VCL can be setup based on a traditional or Peer-to-Pear (P2P) Grid Computing. While several VCLs are currently using the traditional Grid, few have been reported utilizing P2P Grid.

The latter provides with an alternative computing system, which mainly targets the scalability of the system and often with improved flexibility and interactions. We studied whether P2P Grid could provide an improved platform over its counterpart. We inspected large number of systems, examples of which are presented in this paper. We scrutinized their features, capabilities, and performance. Our investigation indicates that P2P Grid exhibits a superior behavior over its traditional counterpart for VCL setting. This is especially true for courses such as Parallel Computing, Simulation, and Networking since P2P Grid offers accessing to larger scale computational and data resources as well as much improved collaborative environment in heterogeneous and distributed communities.

BGSU Grid: An Experimental and Educational Grid Environment

Hassan Rajaei, Amber Dhavale, Moheeb Alwarsh and Peter Dillon

Summary

Grid computing enables massive scale computation with resources that are geographically dispersed over large area. With the advent of Grid Computing, computer resources comprising of different administrative domains are able to be coupled together to working towards a common goal. It also enables user to perform high computing tasks. Apart from these, it is also useful for students, educators, and researchers as they can perform their experiments on the grid and use its tremendous computation potential to a great extent. One such effort regards creating a computational grid to benefit the users of the scientific and distributed computing community at BGSU. This paper presents the architectural details and the steps needed for the development of a working grid for educational purposes. It presents the actions needed to setup the infrastructure for the grid creation. It explains how to create virtual clusters, configure them and add them to the grid. It also explains the steps needed to install the Globus toolkit which provides the communication channel between all the clusters in the grid. Finally, the paper provides suggestions to make this grid even more flexible and improved high computation tasks.

Putting Logic in Modeling of Biological Neuron – A New Framework

Aftab Ahmad and Richard Wells

Summary

In this paper and the accompanying presentation, we discuss various frameworks used for modeling communications among biological neurons and their networks. Following the framework discussion, we highlight various modeling attempts made in the past, their strengths and limitations. Along the way, we present the role of technological advancements in making headways in quantitative modeling, and the state-of-the art in such techniques. We also present a novel framework in which a neural processing unit is viewed as a node in a heterogeneous network of clusters of neural processing units. Neural processing units are scalable as appropriate for various levels of modeling in the central nervous system (CNS). We believe this scalability is feasible from the neuron and sub-neuron level all the way up to major tissue systems encompassing millions of neurons. The approach has similarities to the one presented by Cohen and Grossberg (Human Neurobiology 1986 5:1-22) in explaining speech and Damasio (Cognition 33(1989) 25-62) in explaining neural basis of memory and recognition. In the proposed framework, we view a neural processing unit ("neuron") as consisting of interconnected smaller units ("organelles") that together generate a composite signal ("activity") consisting of physiological and logical groups of signals. These groups are responsible for specific tasks, such as physiological signaling, signal routing and mental function coding (neural code) with 'standard' interfaces between signal groups. We contend that despite the variety of signals processed

in the CNS, the interfaces between same signal groups are in some sense "standardized" for all communications. In our framework, we define an organelle as source of a distinct signal group. Thus it does not have to be the sub-somal organelle delimited by its own membrane. The benefits of such a framework are that (i) it assumes that the mental function is topologically coded in only a subset of the neuronal signals that gives the possibility of restricting research on mental functions on certain parts of neuronal signals (Malsburg, Handbook of Brain Theory and Neural Networks, 2003, pp. 365-8), and (ii) it assume standardized interfaces between logical signal groups that makes it possible to have common models of different mental functions, such as cognition, memory, neuro-muscular and audio-visual functions. We will present various experimental set ups possible for deriving quantitative models under this framework.

Simulation of Mobile Networks using Discrete Event System Specification Theory

Mohammad Moallemi, Gabriel Wainer, Shafagh Jafer, Gary Boudreau and Ronald Casselman

Summary

The fourth generation (4G) of mobile telecommunica-tion technology provides ultra-band internet access for mo-bile devices such as smartphones, tablets, and laptops. One of the challenges in the Long Term evolution (LTE) 4G networks is the low data rate for cell-edge users as well as coverage gaps. In this paper, we define and evaluate models for analysis of performance of mobile networks architectures defined by 3GPP. We used the Discrete-Event System Specification (DEVS) formalism to model the mobile networks and implement the framework. The proposed model implements the deployment layout of the Base Station (BS) cellular antennas, and it manages the distribution and movement of the User Equipment (UE) devices. The model calculates the Propagation for each BS, as well as the pathloss in the links between BSs and the UEs in the range. It also computes the power received by the BS and the UE in each link. These results will be used in the design of models for Coordinated Multipoint approach in delivering faster data.

DEVS-based Modeling of Coordinated Multipoint Techniques for LTE-Advanced

Misagh Tavanpour and Gabriel Wainer

Summary

Considering the ever increasing bandwidth demand of the users in cellular networks, there has been many efforts to offer new standards to support users' requirements and increasing their performance in mobile networks. One of the promising mobile communication standards for the Fourth Generation (4G) cellular systems is Long Term Evolution Advanced (LTE-Advanced). This technology tries to provide high data rates and to improve the users' quality of service by using a number of technologies including the Coordinated Multipoint (CoMP) method. Here we have used Discrete Event System Specification (DEVS) formalism to model a mobile network using two approaches in CoMP: Coordinated Scheduling/Beamforming and Joint Processing. Results reveal that by using these approaches the interference level decrease and also cell edge users experience higher performance.

Using an Agent-Based Friend Circle Creator Model to Analyze Drivers of Consumer Choice: Network Effects Vs. Value Proposition

Farhaan Mirza and Fernando Beltrán

Summary

Network industry products and services rely on designing competitive business models including aspects of consumers attracting other consumers. Consumer decision-making is a complex process

involving rich attributes that include value proposition consideration and network effects. Using compatible products within an organization, home or friends results in greater utility and satisfaction emphasizing the consumer decisions are not just based on value but also what their peers recommend and use. This paper presents a generic Friend Circle Creator (FCC) Agent Based Model (ABM), which leverages network formation theory to create and evolve friend circles of consumer agent population. These friend circles can be used to simulate consumer decision-making scenarios for cases present with network externalities. This can be effective for the analysis of drivers and business models in network industries via agent based modeling. We apply the FCC model to a mobile phone plan case study. The results of this case study demonstrate how presence of network effects is able to retain a large population of consumers in an inefficient deal. FCC can be used as a module to complement larger ABMs to enhance analysis in studying drivers of consumer decision-making.

Accurate Heavy Tail Distribution Approximation for Multifractal Network Traffic

Jeferson Stenico and Lee Luan Ling

Summary

In this paper, we propose the use of a Gaussian mixture model to represent the heavy tail distribution of modern network traffic traces. Another novel contribution of this work is the derivation of a general expression for loss probability estimation in a single server queueing system for traffic traces with multifractal characteristics. The efficiency of this statistical modeling and the accuracy of the estimated loss probabilities are experimentally validated by comparing with other four multifractal based approaches: two of them considering two specific heavy tail distributions (lognormal, Pareto) and the well-known MSQ (Multiscale Queue) and CDTSQ (Critical Dyadic Time-Scale Queue) methods.

Modeling the Access Market of the Two-Sided Ultra Fast Broadband Platform in New Zealand

Farhaan Mirza and Fernando Beltrán

Summary

Local Fibre Companies (LFCs) and the government of New Zealand are jointly implementing a nation-wide fibre-optics network, a project known as the Ultra-Fast Broadband (UFB) initiative, expected to cover 75% of households by 2019. New opportunities are expected to open up because the UFB network by regulation forbids LFCs to directly provide retail services. Consumers will need to purchase fibre services from Retail Service Providers (RSPs). The UFB represents a scenario of a two-sided platform, with consumers and RSPs on each side. Using two-sided platform theory and normative economics this paper presents theoretical model by Beltrán (2012) and extends it to an agent-based simulation. The results assured having a great number of users on one side increases the number of users on the opposite side. The UFB platform currently subsidizes fibre lines for consumers. The industry debates whether subsidization should continue; the results indicate that subsidy can be reduced when a large number of users on either side appear in the market. This case study presents us with a timely unique opportunity to analyze the issues involved as the market evolves and stabilizes.

Design and Implementation of Hybrid Topology Discovery Protocol for MPLS-TP Network

Jin Seek Choi

Summary

In this paper, we propose a hybrid topology discovery protocol for mobile backhaul. As a distributed neighbor discovery protocol, we use IEEE 802.1AB LLDP protocol. For collecting the neighbor

information and topology construction, we utilize a centralized control and management controller as an extension of PCEP and PCE protocols (RFC 5440 and 4655). We demonstrate the efficiency of the proposed protocol on an actual MPLS-TP based test-bed.

Performance Analysis of Current Data Hiding Algorithms for VoIP

Harrison Neal and Hala ElAarag

Summary

Steganography techniques attempt to hide pertinent information inside of other harmless information, so as to avoid detection by an adversary. A good amount of research has been done thus far on mediums that aren't processed in real-time. User-friendly products using these techniques can easily be purchased by average consumers. Real-time mediums have recently received attention as VoIP and other real-time media has entered the mainstream. Several approaches for hiding information within VoIP streams in real-time have been proposed, but little has been done to compare the performance of the algorithms proposed in the literature. In this paper, we test several current data hiding techniques on a variety of G.711 audio recordings, with the intent of giving readers a clearer understanding of which of the algorithms would best suit their purposes. We use important performance metrics to evaluate the algorithms, namely, throughput, noise-to-signal ratio and the Perceptual Evaluation of Speech Quality algorithm. Our results show that the method by Aoki allows for best throughput during silence and low volume conditions, and both methods by Ito et al, and Miao and Huang offer good throughput in noisy environments. Vulnerability to steganalysis is also considered. We devise a technique that illustrates that the algorithm by Miao and Huang is detectable as well as other LSB-based algorithms which have already been shown to be detectable by other means.

Secure Data Transmissions

Thouraya Bouabana-Tebibel, Nidal Teibibel and Selma Zemmouri

Summary

In Mobile Ad hoc networks energy is a critical resource, highly consumed by routing functions. In order to preserve it, nodes may decide not to participate in forwarding others' packets and drop them. Isolating these nodes is an efficient solution to decrease packet's loss. We propose in this paper a new secure protocol to monitor, detect, and safely isolate such misbehaving nodes. The proposed solution is based on the Probing technique. It also uses hash chains and Diffie-Hellman protocol to authenticate the nodes during data exchange. The secure protocol is analyzed using the NS-2 simulator.

Hash Chain to Secure Proactive Protocols

Thouraya Bouabana-Tebibel and Khadidja Ayad

Summary

Several secure extensions have been proposed to deal with the OLSR proactive routing protocol security, but they often involve a very high resource consumption that degrades network performances. The protocol ADVSIG is one of these extensions. It presents an efficient security approach, but generates very high computational costs due to the cryptographic operations it performs on the control messages. In this paper, we present a secure mechanism for OLSR, based on ADVSIG protocol, that we call ADVHCA. Its purpose is to improve ADVSIG performances using hash chains to reduce the cost of securing HELLO control messages. A watching mechanism is also

proposed to counter the wormhole attack. The whole solution is simulated and analyzed using NS2.

A Recommendation System for Twitter Users in The Same Neighborhood

Meshary AlMeshary and Abdolreza Abhari

Summary

This paper proposes a new idea that Natural Language Processing, Google Translate API's and Fuzzy Set concept can be used to help the twitter user who has moved to a new society or culture, for example, a student moving to Toronto, Canada from his/here native country of Saudi Arabia. It discusses taking history tweets in his/her mother language and predicting interests after he has moved to his/her new location. Then this proposed system translates these interests, searches locally and then recommends Followees, Followers and Hashtags based on his/her interests. This new proposed system will help the user become aware of what is going on in his/her new location, help him/her to make connections and engage with his/her new city.

Towards a Theory of Interface-Based Design of Hierarchical Reactive Systems

Herbert Praehofer

Summary

This paper presents a formal methodology for hierarchical interface-based design of component-based reactive automation systems with behavioral contracts. Based on seminal work on interface-based design of de Alfaro and Henzinger a hierarchical component approach with behavioral interface contracts and verification methods for checking that components fulfill specified contracts is presented. In contrast to other approaches, in this approach components form a strict hierarchical structure of upper and subordinate components. We discuss different questions which arise in such settings and present formal methods to answer those. Moreover, as an extension of the interface-based design methodology, a method is introduced which allows deriving the externally observable behavior of a component as a structure-preserving abstraction.

Multiple Real-Time Semantics on top of Synchronous Block Diagrams

Andreas Naderlinger

Summary

Synchronous block diagrams form an established fundament for the model-based development of embedded real-time systems. Their synchronous reactive (SR), also called zero execution time, semantics offers indisputable advantages in designing, testing and verifying control algorithms but poses problems in the translation of multi-rate models into code. In this paper, we contrast the semantics of three different real-time programming paradigms and discuss a mechanism to represent them in models with SR semantics. This representation is based on MATLAB/Simulink blocks that are not characterized by the typical zero time behavior but whose execution may last for and optionally consume a finite amount of simulation time. Each such block represents a task in the sense of a real-time operating system. All tasks within a model may be scheduled with a static-priority approach. This allows us to observe simulations that are closer to the real timing behavior of control applications and also to consider preemption effects already in the simulation.

Metamorphic Differential Simulation Using the Multi-Delay Timing Model

Peter Maurer

Summary

Here we show that the Event Driven Condition Free (EVCF) simulation technique for gate-level circuits can be extended to the multi-delay timing model. In the multi-delay timing model, gates have different integer delays. Events are produced out of order and must be sorted for processing. The EVCF technique has shown spectacular gains in performance for the zero-delay and unit-delay models. The gains here are somewhat less spectacular, but are substantial, showing that the EVCF technique is an effective method for improving the performance of multi delay simulation.

Systematic Management of Simulation State for Multi-Branch Simulations in Simulink

Zhi Han, Pieter Mosterman, Justyna Zander and Fu Zhang

Summary

Systematic simulation is a technique related and motivated by the formal analysis of hybrid dynamic systems. It combines the exhaustive and conservative nature of traditional model checking with numerical simulation for providing efficient algorithms to manage simulations. Multi-branch simulation is the concept advancing simulation efficiency by reducing the number of state transitions. This paper

introduces an approach to implement multi-branch simulation into industry-proven modeling and simulation environment, Simulink$^{\mbox{\tiny\textregistered}}$. The notion of {\it simulation state} which is distinctly different from the {\it dynamic system state}, is introduced for Simulink models. From this, a novel semantics based on transition systems is then developed. In a prototype implementation, these semantics are encoded in the current architecture of the Simulink engine and enable demonstrating the benefit of such type of a simulation by three case studies.

Creating Suites of Models with System Entity Structure: Global Warming Example

Bernard P. Zeigler, Chungman Seo, Robert Coop and Doohwan Kim

Summary

We describe how to develop a suite of models in the MS4 Modeling Environment. The approach employs the operation of merging of System Entity Structures supported by the environment. After construction, the suite of models can be hosted on Model Store, the cloud-based repository of models provided by MS4 systems as a basis for further collaborative model development. A suite of models, relating to Global Warming is used as an example. We discuss enhanced browsing as necessary to enable a developer to work effectively in a marketplace environment.

DEVS Modeling and Simulation Methodology with MS4Me Software Tool

Chungman Seo, Bernard P. Zeigler, Robert Coop and Doohwan Kim

Summary

There are many implementations of DEVS Modeling and Simulation in various computer languages and software tools. Most of them focus on modeler-friendly approaches which mean a user should have knowledge of modeling and computer languages. In this paper, we introduce high and low level design methodology to help domain experts (who might not have an in-depth understanding of DEVS modeling theory) solve their domain problems with DEVS modeling and simulation software called MS4 Modeling Environment (MS4 M)e. The tool enables high level model design through a sequence diagram from which template DEVS models are automatically created. The sequence design is converted to a System Entity Structure (SES) document representing a coupled model. The template DEVS models are written to constrained natural language called DEVS Natural Language (DNL) to express DEVS atomic modesl which MS4 Me displays to a state diagram as a low level model design. The state diagram contains detailed information from the domain experts who provide logic, variables, and message types for each atomic model. More in-depth technical implementation details are provided by DEVS modelers working together with domain experts. In this manner, MS4 Me provides a collaborative DEVS modeling and simulation environment for domain experts and DEVS modelers.

Efficient Online Analysis of Accidental Fault Localization for Dynamic Systems using Hidden Markov Model

Ning Ge, Shin Nakajima and Marc Pantel

Summary

This paper proposes a novel approach to do online analysis of accidental fault localization for dynamic systems by using Hidden Markov Model (HMM). By introducing reasonable and appropriate abstraction of complex system, HMM is used to represent the fault and no-fault states of system's components and system's behaviour. The HMM is parametrized to be statistically equivalent to real system's behaviour. Inspired by the principles of Fault Tree Analysis and maximum entropy in Bayesian probability theory, we propose the algorithms to estimate HMM's parameters, avoiding to pass through

learning task, because the learning data for accidental fault in real system is difficult to obtain. We design a specific test bed to generate large quantity of test cases, and give out the experimental results to assess the accuracy and efficiency of proposed approach. Meanwhile, we apply the approach to a simple helicopter control system case study, and give out convincing results.

Enabling Formal Analysis of Energy-Aware Automotive Embedded Systems in EAST-ADL

Eun-Young Kang and Pierre-Yves Schobbens

Summary

Energy-Aware Real-Time (ERT) systems are increasingly complex and have pervaded various areas, from automotive to telecommunication systems. EAST-ADL, an automotive specific architectural description language dedicated to safety-critical embedded control systems, has been proposed to harness this complexity. However, the current concept of EAST-ADL provides limited support for modeling and analysis of ERT behaviors due to the absence of energy constraints modeling notations and the lack of formal semantics. In this paper, we tackle that shortcoming by extending EAST-ADL notation with energy constraints and integrating the extension with formal analysis techniques based on the ERT constraints. A mapping strategy is proposed to facilitate the guarantee of integration. Furthermore, we develop a procedure that transforms the EAST-ADL prototype model to the UPPAAL model for model checking. The analysis techniques including the mapping strategy are validated and demonstrated on the Brake-By-Wire case study.

Observations on Real-time Simulation Design and Experimentation

Soroosh Gholami and Hessam Sarjoughian

Summary

Modeling and simulation provides a convenient way for evaluating operability of designed systems (e.g., Network-on-Chip) in their desired target environments. Where applicable, real-time modeling with real-time simulation extends logical-time M&S capabilities by evaluating the degree to which system requirements can be satisfied in actual operational scenarios. Simulations can be directly observed and evaluated in realistic settings. This brings about a well-known challenge –simulation experimentations are never without computational cost. This leads to real-time simulation (adversely) affecting simulation results, sometimes drastically, if not carefully designed for. In this paper, in view of finite computational resources for executing simulations in real-time, new observations on data collection and evaluations are described for the Action-Level Real-Time DEVS simulator. Simple and complex example real-time models are developed in select simulators, experiments with varying degrees of data collection volume are conducted, and results are discussed.

Grand Challenges on the Theory of Modeling and Simulation

Simon Taylor, Azam Khan, Katherine Morse, Andreas Tolk, Levent Yilmaz and Justyna Zander

Summary

Modeling & Simulation (M&S) is used in many different fields and has made many significant contributions. As a field in its own right, there have been many advances in methodologies and technologies. In 2002 a workshop was held in Dagstuhl, Germany, to reflect on the grand challenges facing M&S. Ten years on, a series of M& S Grand Challenge activities are marking a decade of progress and are providing an opportunity to reflect and plan for the future. This second Grand Challenge Panel brings together a new set of experts from both industry and academia to reflect on M&S Grand Challenges. Themes include big simulation, coordinated modeling, large scale systems

modeling, human behavioral modelling, composability, funding availability, cloud-based M&S, engineering replicability into computational models, democratization of M&S, multi-domain design, executing and targeting hardware platforms and education. It is hoped that these activities will provide inspiration to those already working in or with M&S and those just beginning their career.

The Impact of Operations Strategies for Emergency Room in Taiwan

Shao-Jen Weng, Po-Yu Huang, Wei-Hsiu CHANG, Lee-Min Wang and Chun-Yueh Chang

Summary

First aid is a primary part in the medical system; however, large-scale medical centers are facing the dilemma of overcrowding. When the number of emergency patients increases over the allocation of manpower and equipment, emergency is likely to be overloaded. Such a dilemma might crowd out the resources for critical patients, seriously affect the emergency service quality, and reduce the morale of staff before the patients being safe. With system simulation, this study establishes an emergency simulation model aiming at the researched subjects to discuss the authenticity of present emergency room. Furthermore, NEDOCS, the emergency compound standard, is utilized for evaluating the overcrowding degree in emergency rooms. Two strategies, proposed for improving the overcrowded emergency rooms receiving emergency patients, are also evaluated the effects on the overcrowding degree with NEDOCS. The outcomes show that the proposed strategies could actually improve the overcrowding in emergency rooms.

Occupancy Analysis using Building Information Modeling and Cell-DEVS Simulation

Sixuan Wang, Gabriel Wainer, Vinu Subashini Rajus and Robert Woodbury

Summary

Building Information Modeling (BIM) and its open standard Industry Foundation Classes (IFC) are becoming popular in the design phase in the Architecture and Construction industry. Here, we focus on integrating BIM and DEVS (Discrete Event systems Specification) simulation of occupancy analysis. We present a case study for Copenhagen's New Elephant House, where people can move with different direction probabilities and wait randomly when visiting in the two floors of this building. The idea is to automate to extraction of building information that can be subsequently used in a simulation. We also show how to obtain advanced 3D visualization within BIM authoring tools. This work brings designers to understand better among different building properties occupancy management and future improvement.

NOISYSIM: exact simulation of stochastic chemically reacting systems with extrinsic bounded noises (WIP)

Giulio Caravagna, Giancarlo Mauri and Alberto d'Onofrio

Summary

Cells are noisy biochemical systems very sensitive to statistical fluctuations induced by molecules present in low-numbers. In such a case stochastic models outperform deterministic approaches, instead preferable when large numbers are involved. Also, the dynamics of a network depends on its interplay with many (often unknown) other networks and random extracellular signals. Unfortunately, modeling exhaustively even only all the major interactions is not only prohibitively difficult, but also a major computational challenge. Classical abstractions use extrinsic unbounded gaussian noises to model these interplays. In case of low molecule numbers and colored noises this hybrid approach couples the birth-death discrete dynamics with stochastic differential equations. However, recent

literature showed that extrinsic bounded noises are a more realistic abstraction mechanism of interplay. Hence, an automatic tool to asses whether biochemical noise plays a functional role for a target network is desired. To this extent we present NOISYSIM, a Java library to perform simulations of stochastic chemically reacting systems where both intrinsic fluctuations and extrinsic bounded noises are considered. Intrinsic low-numbers fluctuations are accounted by a Gillespie-like approach whereas extrinsic noises are modeled as Langevin stochastic equations affecting the model jump rates. NOISYSIM allows to approximate the solution of the Chapman-Kolgomorov equation characterizing the system. NOISYSIM models can be hand-coded or automatically generated by a code generator, provided an input textual file.

Agent-Oriented Approach Based on Discrete Event Systems (WIP)

Paul-Antoine Bisgambiglia, Paul Antoine Bisgambiglia and Romain Franceschini

Summary

Inspired by existing works, in this paper, we propose software architecture for coupling the MAS and DEVS formalism. This architecture is designed to enable the modeling of large quantities of agents. Previous works often associated with an agent to a DEVS model. The complexity of the system increases proportionately with the number of agents. We describe an approach to group a set of agents in the same DEVS model, and allow representing many more agents.

Survival vs. Revenue: Modelling and Reasoning on Population Dynamics (WIP)

Andrea Bracciali, Giulio Caravagna and Amjad Ullah

Summary

In this paper we show how stochastic quantitative analysis can assess the effectiveness of a hunting policy with respect to the dynamics of a target population. We model a population dynamics problem characterised by the tension between {\em survival} of the population and {\em revenue} that can be obtained by its exploitation. We analyse some features of the population and show how to properly tune the hunting parameters to set an optimal policy ensuring sustainability of the population. Our main aim is to clarify how well the proposed techniques address the problem, allowing us to devise a quite accurate description of the model population.

A Cellular Automaton Model for Psoriasis Disease

Morgan Germain, Christopher Banerji, Chrysanthi Ainali and Nour Shublaq

Summary

Psoriasis is a highly prevalent autoimmune disorder of the skin, which manifests clinically via the formation of a thickened epidermis, and a scale-like appearance in affected regions known as psoriatic plaques. The disease is highly complex, arising at least in part via a systemic perturbation of cytokine and chemokine dynamics. In addition, psoriasis is both genetically and phenotypically heterogeneous, with patients displaying highly diverse molecular profiles and plaque structures. An understanding of the differences driving phenotypic diversity in psoriasis is thus essential to positing more effective and personalisedtherapeutics. In this paper we develop and implement a cellular automaton model, based on the biology of psoriasis plaque formation, to investigate the mechanisms of psoriasis heterogeneity. Our preliminary model is capable of simulating a wide array of clinically relevant plaque structures, for given parameter regimes, in a manner that permits hypotheses to be generated and tested, on the molecular mechanisms driving the differences between the different clinical phenotypes.

Abstract

Abstraction in Physiological Modelling Languages

Steve McKeever, Mandeep Gill, Anthony Connor and David Johnson

Summary

In this paper we discuss two projects looking at applying advanced abstraction mechanisms from software engineering to the field of physiological modelling. We focus on two abstraction mechanisms commonly found in modern object-oriented programming languages: generics and inheritance. Generics allows classes to take other classes as parameters, allowing common behaviour to be described with particularities abstracted away. We demonstrate this technique on an example from heart modelling. Inheritance allows one to reuse code and to establish a subtype of an existing object. We focus on the benefits reaped from inheritance where this property enables run-time substitutability. This technique is demonstrated within the context of multi-scale tumour modelling. Finally, we look at how combining both techniques enables greater modularity and the construction of reusable modelling frameworks for the rapid creation and extension of families of biological models.

Model-based, Composable Simulation for the Development of Autonomous Miniature Vehicles

Christian Berger, Olaf Landsiedel, Elad Schiller, Michel Chaudron and Rogardt Heldal

Summary

Modern vehicles contain nearly 100 embedded control units to realize various comfort and safety functions. These vehicle functions consist of a sensor, a data processing, and an actor layer to react intelligently to stimuli from their context. Recently, these sensors do not only perceive data from the own vehicle but more often also data from the vehicle's surroundings to understand the current trac situation. Thus, traditional development and testing processes need to be rethought to ensure the required quality especially for safety-critical systems like a collision prevention system. On the example of 1:10 scale model cars, we outline our model-based and composable simulation approach that enabled the virtualized development of autonomous driving capabilities for model cars to compete in an international competition.

Data and Behavior Decomposition for the Model-Driven Development of an Executable Simulation Model

Gürkan Özhan and Halit Oğuztüzün

Summary

In a previous work, we have presented a two step automatic transformation of Field Artillery Conceptual Model (ACM) into High Level Architecture (HLA) Federation Architecture Model (FAM) into executable distributed simulation code. The approach followed adheres to the Model-Driven Engineering (MDE) philosophy. ACM is comprised of a data component, based on UML class diagrams, and a behavioral component, based on Live Sequence Chart (LSC). The ACM modeling and its transformation to FAM for the common Adjustment Followed by Fire For Effect (AdjFFE) mission has been presented as the case study. BatteryFDC, which is an abstraction of a battery's fire direction center, is the central LSC instance in ACM. In this paper we focus inside the BatteryFDC, develop its lower level "decomposed" conceptual model, called Fire Direction Center Model (FDCM). Then the FDCM modeling and its transformation to FAM for the AdjFFE mission pertaining to FDC scope is demonstrated. Finally, simulation code generation from the FDC FAM is discussed.

Model Composability and Execution across Simulation, Optimization, and Forecast Models

Hessam Sarjoughian, James Smith, Gary Godding, and Mohammed Muqsith

Summary

We present a novel simulation platform called Optimization, Simulation, and Forecasting (OSF) for the domain of manufacturing and logistics supply-chain systems. It supports composition of DEVS, LP, and forecast models using an extended Knowledge Interchange Broker. Models developed in DEVS-Suite simulator, OPL-Studio optimization, and a heuristic Inventory Strategy Forecaster (ISF) can be composed using a new set of scalable XML Schemas developed for DEVS, LP, and ISF models. The addition of forecast modeling offers new kinds of supply-chain system simulation. In particular, alternative customer demand forecast “bias correction” methods can be evaluated optimized operation of supply-chain processes. The OSF platform affords modeling pair-wise interactions among process, optimization, and forecast models. The KIB coordinates simulation (execution) of the DEVS, LP, and ISF models in a sequential fashion. Composition of each pair of DEVS, LP, and ISF models leads to scalability for specifying model interactions. Independent execution of each model allows flexible computation platforms. They simplify defining a large number of different data transformations. The concept, basic architectural design, and implementation of this composable simulation platform are highlighted using example single- and multi-echelon semiconductor manufacturing, logistics systems.

On the Representation of Product Lines using Pluggable Software Units: Results from an Exploratory Study

Fernando Barros

Summary

The effective development of software product lines (SPLs) requires the ability to create a large variety of applications from a repository of assets. These assets provide the basic building blocks for supporting the creation of each specific product. In this paper we exploit the potential of independent and pluggable software units (PUs) for assembling the products of a related family. PUs support application variability through {\em Inheritance of Topology} (IT), a construct that reuses the topology of PUs network models. IT enables new applications to be derived from existing ones by just requiring the definition of the differences. We present results from the development of a microwave oven SPL.

4SEE: a Model-driven Simulation Engineering Framework for Business Processes Analysis in a SaaS paradigm

Paolo Bocciarelli, Andrea D'Ambrogio and Daniele Gianni

Summary

The intrinsic geographical distribution and the increasingly complexity are the two main properties that have not been fully addressed by existing simulation tools for business process (BP) analysis.. Quantitative analysis is a central means for BP evaluation at design time and/or execution time, and it is therefore an essential enabler for the BP design and/or dynamic reconfiguration aiming to meet pre-agreed QoS.

In this respect, this work proposes a model-driven QoSaware framework for design and run-time simulation-based quantitative analysis of BPs. Specifically, the framework is based on a distributed simulation approach that basically replicates the service-oriented infrastructure of a BP into the corresponding simulation infrastructure based on the HLAEvolved standard. The framework assumes

a scenario in which service providers publish a set of simulation-oriented services that can be subsequently used by interested consumers to dynamically discover and evaluate the QoS of these services. Key to the economical feasibility of this scenario is that a model-driven approach supports the automatic derivation of the simulation software from the BPMN (Business Process Model & Notation) models of the actual BPs.
The paper presents 4SEE, a model-driven framework that exploits a service-oriented distributed simulation approach for BP analysis. The paper also presents an example application to a BP for an e-commerce scenario.

GAMETE: General Adaptable Metric Execution Tool and Environment (WIP)

Kurt Rohloff, Kyle Usbeck and Joe Loyall

Summary
In this paper we introduce the General Adaptable Metric Execution Tool and Environment (GAMETE) to aid the design, measurement, and analysis of cyber-physical systems (CPSs). GAMETE is a general and extensible environment for evaluating and computing metrics associated with the performance and complexity of CPS designs. GAMETE supports a wide array of metrics that it generates over simulation and experimental output data from CPSs. Key features of GAMETE are its 1) execution environment to host the simulations of CPS models, 2) unified data representation to host simulation and experimental data from CPSs, 3) dynamic metric library that supports the semi-automated evaluation of a wide range of metrics, and 4) standards-based integration with design toolchains. The contribution of this paper is the presentation of a reference architecture for batch metric computation and a case-study where GAMETE helped to quantitatively evaluate the performance of a CPS.

A Metamodel-Based Approach For Generalizing Requirements In Database-Driven 3D Simulation (WIP)

Martin Hoppen, Michael Schluse and Juergen Rossmann

Summary
In our previous work, we presented an approach for runtime synchronization on schema and data level between a real-time simulation database and a central database. A wide range of 3D simulation applications like Virtual Testbeds for space missions, industrial automation applications or geoinformation systems for city and forestry scenarios already benefit from this approach. To apply it to other database systems, we now define general requirements using methods adopted from model-driven engineering. By building metamodels and defining model transformations in between, the general fitting of the database systems can be analyzed and enforced. To integrate requirements for data synchronization, not only structures for schema components, but also for their instantiation must be part of these metamodels. An additional pivotal metamodel can be used to guarantee certain modeling concepts within the database systems. Here, the Unified Modeling Language (UML) is a reasonable option. Besides their metamodels, some requirements are also imposed on the databases' runtime systems.

Model-based Animation of Micro-Traffic Simulation (WIP)

Philip Guin and Eugene Syriani

Summary
Testing discrete-event simulation models is often done at the level of traces. However, visual feed-back to the modeler is crucial as he is very often a domain expert with limited computing knowledge. We propose a generic framework for graphically animating the visualization of DEVS simulations to

enable testing of the simulation model at the domain-specific level. This paper reports initial work for animating micro-traffic simulation with our framework.

Principles for the Realization of an Open Simulation Framework Based on fUML (WIP)

Jeremie Tatibouet, Arnaud Cuccuru, Sébastien Gerard and François Terrier

Summary

Model-based engineering is becoming a de facto para-digm for designing complex systems and software. By being executable, models are easier to understand, as well as sys-tems they abstract. UML is the most natural choice for modeling. fUML is an executable subset of UML with precise operational semantics. From causal relations defined in a model, fUML semantics only constructs partial execution orders. When considering fUML in a simulation process, this limitation is possibly an issue for engineers to observe various execution schemes and to have a representative execution of a system model. Usually simulation frameworks control the execution of an application thanks to a dedicated entity. This latter is responsible for the construction of the execution order conforming to the semantics of a specific Model of Computation (MoC). Furthermore it can be used to reflect extra-functional aspects like time. In order to overcome these limitations, this paper proposes principles to use fUML as a simulation environment. We propose to extract the execution control policy from a fUML model and to delegate it to a specific simulation library defining MoCs as fUML models. This library is responsible for controlling the execution and simulating extra-functional aspects. This approach provides the required flexibility and openness needed to support various applications domains. The solution is evaluated on a simple, but representative example.

Transformation of Extended Actigram Star to BPMN2.0 and Simulation Model in the frame of Model Driven Service Engineering Architecture

Hassan Bazoun, Gregory Zacharewicz, Yves Ducq and Hadrien Boye

Summary

Cooperation between different enterprises in order to provide product and related services has become a must in order to set up alliances and benefit more from market opportunities. This evolution has encountered several problems, like interoperability when trying to exchange data between heterogeneous systems. This paper shows how a model-driven approach can be an answer to service system implementation and interoperability problems, and in particular the necessity to provide transformation mechanisms from Extended Actigram Star models to BPMN models. At the end we propose a last transformation to G-DEVS simulation models in order to validate behavioral properties of the model before going to implementation.

Hybrid Agent based Simulation with Adaptive Learning of Travel Mode Choices for University Commuters (WIP)

Nagesh Shukla, Albert Munoz, Jun Ma and Nam Huynh

Summary

This paper presents a methodology for developing a hybrid agent-based micro-simulation model to capture the impacts of commuter travel mode choices on a University campus transport network. The proposed methodology involves: (i) developing realistic population of commuter agents (students and staff); (ii) assigning activity lists and travel mode choices to agents using machine learning method; and, (iii) traffic micro-simulation of the study area transport network. This furthers the understanding

of current transport modal distributions, factors affecting the travel mode choice decisions, and, network performance through a number of hypothetical travel scenarios.

Comparison of Three Agent-Based Platforms on the Basis of a Simple Epidemiological Model (WIP)

Kishoj Bajracharya and Raphael Duboz

Summary

With the extensive use of agent-based modeling and simulation these days, many agent-based platforms are available. The objective of this paper is to compare three agent-based platforms: NetLogo, Repast, and Cormas based on the results of the simulation obtained from the same set of experimental scenarios. For this purpose, agent-based SIR model is chosen to study the pattern of the spread of an infectious disease within certain population over time. The methodology for the comparison is to design and implement the same agent-based SIR model in all these platforms, perform numerous experiments with the model and compare the outputs obtained from them using cross-correlation analysis and similarity measure using Manhattan distance. From the experimental tests, we conclude that all agent-based platforms do not give the similar results. We found that there is similarity between the platforms NetLogo and Cormas but dissimilarity between the platforms Repast and Cormas. Agent-based platforms are not suitable for making accurate predictions or forecasting because we cannot trust the results.

Semantics for an Interdisciplinary Computation (WIP)

Justyna Zander and Pieter Mosterman

Summary

Semantics for an interdisciplinary computation is becoming increasingly difficult to capture while dealing with multi-domain problems. Expertise from Computer Science, Computer Engineering, Electrical Engineering, and other disciplines merges as engineering challenges in modern systems, such as, Cyber-Physical Systems, Smart Cities, and Bionic Systems must be tackled in a methodological manner. In this paper, a formalization of such a computational semantics is proposed. It is based on the experience of a Computer Scientist, Mathematician, and an Engineer when their efforts converge to design a complex system. The design is embedded in the Model-Based Design process and a simulation aids to build the actual system implementation. To let the experts achieve the same understanding level, a declarative layer for simulation semantics is defined. This introduces abstraction and helps understand the behavior of the interacting elements in a system design using mathematical principles that are easier to embrace for more diverse scientific communities.

Revisit of System Variable Trajectories (WIP)

Moon Ho Hwang

Summary

This paper investigates the trajectory that represents a patterns of system dynamics. In this paper, a trajectory is concatenations of building blocks, called segments. The mathematical incompleteness of trajectory definitions \cite{Zeigler:1976}, \cite{ZPK:2000}, \cite{Giambiasi:2001} in terms of lack of explanation for multiple values at boundaries are resolved in this paper by allowing codomain is not just a set Z, but Z^+ that is a set of strings of the set Z. Moreover, relationship of trajectory classes, as well as associating variables are clarified in the end.

Hybrid Systems Modeling and Verification with DEVS (WIP)

Hesham Saadawi and Gabriel Wainer

Summary

Hybrid systems (where continuous and discrete phenomena interact) are found in many natural and artificial systems. An important example, real-time embedded systems usually include discrete-event controllers interacting with a continuous plant. Verifying these real-time systems for correct behavior is of utmost importance, as results of incorrect behavior are usually catastrophic. To complement the use of Modeling and Simulation study of such hybrid real-time systems, we extend here the verification method, based on RTA-DEVS, hybrid Timed Automata and the QSS that was introduced in [1], which allows verifying real-time hybrid systems modeled by DEVS formalism. This extension allows the formal verification of continuous subsystems modeled with general QSS method.

Informal DEVS Conventions Motivated by Practical Considerations (WIP)

Rhys Goldstein, Simon Breslav and Azam Khan

Summary

The formalism known as the Discrete Event System Specification (DEVS) provides a set of mathematical elements for modeling time-varying systems. When DEVS is applied in the form of an executable representation, however, some deviation from the formalism is unavoidable. By proposing a set of informal DEVS conventions, we show how certain changes to the formalism, some previously adopted, others less explored, may help simulation tools appeal to users who stand to benefit from DEVS theory but are more cognizant of practical issues. Our conventions use parameters and statistics to encapsulate the state of an atomic model and the composition of a coupled model. They also include changes both to transition functions and the ordering of simultaneous events to promote convenience, efficiency, and reproducibility.

A Method for DEVS Simulation of E-Commerce Processes for Integrated Business and Technology Evaluation (WIP)

Carlos María Chezzi, Ana Rosa Tymoschuk and Ricardo Lerman

Summary

Performance evaluation of electronic commerce processes requires an integrated vision of the capacities offered by computational resources, website functionalities, and resulting financial outcomes. Simulation is a tool that allows trying out alternative business configurations before implementation. This requires a method that articulates models construction, representing the relation between business and technological resources. DEVS is a modeling framework for discrete event simulation based on systems theory and which offers resources to model complexity and stochastic behavior. This work is intended to propose a DEVS models design method for simulating electronic commerce processes. This method is implemented in DEVSJAVA tool and is proved by developing a B2C real case study involving a retail company of electronic items, information technology, and household goods.

GAMME, A Meta-Model to Unify Data Needs in Simulation Modeling (WIP)

Judicaël Bedouet, Nicolas Huynh and Romain Kervarc

Summary

Complex system studies, especially in the aerospace context, where systems are too expensive and too critical to allow real experimentation, make extensive use of simulation. A drawback of the

Abstract

simulation approach is that, in general, aerospace systems studied are so large that their simulations are quite difficult to develop. Indeed, such a simulation will generally involve simulation components coming from various sources and sharing information. There, one may see two opposite constraints. On the one hand, the simulation components are developed independently from each other (or potentially pre-exist) and hence need to manage on their own the data that they need. On the other hand, overall data consistency has to be ensured in the simulation, especially for shared data.
An interesting way to solve this issue consists in structuring the data, i.e. defining a datamodel that will be used as a support to specify all operations relevant to data (access, storage, ...): one may see this approach as the application of model-driven methods to the central point of data in a simulation. This paper presents GAMME, a home-made data-centered framework for the development of large-scale simulations, as well as uses of this framework in various simulations.

Abstract

Modeling and Humanities

Conditions and Consequences of Language Choice: A linguistic inquiry on bilingualism using ABMs

Jacob Rosen and Teresa Satterfield

Summary

In this paper we implement an agent-based model using RePast Simphony 2.0 to explore constraints placed on language choice in multilingual situations. Efforts to explain 'why language A is used in context (i) and language B is used in context (ii)' have met with very little success in traditional linguistic research. By creating an artificial society, we are able to disentangle the complex interplay of linguistic, psychological and socioeconomic variables involved in these language contact phenomena and to pinpoint underlying regularities in language choice. We introduce an indicator of language choice that we coin the 'LINgUini' index, on analogy with the standard economic measure of income inequality known as the Gini index (Gini 1912). We additionally define an 'Accumulated LINgUini Coefficient (ALC)' as a measure of observed linguistic inequality, analogous to wealth inequality measured by the Gini index. The LINgUini focuses on the primary process by which linguistic knowledge is acquired and/or reinforced, while the ALC measures the resulting language distribution. Our model sheds light on the ramifications of various language policies, demonstrating the extent to which restrictive language practices disparately affect groups within a society. The results of our model indicate that local-level language inequality has compounding linguistic and socioeconomic effects on the society at large, as validated by real world scenarios involving immigrant workers.

Emerging M&S Applications in Industry and Academia

An Extended Research Framework for the Simulation Era

Martin Ihrig and Klaus G. Troitzsch

Summary

The paper proposes a novel research architecture for social scientists that want to employ simulation methods. The new framework gives an integrated view of a research process that Involves simulation modeling. It highlights the importance of the theoretical foundation of a simulation model and shows with the help of the non-statement view and its structuralist theory reconstruction how new theory-driven propositions and hypotheses can be derived from simulations that are empirically testable. It also illustrates the role of theory-based simulation environments. The paper describes the different aspects of the framework in detail and shows how it can help structure the research efforts of scholars interested in using simulation.

M&S Methodological Challenges

Jose Padilla, Andreas Tolk and Saikou Y. Diallo

Summary

M&S provides a formal way to generate or test existing knowledge. Like mathematics, M&S provides an apparatus for deduction while generating data that can be used for statistical inference. However, unlike mathematics, M&S's formal approach varies from user to user opening the criticism that one can model "everything one wants" as M&S does not have a widely accepted axiomatic body of knowledge like mathematics has. Unlike empirical experimentation, simulated experiments have been epistemologically questioned about how to relate results to reality. This paper provides a discussion of how M&S's formality is a strong methodological support that generates knowledge, but the discipline of M&S needs to address methodological challenges. Models need to address issues like assumptions, coherence and traceability and simulations have to address issues like computer tractability and empirical validation. We'll discuss these issues from the perspectives of what we use as inputs to build models and simulations (data, theory or both) and what their purposes are (theory creation or theory testing). Ultimately, M&S knowledge claim justification lies within the purview of the disciplines that use it and on what they consider to be acceptable as knowledge as long as the above mentioned M&S issues are sufficiently addressed.

On the Evolution of Agency and Implications for Comprehensively Modeling it

Dante Suarez

Summary

The basic premise of this proposed article is that agency is an evolved trait. Agency in nature exists to the degree that organisms can act independently from their environment, and is here considered to be the result of an evolutionary process that takes places hierarchically and in multiple dimensions. The article proposes further discussion on the need to create appropriate simulation methodologies that capture the multiple levels of reality, particularly in the social and biological realms. Such methodologies should allow for the joint representation of micro, meso and macro ontological levels of agency. This work proposes the methodology of Distributed Agency as a means to capture the fractal nature of the agents that may more realistically capture the contextualized interaction present in social and biological phenomena. Agency is proposed as a 'currency' in which we can express structure and information to express and eventually understand the way in which evolutionary

processes interact to create the complex world we inhabit.

Effective Simulation of Earth Moving Projects

Jamal Siadat

Summary

In construction, earth-moving (EM) projects are generally large projects characterized by uncertainties. The use of costly equipment coupled with the complexity of their interactions has resulted in various planning challenges. Process-based simulation allows for the modeling of complex operations in a controlled environment. In the context of EM projects, process-based simulation has demonstrated its effectiveness in predicting project durations, costs as well as resource requirements. However, these templates are developed by simulation experts using advanced computer programming techniques. As a result, understanding the details of the interactions within the model or enhancing them to fit a particular purpose can be a daunting task. This paper presents Earth-Sim, an EM template developed using the SimFC simulation platform. Earth-Sim mimics the behaviors found in an earlier version of the SIMPHONY EMS template. SIMPHONY EMS was chosen because a) it is a well-recognized template which models all activities within the EM process; and b) it has been validated against data obtained from construction job-sites. This paper explains how Earth-Sim was developed solely using the common elements found in SimFC without any programming. Furthermore, the results obtained from Earth-Sim are compared against results from SIMPHONY EMS to illustrate the validity of the outputs.

Perception of a Building Construction Schedule

Kais Samkari, Ralf Gnerlich and Volkhard Franz

Summary

Evaluating a schedule means making a judgment about the schedule after thinking carefully about its duration, cost, and the probable quality of its deliverable product. Despite recent advances in 4D visualization, (i.e., 3D building geometry + time), only few have challenged its use in evaluating construction schedules. The intents of the planning that provide the means for evaluating schedules and making business-oriented decisions are missing during the visualization. Yet, 4D visualization has focused mainly on the visual detection of conflicts in time and space. This project proposes an approach to extend 4D visualization into a level we call perception, with the aim to support the decision-making process of a construction company during the phase of planning and execution. By gathering and then reproducing planning intents during the visualization of a large-scale building construction schedule, the application of our approach eases and accelerates the ability to comprehend a construction schedule. It also communicates planning intents among the project practitioners. A modeling tool and a simulation tool are utilized in order to acquire valid planning details. In this paper, our perception model that builds on a 4D model is presented. Then, the types and the sources of the planning intents, as well as a prototype implementation and an example, are described.

ADVANCED MODELING & SIMULATION BASED TOOLS FOR SUPPORTING THE DESIGN AND MANAGEMENT OF A JOB ORDER MANUFACTURING SISTEM

Francesco Longo, Letizia Nicoletti, Alessandro Chiurco, Adriano Solis, Marina Massei and Rafael Diaz

Summary

The main goal of this paper is to describe the development and the first use of a simulation model related to a real manufacturing system devoted to produce furniture for schools, universities and

offices. The simulation model is equipped with a dedicated animation and input/output section (that allow changing different system parameters and monitoring multiple performance measures). After the verification and validation, the simulation model has been used to evaluate the economic convenience in acquiring some new automated machines for the painting department. To this end, the performances of the actual production scenario are compared with the performances of a new potential production scenario (characterized by the new automated painting machines) and an economic analysis based on the discounted payback period is carried out.

A Throughput Simulation Of Port Of Beirut

Jean-Paul Arnaout, Samar Hallab and Caline El Khoury

Summary

Up to 600,000 tons of goods (imports & exports) flow yearly through Port of Beirut (POB). Hence, an incident at the port (Natural or manmade) that results in its congestion or blockage will have distressing consequences not only to the Lebanese community, but also to the regional trade and economy. In this paper, a simulation model of the port operations up to the container level is developed. The model allowed us to analyze and evaluate system changes such as resource capacities and security changes that affect the port's operations, and observe their impact on the port's performance. The simulation results indicated that the current port capacity levels are sufficient for daily normal operations. Furthermore, a security incident was tested and its impact highlighted.

Electric Load Forecasting using Support Vector Machines for Robust Regression

Sonia De Cosmis, Renato De Leone, Erik Kropat, Silja Meyer-Nieberg and Stefan Pickl

Summary

The load forecasting problem is the core of nearly all decisions made in energy markets. The electricity load demand is influenced by numerous factors - ranging from weather conditions over seasonal effects to socio-economic influences. In this paper we present first computational results using a linear approach supported by support vector machines for robust regression.

Different Modeling and Simulation Approaches applied to Industrial Process Plants

Agostino G. Bruzzone, Francesca Madeo, Margherita Dallorto, Davide Poggi and Angelo Ferrando

Summary

The Process Industry represents a business sector currently affected by a positive trend in Fast Developing Areas; as result the Modeling & Simulation is becoming back pretty active in this sector to support plant engineering, automation and control solutions. In this paper, it is proposed a state of art about solutions in modeling Industrial Process Plants; then the authors propose a model as decision support system for a chemical industry with focus on logistics activities. The case highlights the importance of M&S for supporting Industrial Companies in decision making and analysis. The proposed work includes description of the different phases: Data Collection (Flow Data, Time Tables and Costs Tables are critical), Conceptual Model Development, Model Implementation to simulate logistic processes and Execution & Analysis.

Interdisciplinary Systems and Simulation Studies for an Innovative Undergraduate Program

Anatoly Kurkovsky

Summary

Abstract To improve student critical and systems thinking abilities, we propose a simulation-based

approach to teach and to conduct interdisciplinary systems studies as a part of an innovative undergraduate program. In this paper, we propose a sequence of simulation courses, discuss their goals and structure. To demonstrate the improved problem-solving ability of our students we briefly describe their systems simulation research projects in several areas. Some of our undergraduate student simulation projects were nationally recognized at the Student Research Contests at ACM affiliated conferences.

Integrating the Computer Science Curriculum by Using Robot Soccer Simulator

Vadim Kyrylov

Summary

Robot soccer simulator is a reasonably complex software system that appears to be suitable as an instructive case study for Computer Science and Information Technology curricula. This has been noticed by many educators. All of them were using the well-known RoboCup soccer simulator. However, previous studies that explored this opportunity were narrowly focused on courses in Robotics and AI neglecting other possibilities. To some extent, this could be explained by that the RoboCup simulator is over complicated for undergraduate students. We overcome this difficulty by proposing a simplified, yet sophisticated enough, soccer simulator having some extra features. As the result, our simulator, Tao of Soccer, can be used in a wide range of CS & IT courses. This paper explores opportunities for across-curriculum integration using Tao of Soccer as a business case and the synergies that this approach can create for learners.

Challenges With Simulator Development For Ultrasonography Training: Developing Hardware — Software Interface

John Sokolowski, Catherine Banks, William Richards and Hector Garcia

Summary

This paper discusses the challenges of optimizing the hardware - software interface in developing an ultrasonography simulator training tool. The tool will be used to train medical clinicians whose practice involves comprehensive and problem-specific physical examination of the patient with the use of ultrasound. Ultrasonography is a user-dependent technology; operators must possess both physical and cognitive ultrasonography capability to include mechanical manipulation of the transducer and image capture and interpretation. There are three major challenges in developing a simulator training tool that provides both physical (hardware) and cognitive (software-visualization) learning experiences: 1) interface design, 2) hardware utilization, and 3) the integration of software for simulating volume of ultrasound beams and visualization of images. Multi-disciplinary expertise and numerous iterations of integrating hard- and software capabilities have brought about the success of both mechanical components and visualization capability of this ultrasonography simulator training tool.

Metamodeling by using Multiple Regression Integrated K-Means Clustering Algorithm

Emre Irfanoglu, Ilker Akgun and Murat Gunal

Summary

A metamodel in simulation modeling, as also known as response surfaces, emulators, auxiliary models, etc. relates a simulation model's outputs to its inputs without the need for further experimentation. A metamodel is essentially a regression model and mostly known as "the model of a simulation model". A metamodel may be used for Validation and Verification, sensitivity or what-if analysis, and optimization of simulation model. In this study, we proposed a new metamodeling

approach by using multiple regression integrated K-means clustering algorithm especially for simulation optimization. Our aim is to evaluate the feasibility of a new metamodeling approach in which we create multiple metamodels by clustering input-output variables of a simulation model according to their similarities. In this approach, first, we run the simulation model of a system, second, by using K-Means clustering algorithm, we create metamodels for each cluster, and third, we seek the minima (or maxima) for each metamodel. We also tested our approach by using a fictitious call center. We observed that this approach increases the accuracy of a metamodel and decreases the sum of squared errors. These observations give us some insights about usefulness of clustering in metamodeling for simulation optimization.

Integrating Fuzzy Expert System with Discrete Event Simulation to Determine Configuration of Resources Level for an Emergency Unit

S.Mohsen Hosseini, Seratun Jannat and Abdullah Al-Khaled

Summary

As healthcare system has become more competitive, new challenges arise into their management such as improving the patient flow, reducing the patient waiting time and determining the optimal number of resources. This research proposed a new approach based on integrating fuzzy expert system and discrete event simulation (DES) to properly configure the resources level of an emergency unit. We first implemented DES to simulate the patient flow of emergency unit, and then a fuzzy controller with three input variables, one output and fifteen rules are defined. The input to fuzzy controller is the output of DES; average patient waiting time in the CT and MRI queues, and budget availability, while the output of fuzzy controller is the percentage of increase on resource level.

ExascaleWorkload Characterization and Architecture Implications

Prasanna Balaprakash, Darius Buntinas, Anthony Chan, Apala Guha, Rinku Gupta, Sri Hari Krishna Narayanan, Andrew Chien, Paul Hovland and Boyana Norris

Summary

We use a hybrid methodology based on binary instrumentation and performance counters to characterize a set of proxy applications (mini-apps and PETSc applications) representative of a broad range of scientific applications (and particularly DOE's future high performance computing workloads). From this empirical basis, we create statistical models that extrapolate application properties (instruction mix, memory size, and memory bandwidth) as a function of problem size. We validate them and project the first quantitative characterization of an exascale computing workload. Finally, the exascale workload is used to evaluate a radical new exascale architecture, stacked DRAM with processor under memory (PUM). Of the two projections, one shows major potential benefits in using PUM. However, the second, more conservative projection suggests that only a small number of exascale applications are likely to be memory-bandwidth limited, but even these are fundamentally memory-capacity limited.

Buffering IO for Data Management in Multi-physics Simulations

William Dai

Summary

A library for parallel IO and data management has been developed for multi-physics simulations. The goal of the library is to provide sustainable, interoperable, efficient, scalable, and convenient tools for parallel IO and data management for high-level data structures in numerical simulations, and to provide tools for the connection between applications. The high-level data structures include one- and multi-dimensional arrays, structured meshes, unstructured meshes, the meshes generated through (block-based, patch-based, and cell-based) adaptive mesh refinement, variables associated with these meshes, and data defined on particles in particle simulations. The IO mechanism can be collective and non-collective. The library is typically used for restarting files, visualization files, and files connecting different applications. The library is based on MPI-IO. Compared with the IO performance of MPI-IO, the overhead to write the explicit users' data structures are less than five percent. To further improve IO performance, in addition to the bookkeeping data, the library could buffer problem-size data before calling MPI-IO while keeping users' explicit high-level data structures. The buffering mechanism improves IO performance by a factor 10 to 20 in multi-physics simulations involving AMR and unstructured meshes.

SimMatrix: SIMulator for MAny-Task computing execution fabRIc at eXascales

Ke Wang, Kevin Brandstatter and Ioan Raicu

Summary

Exascale computers (expected to be composed of millions of nodes and billions of threads of execution) will enable the unraveling of significant scientific mysteries. Many-task computing is a distributed paradigm, which can potentially address three of the four major challenges of exascale computing, namely Memory and Storage; Concurrency and Locality; and Resiliency. Exascale computing will require efficient job scheduling systems, which is several orders of magnitude beyond the state-of-art job scheduling systems, which tend to have centralized architecture and are relatively heavy-weight. This paper proposes a light-weight discrete event simulator, SimMatrix, which simulates job scheduling system comprising of millions of nodes and billions of cores/tasks. SimMatrix supports

both centralized (e.g. first-in-first-out) and distributed (e.g. work stealing) scheduling. We validated SimMatrix against two real systems, Falkon and MATRIX, with up to 2K-cores, running on an IBM BlueGene/P system, and compared SimMatrix with SimGrid and GridSim in terms of scalability and resource consumption. Results show that SimMatrix consumes only 2 byte, 6 us per task for centralized scheduling, and 20 bytes, 90 us per task for distributed scheduling at scales up to 1 million nodes, 1 billion cores, and 10 billion tasks. These relatively low costs per task at exascale levels of concurrency, will lead to innovative studies in scheduling algorithms at unprecedented scales.

Exploring Reliability of Exascale Systems through Simulations

Dongfang Zhao, Da Zhang, Ke Wang and Ioan Raicu

Summary

Exascale computers, i.e. 10^{18} FLOPS, is predicted to emerge by the end of this decade with millions of nodes and billions of concurrent cores/threads. One of most critical challenges for exascale computing is how to effectively and efficiently maintain the system reliability. Checkpointing is the state-of-the-art technique for high-end computing systems reliability that has proved to work well for current petascale scales. This paper investigates the suitability of checkpointing mechanism for exascale computers, across both parallel filesysetms and distributed fielsystems. We built a model to emulate exascale systems, and developed a simulator, RXSim, to study its reliability and efficiency. Experiments show that the overall system efficiency and availability would go towards zero as system scales approach exascales with checkpointing mechanism on parallel filesystems. However, the simulations also suggest that a distributed filesystem with local persistent storage per node would offer excellent scalability and aggregate bandwidth, enabling efficient checkpointing at exascale.

Performance of an Intuitive Hash Table in Shared-Memory Parallel Programs

Christopher Cischke

Summary

Much research has been done and effort expended to design associative arrays or “hash tables” for parallel architectures. These efforts focus on a variety of techniques, including data distribution patterns, data access patterns, tiny changes to the hash function and the buffering of accesses. These efforts are not without merit, but the additional work laid on the programmer or the specialized nature of some of the layouts leads to a very low rate of return. Considering the push for modern parallel programming languages which abstract away the underlying architecture, a more intuitive version of the hash table is appropriate. We discuss the design and implementation of a hash table that is deliberately disconnected from the hardware. The implementation is done in the PGAS language Unified Parallel C. A series of tests are run against the design to obtain performance metrics. The metrics are evaluated along with recommendations for future work and usage. The results show great promise for a "write-once, read-many" type of table with no additional synchronization. Specifically, we find that oversizing the underlying storage by a factor of 2.25, we achieve a miss penalty of only 1 additional hop in the probe sequence. The table is shown to safely and reliably store the data. It is, in short, a synchronization-free, high-performance parallel hash table implemented in an intuitive fashion.

Hybrid Parallel Algorithm for Simulation of Seismic Wave Propagation in 3D Models Containing Intrusions with Complex Properties

Viktor Kostin, Vadim Lisitsa, Galina Reshetova, Vladimir Tcheverda and Dmitry Vishnevsky

Summary

This paper presents an original algorithm for simulation of seismic waves in models containing geological formations with complex properties such as anisotropy, attenuation, and small-scale inhomogeneities. Each of these structures require special treatment either small gridding or computationally intense models and algorithms. Meanwhile, these formations typically take as few as 25\% of the model, thus computationally expensive approaches can be used locally, while efficient algorithm can be applied elsewhere. However, the designed hybrid algorithm is heterogeneous thus the main focus of this research is the efficient parallel implementation via domain decomposition.

Simulating Resilience in Transaction-Oriented Networks

Dmitry Zinoviev, Hamid Benbrahim, Greta Meszoely and Dan Stefanescu

Summary

The power of networks manifests itself in a highly non-linear amplification of a number of effects, and their weakness -- in propagation of cascading failures. The potential systemic risk effects can be either exacerbated or mitigated, depending on the resilience characteristics of the network. The goals of this paper are to study some characteristics of network amplification and resilience. We simulate random Erdos-Renyi networks and measure amplification by varying node capacity, transaction volume, and expected failure rates. We discover that network throughput scales almost quadratically with respect to the node capacity and that the effects of excessive network load and random and irreparable node faults are equivalent and almost perfectly anticorrelated. This knowledge can be used by capacity planners to determine optimal reliability requirements that maximize the optimal operational regions.

Storm Surge Simulation and Load Balancing in Azure Cloud

Abhirup Chakraborty, Milinda Pathirage, Isuru Suriarachchi, Kavitha Chandrasekar, Craig Mattocks and Beth Plale

Summary

Cloud computing platforms are drawing increasing attention of the scientific research communities. By providing a framework to lease computation resources, cloud computing enables the scientists to carry out large-scale experiments in a cost-effective fashion without incurring high setup and maintenance costs of a large compute system. In this paper, we study the implementation and scalability issues in deploying a particular class of computational science applications. Using Platform-as-a-Service (PAAS) of Windows Azure cloud, we implement a high-throughput Storm-Surge Simulation in both a middleware framework for deploying jobs (in cloud and grid environment) and a map-reduce framework. We present the detailed techniques to balance the simulation loads while parallelizing the application across a large number of nodes.

Cloud MapReduce for Particle Filter-based Data Assimilation for Wildfire Spread Simulation

Fan Bai and Xiaolin Hu

Summary

Abstract— MapReduce is a domain-independent programming model for processing data in a highly parallel fashion. With MapReduce, parallel computing can be automatically carried out in large-scale commodity machines. This paper presents a method that utilizes the parallel and distributed

processing capability of Hadoop MapReduce for particle filter-based data assimilation in wildfire spread simulation. We parallelize the sampling and weight computation steps of the particle filtering algorithm based on the MapReduce programming model. Experiment results show that our approach significantly increases the performance of particle filter-based data assimilation.

Multiple Objective Scheduling of HPC Workloads Through Dynamic Prioritization

Tyler Simon, Phuong Nguyen and Milton Halem

Summary

We have developed a very efficient single queue scheduling system that utilizes a greedy knapsack algorithm with dynamic job priorities that satisfies high level objectives while maintaining high utilization of the HPC system or collection of distributed resources such as a computational GRID. We provide simulation analysis of our approach in contrast with scheduling strategies of shortest job first; longest waiting jobs first and large jobs first. Further, we look at the effects of system size on the total workload response time and find that for real workloads, the relationship between response time and system size follows an inverse power law. Further, our approach does not require system administrators or users to identify a specific priority queue for each of their jobs. Our proposed scheduler performs an exhaustive parameter search for a, per job, priority calculation to balance high level objectives objective and provide guaranteed performance for four classes of jobs in a workload. The system administrator needs only tune the prioritization parameters (knobs) and the system scheduler will behave accordingly, such as reducing wait time for jobs that are above average size with small runtimes. We demonstrate that our approach works very well on workloads that have many independent tasks. We evaluate our scheduler on a realistic scientific data processing mixed workload workload and realistic HPC workload trace from the parallel workloads archive.

Arbiter Work Stealing for Parallelizing Games on Heterogeneous Computing Environments

Wessam AlBahnassi, Dhrubajyoti Goswami and Sudhir P. Mudur

Summary

Games are simulations of the physical and imaginary worlds. Games nowadays run on commodity platforms that include different categories of powerful computing elements with varying capabilities. To benefit from this variety, suitable mapping of works to computing elements is essential for optimal performance. Arbiter Work Stealing (AWS) is a new scheduler addressing this requirement. The AWS scheduler builds on the classical work stealing algorithm by adding an upper layer that “manages” multiple running instances of the work stealing algorithm. AWS automatically schedules the dynamically generated game application tasks to appropriate processors using a cost model that takes into account current work load, execution times, data locality, and data transfer rates. Experimental results show that incorporating AWS to schedule tasks of a parallel game application yields superior performance through better utilization of the available re-sources and through better use of data locality in a heterogeneous computing environment.

Task Mapping in Rectangular Twisted Tori

Cristóbal Camarero, Enrique Vallejo, Carmen Martínez, Miquel Moreto and Ramón Beivide

Summary

Twisted torus topologies have been proposed as an alternative to toroidal rectangular networks, improving distance parameters and providing network symmetry. However, twisting is apparently less amenable to task mapping algorithms of real life applications. In this paper we make an analytical

study of different mapping and concentration techniques on 2D twisted tori that try to compensate for the twisted peripheral links. We introduce a performance model based on the network average distance and the detection of the set of links which receive the highest load. The model also considers the amount of local and global communications in the network. Our model shows that the twisted torus can improve latency and maximum throughput over rectangular torus, especially when global communications dominate over local ones and when some concentration is employed. Simulation results corroborate our synthetic model. For real applications from the NPB benchmark suite, the use of the twisted topologies with an appropriate mapping provides overall average application speedups of 2.9\%, which increase to 4,90\% when concentrated topologies ($c=2$) are considered.

High Performance Distributed Scheduling Algorithm

Ankur Narang, Abhinav Srivastava and Rudrapatna Shyamasundar

Summary

Exascale computing requires complex runtime systems that need to consider affinity, load balancing and low time and message complexity for scheduling massive scale parallel computations. Simultaneous consideration of these objectives makes online distributed scheduling a very challenging problem. Prior distributed scheduling approaches are limited to shared memory or primarily use work-stealing across distributed memory nodes for load-balancing or depend on the programmer specified affinity. However, the performance of work-stealing and affinity driven scheduling algorithms degrades when the input is irregular(UTS) and/or sparse (for example: Kmeans clustering, Cholesky factorization or Conjugate Gradient). In this paper we present a novel adaptive distributed scheduling algorithm (ALDS) for multi-place parallel computations, that uses a unique combination of remote (inter-place) spawns and remote work steals to reduce the overheads in the scheduler, which helps to dynamically maintain load balance across the compute nodes of the system. Using parallel machine learning algorithms such as Suppor Vector Regression running concurrently with program execution on the target architecture, ALDS can automatically and adaptively tune the parameters for scalable performance. Our design was implemented using GASNet API and POSIX threads. For the UTS (Unbalanced Tree Search) benchmark (using 2048 nodes of Blue Gene/P), we deliver superior performance than Charm++.

An Efficient Parallel Solution to the Wigner-Poisson Equations

Anne Costolanski, C. Timothy Kelley, Gary Howell and Andrew Salinger

Summary

A new model for studying the behavior of nanoscale tunneling devices has been developed in C++ using the Wigner-Poisson formulation. This model incorporates the parallel solvers of Sandia National Lab's Trilinos software with the efficient use of parallel data structures to create a code that scales well to a high number of processors. It also incorporates non-uniform meshes to discretize the solution space and higher order numerical methods to reduce simulation run times and increase numerical accuracy. The improvements inherent in the new C++ model will improve the quality of numerical simulations, and allow longer and more complex nanoscale devices to be modeled.

Probability-One Homotopy Maps for Tracking Constrained Clustering Solutions

David Easterling, Shahriar Hossain, Layne Watson and Naren Ramakrishnan

Summary

Modern machine learning problems typically have multiple criteria, but there is currently no systematic

mathematical theory to guide the design of formulations and exploration of alternatives. Homotopy methods are a promising approach to characterize solution spaces by smoothly tracking solutions from one formulation (typically an “easy” problem) to another (typically a “hard” problem). New results in constructing homotopy maps for constrained clustering problems are here presented, which combine quadratic loss functions with discrete evaluations of constraint violations are presented. These maps balance requirements of locality in clusters as well as those of discrete must-link and must-not- link constraints. Experimental results demonstrate advantages in tracking solutions compared to state- of-the-art constrained clustering algorithms.

Cache Efficient Implementation for Block Matrix Operations

Lukas Polok, Viorela Ila and Pavel Smrz

Summary

Efficiently manipulating and operating on block matrices can be beneficial in many applications, among others those involving iteratively solving nonlinear systems. These type of problems consists of repeatedly assembling and solving sparse linear systems. In the case of very large systems, without a careful manipulation of the corresponding matrices, solving can become very time consuming. This paper proposes a memory storage scheme convenient for both, numeric and structural matrix modification and, at the same time, allowing efficient arithmetic operation. The advantage of the new scheme is demonstrated through exhaustive tests on the popular Florida Sparse Matrix Collection. Furthermore the scheme was used to implement a nonlinear solver and tested on a graph nonlinear optimization application.

GPU-Based Monte Carlo Simulation for the Gibbs Ensemble

Eyad Hailat, Kamel Rushaidat, Jason Mick, Loren Schwiebert and Jeffery Potoff

Summary

Scientists are interested in simulating large biomolecular systems for longer times to get more accurate results. However, longer running times means more execution steps with large computation overhead.

We present an implementation of Monte Carlo simulation for the Gibbs ensemble using Lennard-Jones atoms on GPUs. Moreover, we use massive multithreading to utilize the large number of cores that the GPU has and hide the parallel setup overhead, such as global memory access and kernel launch overhead.

However, this process of porting the code to the GPU includes managing the available resources such as the number of registers, the amount of shared memory, number of threads per Streaming Multiprocessor, and global memory bandwidth used by each thread and kernel.

To the best of our knowledge, no other similar work that uses the GPU on this scale has been done for Monte Carlo simulation of the Gibbs ensemble. The evaluation results show over 45 times speedup using a commodity GPU compared to running on a single processor core.

GPU Accelerated Discontinuous Galerkin Methods For Euler Equations And Its Adjoint

Martin Siebenborn and Volker Schulz

Summary

This paper investigates the potential of GPU clusters to speed up simulation and discrete adjoint solution of three dimensional Euler equations on unstructured curved grids. For that purpose a higher-order Runge-Kutta discontinuous Galerkin method is applied and parallelized over a system of

multiple GPUs. It is shown how this solver works together with an artificial viscosity approach in transsonic flow simulations. The main focus is on the derivation of the discrete adjoint formulation and its GPU implementation.

An Efficient Implementation of Range-Doppler Algorithm on GPGPU

RAMAKRISHNA REDDY V, TIRUPATHI T, ANURADHA R, MAHENDRA P, PRAMOD KUMAR K and GEETA VARADAN

Summary

Fast Fourier Transform (FFT) is a key part in Signal Processing and forms an important part of building Synthetic Aperture Radar (SAR) Processor. Range Doppler Algorithm is the most common method used in implementing SAR Processor, which accepts raw SAR data and produces SAR images as output. The implementation of FFT greatly affects the performance of SAR image formation process. Although many implementations of FFT on GPU are available today, most of them are vendor specific, more generic in nature thereby require additional overheads in terms of data accesses from memory, thereby increases the latency etc. In this paper, an optimised approach of implementing FFT on GPU is presented more specific for SAR processor in which, FFT is combined with other operations like Convolution, Transpose etc. This approach reduces global memory accesses and launch of multiple kernels on GPU. This implementation not only improves performance of SAR processor by decreasing overall time taken, but also makes it an ideal implementation for processing of SAR data in real time.

Simulating Nonlinear Nano-to-Micro Scaled Material Properties and Effects at the Architectural Scale

Simin Wang, Andrew Lucia and Jenny Sabin

Summary

The problem of simulating atypical and nonlinear nano-to-micro scaled material properties at the architectural scale is untenable given the complexity of calculating such data through the use of existing rendering and simulation platforms. Though existing rendering engines enable the simulation of material optical properties such as transparency, translucency, and color, the unique behavior of many nonlinear materials' angular dependence and wavelength filtering properties requires the development of new methods for the simulation of such materials. As part of the ongoing trans-disciplinary research project, eSkin-a project to develop passively responsive building façade systems, this work demonstrates the effectiveness of simulating nonlinear material properties at the nano-to-micro scales deployed through simulation at the architectural scale. Overall, this project seeks to explore materiality from nano-to-macro scales based upon understanding of non-linear, dynamic human cell behaviors on geometrically defined substrates. The insights as to how cells can modify their immediate extracellular matrix microenvironment with minimal energy and maximal effect will lead to the biomimetic design and engineering of highly aesthetic, passive materials, and sensors and imagers that will be integrated into responsive building skins at the architectural scale. The simulation of these material and biological behaviors at multiple length scales across time and in space presents a complex set of simulation and modeling problems, especially in discerning the scalability of nano-to-micro scale effects into architectural scenarios. This paper describes our first catalogue of tools where desired optical properties of micro array structures are first simulated in order to extract angle and wavelength dependent quantitative optical data. Once calculated, these optical properties are then redeployed through architectural scale simulations utilizing custom written platforms and algorithms.

The Faraday Pavilion: Activating Bending in the Design and Analysis of an Elastic Gridshell

Paul Nicholas, Elisa Lafuente Hernandez and Christoph Gengnagel

Summary

This paper reports the architectural and engineering design, and construction, of The Faraday Pavilion, a GFRP elastic gridshell with an irregular grid topology. Gridshell structures are self-formed through an erection process in which they are elastically deformed. In this project, the geometry of the gridshell is form-found through the simulation of bending, where the calculation and steering of this aspect becomes a central part of both architectural and engineering design processes.

In this paper, we examine the architectural and engineering processes of simulation employed for the Faraday Pavilion project, and identify and discuss the advantages and disadvantages of both methods. The shell form and grid topology emerge from the architectural simulation, in which different calculative models relating to the material, element and structural scales are solved and synthesized within a force-based model. This qualitative model then provides the input for quantitative engineering simulation, where the equilibrium shape and load-bearing capacity of the elastically-bent structure is calculated with a non-linear, three-dimensional finite element model within the FEM-package Sofistik. These two approaches follow the same staged process, which relates directly to the later process of on-site construction, yet have important differences relating to the interaction with the design of the structure, differences in the definition of supports, connections and elements, the speed of calculation and the magnitude and precision of the results.

Self-Learning Algorithm as a Tool to Perform Adaptive Behaviour in Unpredictable Changing Environments - A Case Study

Elite Sher, Angelos Chronis and Ruairi Glynn

Summary

The current trend of adaptive and responsive architecture is expected to improve buildings' performance and create more efficient building systems. One of the major areas of research under this scope is adaptation to load distribution, the manipulation of external loads and internal force distributions over a structural element, changing over time.

Current studies that examine adaptive behaviour of structural elements in changing environments follow two main approaches: The first develops systems that react according to a database of predicted, pre-calculated situations. This process has limited results in a versatile environment, since not all situations are known. The second approach achieves real-time optimization process which involves massive calculations in real-time.

The basic assumption is that forces are applied in an unpredictable manner, and therefore it's impossible to predict or calculate all load distributions' combinations. This study aims to achieve an adaptive behaviour in real-time by implying learning abilities on a structural component. By this it will overcome the weaknesses of the current approaches as presented above. This was done by exploring a case study – a lightweight canopy – that can adapt to different load distribution by changing its shape, and avoid reaching a break-point. An Artificial Neural Network (ANN) algorithm, trained by a set of optimized solutions using a Genetic Algorithm (GA), was applied on the prototype. The use of the GA is essential in acquiring a database of finite solutions with which the ANN is trained.

In this study the complex calculations were conducted 'off-line' and the prototype was operating in a 'decision-making' mode in real- time. Results show that although the optimized database didn't include all the possible load distributions, it proved sufficient for the ANN to find the pattern of needed reaction and the case study successfully exhibit self-learning, and acquired the ability to adapt to unpredictable changing forces.

Choreographic Architecture: Inscribing Instructions in an Auxetic Based Material System

Theodoros Themistocleous and Chronis Angelos

Summary

This paper presents the development of an SLS 3D printed auxetic structure actuated to a predefined form by an embedded pneumatic network through an iterative process of feedback between digital simulation and physical testing. This feedback process is critical to the development of a more accurate predictive model and to compose the geometry of the suggested structure. An approach based on the emergence of final structure from the convergence of the behaviour of sub – structures has been introduced from the beginning and a methodology based on the analysis and synthesis of the simplest sub-system is the core of this research. The results indicate a promising simulation environment and a novel methodology for the design and fabrication of auxetic structures with embedded pneumatic actuation. This exploratory research suggests a fertile research space within the field of adaptive architecture and kinetic design.

Façade Apertures Optimization: Integrating Cross-Ventilation Performance Analysis in Fluid Dynamics Simulation

Chrysanthi (Sandy) Karagkouni, Ava Fatah gen Schieck, Martha Tsigkari and Angelos Chronis

Summary

Performance-oriented design has as a primary aim to in-troduce spaces that achieve acceptable levels of human comfort. Wind-induced airflow has a significant role to the improvement of occupants' comfort in a building. This paper explores the extent to which simulation of natural airflow can potentially be a contributing parameter in the conception of performance-aware designs. Testing the natural ventilation performance of a pavilion the study employs Fast Fluid Dynamics simulation. A performance analysis is conducted, whereby an array of automated feedback loops carried out by a genetic algorithm can produce a number of acceptable solutions as regards the optimization of facades' openings. The experimentation conducted proves the ability of the model to yield design instances that fulfill a number of environmental criteria re-lated to airflow and human comfort. In this light, the paper suggests that the aforementioned method can be used as an experimentation platform to influence the direction a de-signer may take when considering a design proposal.

A Review Of The Brazilian NBR 15575 Standard: Applying The Simulation And Simplified Methods For Evaluating A Social House Thermal Performance

Tassia Helena Teixeira Marques and Karin Maria Soares Chvatal

Summary

The new Brazilian ABNT NBR 15575 Standard recommends two methods for analyzing housing thermal performance: a simplified and a computational simulation method. The aim of this paper is to evaluate both methods and the coherence between each other. For this, the thermal performance of a low-cost single-family house was evaluated through the application of the procedures prescribed by the Standard. To accomplish this study, the EnergyPlus software was selected. Comparative analyses of the house with varying envelope U-values and solar absorptance of external walls were performed in order to evaluate the influence of these parameters on the results. The results have shown limitations in the current Standard computational simulation method, due to different aspects: weather files, lack of consideration of passive strategies, and inconsistency with the simplified method. Suggestions for improving the current Standard are indicated, so that it could better represent the real thermal performance of social housings in Brazil.

Thermal Reconstruction of a Crime Scene Using Calibrated Simulation

Nathan Brown, Susan Ubbelohde, George Loisos, Santosh Philip and Ibone Santiago

Summary

This study utilized energy simulation in support of a forensic pathology time of death analysis for a corpse discovered in a single family residence two years prior to the study. With the availability of subhourly comprehensive energy analysis tools, the study sought to accurately model thermal conditions in the house and to identify potential errors associated with using this model to simulate conditions around the time of death. Temperature and weather monitoring equipment were installed in the house over a five week period. This site data as well as weather data gathered from nearby weather stations provided the basis for calibrating a thermal model of the house using EnergyPlus. The energy model was constructed to represent the house as accurately as possible based on police photographs, a site visit, and a study of vintage building codes. An incremental process of calibration was used to ensure the highest accuracy for the room where the deceased was discovered. The

thermal model was able to predict the temperature in the room of interest within 2.5F with 90% confidence. This model was then altered to account for known differences between the monitoring period and the period of interest, and used to predict what the temperature profile had been at the time of death. Options for further analysis are presented to quantify error due to assumptions about known differences.

Modeling, Analysis and Simulation of a Form-Found Civic Sculpture for Lower Manhattan

Zak Kostura, Erin Morrow and Ben Urick

Summary

Analysis and design of an 8-storey cable net sculpture for a new transit center in Lower Manhattan required its designers to adopt a highly integrated computational approach. This approach combined aspects of structural analysis, form-finding, 3D and parametric modeling to achieve the artistic objectives of the sculptural form while ensuring desired performance of the extensive tensile system. This paper presents an overview of the artistic and functional objectives of the cable net and describes in detail the design approach of the project team, including software integration, nonlinear analysis, geometric modeling, documentation and construction administration. It outlines a partial approach toward performance-based design for a system with strong aesthetic objectives and a collaborative approach to construction administration to manage risk amogst the various stakeholders.

Visualization in 3ds Max for Cell-DEVS Models Based on Moving Entities

Victor Freire, Sixuan Wang and Gabriel Wainer

Summary

Building Information Modeling (BIM) increasingly ben-efits from modeling, simulation and visualization techniques. 3D visualization can provide a better way to obtain visual simulation results in BIM authoring tools. In this paper, we focus on improving interoperability, traceability, reusability and visibility of 3D visualization. We employ the DEVS (Discrete Event Systems Specification) formalism and its cellular extension Cell-DEVS, providing a method for visualizing Cell-DEVS models based on moving entities. We used this technique to develop a 3ds Max visualization plug-in for Cell-DEVS models based on BIM. This tool can show different animation models and allows designers to filter the building for visibility. We also show two case studies applying this tool for evacuation and occupancy simulation.

Evaluating the Performance Robustness of Fixed and Movable Shading Devices Against Diverse Occupant Behaviors

William O'Brien

Summary

Occupant-related energy use continues to use very simple and rigid rules when a buildings energy performance is predicted using building performance simulation (BPS). This is likely an artifact of envelope load-dominated buildings. But as envelopes and HVAC become more efficient, the role that occupants are playing an increasingly important role on building performance; especially highly efficient ones (e.g., net-zero energy buildings). Traditionally the associated uncertainty of these effects has been excused from the designer. However, evidence has shown that well-designed buildings can greatly reduce this uncertainty if they are designed to have greater resilience against a wider range of conditions. One cause for people to act in energy-intensive ways is if they encounter prolonged and

consistent discomfort (visual, thermal, and acoustic). Thus, the use of higher resolution models that identify possible discomfort are critical to successful high performance building design and operation. This paper proposes a method using a combination of probabilistic occupant models and explicit models of adaptive comfort to gain an improved understanding of robust building design.

Simulating the Sensing of Building Occupancy

Simon Breslav, Rhys Goldstein, Ben Doherty, Dan Rumery and Azam Khan

Summary

Accurate building occupancy information can be beneficial in minimizing energy use by improving the intelligence of a Building Automation System (BAS) and helping designers predict the effect of different design options on occupant behavior. However, current occupancy measurements are quite inaccurate due to limitations in sensing technology and the resulting discrepancies between sensor data and what actually happens. In this paper we explore the use of simulation to model occupant behavior in combination with motion sensors to be able to study the relationship between known and measured occupant behavior. An extensible occupancy model, influenced by computational cognitive science and implemented using established modeling conventions is presented along with a simple experiment comparing the effects of different sensor density levels.

Development of Discrete Event System Specification (DEVS) Building Performance Models for Building Energy Design

H. Burak Gunay, William O'Brien, Rhys Goldstein, Simon Breslav and Azam Khan

Summary

The discrete event system specification (DEVS) is a formalism for describing simulation models in a modular fashion. In this study, it is exploited by forming submodels that allow different professions involved in the building design process to work independently to create an integrated model. These submodels are the building, the HVAC system, and the occupant. In this study, a coupled DEVS building energy model of a generic office space is presented to demonstrate the viability of the DEVS formalism for BPS based design. Results indicate that the DEVS formalism is a promising way to improve poor interoperability between models of different domains involved in building performance simulations.

City information modeling (CIM) and urbanism: blocks, connections, territories, people and situations

Todor Stojanovski

Summary

The urban theory is voluminous body of knowledge. There is a kaleidoscope of urban definitions and standpoints, but there are no tools that capture the variegated viewpoints and representations in urbanism. Can we integrate these fragments?

I look at different urban theories and representations in architecture, sociology, geography, transportation and computer science to conceptualize city information modeling (CIM). CIM is discussed as a system of blocks or 3D spaces and dynamic relations as connections that define and redefine territories. The urban life today is a sequence of temporally inhabited and interconnected spaces, movable or fixed. The connections between spaces inspire or inhibit contacts and interactions between people. They bend times and continuosly shape and reshape spaces, sociabilities and situations. In architecture there was an evolution from computer-aided design (CAD) to building

information modeling (BIM), but in urbanism, where the geographic information systems (GIS) dominate, there is no such analogy.

A Study of the Relationship between Urban Form and Environmental Performance for Three Urban Block Typologies in Paris

Ji Zhang

Summary
This study explores the relationship between urban form and environmental performance by analyzing three representative urban street block typologies designed as proposed by various architects through the urban history of Paris. The performances of these typologies in terms of daylight potential, annual insolation, exposure to the sky, and potential to produce urban heat islands were simulated and compared across the typologies. The implications of the results in 1) the importance of appropriate performance indicator to be used and 2) the relationship between urban form, density, and environmental performance were discussed.

End-node Approach for Pedestrian Flow Simulation

Hiroshi Ota

Summary
Studies on urban networks often focus only on street systems, such as streets as links and junctions as nodes. This paper proposes the evaluation model for "Building-nodes", to examine how they contribute to the whole urban network. By the method of discrete system simulation, which is often used for evaluation of TCP/IP protocol studies, the author introduce the approach to treat urban network as the queueing network where "end-node congestion controls" are possible, to change the service time rate or numbers of service of the building. The result of simulation on Ginza shows the potentials of queueing network approach, and the advantage of decentralized intervention on urban network.

Designing-In Performance: Cloud based Simulation and Multidisciplinary Design Solution Space Search

Shih-Hsin (Eve) Lin and David Gerber

Summary
This research is built upon a previously established multidisciplinary design optimization (MDO) framework and further explores the impact of this framework on the early stages of design. Specifically, this paper addresses the potential of introducing a cloud-based approach to tackle geometrically complex design problems and to facilitate early stage design exploration. To address these interests two experiment sets are presented and then discussed in the context of the application of cloud-based computing. First, is a hypothetical scenario possessing complex geometry to understand how the existing established framework assists in the exploration of complex geometric design problems. Second, is a pedagogical benchmark case allowing for the observation of the human versus automated decision making process. By comparing these processes the impact of the established MDO approach on “designing-in performance” and the potential impact of applying cloud-based computing to the MDO framework can be revealed and discussed.

From Statistical to Diagrammatic Geo-spatial & Time Based Data Visualization Through Parametric Modeling

Ming Tang, Chris Auffery and Mingming Lu

Summary

This paper examines the result of an ongoing collaborative interdisciplinary research project on geospatial data visualization involving faculty and students from School of Energy, Environmental, Biological and Medical Engineering (SEEBME); and the School of Architecture and Interior Design (SAID), and School of Planning (SOP) at University of XXX. The paper describes experiential learning outcomes in the application of geospatial data to generate diagrammatic representations, as well as models and animation used in engineering, architecture and urban planning to specific urban issues such as urban health, education, crime, air pollutions as they are currently being confronted in major cities such as XXX. The paper focuses on how to reconstruct geospatial and time-based data into various representations. It describes the process of visualizing and representing database with emerging parametric modeling and animation tools. Start with a data base, the parametric design tools are used to decode and recode the social, cultural, economic and environmental complexity within the parametric equation. Computational tools such as GIS, Excel, Maya, Rhino and Grasshopper are used to build the platforms that allow parametric control of the rendered outcome.

The computational methods are extended by exploring, collecting, analyzing, and visualizing urban information and interactively representing the information through digital technology. The project examines: 1) how to visualize EPA data on air pollutants such as CO, Nox, PM2.5 and Ozone; 2) how to build 3D parametric urban models to reflect human health data; 3) how environmental data such as air pollution and social data such as crime factors can be integrated into diagrammatic visualization and stimulate planning solutions.

Integrated Design in the Simulation Process

Martha Tsigkari, Angelos Chronis, Sam Conrad Joyce, Adam Davis, Shuai Feng and Francis Aish

Summary

During the past decade the construction industry has been witnessing a constant shift in the way it operates. The advances of technology have made possible the adaptation of a more direct, performance-driven design approach based on multi-objective - and sometime contradicting – criteria of environmental, structural, economic and aesthetic impact. As a consequence, the various teams of consultants involved in the process no longer inform it consecutively, forcing various changes at different stages of the design. Instead, building projects increasingly comprise numerous design issues that can be delegated to small groupings of architects, engineers, and consultants to be resolved simultaneously, in parallel. In the light of this new status quo, the significance of new customized simulation tools and interfaces, capable of providing near real-time feedback and driven by multiple input criteria, looms as a potential game changer to the industry. This paper outlines the advances implemented by the authors to support these new integrated workflows.

Building Simulation Weather Forecast Files For Predictive Control Strategies

José A. Candanedo, Éric Paradis and Meli Stylianou

Summary

Research on model-based predictive control (MPC) for buildings has received significant attention in recent years, given its potential for load management and reduced energy costs. As it name indicates,

MPC is a technique that uses a model of the system and a forecasts of expected disturbances (in the case of buildings, weather and occupant loads) to predict the response of the system and act accordingly. Despite being a promising strategy, several obstacles need to be overcome. One of these obstacles is the lack of tools that allow adapting online weather forecasts –increasingly accurate, detailed and often free of charge– to the needs of building modelling tools. Building simulation tools usually employ a weather file that is representative of historical weather. In the case of MPC, a weather file periodically updated is required. This paper, an effort in this direction, presents a pilot project on the development of EnergyPlus weather files (EPW) based on available weather forecast data produced by the Canadian Meteorological Service. Each of these weather files contains forecast information with a prediction horizon of two days. Furthermore, the EPW file contains actual recorded weather data for the previous year; these measurements are essential for setting up initial conditions in the building model. Having a building model, initial state and forecast data it is then possible to investigate the effect of different control algorithms. The proposed approach could be adapted to different weather file formats, geographical locations, and data availability.

How Hot Can the University Campus Get in 2050? Environmental Simulation of Climate Change Scenarios at an Urban Neighbourhood Scale

Chengzhi Peng and Amr Elwan

Summary

The paper presents a pilot study into environmental simulation of a university campus as an example of simulating urban neighbourhood design under climate change scenarios. The steps of achieving what we call outdoor-indoor coupled environmental modelling are first described through the uses of two simulation tools: ENVI-met and AutoDesk Ecotect. ENVI-met is used to generate outputs describing neighbourhood outdoor micro-climate. Ecotect, on the other hand, is used to report a building's indoor environments. We show that how ENVI-met can be applied to contextualize Ecotect's building performance simulation. Next, we used the Climate Change Weather File Generator for UK tool developed at the University of Southampton to generate weather data files as projection of climate change scenarios. The future weather data were then used to run ENVI-met and Ecotect simulations of the campus site.

Working with postgraduate students, we carried out ENVI-met simulation of the campus neighbourhood site for present day (2012) and for 2050. The outputs were then applied to Ecotect simulations of four buildings in the neighbourhood. Based on the 2012 and 2050 results, the students developed climate change adaptation strategies and redesigns.

We discuss the implications of the pilot study for further research in several areas: (1) Continuous advance in urban environmental modelling at the scale of an urban neighbourhood will provide the essential micro-climatic context for more credible individual building performance simulation under climate change scenarios; (2) We now have the technical capacities for urban neighbourhood outdoor and individual building indoor simulations, but they cannot give us holistic pictures of outdoor-indoor interactions when operated alone; (3) The current system implementation of ENVI-met requires several days to complete a simulation cycle which is problematic for interactive design; and (4) Comprehension and communication of the entire environmental simulation outputs under climate change scenarios are overwhelming even to trained eyes.

Improving Building Performance at Urban Scale with a Framework for Real-time Data Sharing

Xiufeng Pang, Tianzhen Hong and Mary Ann Piette

Summary

At the urban scale, buildings are close to each other and share many common features such as micro climates, building functions and occupancy patterns. Some solutions for a single building will work for multiple buildings nearby. Weather measurements from one station with high accuracy well-maintained sensors can often be shared, in contrast to today's systems where each building has its own poor quality weather measurements. In this paper, we will introduce the rapid urban scale energy modeling and its application in real-time to improve building performance at the urban scale. We will first discuss a high quality weather station network that can be deployed at the urban scale, which provides the measurements for outdoor air temperature, relative humidity, direct solar radiation, diffuse solar radiation, global horizontal solar radiation, wind speed and direction, CO2 concentration, and indication of rain and snow. We then describe a framework to collect and store weather measurements, smart meter data as well as building characteristics from building owners and utility companies, create building models automatically, and distribute information to many buildings in real-time. The information distributed to users includes weather data (real-time, historical, and predicted), predicted energy performance, and continuous operation improvement suggestions.

Isomorphic City: A Customizable Future Scenario

Susannah Dickinson, David Gonzalez and Kyle Szostek

Summary

This paper discusses a future city design/research project for an existing city in the desert southwest of the United States of America. The project, Isomorphic City, set in the year 2087 develops a truly customizable and ever-adapting computational approach to the built environment. The project was shaped by environmental criteria and social media. Part of the challenge was to design digital methodologies that could simulate this scenario in as live a way as possible, incorporating real-time, live data into the equation. Form was the result of inputted parameters verses the making of form in an object-like fashion. Going from a rule based way of simulating the complex urban condition to a more human agent-based approach based on collective intelligence and social behaviour patterns.

A Collaborative Multi-Touch, Multi-Display, Urban Futures Tool

Michael Van Der Laan, Ronald Kellett, Cynthia Girling, Maged Senbel and Tao Su

Summary

Recent technological advances in multi-touch, multi-display computing interfaces and networking software have enabled the integration of all three roles into a single collaborative work space. This paper describes the development of one such application focused at carrying out complex urban design exercises through simple, transparent, and interactive means. Constructed through a federated system architecture, the system connects three independent applications: Google Earth, a Building Information Model (BIM) database, and an Indicators Dashboard (ID). The goal of this work is to provide a diverse group of stakeholders with a better understanding of the environmental impact and tradeoffs associated with a range in potential urban futures.

Visualization in 3ds Max for Cell-DEVS models based on Building Information Modeling

Sixuan Wang, Gabriel Wainer, Rhys Goldstein and Azam Khan

Summary

Simulation-based design can enable a number of advanced architectural and engineering applications such as energy modeling, occupant behavior prediction, or structural integrity analysis. To help make simulation-based design practical, scalability in terms of data and computation is needed. By using a Model-Driven Architecture (MDA) approach together with the RISE (RESTful Interoperability Simulation Environment) web interface, a generic scalable simulation design framework is presented. In our system, Building Information Modeling (BIM) data is represented in the Industry Foundation Classes (IFC) open standard from which Domain Specific Models (DSM) may be extracted for particular applications. The open RISE interface to a DEVS (Discrete Event System Specification) simulation provides computational scalability. We present a case study in which our system is applied to an evacuation model of a multi-floor building. We also show a 3D visualization of the simulation results to support further decision making. By enabling designers to extract information automatically from IFC and run simulations remotely, this kind of scalable system makes simulation a viable part of the design process.

Evaluation of Indoor Climate in Low Energy Houses

Liesbeth Staepels, Griet Verbeeck, Staf Roels, Liesje Van Gelder and Geert Bauwens

Summary

For the last couple of years new dwellings have evolved to better insulated buildings, who consume less energy. According to the EU EPBD, new buildings need to be nearly-zero-energy by 2021. In anticipation the Flemish Government tightens the energy requirements for newly built dwellings and other buildings on a regular base. Some individuals, however, choose to already go beyond these requirements, making it possible to evaluate the real performance of low energy houses, and to set guidelines for the future to build low energy dwellings.

The research presented here analysed 70 recently built dwellings in Flanders, ranging from standard execution up to very low energy, even energypositive, houses. They also cover a wide range of construction methods, airtightness levels, insulation types, types of heating and ventilation systems,... In order to evaluate the quality of the indoor environment, a monitoring campaign of the temperature, humidity and CO2-concentration in living room, master bedroom and bathroom was set up, both during winter and summer period.

Both in winter and summer, the temperature is mostly within comfort boundaries. However, in better insulated dwellings the mean temperature is generally somewhat higher and the deviation is smaller and on warm days the temperature can rise uncomfortably in both living room and bedroom. Results of the CO2 and humidity measurements show good to reasonably good indoor air quality, independently from the type of ventilation system.

HubPod: Integrating Acoustic Simulation In Architectural Design Workflows

Brady Peters, Jane Burry, Nicholas Williams and Daniel Davis

Summary

This paper reports on research that seeks to integrate acoustic simulation into the architectural design workflow. The goal of this research is to develop rapid and accessible workflows for architects

that allow them not only to tune the acoustic performance of designs at the scale of the room, but also at the level of the geometry and materiality of the surface. The project that serves as the test case is the HubPod, a semi-enclosed meeting room situated within an open working environment. As this study builds on previous research which investigates the acoustic properties of hyperboloid surface geometry, the main drivers for design were both the acoustic performance as well as the complex geometric and fabrication constraints involved with setting out and constructing the hyperboloid geometry. This paper focusses specifically on the integration of the acoustic simulation. Four design workflows were developed: two of these allowed for the investigation the acoustic performance of the room using acoustic simulation software; the other two allowed for the measurement and visualisation of the acoustic performance the surface using custom written scripts to calculate and visualise sound scattering. This paper will present some of the data produced by these simulations, and reflect on the value of the different workflows and simulation methods to this architecture project.

Data Mining using ANN for finding the effects of Building Structure on Thermal Comfort Parameters

Lubaid Ahmed and Abdolreza Abhari

Summary
The main objective is to find any data patterns in the thermal comfort data of a building environment datasets collected using wireless sensor network. There are many data mining methods available to search data patterns. Datasets are gathered using wireless sensor network. These collected datasets are then stored in Oracle database. Database attributes are composed of thermal comfort values of 4th floor of the building. The main goal of this research is to find data patterns and effect of different attributes on thermal comfort in building structure design. This will help to better understand the relation between the structure design and thermal comfort parameters in a building.

A Generalised Event Driven Framework For Building Occupancy

Gandherva Gunathilak, Aiswarya Prasannakumar, Negin Nazarian and Homa Naeimi

Summary
Building occupancy is very important for building energy simulation and research, but to generate occupancy model which is closer to the real world occupancy patterns is a very challenging task. In this paper we have constructed a generalised framework for the simulation of building occupancy by considering many factors which will influence the building occupancy in the real world.

The real life events such as lunch breaks, holidays ...etc. affects the occupancy patterns of real humans. The real humans also interact and work together as groups. As the occupancy of the real humans is greatly affected by these events and groups, the consideration of events and groups in the human occupancy model is very important. Therefore the proposed model incorporates the concept of events and groups. Events are properly categorised as personal or global events, deterministic or probabilistic and group based or non-group based events.

Unlike the previous building occupancy models which were based on Markov chains, the proposed framework is fully event driven and group based; this makes it closer to reality. The proposed model develops a generalised framework which will be able to simulate the occupancy patterns for any building be it an office, lab or even a house, then the model will also be able to produce the building occupancy patterns for the entire building, parts of a building or even a single room.

Simulation for Planning Passenger and Freight Transportation System Projects

Beth Kulick

Summary

Transportation projects, such as those for maritime ports, airports, passenger rail and freight rail are typically large investments and they can be a complex system that include multiple modes, new technologies, operating concepts, and operators. These projects are initiated by metropolitan planning organizations, city port authorities, and statewide department of transportation agencies and others. Architectural or engineering services firms are often contracted to assist with the project planning steps. The planning processes include evaluating and ranking alternatives with subjective and quantitative criteria. Additionally, as projects evolve, there is a need to gain stakeholder approval and conduct environmental impact reviews. Simulation modeling provides a unique and flexible framework to assist with concept development, stakeholder consensus building, and public approval during environmental impact reviews. Modeling provides the ability to quantify concept performance differences between alternatives and demonstrate that a concept provides operational sustainability for each of the stakeholders and modal flows. This paper describes several transportation planning projects and how simulation modeling can provide quantitative performance metrics to support the planning processes to enable the project to move towards advanced design and engineering stages.

Preliminary Results of Model Predictive Control of Shading Systems

Brent Huchuk, William O'Brien and Cynthia Cruickshank

Summary

Shades in buildings are widely installed and an effective technique for controlling cooling loads and occupant comfort. The approach to optimization is done through the use of model predictive control facilitated by the use of Matlab (Mathworks 2011) and EnergyPlus (DOE 2012). A model of a typical office space located in Ottawa, Ontario has been created and the model was developed for analysis under variable conditions. The analysis has resulted in the generation of an advanced reactive system facilitated by the use of the energy management system built within EnergyPlus along with a predictive control system optimized for the minimizing of the energy demand by the office space. The predictive system at this stage is delivering reductions of 5% during shoulder season over its reactive counterpart but this work is still on-going.

Modeling and Simulation for Improving Future Ambulance Patient Compartments

Deogratias Kibira

Summary

Emergency medical services (EMS) providers riding in ambulance patient compartments, while caring for patients, are at high risk of suffering injuries in case of a vehicle crash or sudden maneuver. One option to reduce this risk is to have providers use seat belts. However, providers have complained that the seat belts make it difficult to reach equipment and supplies necessary to treat patients. Another option is to redesign the layout of the patient compartment to (1) reduce hazards to both providers and patients and (2) improve access to patients, equipment, and supplies. A new design, based on ergonomic guidelines and user design requirements, has been developed. This paper describes the application of modeling and simulation in evaluating the redesign options. Evaluation is based on the effectiveness of the redesign in facilitating the providers ability to perform a range of clinical care tasks while seated and restrained. Simulation results and subsequent design revisions of the prototype will be used to recommend new design requirements and guidelines to existing ambulance design standards.

Reasoning, Planning and Goal Seeking for Small Unit Combat Simulation

Thomas Stanzione

Summary

Technology Solutions Experts, Inc. (TSE) is the primary developer of the Infantry Warrior Simulation (IWARS) system for the U.S. Army Natick Soldier Research, Development, and Engineering Center (NSRDEC). As part of continuing Research and Development (R&D) in Small-Unit (SU) combat operation simulation behaviors, TSE is developing algorithms for automation of SU and Soldier agent tasks and missions in constructive simulation, and for transition to Soldier operational decision-support tools. TSEs solution is the Reasoning, Planning, and Goal Seeking (RPGS) architecture, and it is targeted at the next generation of constructive simulations requiring autonomous and intelligent Soldier agents that are capable of problem solving; considering multiple courses of action; coordinating with friendly forces; following chain of command; and using Tactics, Techniques, and Procedures (TTPs) to guide operations. Intelligent Soldier agents guided by RPGS methodologies and algorithms will be able to execute complex tasks given only mission goals, initial/boundary conditions, and constraints. As part of this R&D project, TSE is creating a formal model of the Soldier and SU battlespace on which reasoning can be conducted. TSE has identified two technical standards for battlespace knowledge systems that will provide a foundational model for this project: the Joint Consultation, Command, and Control Information Exchange Data Model (JC3IEDM) and the Coalition Battle Management Language (C-BML). TSE is using JC3IEDM as the basis for representing information about battlefield entities. C-BML uses the knowledge elements in JC3IEDM and consists of a formal language for specifying orders and reports by specifying the "who, what, when, where, and why" of a mission order. TSE is using C-BML to describe mission goals and constraints that the analyst gives to Soldier agents, which will be used as input to the RPGS behavior engine to generate agent behavior. This paper discusses the use of these standards for a battlespace representation and the new technologies and capabilities being developed as part of this project and the contribution to human decision making and behavior representation for military and commercial constructive simulations.

Low-level Battle Management Language

Anders Alstad

Summary

TNO (The Netherlands) and FFI (Norway) are cooperating in extending a COTS Computer Generated Forces (CGF) tool with a Coalition Battle Management Language (C-BML) interface for executing C BML orders and issuing reports. Due to the lack of satisfactory models for command and control (C2)/ combat management in existing CGF tools, TNO and FFI have investigated the use of external agent frameworks. Two different modeling paradigms have been used: Belief, Desire, Intention (BDI) and Context based Reasoning (CxBR).

As part of this work a Low level Battle Management Language (Low level BML) has been created for communication between the C2/combat management agents and the CGF tool over High Level Architecture (HLA). The hierarchy of combat management agents decompose a C BML order into Low level BML commands and tasks understandable by a CGF tool. The agents also receive Low level BML events reported by the CGF tool and make use of these for agent behavior and C BML reports.
This paper presents the structure of Low level BML, how it is used and the rationale behind it.

Collaborative Modeling & Tailored Simulation for COA Validation

Mark Sumile

Summary

Course of Action (COA) analysis and wargaming gaps and requirements have been analyzed and discussed for decades, but developments to date have not yet addressed the potential of a collaborative information environment (CIE) to enable COA modeling and validation while planning during execution. This paper is operationally focused, concentrating on the key information threads that can describe the range of military operations and illustrating how those threads, when appropriately linked in a well-formed CIE, can facilitate the quantitative validation of both individual and coordinated COAs. Furthermore, unlike most operationally-focused articles, the concepts behind this paper have been reformed to be compatible with technology-focused principles that can be found in Engineering Principles of Combat Modeling and Distributed Simulation [Tolk 2012] and in information management concepts such as those mentioned in “Using Ontologies for Simulation Modeling” [Benjamin, Patki and Mayer 2006].

A Realistic Implementation for Simulating Side-Channel in Mobile Ad Hoc Networks

Ming Li, Mazda Salmanian and Peter C. Mason

Summary

In this paper, we present the necessary methods and techniques for simulating a wide-band multi-hop side-channel between two multi-hop peer nodes in a Mobile Ad hoc Network (MANET). Simulating such a side-channel is helpful in understanding its potential and experimenting with its cyber warfare benefits, and for discovering effective ways to detect it. Implementing a content-bearing side-channel in which the full frame payload is used for messaging requires the ability to access the full communication stack in the simulator. We have implemented a fully functional multi-hop side-channel on the EXata/Cyber (QualNet) simulation tool to a level of detail where it could potentially be used in-line with applications such as voice or video for real-time, real-life emulations. We provide the details of our implementation and evidence of the benefits of such a side-channel via test scenarios. Such

simulations may be used to facilitate military personnel's understanding of the effects cyber tools may have on their operations, in particular, Adaptive Dispersed Operations where military units are mobile.

Representing the Ballistic Missile Defense System using Agent-based Modeling

Christopher Lynch, Saikou Diallo and Andreas Tolk

Summary

This paper seeks to explain the applicability and advantage of modeling and simulating the Ballistic Missile Defense System (BMDS) using the Agent-based modeling (ABM) paradigm. This is accomplished through the application of the Modeling and Simulation – System Development Framework (MS-SDF) which provides a framework for capturing the BMDS and creating a model that integrates the human-in-the-loop decision maker into the design. The addition of the human-in-the-loop decision maker is an essential component of the BMDS and is a gap that is has not been sufficiently addressed by other works. ABM allows for the specific elements within the BMDS to be represented and allows for the creation of a highly-configurable simulation environment. The process of creating the model and simulation is provided through the MS-SDF. A reference model is used to identify the components and the characteristics of the BMDS. A conceptual model provides the plan for creating the simulation based on the material contained in the reference model and the simulation is then built based on the conceptual model. This process provides a level of traceability to the model that helps to verify and validate the model and simulation.

Evaluating the Applicability of Cloud Computing Enterprises in Support of the Next Generation of Modeling and Simulation Architectures

Harry Johnson and Andreas Tolk

Summary

Traditional computing employs client/server architectures where the client software can issue service requests to the server. Cloud computing offers the ability to transparently provide computing services remotely to users through the Internet, freeing them of the burdens associated with managing computing resources and facilities In order to fully exploit the benefits of computing and network progress, the simulation community must identify and resolve the challenges of distributing the next generation of modeling and simulation architectures among cloud computing enterprises

Poster Track

Abstract

DEV&DESS-Based Cyber-Physical Systems Modeling Language with Uncertainty Consideration

Hae Young Lee, Ingeol Chun and Won-Tae Kim

Summary

This paper presents our visual modeling language for large-scale cyber-physical systems (CPS) based on the discrete event and differential equation system specification (DEV&DESS) formalism and its extensions for uncertainty consideration. Prototypes of CPS modeling and simulation environments developed based on the language are then presented.

Discrete Event Simulator Benchmark Design

Carl Hein and Jon Russo

Summary

When selecting simulators for new applications, or when designing new simulators, it is useful to compare event-engine performance based on controlled measurements. Standard benchmarks would enable convenient performance comparisons between Discrete Event Simulator (DES) engines. This paper discusses requirements for designing well formed simulation benchmarks, and suggests two initial benchmark models for investigating performance and scalability. Eventually, a larger suite of benchmark models would enable more complete simulator characterizations.

Simulation and Optimization of Systems with Delays

John T. Betts, Stephen L Campbell and Karmethia C Thompson

Summary

Simulation and control of systems with delays is an important task in working with many applications. While specialized software exists for certain types of problems few general purpose optimization and simulation software environments exist that can easily incorporate delays. Often if they can work with delays, there are restrictions on the types of delays that are allowed. In this talk we discuss progress on a general purpose industrial strength simulation and optimization package that works with a large variety of systems that involve both differential algebraic equations and delays.

Transmitted Simulation from Vibrating Object Sound

Yuta Kinoshita, Yuko Aoyama and Kazutaka Kitamori

Summary

The research of an auditory function of robots to communicate with people is being applied in the field of Precision Engineering. This research describes on Vibrating Object Sound Sensor (VOSS) which detects sound information from a variety of situations to improve the recognition function of situations of swarm robots. VOSS recognizes various situations by sampling sounds of the result of Sourced Simulation (SS) which simulates the vibration of objects and Transmitted Simulation (TS) which simulates the transmitting process through the air.

SCS Membership Meeting

First Annual Membership Meeting

Tuesday, April 9, 2013

12:30 pm

The meeting will be held
in the Mission Ballroom

Agenda

Welcome by the SCS President

State of SCS Briefings

- **Chairman of the Board**
- **Treasurer Update**
- **VP Conference Update**
- **VP Membership Update**
- **VP Publication Update**
- **VP Education Update**
- **News from the SCS Office**

General Discussion

Upcoming SCS Conferences

2013 Summer Simulation Multi-conference (SummerSim'13)

July 7 - 10, 2013

The Fairmont Royal York, Toronto, ON, Canada

The 2013 Summer Simulation Multiconference (SummerSim'13) is an annual conference sponsored by The Society for Modeling and Simulation International which covers state-of-the-art developments in computer simulation technologies, as well as scientific, industrial, and business applications. Areas covered include high-performance computing technologies, models and algorithms, GUI visualization technologies, communications and much more. Application disciplines covered include advanced telecommunication; computer systems; military, government & aerospace; energy, and other industries.

The conference includes keynote speeches presented by technology and industry leaders, technical sessions, professional development courses and seminars, as well as vendor exhibits. Scientists, engineers, managers, educators, and business professionals who develop or use simulation tools are invited to participate and present original papers. Proposals are solicited for papers, panels, tutorials, workshops, seminars, exhibits, social activities and for other presentation, discussion and sponsorship formats. People are always welcome to benefit by taking an organizing role. SummerSim'13 offers many ways to promote simulation products and to enhance corporate images. You are invited to use the Summer Simulation Multiconference in ways that best serve your interests.

SummerSim'13 will include invited speakers, quality refereed papers, timely topical workshops, joint plenary sessions, consolidated registration, and access for registrants to all Multi-conference activities.

The following topic areas are scheduled:

- International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS'13)
- Summer Computer Simulation Conference (SCSC'13)
- Grand Challenges in Modeling & Simulation (GCMS'13)

Please visit www.scs.org for key dates and deadlines, or call the SCS office at (858) 277-3888

SpringSim'13 Survey

Please take a moment to fill out this survey and return to the registration desk, via email to scs@scs.org, or via mail to SCS at 2598 Fortune Way, Suite I, Vista, CA 92081. THANK YOU! Your feedback will help us to improve future Spring Simulation Multi-Conferences!

1. Which track did you attend? (circle) ADS ANSS CNS EAIA HPC MMS SIMAUD TMS/DEVS MATH POSTER

2. Which describes you best (circle) ATTENDEE PRESENTER EXHIBITOR OTHER

(if other please explain) _____

3. How satisfied were you with the conference registration process? (circle)

VERY SATISFIED SATISFIED DISSATISFIED VERY DISSATISFIED NOT SURE

4. How satisfied were you with the conference fees compared to other conferences? (circle)

VERY SATISFIED SATISFIED DISSATISFIED VERY DISSATISFIED NOT SURE

5. How satisfied were you with the conference materials provided? (circle)

VERY SATISFIED SATISFIED DISSATISFIED VERY DISSATISFIED NOT SURE

6. Overall, how satisfied were you with the speakers/presentations? (circle)

VERY SATISFIED SATISFIED DISSATISFIED VERY DISSATISFIED NOT SURE

7. Overall, how satisfied were you with the conference location and facilities? (circle)

VERY SATISFIED SATISFIED DISSATISFIED VERY DISSATISFIED NOT SURE

8. What did you like best/least from this year's conference? (please write in)

_____

_____

_____

9. What would you like to see at future SpringSim conferences? (locations, exhibitors, topics, etc)

_____

_____

10. What other conferences do you typically attend? (please write in)

_____

_____

THE SOCIETY FOR
MODELING & SIMULATION
INTERNATIONAL

2598 Fortune Way, Suite I
Vista, CA 92081
858-277-3888 (office)
858-277-3930 (fax)
www.scs.org