2012 International Simulation Multi-Conference

SummerSim'12 Program Book

8-11 July 2012

Architecture Complex, Genoa University

Genoa, Italy

The Society for Modeling & Simulation International (SCS)

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2012 International Simulation Multi-Conference (ISMC'12)

PROGRAM BOOK

July 8-11, 2012
Genoa University; Genoa, Italy

Architecture Complex
Stradone Sant' Agostino, 11 – 16123 Genova

Sponsored by SCS in cooperation with IEEE Communications Society & ACM

General Chairs

Agostino Bruzzone, Simulation Team MISS, DIME, University of Genoa, Italy
Franco Davoli, DITEN, University of Genoa, Italy

Program Chair

Francesco Longo, MSC-LES University of Calabria, Italy

ISMC'12 SYMPOSIA ACRONYMS, DEFINITIONS & ORGANIZERS

SCSC - Summer Computer Simulation Conference

General Chair
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Francesco Longo, MSC-LES Univ. Calabria, Italy

Program Chair
Miquel Angel Piera, University Autonoma de Barcelona, Spain

The Summer Computer Simulation Conference represents one of the oldest events in M&S worldwide and at the same time the top Conference with state of art of the most innovative Simulation Technologies. Summer Computer Simulation Conference (SCSC2012) focus is on Simulation as Enabler for the Future; in fact Modeling and Simulation (M&S) is a very critical area for supporting Research and Development, as well as competitiveness, worldwide. New technologies are enabling new uses of M&S and increasing its impact in new areas. SCSC2012 provides an International Forum for presenting the State of the Art in the International Simulation Community as well as the Effectiveness of Simulation Experiences in World Businesses. The best overall papers, as selected by the Conference Committee, will be considered for possible publication in special issues of International Journals.

SPECTS - International Symposium on Performance Evaluation of Computer & Telecommunication Systems

Honorary Chair
Mohammad S. Obaidat, Monmouth University, NJ, USA

General Chair
Jose Luis Sevillano
Univ. of Seville, Spain

Program Chairs
Raffaele Bolla, Univ. of Genoa, Italy
Pere Vilà, Univ. of Girona, Spain
Isaac Woungang, Ryerson Univ., Canada

The International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS2012) is an annual international conference acting as forum for professionals involved in performance evaluation of computer and telecommunication systems. Performance evaluation of computer systems and networks has progressed rapidly in the past decade and has begun to approach maturity. Significant progress has been made in analytic modeling, simulation, and measurement approaches for performance evaluation of computer and telecommunication systems. SPECTS is technically co-sponsored by IEEE Communications Society. Accepted papers of SPECTS are archived in IEEE Xplore.

GCMS - Grand Challenges in Modeling & Simulation

General Chair
Roy Crosbie, California State University, Chico, USA

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Program Co-Chairs
Kelly Cooper, Office of Naval Research, CA, USA
Mhamed Itmi, INSA-ROUEN, France

The 5th International Conference on Grand Challenges in Modeling and Simulation (GCMS2012) is one of the main SummerSim2012 conferences, organized by the Society for Modeling and Simulation International (SCS). Following the success of the earlier conferences in Edinburgh, Istanbul and Ottawa the focus of GCMS2012 will continue to be on the major challenges that must be met if the full potential of modeling and simulation is to be realized. Significant progress in M&S methods and applications has accompanied the rapid growth in the power and cost-effectiveness of available computer systems, but many challenges remain.

ICBGM – International Conference on Bond Graph Modeling & Simulation

General Chair

Jose J. Granda, California State University, USA

Program Chair

Francois Cellier, ETH Zentrum, Switzerland

The 2012 International Conference on Bond Graph Modeling and Simulation brings together research paper presentations, panel sessions, tutorials, workshops, seminars, industrial applications, and software demonstrations that use Bond Graph modeling methods. There will be also featured plenary speakers and some special invited presentations.
This conference will focus on Bond Graph modeling techniques for dynamic systems. Theoretical principles for electrical, mechanical, hydraulic, pneumatic, and control system applications will be presented. Leading industrial users of the method in automotive, aircraft, fluid power, kinematics, multibody systems, and social and biological systems have been invited.

GENERAL INFORMATION

FOR ISMC'12 ATTENDEES

Registration

Your registration for the 2012 International Simulation Multi-Conference (ISMC'12) includes morning and afternoon breaks each day, the Monday evening reception and access to all sessions, tutorials and special presentations (unless otherwise noted).

Registration Hours (*Room 4A*):

- **Sunday**, July 8 (pre-registered badge pickup ONLY) – 3:00pm-5:00pm (hallway outside of Room 4A)
- **Monday**, July 9 – 7:30am–5:00pm
- **Tuesday**, July 10–7:30am–5:00pm
- **Wednesday**, July 11-7:30am–Noon

If you have questions during the event, feel free to stop by the Registration Desk.

Breaks

- **Monday**, July 9 – 10am–10:30am | 3-3:30pm *–Sottoporticato*
- **Tuesday**, July 10 – 10am–10:30am | 3-3:30pm *–Sottoporticato*
- **Wednesday**, July 11 – 10am–10:30am | 3-3:30pm *–Sottoporticato*

Meetings

- **SCS Board of Directors Meeting -** Sun., July 8, **Room:** 4A

Monday Evening Reception & Announcement of Best Paper Awards

- There will be a reception with drinks and a buffet-style dinner in the Giardini del Chiostro area for all attendees, on Monday, July 8 beginning at 5:30pm (dinner will be served at 6:30pm). The Best Paper Awards will be presented at the reception.

Optional Tuesday Evening Paid Banquet

- There will be an optional paid dinner banquet at a Genoa area restaurant as well as a walking tour of the area for 55 Euros (including bus fare) per person on the evening of Tuesday, July 10. An email with further information was sent out to all pre-registered attendees. Some onsite availability might be able to be accommodated; please see the Registration Desk in Room 4A for further information. Space is limited on a first-come, first-served basis.

Tutorials

- **TUTORIAL: Learning the Bond Graph Method For Modeling & Simulation of Mechatronics Systems** - Sun., July 8, 2:00-5:00pm
  Room: Benvenuto
  Presenters: Prof. Jose Granda, California State University, Sacramento
- **TUTORIAL: Simulation Conceptual Modeling** – Sun., July 8, 2:00-5:00pm
  Room: 4C
  Presenters: Nathalie Harrison, Defence R&D Canada-Valcartier & William F. Waite, The AEgis Technologies Group, Inc.
- **TUTORIAL: Green Technologies for Smarter Next-Generation Wire-line Networks –** Wed., July 11, 2:00-5:00pm
  Room: Benvenuto
  Presenters: Raffaele Bolla, DITEN Univ. of Genoa & Roberto Bruschi, National Inter-University Consortium for Telecommunications (CNIT)

Keynote Presentations

Keynote Speaker: Aldo Zini
Cetena S.p.A, Genoa, Italy
Monday, July 9 9:00am-10:00am Room: Benvenuto
Title: Virtual Ship: Dream or Reality

Biographical sketch

Aldo Zini, Head of IT Department at Cetena S.p.A.

Since 1991 he has been working in CETENA dealing with information technologies problems. He was involved in several projects dealing with I.T. applications in shipbuilding and shipping areas: CAD systems, Neural Networks, Ship Survivability Analysis, Virtual Prototyping, Expert Systems, Database, dynamic WEB sites, technical computational code, graphical interfaces.

He took part to the NATO NG6 Specialist Team on Simulation Based Design and Virtual Prototyping and to the NIAG Sub Group 60 on SBD & VP.

He was involved as scientific responsible in several European research Projects, i.e. HYDROSES and MATSTRUTSES. He is member of Liophant Simulation and member of the MIMOS Editorial Board.

Keynote Speaker: Mario Marchese
University of Genoa
Monday, July 9 2:00pm-3:00pm Room: Benvenuto
Title: The Evolution of Internet Technology, From Pervasive to Cloud Computing

Abstract

The Keynote Speech will begin by focusing on the evolution of the Internet and by showing statistics about world Internet usage and about Internet penetration rates, structured for geographic regions. Updated and four years old values will be compared to give an idea of the impressive growth. The audience will be challenged with the following question: given this Internet growth, is now Pervasive Computing real? The paradigm of pervasive computing envisages a world where a wide set of quantities (vibrations, heat, light, pressure, magnetic fields, ...) are acquired through sensors and transmitted through suitable seamless communication networks for information, decision, and control aim. Is it a reality now or is it still a dream? It is probably a current reality but interdisciplinary advances are required to innovate in the field of pervasive computing and networking: new communication and networking solutions, new and less complex operating systems, miniaturized memorization capacity, innovative decision algorithms, efficient signal processing, context-aware solutions. Possible applications extend to all environments where monitoring and connecting the physical world is important: civil protection, transportation, military, underwater, space monitoring and communications, among others. In practice the aim is to create a pervasive network of heterogeneous devices which communicate data with each other and with other networking devices in a seamless way through heterogeneous network portions. So, the aim is connecting anything, from anyplace, at

anytime, but these are the three keywords of the Internet of Things paradigm, born independently of pervasive networking, but now strictly connected to it.

In short, a pervasive network is a telecommunication network composed of heterogeneous devices, differentiated for size, dynamics, and functions; and connected through heterogeneous communication solutions. This operative framework is also called Future Internet, an IP (Internet Protocol) pervasive network of networks, where end systems include non-IP-based devices, like some sensors. The concept of Future Internet has no explicit limits. It may include interplanetary communication, environment that needs dedicated technologies and protocols and, up to now, has used particular and isolated communication networks.

To extend the idea of pervasive communications including interplanetary and other challenging links implies adding to the classical problems of pervasive communications such as quality of service, mobility and security, the peculiarities of interplanetary links such as intermittent connectivity, disruptive links, large and variable delays, and high bit error rates which are currently tackled through the paradigm of Delay Tolerant Networks (DTNs).

The strong link among the mentioned underlined concepts will be evidenced also through practical examples and stimulating figures during the Keynote Speech. Special attention will be given to related research activity so to stimulate questions and discussions.

The last part of the Speech will be dedicated to complete the evolution of Pervasive Computing up to Cloud Computing.

The cloud model is composed of:

1) five essential characteristics: on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service; 2) three service models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS); 3) four deployment models: private clouds, community cloud, public cloud, and hybrid cloud.

SaaS represents the capability provided to the consumer to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through client interfaces, such as a web browser and/or program interfaces. PaaS focuses on the capability provided to the consumer to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming tools supported by the provider. IaaS evidences the capability provided to the consumer concerning processing, storage, networks, and other computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. Another model is important to mention: Data as a Service (DaaS), which focuses on the capability provided to the consumer to access shared Data in the Cloud.

In this context it is topical to evidence the importance of "new" tools: Smartphones. Which is their role in the Cloud? Terminals for voice and data? Hubs? Sensors? Do they use the Cloud or are they a part of the Cloud? The Speech will try giving and soliciting answers.

Biographical sketch

Mario Marchese (S'94–M'97–SM'04) was born in Genoa, Italy in 1967. He got his "Laurea" degree cum laude at the University of Genoa, Italy in 1992 and the Qualification as Professional Engineer in April 1992. He obtained his Ph.D. (Italian "Dottorato di Ricerca") degree in "Telecommunications" at the University of Genoa in 1996.

From 1999 to 2004, he worked with the Italian Consortium of Telecommunications (CNIT), by the University of Genoa Research Unit, where he was Head of Research. Since February 2005 he has been Associate Professor at the University of Genoa. He is the founder and still the technical responsible of Satellite Communications and Networking Laboratory (SCNL) by the University of Genoa, which contains high value devices and tools and implies the management of different units of specialized scientific and technical personnel. Since 2009 he has been also technical co-responsible of the Digital Signal Processing Laboratory (DSP) by the University of Genoa.

Over the years he acquired a great experience in projects (both concerning technical managing, implementation details, and composing financial and technical plan) funded by national and international entities, dedicated to: design, implementation, installation and validation of telecommunication infrastructures; design and validation of satellite networks for environmental monitoring via radar; performance evaluation of networks oriented to tele-education and multimedia applications; transport

protocol and resource management for telecommunications networks; low complexity and energy aware signal processing for mobile devices; context aware systems; simulation and emulation of components.

Additionally to his teaching activity at University, he is responsible as Member of the Managing Committee of 10 Masters e 20 Training Courses at the Military Telecommunications School in Chiavari years 2008-2014, where he is also the Chair of the Master in Advanced Telecommunications, since 2008, and Member of the Steering Board Master of the Master in Telecommunications, since 2008.

Concerning scientific knowledge dissemination and standardization activity:
- He was the Official Representative of CNIT within the European Telecommunications Standard Institute (ETSI) from 1999 to 2005, he is active member in the Satellite Earth Station (SES) Broadband Satellite Multimedia (BSM), where he contributed to introduce the SI-SAP (Satellite Independent – Service Access Point) and to design it.
- He is one of the Past-Chair of the IEEE Satellite and Space Communications Technical Committee that he Chaired from 2006 to 2008 and Senior Member of the IEEE.
- He is author and co-author of about 200 scientific works, including international magazines, international conferences and book chapters.
- He is the author of the book "Quality of Service over Heterogeneous Networks", John Wiley & Sons, Chichester, 2007.
- He is Associate Editor of the International Journal of Communication Systems (Wiley) and of the IEEE Wireless Communications Magazine.
- He is in the Editorial Board of the IEEE Wireless Communications.
- Winner of the IEEE ComSoc Award "2008 Satellite Communications Distinguished Service Award" in "recognition of significant professional standing and contributions in the field of satellite communications technology".
- He has organized Special Issues of International Journal and Magazines (Wiley International Journal of Communications Systems, IEEE Wireless Communications, IEEE JSAC, Elsevier Computers and Electrical Engineering Journal, IEEE Systems Journal) on topics about Wireless and Satellite Telecommunications Networks and Systems.
- He has been Member of the Organizing Committee of Globecom 2010, Miami, USA. He has been Technical Program Co-Chair of the following international conferences: SPECTS 2005, Philadelphia; IEEE Globecom 2006 - Satellite and Space Communications Symposium, San Francisco; IEEE Globecom 2007 - Wireless Networking Symposium , Washington DC; ICC'08 - General Symposium, Beijing; IEEE Globecom 2008 Symposium on Selected Areas in Communications, New Orleans; ICC'09 - Wireless Networking Symposium, Dresden. He has been in the Technical Program Committee of more than 30 International Conferences, where he has also often been Session Chair and/or Session Organizer and often presented his scientific articles personally.

His main research activity concerns: Satellite and Radio Networks, Transport Layer over Satellite and Wireless Networks, Quality of Service and Data Transport over Heterogeneous Networks, Emulation and Simulation of Telecommunication Networks and Satellite Components, Low Complexity and Energy Aware Signal Processing for Mobile Devices (e.g., Smartphones), Context Aware Systems.

Keynote Speaker: Wolfgang Borutzky
Bonn-Rhein-Sieg University of Applied Sciences
Tuesday, July 10 9:00am-10:00am Room: Benvenuto
Title: Bond Graph Modelling for the Analysis of Fault Scenarios in Hybrid Systems

Abstract
Bond graph modelling starts from the consideration of the energy exchange between system components and possible conversions of energy from one form into another. As the exchange and transformations of energy happen to be continuous with respect to time, the methodology initially was limited to the representation of continuous time models.

In the course of the past decades various approaches based on ideal or non-ideal switches, controlled junctions, or switched power junctions have been proposed to extend the bond graph methodology to hybrid system models. The focus has been mainly on the simulation of the dynamic behaviour.

On the other hand, bond graph modelling has been increasingly used for (robust) fault detection and isolation (FDI) in continuous system and process models as the basis for fault diagnostics and automatic process supervision. Only recently, bond graph-based FDI has also been applied to hybrid system models.

The paper briefly surveys the bond graph modelling of hybrid systems and presents the author's bond graph approach to the analysis of fault scenarios in hybrid systems by means of some illustrative examples. The presentation concludes by considering aspects such as the generation of system mode dependent adaptive thresholds for fault indicators that help avoid missing or false fault detections which is essential for a correct fault diagnosis.

Keywords: Hybrid systems, system mode independent bond graph representation, FDI, adaptive fault thresholds, incremental bond graphs.

Biographical sketch

Wolfgang Borutzky obtained his University Diploma Degree in Mathematics as well as his Doctoral Degree in Mechanical Engineering from the Technical University of Braunschweig, Germany. He is a Professor for Modelling and Simulation of Engineering Systems at Bonn-Rhein-Sieg University of Applied Sciences in Germany.

He came across bond graph modelling by a survey article of Prof. A. Schöne back in 1980 when he was appointed a research assistant at an institute for control of the Technical University of Braunschweig, Germany. Since that time, the bond graph methodology has become his favourite subject in research and in teaching. His research includes modelling and simulation methodologies and modelling languages as well as modelling, simulation, control and fault diagnosis of mechatronic systems.

He has published in the proceedings of many international conferences on Modelling and Simulation and in refereed scientific journals. He is the author of the 2010 Springer monograph titled Bond Graph Methodology -- Development and Analysis of Multidisciplinary Dynamic System Models. He is also the editor and a co-author of a 2011 Springer compilation text on Bond Graph Modelling of Engineering Systems with contributions from experts in various fields from all over the world.

Since 1990 he has served in many international scientific conferences on Modelling and Simulation in various capacities and was an invited speaker to some international conferences. Moreover, he has given invited lectures and short courses in industry on bond graph modelling.

He is a senior member of SCS and a member of the IASTED Technical Committee on Modelling and Simulation and serves on the Editorial Board of some modelling and simulation related scientific journals.

Keynote Speaker: Prof. Jose J. Granda, PhD
Department of Mechanical Engineering
California State University, Sacramento, CA, USA
Wednesday, July 11 9:00am-10:00am Room: Benvenuto
Title: The Grand Challenges for Modeling and Simulation in Space Exploration

Abstract

Humanity faces great challenges to conquest and learns what is beyond our planet. These are marked with successes and adversity. Many successes are learned from failures. Can we as scientists and engineers use our knowledge to predict failure or success using our Modeling and Simulation tools? Failure is part of success as death is part of life. The question is what it takes to manage risk and learn from adversity to be successful? We recall what happened in 1986 and in 2003 where the memories of Challenger and Columbia changed the way engineers and scientist approach the conquest of space. These were great adversity moments, but we raise the question: did they help us be where we are today in our knowledge to carry out successful missions? How was man able to overcome these challenges? What is the role that Modeling and Simulation played?

Great engineering problem solutions arise of little events that happen when engineers brainstorm and think about solutions while they are not even working at their desks or in the lab. The development and birth of new technologies is the result of creativity and being persistent in the pursuit of a solution. In the exploration of space the design of space vehicles becomes the greater challenge to carry man into space and bring him safely to Earth. One of NASA's famous posters shows an astronaut with his son in his arms and the little one is thinking "My daddy has friends in high places". Who are his friends in high places? He is thinking of you and I who are engineers and have the challenge to use our knowledge to send his daddy to space and bring him

safely back. This can only be achieved if we are sure of what we as engineers are doing. Since we cannot construct and operate on Earth a huge laboratory such as the International Space Station exactly as if it were in space, we have to rely on Modeling and Simulation to learn and be sure of what we are doing. In this endeavor several Modeling and Simulation techniques are keys to the development of space vehicles and for the testing and verification phase. One of them is as combination of Solid Modeling with three dimensional Dynamic Analysis and Finite Element Modeling. Another is the use of software tools to produce models quickly and precisely, particularly when the problems are multidisciplinary in nature such as Mechatronics Systems. Here Bond Graph Modeling and Simulation technology plays a very important role.

During space missions, real challenges occur in real time. How computer models and simulation can help man make the decisions? We need to examine the experiences of the Shuttle flights and remember the challenges. STS-114, Shuttle Discovery, in July 2005, the return to flight right after Columbia challenged engineers to make a decision to send an astronaut outside and pull out the fillers between the thermal protection system tiles. Computer simulations had shown that aerodynamic effects could appear on reentry affecting the boundary layer a potential risk to the Shuttle Discovery and its crew. STS-118 Shuttle Atlantis in June 2007 saw the repair of the gap in the Orbital Maneuvering System (OMS) thermal blanket (heat shielding) which was conducted during an EVA (External Vehicle Activity) and the temporary shutdown of the ISS control system. STS-125, Shuttle Atlantis mission to the Hubble Telescope in May 2009 posed a risk since there was no space station to retreat is something went wrong. In each of these grand challenges for NASA engineers and scientists, computer modeling and simulations were at their side.

Prof. Granda will explore these challenges and the solutions and share his experiences as a NASA Faculty Fellow in his role as an engineer and Professor working side by side with NASA engineers in the Space Shuttle and the International Space Station program. The program ended with STS-135 on July 21, 2011 with the last flight of Space Shuttle Atlantis. The lessons learned have allowed him and his NASA colleagues at the Integrated Guidance, Navigation and Control Branch at the Johnson Space Center in Houston to continue to work building on the lessons of the past for the new vehicles of future space exploration. One of these is the New Morpheus Autonomous Lander. He will also share his experiences in his role as one of NASA's spokespersons for Latin America and Europe during 17 missions in which he participated since 2005.

Biographical sketch

Prof. Jose J. Granda, PhD is a Professor of Mechanical Engineering at the California State University in Sacramento. He obtained his M.S, and Ph.D. degrees in Mechanical Engineering from the University of California, Berkeley and Davis respectively. He is currently Chairman of the Technical Activity Committee on Bond Graph Modeling and Simulation of the Society for Computer Simulation. He serves as General Chair for ICBGM'2012 (International Conference on Bond Graph Modeling and Simulation. The University of California, Davis awarded him an award as the Distinguished Engineering Alumni Award. The California State University awarded Prof. Granda the Outstanding Scholarly Achievement Award. Prof. Granda is an expert in computer modeling and simulation of Mechatronics Dynamic Systems with experience in dynamics and design of ground and space vehicles. Prof. Granda has done research and teaching in European universities such as the University of Applied Sciences in Bonn-Rhein, Germany. He was also invited as Visiting Professor at the Swiss Federal Institute of Technology (ETH), Zurich Switzerland.

Since 2002, he has worked with NASA as a NASA Faculty Fellow, first at the NASA Langley Research Center as part of the Morphing Project and then at NASA Johnson Space Center as part of the engineering team of Space Shuttle Discovery STS-114 mission to the International Space Station. He worked for NASA Ames and the Kennedy Space Center, invited by the Exploration Systems Mission Directorate (ESMD). Prof. Granda is one of NASA mission engineering spokespersons. He served as NASA spokesperson for 17 missions of the the Space Shuttle program for Atlantis, Endeavour and Discovery Shuttles on their missions to the Space Station and the Hubble Telescope, STS-135, STS-134, STS-133, STS-132,STS-131, STS-130, STS-129, STS-128, STS-127, STS-126, STS-124, STS-123, STS-122, STS-118, STS-117, STS-114. He is responsible for the mission status updates for all Latin American Countries and other Spanish speaking countries around the world. Using social media, he is engaged in activities to motivate young people to become engineers and scientists. His can be found on Twitter at @SrNASA for following the latest NASA missions at http://twitter.com/SrNASA in English and Spanish.

Welcome to SummerSim 2012 from the General Chairs

Agostino Bruzzone
DIME-University of Genoa, Italy

Franco Davoli
DITEN-University of Genoa, Italy

We wish to express our warmest welcome to all the participants and organizers of the conferences making up this 2012 Summer Simulation Conference (SummerSim 2012). This year we feature 4 parallel conferences: the International Symposium on Performance Evaluation of Computer and Telecommunication Systems (**SPECTS 2012**), the Summer Computer Simulation Conference (**SCSC 2012**), the 5th International Conference on Grand Challenges in Modeling and Simulation (**GCMS 2012**); and, last but not least, the International Conference on Bond Graph Modeling and Simulation (**ICBGM 2012**). The SummerSim 2012 participants are entitled to attend all the sessions and activities of the constituent events (SPECTS, SCSC, ICBGM and GCMS).

SummerSim offers a great forum for worldwide researchers and practitioners from academia, industry, business, and government to share their expertise, results and research findings in all areas of M&S. This year's edition includes a strong technical program, distinguished keynote speakers, and insightful tutorials. The location we have chosen for all events is the Faculty of Architecture of the University of Genoa, which is situated in the heart of the old town, in an impressive setting blending old and new on the hill of "Castello", the very first settlement of the town of Genoa.

In fact, we are proud to host this year's edition of SummerSim in Genoa, Italy. Genoa is at the core of the Italian Riviera, and it used to be one of the great Maritime Republics (Amalfi, Genoa, Pisa, and Venice). During the Middle Ages the town represented a strategic location in world history (i.e. being considered the real home town of Christopher Columbus, Banking and Stock Exchanges). Besides a chance to visit Genoa - which offers great and diverse settings, from one of the largest old towns in Europe to the new "Porto Antico" area, featuring a beautiful aquarium - participants will get the opportunity to enjoy world famous beaches and locations such as Portofino and the Cinque Terre.

The features of the single conferences composing SummerSim 2012 will be highlighted in the respective General Chairs' messages. Here we wish to thank the many individuals, whose dedicated effort contributed to the success of the event. Our sincere appreciation goes to all authors including those whose papers could not be accommodated in the program, and to all presenters. Many thanks are due to our distinguished keynote speakers, Prof. Mario Marchese (SPECTS), Dr. Aldo Zini (SCSC), Prof. Wolfgang Borutzky (ICBGM), and Prof. Jose Granda (GCMS), and to tutorial presenters, Dr. Roberto Bruschi, Prof.Raffaele Bolla, Dr. Bill Waite, D. Nathalie Harrison, and again Prof.Jose Granda. We also thank all General Chairs, Program Chairs and Vice Chairs of the four conferences. Special thanks are due to Prof. Hamid Vakilzadian for his continuous organizational support and encouragement, and to Oletha Darensburg and Aleah Hockridge of the SCS office. Many thanks also deserve Ms Clotilde Fertini-Canepa for her invaluable help in the logistic organization, the Dean of the Faculty of Architecture, Prof. Stefano Musso, Ms Paola Berrutto from the Service Center of the Faculty and Dr.Marina Massei from DIME.

On behalf of the Society for Modeling and Simulation International, SCS, we invite all of you to join us at SummerSim 2012 in Genoa, Italy.

Agostino Bruzzone and Franco Davoli, General Co-Chairs, SummerSim 2012

Upcoming SCS Conferences

New SCS Conference:
2012 Autumn Simulation Multiconference

October 28-31, 2012

Hyatt Regency Mission Bay; San Diego, CA, USA

The 2012 Autumn Simulation Multiconference is a state-of-the-art conference involving several different academic subjects and areas of professional activity. AutumnSim provides a unique opportunity to learn about emerging M&S applications in many thriving fields. Areas covered include Defense & Military, Homeland Security, Medical Processes, Education & Training, and Energy, Climate & Environment. The inaugural year of this conference proudly coincides with the 60th anniversary of the Society for Modeling and Simulation (SCS). This conference meets the needs of our simulation community by offering rigorous paper reviews, as well as those of our industry participants by providing a broad range of technical topics. Proposals are solicited for papers, panels, tutorials, workshops, seminars, social activities and for other presentation, discussion and sponsorship formats. Opportunities are also available for organizing and volunteering roles.

Please visit http://scs.org/conference/autumnsim/2012/ for key dates and deadlines

The following topic areas are scheduled:

· Education and Training (ETMS'12)

· Defense and Military (DMMS'12)

· Energy, Climate & Environment (ECEMS'12)

· Homeland Security (HLSMS'12)

· Medical Processes (MPMS'12)

2013 Power Plant Simulation Conference

January 28-February 1, 2013

Tampa International Plaza Hotel; Tampa, FL, USA

The Power Plant Simulation Conference is an international conference on the state of the worldwide power plant simulation industry and includes technical presentations by technology and industry leaders, panel discussions, roundtable discussions and vendor exhibits. Two tracks are available for attendees and presentations: Fossil and Nuclear.

This annual conference brings together the membership of the Utility Simulator User Group (USUG) with industry peers, contractors, vendors, suppliers, standards committee members, and regulators for a three-day workshop focused on the special needs of the nuclear and fossil power plant simulation community.

Please visit http://scs.org/conference/powerplantsim/2013/ for more information about PowerPlantSim'13

Upcoming SCS Conferences Continued

2013 Spring Simulation Multiconference

April 7-10, 2013

Bahia Resort; San Diego, CA, USA

The 2013 Spring Simulation Multiconference (SpringSim'13) is an annual conference co-located with SISO's Spring Interoperability Workshop (SIW), 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; environment, 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. SpringSim'13 offers many ways to promote simulation products and to enhance corporate images. You are invited to use the Spring Simulation Multiconference in ways that best serve your interests.

Please visit http://scs.org/conference/springsim/2013/ for more information on SpringSim'13

The following topic areas are tentatively scheduled:

· Agent Directed Simulation (ADS)

· 46th Annual Simulation Symposium (ANSS)

· 16th Communications and Networking Symposium (CNS)

· Symposium on Theory of Modeling & Simulation – DEVS Integrative M&S Symposium (TMS/DEVS)

· Emerging M&S Applications in Industry and Academia Symposium (EAIA)

· 21st High Performance Computing Symposium (HPC)

· Military Modeling & Simulation (MMS)

· Symposium on Simulation for Architecture and Urban Design (SimAUD)

· Posters and Work-in-Progress Track

Join Us Next Year:
2013 Summer Simulation Multiconference

Dates TBD; July 2013

Toronto, ON, Canada

Please visit www.scs.org/conferences for updates on next year's SummerSim conference in Toronto!

GCMS

2012 Conference on Grand Challenges in Modeling and Simulation (GCMS'12)

July 8-11, 2012

Architecture Complex, Genoa University
Stradone Sant' Agostino 11, Genoa, Italy

Part of the 2012 SummerSim Multi-Conference

Sponsored by:
The Society for Modeling and Simulation International (SCS)

General Chair: **Dr. Roy Crosbie, California State University, Chico**
Email: ***rcrosbie@csuchico.edu***

Program Chair: **Dr. Hamid Vakilzadian, University of Nebraska-Lincoln**
Email: ***hvakilzadian1@unl.edu***

VLCS Program Co-Program Chairs:
Mr. Terry Ericsen, Office of Naval Research
Ms. Kelly Cooper, Office of Naval Research

MTSA Program Co-Program Chairs:
Dr. Ralph Huntsinger, California State University, Chico
Dr. Mhamed Itmi, INSA-ROUEN, France

ICCRE Co-Program Chair:
Ms. Priscilla Elfrey, NASA, USA

We are delighted to inform you that we have an excellent technical program that covers a range of challenging problems in Modeling and Simulation that are not addressed by any other conference. These problems can be related to development of new methods of solving the complex equations arising in a particular application, or a new software product that brings greater power into the hands of users of M&S, or a new architecture that so enhances the power of simulation systems that new, previously out-of-reach applications can be tackled.

S U N D A Y, July 8, 2012

SummerSim'12 TUTORIAL SESSION I: 2:00pm--5:00pm

Room: Benvenuto

Learning the Bond Graph Method for Modeling and Simulation of Mechatronic Systems

Presenter*: José J. Granda, California State University, Sacramento, CA, USA*

SummerSim'12 TUTORIAL SESSION II: 2:00pm--5:00pm

Room: 4C

Simulation Conceptual Modeling

Presenters: *Nathalie Harrison*, Defence Research and Development Québec, Canada
Bill Waite, AEgis Technologies Group, Huntsville, AL, USA

M O N D A Y, July 9, 2012

SummerSim'12 - OPENING SESSION: 8:30am--9:00am

Room: Benvenuto

Welcoming Addresses

SummerSim'12 - KEYNOTE SESSION I: 9:00am--10:00am

Room: Benvenuto

Keynote Address Sponsored by SCSC Conference:
Keynote Speaker: *Aldo Zini*
Title: **Virtual Ship: Dream or Reality**

GCMS - TECHNICAL SESSION 1: 10:30am--12:00pm

Room: 5L

Session Chair: Terry Ericsen, Office of Naval Research

M&S OF LARGE SCALE SYSTEMS I

INTEGRATED SIMULATION FRAMEWORK FOR CRASH BACK OPERATION
Stefano Brizzolara, Pradya Prempraneerach, George Karniadakis and Chryssostomos Chryssostomidis

TOWARDS SELF-HEALING OF LARGE-SCALE COMPLEX SIMULATIONS
Tomasz Haupt and Nitin Sukhija

M O N D A Y, July 9, 2012

RESEARCH TRENDS IN HIGH PERFORMANCE COMPUTING APPLICATION ON LARGE SCALE POWER SYSTEM OPERATION
Ranjit Amgai, Jian Shi, Sherif Abdelwahed and Yong Fu

SummerSim'12 - KEYNOTE SESSION II: 2:00pm--3:00pm

Room: Benvenuto
Keynote Address Sponsored by SPECTS Conference:
Keynote Speaker: Mario Marchese
Title: **The Evolution of Internet Technology, From Pervasive to Cloud Computing**

GCMS - TECHNICAL SESSION 2: 3:30pm--5:15 pm

Room: 5L
Session Chair: Roy Crosbie, California State University, Chico

M&S METHDOLOGY AND APPROACH

PLANNING A MODELING AND SIMULATION APPROACH THAT LEADS TO ACTIONABLE INSIGHTS
Janel Nixon, Francesco Perra, Aldo Guagnano and Natalino Dazzi

SIMULATION OF CLOCK UNCERTAINTY IN WIRELESS SENSOR NETWORKS
H. Huang, H. Vakilzadian, Z. Zhong, and D.P.F. Moeller

USING SIMULATION GENERATION TEMPLATES TO INTERFACE SIMULATION ANALYSIS TOOLS WITH DESIGN SPACE MODELS
Grant Conklin, Roger Dougal and Blake Langland

MULTI-RATE SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS USING A SIMILARITY TRANSFORMATION
Richard Bednar and Roy Crosbie

INTERFACING TECHNIQUES FOR FPGA-BASED DISTRIBUTED SIMULATION
John Zenor and Kurtis Kredo II

T U E S D A Y, July 10, 2012

SummerSim - KEYNOTE SESSION III: 9:00am--10:00am

Room: Benvenuto
Keynote Address Sponsored by ICBGM Conference:
Presenter: *Wolfgang Borutzky*
Title: **Bond Graph Modeling for the Analysis of Fault Scenarios in Hybrid Systems**

T U E S D A Y, July 10, 2012

GCMS - TECHNICAL SESSION 3: 10:30am--12:00pm

Room: 5L

Session Chair: Mhamed Itmi, INSA-Rouen, France

TRANSPORTATION

FROM MOTORWAYS ON THE SEA TO MOTORWAYS OF THE RIVER: A SIMULATION BASED DECISION MAKING APPROACH DEVELOPING DRY PORTS
Dietmar P.F. Möller

UNDERSTANDING THE DIVERGING DIAMOND INTERCHANGE USING DISCRETE EVENT SIMULATION
Dietmar P. F. Moeller, Michael Anderson and Bernard Schroer

CONCEPT OF AN AGENT-BASED FRAMEWORK FOR MODELING CIVIL AIRCRAFT SWARM BEHAVIOR IN FORMATION FLIGHT
Yousef Farschtschi, Dietmar P. F. Moeller and Volker Gollnick

GCMS - TECHNICAL SESSION 4: 1:30pm--3:00pm

Room: 5L

Session Chair: Ralph Huntsinger, California State University, Chico

PERFORMANCE, STABILITY, AND VALIDATION

CONSIDERATIONS FOR VERIFICATION AND VALIDATION OF ELECTROMAGNETIC TRANSIENT SIMULATION MODELS OF SHIPBOARD POWER SYSTEMS
James Langston, Karl Schoder, Isaac Leonard, Michael Steurer and Mike Sloderbeck

DEVELOPMENT OF A VULNERABILITY METRIC FOR ELECTRIC-DRIVE SHIP SIMULATIONS
Julie Chalfant, David Hanthorn and Chryssostomos Chryssostomidis

DISCRETE EVENT SIMULATION PERFORMANCE - BENCHMARKING SIMULATORS
Alexander Pacholik, Wolfgang Fengler, Tommy Baumann and David Grüner

A DISCUSSION ON THE POSSIBLE OVERESTIMATION OF THE ADVERSE EFFECT OF CONSTANT POWER LOADS ON SYSTEM STABILITY
Lin Zhu, Marco Cupelli, Huiting Xin and Antonello Monti

T U E S D A Y, July 10, 2012

GCMS - TECHNICAL SESSION 5: 3:30pm--5:00pm

Room: 5L

Session Chair: Terry Ericsen, Office of Naval Research

M&S METHDOLOGY AND TOOLS

AUTONOMY OF SOS: THE TENDENCY NOTION
Alain Cardon, Mhamed Itmi and Ralph Huntsinger

A HYBRID QUANTIZED DISCRETE EVENT SIMULATION USING THE PROPERTIES OF LATENCY INSERTION METHOD
Charikleia Mamai, Rodrigo Leonard, Igor Kondratiev and Roger Dougal

DEVELOPMENTS IN INTEGRATION OF SIMULATION TOOLS
John Pearce and Ryllan Kraft

A SIMULATION BASED ANALYSIS IN OFFSHORE WIND ENERGY TECHNOLOGY AND SERVICES
Dietmar P. F. Moeller, Clara Blümm, Harald M. Hjelle and Thomas Pawlik

W E D N E S D A Y, July 11, 2012

SummerSim - KEYNOTE SESSION IV: 9:00am--10:00am

Room: Benvenuto

Keynote Address Sponsored by GCMS Conference:
Keynote Speaker: Prof. Jose J. Granda
Title: **The Grand Challenges for Modeling and Simulation in Space Exploration**

Session Chair: Ralph Huntsinger, California State University, Chico

GCMS - TECHNICAL SESSION 6: 10:30am--12:00pm

Room: 5L

Session Chair: Kelly Cooper, Office of Naval Research

M&S OF LARGE SCALE SYSTEMS II

STUDY ON PARALLEL METHODS OF THREE-DIMENSION PARABOLIC EQUATION FOR COMPLEX ELECTROMAGNETIC ENVIRONMENT SIMULATION
Yuewei Shen and Lin Zhang

W E D N E S D A Y, July 11, 2012

A MESH GENERATION STRATEGY FOR REPRESENTING HULL GEOMETRY IN ESRDC SHIP THERMAL SIMULATION AND VISUALIZATION
Emerson Dilay, José Vargas, Juan Ordonez, Rob Hovsapian, Julie Chalfant and Chrys Chryssostomidis

MODELING AND SIMULATION OF AN EQUIVALENT DC MULTI-CONVERTER BASED SHIPBOARD POWER SYSTEM FOR NONLINEAR OBSERVABILITY STUDIES
Juan Jimenez and Chika Nwankpa

GCMS - TECHNICAL SESSION 7: 1:30pm--3:00 pm

Room: 5L
Session Chair: Kelly Cooper, Office of Naval Research

M&S APPLICATIONS

VIRTUAL EXPERIMENTS IN A MULTI-AGENT MODEL OF DEMENTIA
Victor Vickland, Henry Brodaty, Thomas Morris and Rosemarie Sadsad

CO-SIMULATION OF AN FPGA-BASED POWER ELECTRONIC CONVERTER MODEL AND A SMALL TIMESTEP MODEL IN THE RTDS REAL-TIME DIGITAL SIMULATOR
Michael Sloderbeck, Bruce Warkentin, Raveendra Meka, Md. Omar Faruque, James Langston and Michael Steurer

TOWARDS THE IMPLEMENTATION OF A PARALLEL REAL-TIME SIMULATOR FOR DSP CLUSTER
Milahi Marin, Andrea Benigni, Hakima Lakhdar, Antonello Monti and Pieter Collins

SummerSim'12 TUTORIAL SESSION III: 2:00pm--5:00pm

Room: Benvenuto
Green Technologies for Smarter Next-Generation Wire-line Networks
Raffaele Bolla, Roberto Bruschi
Genoa University, Genoa, Italy

10th International Conference on Bond Graph Modeling and Simulation (ICBGM'2012)

July 8-11, 2012

Architecture Complex, Genoa University
Stradone Sant' Agostino 11, Genoa, Italy

Part of the 2012 SummerSim Multi-Conference

Sponsored by:
The Society for Modeling and Simulation International (SCS)
American Institute for Aeronautics and Astronautics (AIAA)

General Chair: **Professor José J. Granda, California State University, Sacramento USA**
Email: ***grandajj@ecs.csus.edu***

Program Chair: **Professor François E. Cellier, ETH Zürich, Switzerland**
Email: ***FCellier@Inf.ETHZ.CH***

The 2012 International Conference on Bond Graph Modeling and Simulation brings together research paper presentations, panel sessions, tutorials, workshops, seminars, industrial applications, and software demonstrations that use Bond Graph modeling methods. There will be featured plenary speakers and some special invited presentations.

This conference focuses on Bond Graph modeling techniques for modeling and simulation of dynamic systems. Theoretical principles for electrical, mechanical, hydraulic, thermal, pneumatic, control and mechatronic systems applications will be presented. Leading industrial users of the method in automotive, aircraft, fluid power, kinematics, multibody systems, and social and biological systems have been invited.

S U N D A Y, July 8, 2012

SummerSim TUTORIAL SESSION I: 2:00pm--5:00pm
Room: Benvenuto
Learning the Bond Graph Method for Modeling and Simulation of Mechatronic Systems
José J. Granda, California State University, Sacramento, CA, USA

S U N D A Y, July 8, 2012

SummerSim TUTORIAL SESSION II: 2:00pm--5:00pm
Room: 4C
Simulation Conceptual Modeling
Nathalie Harrison, Defence R&D Canada
Bill Waite, AEgis Technologies Group, Huntsville, AL, USA

M O N D A Y, July 9, 2012

SummerSim - OPENING SESSION: 8:30am--9:00am
Room: Benvenuto
Welcoming Addresses

SummerSim - KEYNOTE SESSION I: 9:00am--10:00am
Room: Benvenuto
Keynote Address Sponsored by SCSC
Conference: Virtual Ship: Dream or Reality
Presenter: *Aldo Zini*, Cetena S.p.A, Genoa, Italy

ICBGM - TECHNICAL SESSION 1: 10:30am--12:00pm
Room: 4H
Session Chair: Wolfgang Borutzky, Germany

BOND GRAPH THEORY I

Port-based Pendulum Modeling from a Didactic Point of View
Peter C. Breedveld

Analysis of a Singularly Perturbed LTI System: A Bond Graph Approach
Gilberto González-Avalos, Noé Barrera-Gallegos, Noé Villa-Villaseñor

Bond Graph Based Modal Decomposition of Systems with Non-proportional Damping
Lucas S. Louca

Automated Generation and Simulation of Component-based Generalized Bond Graphs
Siyuan Dai, Xenofon Koutsoukos

M O N D A Y, July 9, 2012

SummerSim - KEYNOTE SESSION II: 2:00pm--3:00pm

Room: Benvenuto

Keynote Address Sponsored by SPECTS Conference:

The Evolution of Internet Technology: From Pervasive to Cloud Computing

Presenter: *Mario Marchese,* University of Genoa, Italy

ICBGM - TECHNICAL SESSION 2: 3:30pm--5:00pm

Room: 4H

Session Chair: Jesús Félez, Spain

TRANSPORTATION SYSTEMS

A Bond Graph Approach to Rotor Dynamics
Eilif Pedersen

Bond Graph Modeling and Power-flow Analysis of Range Extended Electric Vehicle Transmission
Mihael Cipek, Joško Deur, Joško Petrić

Modeling Methods for Dynamic Analysis of the Autonomous Morpheus Planetary Lander
José J. Granda, Brett Tuey, Louis H. Nguyen

T U E S D A Y, July 10, 2012

SummerSim - KEYNOTE SESSION III: 9:00am--10:00am

Room: Benvenuto

Keynote Address Sponsored by ICBGM Conference:

Bond Graph Modeling for the Analysis of Fault Scenarios in Hybrid Systems

Presenter: *Wolfgang Borutzky,* Bonn-Rhein-Sieg University of Applied Sciences, Sankt Augustin, Germany

Session Chair: José J. Granda, USA

ICBGM - TECHNICAL SESSION 3: 10:30am--12:00pm

Room: 4H

Session Chair: Joško Deur, Croatia

ROBOTICS

Evaluation of Dynamic Performance of Non-spherical Parallel Orientation Manipulators through Bond Graph Multi-body Simulation
Taufiqur Rahman , Geoff Rideout, Nicholas Krouglicof

T U E S D A Y, July 10, 2012

Bond Graph Modeling of a Mecanum Wheeled Robot
Yang Qian , Ahmed Rahmani, Qiang Zhan

Modeling and Analysis of the Dynamic Performance of a High Speed Selective Compliant Assembly Robotic Arm (SCARA) on a Compliant Support
Migara Liyanage , Geoff Rideout, Nicholas Krouglicof

ICBGM - TECHNICAL SESSION 4: 1:30pm--3:00pm

Room: 4H
Session Chair: Peter C. Breedveld, The Netherlands

THERMODYNAMICS AND BIOMEDICAL SYSTEMS

Extension of Simulation Software for Thermodynamic and Other Systems Including Energy-based Modeling
Forbes T. Brown

True Bond Model of the Thermodynamics of a Compressed Gas Accumulator
Wolfgang Borutzky

Modeling Chemical Reactions Using Bond Graphs
Jürgen Greifeneder, François E. Cellier

Thrombectomy Aspiration Device Model Based on the Blood Clots Platelet Composition and Altherome Plaque Existence by Using the Bond Graph Technique
G. Romero, J. Maroto, M. L. Martínez, G. Pearce

ICBGM - TECHNICAL SESSION 5: 3:30pm--5:00pm

Room: 4H
Session Chair: Geoff Rideout, Canada

BOND GRAPH THEORY II

A New Structural Approach for ARR's Generation from Linear and Linearized Bond Graphs: Approach based on State Structural Observability
Kamel Sia, Aziz Naamane, Nacer K. M'sirdi

Reduced Order Luenberger Observer Design for Switching Systems – Bond Graph Approach
Naima Hadji, Ahmed Rahmani

Bond Graph Model-based Machine Diagnostic with Information Theory Health Metric
Michael D. Bryant, Lalit C. Karlapalem, Jeremy T. Murphy, Rodrigo Ruizpalacios

Bond Graph Support in SystemC AMS
Torsten Maehne, Alain Vachoux

W E D N E S D A Y, July 11, 2012

SummerSim - KEYNOTE SESSION IV: 9:00am--10:00am

Room: Benvenuto

Keynote Address Sponsored by GCMS Conference:

The Grand Challenges for Modeling and Simulation in Space Exploration

José J. Granda ,California State University,
Sacramento, CA, USA

ICBGM - TECHNICAL SESSION 6: 10:30am--12:00pm

Room: 4H

Session Chair: François E. Cellier, Switzerland

ENERGY GENERATION AND DISTRIBUTION

Simulation of the Dynamic Behavior of Catenary Cables Using the Bond Graph Technique
J. Lozano, J. Félez, J. M. Mera, J. D. Sanz

Dynamic Model of an Oilwell Drillstring with Stick-slip and Bit-bounce Interaction
Md. Mejbahul Sarker, Geoff Rideout, Stephen D. Butt

Bond Graph Modeling of a Multibody Wave Energy Converter
Øyvind Ygre Rogne , Eilif Pedersen

Modeling of Wave Energy Converters Using Bond Graph
Adi Kurniawan, Eilif Pedersen, Torgeir Moan

ICBGM - TECHNICAL SESSION 7: 1:30pm--2:15pm

Room: 4H

Session Chair: Michael D. Bryant, USA

FLUIDICS

Study of a Valveless Planar Micropump System – A Modeling Attempt by Bond Graphs
Abdennasser Fakri, P. Poulichet, L. Fakri, T. C. Tien

Bond Graph Modeling of Centrifugal Compressor System
Nur Uddin, Jan Tommy Gravdahl

W E D N E S D A Y, July 11, 2012

ICBGM - TECHNICAL SESSION 8: 2:15pm--3:00pm

Room: 4H

Session Chair: Loucas Louca, Cyprus

ELECTRONICS

A Bond Graph Representation of p-n Junction Diode Using VHDL-AMS
Chung-Chieh Lin, Chin-Ming Hong

Bond Graph Modeling of a Non-linear Buck Converter Using a Linear Graph Approach
Noé Villa-Villaseñor, Gilberto González-Avalos, Jesús Rico-Melgoza

ICBGM - TECHNICAL SESSION 9: 3:30pm--5:00pm

Room: 4H

Session Chair: Eilif Pedersen, Norway

MECHANICAL SYSTEMS

Bond Graph Elements and Structures for Tribology
Michael D. Bryant

Bond Graph Model of Electromechanical Actuation System for a Dry Dual Clutch
Vladimir Ivanović, Joško Deur, H. Eric Tseng

Discontinuities in Physical Modeling: Bond Graph Models of Impact in Multibody Systems
Vjekoslav Damić, Majda Cohodar, Drazen Damić

SummerSim TUTORIAL SESSION III: 2:00pm--5:00pm

Room: Benvenuto

Green Technologies for Smarter Next-Generation Wire-line Networks
Raffaele Bolla, Roberto Bruschi
Genoa University, Genoa, Italy

The 44th Summer Computer Simulation Conference, (SCSC 2012)

July 8-11, 2012

Architecture Complex, Genoa University
Stradone Sant' Agostino 11, Genoa, Italy

Part of the 2012 Summer Simulation Multiconference

Sponsored by:
The Society for Modeling and Simulation International (SCS)

General Chairs: **Prof. Francesco Longo, University of Calabria, Italy**
Email: ***f.longo@unical.it***
Prof. Peter Kropf - Université de Neuchâtel, Switzerland
Email: ***peter.kropf@unine.ch***

Program Chair: **Prof. Miquel Angel Piera, Autonomous University of Barcelona, Spain**
Email: ***miquelangel.piera@uab.es***

The SCSC 2012 conference focuses on modeling and simulation, tools, theory, methodologies and applications, providing a forum the latest R&D results in academia and industry.

In parallel with technical presentations, companies and research groups will be exhibiting their latest products.

Further increasing SCSC's application focus, SCSC12 is adding to the conference program a set of with panels, hot topic sessions and invited industrial sessions.

S U N D A Y, July 8, 2012

SummerSim TUTORIAL SESSION I: 2:00pm--5:00pm

Room: Benvenuto

Learning the Bond Graph Method for Modeling and Simulation of Mechatronic Systems
José J. Granda, California State University, Sacramento, CA

SummerSim TUTORIAL SESSION II: 2:00pm--5:00pm

Room: 4C

Simulation Conceptual Modeling
Nathalie Harrison, Defence Research and Development Québec, Canada
Bill Waite,The AEgis Technologies Group, Huntsville, AL

M O N D A Y, July 9, 2012

SummerSim - OPENING SESSION: 8:30am--9:00am

Room: Benvenuto

Welcoming Addresses

SummerSim - KEYNOTE SESSION I: 9:00am--10:00am

Room: Benvenuto

Keynote Address Sponsored by SCSC:

Virtual Ship: Dream or Reality

Presenter: *Aldo Zini*, Cetena S.p.A, Genoa, Italy

SESSION 1: Monday 10:30am--12:00pm

Room: 5H

Session Chair: Francesco Longo

MODELING AND SIMULATION OF DYNAMIC SYSTEMS

Implementation of the Preisach Model in MATLAB
Norbert Franz, Bernd Güde, Andreas Meyer, Tobias Kipp, Hans Peter Oepen, Dietmar P.F. Möller

Catchment Basin Optimized Management using a Simulation Approach within DEVSimPy Framework*
Jean François Santucci, Laurent Capocchi

Quantitative Analysis of Time and Value Discretization in RF Phase Detectors
Christopher Spies, Pongyupinpanich Surapong, Manfred Glesner, Harald Klingbeil

Subsidy cut and its effect on Tehran Electricity Company: A System Dynamics Approach
Erfan Mehmanchi, Sahar Zahedi Fard

SESSION 2: Monday 1:30pm--3:00pm

Room: 5H

Session Chair: Peter Kropf, Université de Neuchâtel, Switzerland

MODELLING AND SIMULATION APPROACHES

Complex Industrial System Modeling: A Multilevel Methodology
Aida Huerta and Mayra Elizondo

Simulation Modeling Approach to Maritime Container Terminals: A State-of-the-Art Review
Aida Huerta, Francesco Longo, Giovanni Mirabelli

M O N D A Y, July 9, 2012

Rapid Virtual-Human-in-the-Loop Simulation with High Level Architecture
Stefan Puch, Martin Fränzle, Jan-Patrick Osterloh, Christoph Lässche

A Federated Tooling Framework for Formal Analysis of Simulation Models
Ufuoma Bright Ighoroje, Mamadou Kaba Traore

SESSION 3: Monday 3:30pm--5:00pm

Room: 5H
Session Chair: Agostino Bruzzone, University of Genoa, Italy
SIMULATION FOR TRANSPORTATION

Pedestrian Simulation for Urban Traffic Scenarios
Jörg Dallmeyer, Andreas D. Lattner, Ingo J. Timm

Time-domain simulation for marine propulsion applications
Marco Altosole, Massimo Figari, Michele Martelli

Waveform-Level Time-Domain Simulation Comparison Study of Three Shipboard Power System Architectures
James Langston, Mischa Steurer, Jonathan Crider, Scott Sudhoff, Yonggon Lee, Edwin Zivi, Roger Dougal, Yucheng Zhang, Robert Hebner, Abdelhamid Ouroua

Combining Traffic Simulation with Bayesian Networks for improved Quantification of Accident Risk Index
Andreas Andreas Gregoriades, Kyriacos Mouskos, Harris Michail, Konstantinos Katzis

TUESDAY, July 10, 2012

SESSION 4: Tuesday 8:30am--10:00am

Room: 5H
Session Chair: Andreas Tolk, Old Dominium University, Norfolk, VA, USA
M&S FOR DEFENSE & SECURITY

Fuzzy Logic-based Battle Field Mobility Prediction Method in War-game Simulation
Yong Beom Ma, Tae Young Kim, Jae Kwon Kim, Jong Sik Lee

Modelling & Simulation to Support NATO Crises Management Exercise
Francesco Mastrorosa, Agostino Bruzzone, Raniero Castrogiovanni, Luca Sacco, Giuseppe Lorusso, Francesca Madeo

Intelligent Agents for Simulation of Civil Military Cooperation and Psychological Operations
Agostino Bruzzone

TUESDAY, July 10, 2012

SESSION 5: Tuesday 10:30am--12:00pm

Room: 5H

Session Chair: José I. Santos, Luis R. Izquierdo, José M. Galán, INSISOC – University of Burgos, Spain

SIMULATION OF COMPLEX SYSTEMS

Scholarly Communication of Reproducible Modeling and Simulation Research using e-Portfolios
Levent Yilmaz

Simulating Land-Use policies with the use of CPN formalism
Miguel Mujica, Miquel Angel Piera

SESSION 5: Tuesday 10:30am--12:00pm

Room: 5H

A Simulation of an ERP Implementation with Informal Processes
Andrew Greasley and Yucan Wang

Supply Chain Building Blocks – Development of an Agent-Based Platform for Generic Supply Chain Modeling
Mayolo Alberto Lopez Castellanos and Wolfgang Kersten

WEDNESDAY, July 11, 2012

SESSION 6: Wednesday 8:30am--10:00am

Room: 5H

Session Chair: Agostino Bruzzone, University of Genoa, Italy

CAPRICORN PANEL & DEMONSTRATION I

SESSION 7: Wednesday 10:30am--12:00pm

Room: 5H

Session Chair: Agostino Bruzzone, University of Genoa, Italy

CAPRICORN PANEL & DEMONSTRATION II

SummerSim TUTORIAL SESSION III: 2:00pm--5:00pm

Room: Benvenuto

Green Technologies for Smarter Next-Generation Wire-line Networks
Raffaele Bolla, Roberto Bruschi, Genoa University, Genoa, Italy

SPECTS

2012 International Symposium on Performance Evaluation of Computer and Telecommunications Systems (SPECTS)

July 8-11, 2012

Architecture Complex, Genoa University
Stradone Sant' Agostino 11, Genoa, Italy

Part of the 2012 SummerSim Multi-Conference

Sponsored by:
The Society for Modeling and Simulation International (SCS)
IEEE Communications Society (IEEE)

Honorary Chair: **Mohammad Obaidat, Monmouth University, NJ, USA**
Email: ***obaidat@monmouth.edu***

General Chair: **Jose Sevillano, University of Seville, Spain**
Email: ***sevi@atc.us.es***

Program Chairs: **Raffaele Bolla, University of Genoa, Italy**
Email: ***raffaele.bolla@unige.it***
Pere Vila, University of Girona, Spain
Email: ***pere.vila@udg.edu***
Isaac Woungang, Ryerson University, ON, Canada
Email: ***iwoungan@scs.ryerson.ca***

The International Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS2012) is an annual international conference acting as forum for professionals involved in performance evaluation of computer and telecommunication systems. Performance evaluation of computer systems and networks has progressed rapidly in the past decade and has begun to approach maturity. Significant progress has been made in analytic modeling, simulation, and measurement approaches for performance evaluation of computer and telecommunication systems. SPECTS is technically co-sponsored by IEEE Communications Society. Accepted papers of SPECTS are archived in IEEE Xplore.

S U N D A Y, July 8, 2012

SummerSim TUTORIAL SESSION I: 2:00pm--5:00pm
Room: Benvenuto
Learning the Bond Graph Method for Modeling and Simulation of Mechatronic Systems
José J. Granda, California State University, Sacramento, CA

SummerSim'12 TUTORIAL SESSION II: 2:00pm--5:00pm
Room: 4C
Simulation Conceptual Modeling
Nathalie Harrison, Defence Research and Development Québec, Canada
Bill Waite, AEgis Technologies Group, Huntsville, AL

M O N D A Y, July 9, 2012

Opening Session and Keynote Speech: 8:30am--10:00am
Room: Benvenuto
Keynote I
Keynote Speaker: *Aldo Zini*
Title: Virtual Ship: Dream or Reality

Session 1: Ad Hoc and Sensor Networks: 10:30am--12:00pm
Room: 4B
Session Chair: Juan Luis Font, Univ. of Sevilla, Spain

Reliability and Survivability of Vehicular Ad hoc Networks
Dharmaraja Selvamuthu, Resham Vinayak, Xiaomin Ma and Kishor Trivedi

Evaluation of Routing Schemes in Opportunistic Networks Considering Energy Consumption
Annalisa Socievole and Floriano De Rango

Social and Dynamic Graph-Based Scalable Routing Protocol in a DTN Network
Floriano De Rango and Filippo Monteverdi

Wireless Sensor Network deployment using DEVS formalism and GIS representation
Poggi Bastien and Antoine-Santoni Thierry

M O N D A Y, July 9, 2012

Session 2: Internet Technologies: 10:30am--12:00pm

Room: 4C

Session Chair: Alessandro Carrega, Univ. of Genoa, Italy

Servload: Generating Representative Workloads for Web Server Benchmarking
Jörg Zinke, Jan Habenschuß and Bettina Schnor

An Error Concealment Technique and Learning Web Design
Yuan-Chen Liu and Ming-kuan Lee

Exposing Resources as Web services: a Performance Oriented Approach
Ravishankar Kanagasundaram, Shikharesh Majumdar, Marzia Zaman, Pradeep Srivastava and Nishith Goel

Traffic Merging for Energy-Efficient Datacenter Networks
Alessandro Carrega, Suresh Singh, Roberto Bruschi and Raffaele Bolla

Keynote Session II: 2:00pm--3:00pm

Room: Benvenuto

Keynote Speaker: Mario Marchese
Title: The Evolution of Internet Technology, From Pervasive to Cloud Computing

Session 3: Work in Progress: 3:15pm--5:00pm

Room: 4B

Session Chair: Floriano De Rango, Univ. of Calabria, Italy

Empirically Characterizing the Buffer Behaviour of Real Devices
Luis Sequeira, Julián Fernández-Navajas, Jose Saldana, Luis Casadesus and José Ruiz-Mas

Impact of intermittent connectivity for telemetry server applications of vehicular embedded systems in agribusiness: study and modeling of hi-performance architecture
Daniel Mezzalira and Luis Carlos Trevelin

Modelling Packet Capturing in a Traffic Monitoring System based on Linux
Luis Zabala, Armando Ferro and Alberto Pineda

An experimental evaluation of server performance in Networked Virtual Environments
Juan Luis Font, José Luis Sevillano and Daniel Cascado

PHISON: Playground for High-level Simulations On Networks
Marc Manzano, Juan Segovia, Eusebi Calle and Jose L. Marzo

T U E S D A Y, July 10, 2012

Keynote Session III: 9:00am--10:00am

Room: Benvenuto

Keynote Speaker: *Wolfgang Borutzky*
Title: Bond Graph Modeling for the Analysis of Fault Scenarios in Hybrid Systems

Session 4: Networking Techniques: 10:30am--12:00pm

Room: 4B

Session Chair: Jose Saldana, Univ. of Zaragoza, Spain

Smart Proxying for Reducing Network Energy Consumption
Rafiullah Khan, Raffaele Bolla, Matteo Repetto, Roberto Bruschi and Maurizio Giribaldi

A Fast-Converging TCP-Equivalent Window-Averaging Rate Control Scheme
Shih-Chiang Tsao

MAP/SM/1/b Model of a Store and Forward Router Interface
Krzysztof Rusek, Zdzislaw Papir and Lucjan Janowski

Traffic Optimization for TCP-based Massive Multiplayer Online Games
Jose Saldana, Luis Sequeira, Julián Fernández-Navajas and José Ruiz-mas

Session 5: Scheduling Algorithms and Learning Systems: 1:30pm--3:00pm

Room: 4B

Session Chair: Essia Hamouda, Univ. of California, Riverside, USA

Two-Level Scheduling Algorithm for Different Classes of Traffic in WiMAX Networks
Zeeshan Ahmed and Salima Hamma

An Optimal Scheduling Policy for a Multi-flow Priority Queue with Multiple Paths
Essia Hamouda, Nathalie Mitton and David Simplot-Ryl

ATRC: A Swarm-based Robot Team Coordination Protocol for Mine Detection and Unknown Space Discovery
Floriano De Rango and Nunzia Palmieri

Research on VoIP Traffic Detection
Muhammad Mazhar Ullah Rathore and Tahir Mehmood

Session 6: Tools, Methodologies and Applications I: 3:30pm--5:00pm

Room: 4C

Session Chair: Josep L. Marzo, Univ. of Girona, Spain

Capacity Planning of Enterprise Information System through Simulation
Sara Saleem, Paulvanna Marimuthu and Sami Habib

A model of a finite buffer shared by queues with batched Poisson arrivals
Miron Vinarskiy

T U E S D A Y, July 10, 2012

Traffic-level Community Protection in Telecommunication Networks under Large-Scale Failures
Víctor Torres-Padrosa, Marc Manzano, Eusebi Calle and Josep L. Marzo

Enhancing the Oakley key agreement protocol with secure time information
Pawel Szalachowski and Zbigniew Kotulski

W E D N E S D A Y, July 11, 2012

Keynote Session IV: 9:00am--10:00am

Room: Benvenuto
Keynote Speaker: *José J. Granda*
Title: The Grand Challenges for Modeling and Simulation in Space Exploration

Session 7: Wireless and Grid Systems: 10:30am--12:00pm

Room: 4B
Session Chair: K. Karaoglanoglou, Aristotle Univ. of Thessaloniki, Greece

Directing Requests and Acquiring Knowledge in a Large-Scale Grid System
Konstantinos Karaoglanoglou and Helen Karatza

Deriving Test Procedures of Low-Rate Wireless Personal Area Networks
Marina Eskola, Tapio Heikkilä and Pirkka Tukeva

A New Markov-Based Mobility Prediction Scheme for Wireless Networks with Mobile Hosts
Peppino Fazio and Salvatore Marano

Session 8: Tools, Methodologies and Applications II: 10:30am--12:00pm

Room: 4C
Session Chair: Marco Cello, Univ. of Genoa, Italy

Opportunistic Estimation of Television Audience Through Smartphones
Igor Bisio, Alessandro Delfino, Giulio Luzzati, Fabio Lavagetto, Mario Marchese, Cristina Frà and Massimo Valla

Creating and Using Key Network-Performance Indicators to Support the Design of Change of Enterprise Infocommunication Infrastructure
Muka László and Muka Gergely

Maximum Throughput Computation of an Application in a Multi-tier Environment
Subhasri Duttagupta

MILP Formulation for Squeezed Protection in Spectrum-Sliced Elastic Optical Path Networks
Karcius Assis, Raul Almeida and Helio Waldman

W E D N E S D A Y, July 11, 2012

SummerSim TUTORIAL SESSION III: 2:00pm--5:00pm

Room: Benvenuto

Green Technologies for Smarter Next-Generation Wire-line Networks

Raffaele Bolla, Roberto Bruschi
Genoa University, Genoa, Italy

ABSTRACTS

Multi-Rate Solution Of Linear Differential Equations Using A Similarity Transformation

Richard Bednar and Roy Crosbie

Starting with a system of linear differential equations in state variable form, this paper shows how a similarity transformation can be used to decouple the differential equations and put them into a form that allows separate numerical integration for each of the transformed first order differential equations. Thus a larger integration step size can be used for solving one or more of the transformed differential equations with slowly varying dynamics while a smaller step size can be used to solve the differential equations with rapidly changing dynamics. This method of multi-rate integration is not restricted to systems that are physically separable into subsystems with just fast or just slowly changing dynamics, or to bi-rate simulations. Two examples illustrate this method of multi-rate integration and compares results using a more conventional technique.

Study on parallel methods of three-dimension parabolic equation for complex electromagnetic environment simulation

Yuewei Shen and Lin Zhang

The parabolic equation (PE) method is an appropriate approach for the solution of complex electromagnetic environment (CEME) simulation. But for the issue of large-scale CEME simulation, it is very difficult to finish simulation process very fast, parallel computing can be employed to accelerate the calculation efficiently. In this paper, a parallel method of three-dimension parabolic equation (3DPE) for the solution of CEME simulation is proposed. As far as the simulation of a very large domain is concerned, domain decomposition method (DDM) is very efficient to speed up the calculation. First, we decompose the whole calculation domain into many subdomains; and then design a finite difference (FD) domain decomposition procedure by using semi-implicit discrete scheme with larger spacing at interface points; finally, the fully implicit discrete scheme is employed at interior points. Although the DDM can obtain the ideal parallel efficiency, it is very difficult to realize the process for the irregular terrain. When the computational domain is not very large, we can choose parallel direct FD method to speed up the process. First, the appropriate FD schemes are adopted, and then the linear equations can be obtained; finally, the parallel computing is employed to accelerate the solution of linear equations. The parallel methods are tested by some numerical experiments, and the results indicate that the parallel methods can obtain the satisfactory results.

Virtual experiments in a multi-agent model of dementia

Victor Vickland, Henry Brodaty, Thomas Morris, Rosemarie Sadsad

The prospect of conducting virtual experiments for the purpose of replacing real life randomised controlled trials in medical research is still quite illusive. However recent advances in computer simulation have made road for the development of agent-based models in which patients are represented as agents with characteristics similar to real life conditions. The aim of the current project was to develop a computer model that represented real dementia patients and to then assess management strategies on this population. Each virtual patient consisted of three dynamic characteristics reflecting processes of ageing, processes of cognitive decline associated with dementia, and processes associated with behavioural and psychological symptoms of dementia (BPSD) such as depression or aggression. The known effects of therapeutic interventions used in management of BPSD were also implemented in the model. Four experiments were conducted on the population of virtual patients and results were compared between treated and untreated groups.

CONCEPT OF AN AGENT-BASED FRAMEWORK FOR MODELING CIVIL AIRCRAFT SWARM BEHAVIOR IN FORMATION FLIGHT

Yousef Farschtschi, Dietmar P. F. Moeller, Volker Gollnick

A novel concept for an agent-based framework modeling aircraft swarm behavior is presented. The framework will be used as a test platform to validate aircraft swarm behavior during flight in a formation. The increasing number of flights and rising oil prices require methods to cope economically with fossil fuel in the aviation business. This could be achieved adapting biological swarm behavior in aviation. It is known from biology that flock of birds moving mostly in a “V” formation to conserve precious energy. This naturally economically behavior has been used for decades in military aviation and is intended for use also in civil aviation. Therefore this paper focuses on the aircraft formation flight approach, based on a conceptual design of a multi-agent system modeling such a project for civil aviation. In a swarm formation flight parameters on aerodynamics and efficient flight formations will be transferred to agents to realize a cognitive knowledgebase. Thus, the agents are able to hold an efficient formation during the flight on an appropriate track, at which aircrafts have to alternate, especially on the top of the formation which require formation building and formation rotation algorithms, which will be presented. In the context of this concept, the North Atlantic Track System (NATS) will be investigated. It is assumed that several suitable aircrafts meet over the Irish Sea to form a swarm in an appropriate formation like “V” formation and to peel away over Newfoundland for their final destinations. In addition a new slotting approach to structure the NATS will be presented and validated.

DEVELOPMENTS IN INTEGRATION OF SIMULATION TOOLS

John Pearce and Ryllan Kraft

The paper presents recent developments in an ongoing project to integrate the ESL simulation tool with the Virtual Test Bed (VTB). The VTB offers a framework for the development of large-scale multi-discipline simulations. It provides an environment in which to build a simulation and is capable of supporting different solution methods (or “Solvers”). The objective of the present project is to make the particular features of ESL available to users of the VTB through the provision of an ESL Solver. This is achieved by making ESL simulation components available in VTB and seamlessly linking to the external ESL software for compilation and execution, with data being fed back to the VTB for display. A previous paper described the basic approach and initial progress – the present paper reports further progress and concentrates on “modularization” aspects. The VTB provides a standard mechanism for creating multi-input, multi-output modules from schematic diagrams comprising interconnected simulation components. This facility can be used to map a VTB schematic comprising interconnected ESL components into a VTB module, implemented as an ESL submodel, which can be used in other schematics. A second strand has been the implementation of a method to import external ESL textual submodels into the VTB. This facility can be used to map a VTB schematic comprising interconnected ESL components into a VTB module, implemented as an ESL submodel, which can be used in other schematics created in the VTB environment. Both these developments represent a significant advancement of the integration of the two simulation tools and provide valuable pointers to a generalized approach for other solvers. The developments are illustrated with appropriate examples.

A discussion on the possible overestimation of the adverse effect of constant power loads on system stability

Lin Zhu, Marco Cupelli, Huiting Xin, Antonello Monti

This paper discusses the possible overestimation of possible stability problems in power systems with actively controlled loads which show constant power behavior. This overestimation is caused due the simplified modeling of constant power loads for solving problems in an analytical way.

Understanding the Diverging Diamond Interchange Using Discrete Event Simulation

Dietmar P. F. Moeller, Michael Anderson, Bernard Schroer

This paper presents the development of a discrete event simulation model of the diverging diamond interchange (DDI). Specific emphasis is on using simulation to model the DDI, a description of the operation of the simulation model and using simulation to understand the operation of the DDI.

A SIMULATION BASED ANALYSIS IN OFFSHORE WIND ENERGY TECHNOLOGY AND SERVICES

Dietmar P. F. Moeller, Clara Blümm, Harald M. Hjelle, Thomas Pawlik

The development of offshore wind energy in Northern European counties is based on about 20 imple-mented projects. At the end of 2020 it is expected to reach 7 GW in Europe. Today the market for on-shore wind turbines exceeds the offshore market in the EU but this will change. For offshore systems at first the right location in the sea bed has to be determined, thereafter the respective tripods and/or jackets are set depending in the depth of the water. If this has been finished the housing, the generators engines and the rotor blades are assembled. Due to rough environmental conditions offshore systems are highly stressed. To analyze the impact of the rough environment on offshore wind energy systems a physical mock up simulation environment based on a specific climate chamber can be used and/or the computational modeling and simulation approach with which different scenarios can be modeled and analyzed due to different environmental conditions for a long term period perspective.

Considerations for Verification and Validation of Electromagnetic Transient Simulation Models of Shipboard Power Systems

James Langston, Karl Schoder, Isaac Leonard, Michael Steurer, Mike Sloderbeck

Several topics relating to verification and validation of electromagnetic transient models of shipboard power systems are discussed, including the general framework, sensitivity analyses, and uncertainty propagation techniques. As the models of interest are typically computationally expensive to evaluate, approaches for constructing surrogate models are also discussed. A number of techniques and issues are briefly discussed, with references provided for further information. Considerations associated with application of the techniques are presented within the context of the types of models that are considered.

Towards the implementation of a parallel real-time simulator for DSP cluster.

Milahi Marin, Andrea Benigni, Hakima Lakhdar, Antonello Monti, Pieter Collins

The present work presents the recent development in the definition, in the analysis and in the implementation of a new approach for parallel, real-time simulation of dynamic nonlinear power systems. This method combines the advantages of the RCM (Resistive Companion Method) with those of the state equation approach, in order to overcome their respective weaknesses when large systems have to be simulated in real-time.

Towards Self-Healing of Large-Scale Complex Simulations

Tomasz Haupt and Nitin Sukhija

This paper describes a novel software engineering approach for designing self-healing systems to manage complex business processes, such as large-scale simulations. By the employment of service-oriented software engineering methods, mediation, service discovery, and late binding, we externalize and decentralize autonomic managers. These mediation-based managers enable dynamical orchestration of services and hence provide support for autonomic adaptation of the business process in response to failures. The complexity of the resulting self-healing business process manager is reduced as the system is decomposed into a large number of hierarchically organized, small and thus easy to maintain components, each implementing a simple behavior. Similar to systems occurring in nature, the dynamic composition of these small components spontaneously leads to sophisticated healing capabilities.

Development of a Vulnerability Metric for Electric-Drive Ship Simulations

Julie Chalfant, David Hanthorn, Chryssostomos Chryssostomidis

We are developing an overall architectural model of an all-electric ship to perform tradeoff studies in a physics-based environment. The results of the tradeoff studies are presented in standardized metrics that allow rigorous, repeatable comparison. This paper addresses the development of a metric to analyze the impact of support system design on overall ship survivability in the face of damage. The metric must be computed rapidly to enable decision-making during early-stage ship design, yet must accurately represent the survivability aspects of the design. In a companion paper we further explore the metric described herein using several examples of electrical distribution systems onboard a notional destroyer.

A Hybrid Quantized Discrete Event Simulation Using the Properties of Latency Insertion Method

Charikleia Mamai, Rodrigo Leonard, Igor Kondratiev, Roger Dougal

In this work we present a new method to solve electrical circuits by using the properties of Quantized Discrete Event Simulation (QDEVS) and Latency Insertion Method (LIM). The combination of these two methods allows us to perform natural-coupled simulations using LIM while speeding up the simulation through asynchronous variable updating capabilities of DEVS. Through a proof-of-concept implementation in ACSL (Advanced Computer Simulation Language), we were able to calculate the time that each component‘s events will occur thus defining the specifications for a more general future solver that can support independent time stepping for each component. This paper presents a hybrid DEVS -LIM solution of a series RLC electrical circuit and the ACSL code that implements the combined DEVS-

LIM scheme. Furthermore an analysis of the computational performance is provided as well as a comparison between the DEVS-LIM implementation and the traditional LIM in discrete time.

Using Simulation Generation Templates to Interface Simulation Analysis Tools with Design Space Models

Grant Conklin, Roger Dougal, Blake Langland

In this paper, we introduce a method for interfacing a design space model with an analysis tool, a method which can be expanded to any number of tools. We created a software application for modeling an electric ship design space, and then implemented an interface between this model and a simulation tool. The interface is capable of taking the relevant data for a given analysis from the design space model and translating it into a format which the simulation tool can work with. The interface then runs the simulations, processes the data given back to it by the simulation tool, catalogs it, and lets the user access this information. As a result, all the design space and analysis data exists within one model in a format which can be automatically translated to associated simulation tools, which eliminates the need for design teams to manually translate data from one simulation tool to another. The result is that an engineer can operate solely within the confines of the design space modeling tool, analyzing the design space in various ways and critiquing the results without even having knowledge of the existence of the separate simulation tools.

Co-simulation of an FPGA-based Power Electronic Converter Model and a Small Timestep Model in the RTDS Real-Time Digital Simulator

Michael Sloderbeck, Bruce Warkentin, Raveendra Meka, Md. Omar Faruque, James Langston, Michael Steurer

Simulation of a field-programmable gate array (FPGA)-based model with an RTDS Real-Time Digital Simulator. Results are presented toward achieving the goal of simulating high-frequency power electronic converters in real-time co-simulation with a rest-of-system transient model. Power system converter models using the RTDS were previously implemented at rates up to approximately 6 kHz switching frequency using voltage source converter models in a small time-step of ~1.5-2 μsecs. In this work, the FPGA-based transient simulation models of a static and switched RL load are interfaced to the RTDS small timestep model through a traveling wave model. The highfrequency switching models suggest the feasibility of FPGA-based simulation of a high-frequency switching converter.

Integrated Simulation Framework For Crash Back Operation

Stefano Brizzolara, Pradya Prempraneerach, George Karniadakis, Chryssostomos Chryssostomidis

We formulate a modeling and simulation framework that integrates models of an all-electric ship (AES) with ship and propeller hydrodynamic models. In particular we present the first simulation study about the transient behavior of the propulsion system of AES during crash stop and backing maneuvers. A time domain model of all electric propulsion system of a notional destroyer has been coupled with a simplified transient model of the hull and propeller hydrodynamics. The integrated power system of the integrated power system (IPS) includes all main elements of the chain, i.e. from power generators to control units down to frequency controlled electric motors. The simplified unsteady hydrodynamic model of the hull and twin shaft lines with fixed pitch propellers is based on semi-empirical quasi static data corrected with complimentary CFD simulations. The transient behavior of the electrical power distribution and motor control are analyzed and the relevant implications that these kind of violent transient maneuvers have on the engineering of the main electrical components are outlined in the paper.

Research Trends In High Performance Computing Application On Large Scale Power System Operation

Ranjit Amgai, Jian Shi, Sherif Abdelwahed, Yong Fu

Recent trends in smart grid technology and fast switching devices have escalated the need for utilizing high performance computing (HPC) in power system applications. Likewise, with the distributed generation and added intelligence, number of control variables are increasing that requires real-time solution. The need for comprehensive and detailed simulation of such complex interconnected system is of utmost importance for operation, control and monitoring actions. Research works relating to load flow, state estimation, contingency analysis, stability issues, unit commitment and cyber-security issues are discussed with focus in faster computation for efficient decision making. Considering the various aspects over reliable and sustainable power system, this work surveys current progression and suggests the future potentials of HPC application in power system.

Interfacing Techniques for FPGA-based Distributed Simulation

John Zenor and Kurtis Kredo II

Field-programmable gate arrays (FPGAs) offer considerable potential for developing cost-effective simulations of various kinds including distributed multi-rate and high-speed real-time simulations. Interfacing FPGAs to each other and to other computers and to hardware-in-the-loop can present significant problems, particularly where low latency and high throughput are required. Techniques described include PCI, SMA, and custom high-speed point-to-point Ethernet, and include both copper and fiber connections. An example based on a system used for high-speed, multi-rate, real-time simulation is described.

Simulation-Based Approach for Interdisciplinary Systems Studies within an Innovative Undergraduate Program

Anatoly Kurkovsky

Abstract – To improve and increase the student critical and systems thinking abilities, we propose a simulation-based approach to teach and to conduct interdisciplinary systems studies within an innovative undergraduate program. We propose a sequence of the simulation courses that is organized on three levels within the college curriculum. On the first level it is an introduction to interdisciplinary systems simulation course. On the second - simulation tools for subject domain oriented systems studies course. On the third level, we offer the students a set of undergraduate research projects in the simulation area, organized as an interdisciplinary research course. In this paper, we discuss the goals of the simulation courses and their structure. To demonstrate the improved problem-solving ability of our students we briefly describe their systems simulation research projects in several areas. These include: a) educational process management to support sustainability of the college and b) transportation system dynamics analysis for the college and the local community. We use a general-purpose simulation software (ARENA) and an agent-based simulation software (NetLogo) to support our undergraduate educational simulation program.

A Mesh Generation Strategy for Representing Hull Geometry in ESRDC Ship Thermal Simulation and Visualization

Emerson Dilay, José Vargas, Juan Ordonez, Rob Hovsapian, Julie Chalfant, Chrys Chryssostomidis

This work introduces a novel mesh generation technique for representing ship hull and superstructure complex geometries. The method uses as input, state-of-art computer aided design tools (e.g., CAD, SolidWorks) that deliver STL (Standard Transform Language or Stereo Lithography) files which contain all the details of the ship geometry, that are used to produce coarse and representative meshes for complex geometries. The program is a custom mesh generator that can produce a mesh of an entire ship in less than 4 minutes. The previously developed volume element model based thermal management tool (vemESRDC) is enhanced to include the new mesh strategy. The vemESRDC is a thermal simulation tool developed as part of the Electric Ship Research and Development Consortium (ESRDC) funded by the Office of Naval Research (ONR) that is capable of providing quick responses during early stages of ship design. In order to illustrate the application of the methodology, several thermal management simulations are conducted for a hull representative of the US destroyer DDG-51 external geometry operating with the baseline Medium Voltage Direct Current (MVDC) architecture.

Planning a Modeling and Simulation Approach that Leads to Actionable Insights

Janel Nixon, Francesco Perra, Aldo Guagnano, Natalino Dazzi

A structured approach to strategic planning is especially necessary for Very Large Complex Systems (VLCS) involving multiple interacting components, or for those problems that entail a great deal of uncertainty. These complex problems require decision-makers to synthesize many aspects of the problem in order to see the 'big picture'. They must weigh multiple competing objectives side-by-side, and they need to be able to view the many dimensions of the decision space in order to understand the tradeoffs that need to be made. In essence, structured strategic planning embodies the multidisciplinary decision analyses, 'what-if' games, and tradeoffs that the decision-makers explore in their quest to identify the most logical solution to their problem. This paper will demonstrate a recommended approach for planning and executing a modeling and simulation approach for very large complex systems.

Discrete Event Simulation Performance - Benchmarking Simulators

Alexander Pacholik, Wolfgang Fengler, Tommy Baumann, David Grüner

Selecting the right tool for discrete event simulation (DES) is a challenging task. For most simulation purposes, including simulation-based optimization, simulation perfor¬mance is an important aspect in tool selection. Feature selection has been investigated frequently, while performance aspects are disregard in most cases. In this paper we present a benchmark for assessment of simulation performance, which allows comparison of tools regarding strength and weaknesses. As result, five tools are compared in different disciplines, allowing proper tool selection for complex simulation models or long-term simulations.

Modeling and Simulation of an Equivalent DC Multi-Converter Based Shipboard Power System for Nonlinear Observability Studies

Juan Jimenez and Chika Nwankpa

The operation of systems such as shipboard power systems and dc distribution systems are comprised of multiple independently operated converters with coupling behavior. This inherent cross-regulation behavior can lead to harmful operational situations when cascading of controllers limit violation is reached. It is important then to monitor the system during perturbations; if a system becomes unobservable the estimates used in system automation are erroneous. The incorporation of system dynamics into the observability formulation is then a key feature. In this work, dynamics of power electronic equipment is incorporated in the overall system model and the effects of loading conditions are analyzed through simulation of a nonlinear observability formulation of the developed system model.

Autonomy of SoS: the tendency notion

Alain Cardon, Mhamed Itmi, Ralph Huntsinger

We propose a model developing the autonomy of Systems of Systems. For this, we precise the notion of tendency as a transposition of the living organisms case and we develop the notion allowing behavioral intentions. We present a multi-agent model allowing the implementation with this new type of systems.

From Motorways on the Sea to Motorways of the River: A Simulation based Decision Making Approach Developing Dry Ports

Dietmar P.F. Möller

The European Commission has recently published a White Book on the future development of the European traffic policies. In this White Book a decision was launched through increasing the amount of freight car-ried on the sea instead of the land by trucks and trains which require harbors allocated at strategic important locations which are connected through high level Mo-torways of the Sea (MoS) [1]. As a result of MoS the relevance of gateway sea ports hinterland intermodal transportation and logistic infra-structures on the waterways has become an essential issue from the global competitiveness perspective in-troduced as Motorways of the River (MoR) intermodal transportation paradigm. The potential of MoR is the more effective and efficient hinterland connection on the waterways, the high utilization of transport re-sources and infrastructure through the consolidation of goods flows and extending the influence of gateway sea ports in their hinterlands to increase their competi-tiveness, associated with better collaboration and coor-dination in the supply chains. This allows waterway based hinterland logistics and associated concepts tak-ing over an obvious role in designing and managing global supply chains. However, this will require opti-mal solutions when deciding on and developing these hinterland hubs. The simulation based decision making which incorporate adequate scenarios of dry ports in relation to distances, infrastructure, services, etc. are the state-of-the-art approach to accomplish an opti-mized solution.

Bond Graph Modeling of Centrifugal Compressor System

Nur Uddin and Jan Tommy Gravdahl

A novel method of modeling centrifugal compression system for surge control purposes by using bond graphs is presented. By using the bond graph method, we get a simple description of compression systems based on physical phenomena and it is straight forward to get the dynamic equations. It is demonstrated that several active surge control methods can be represented by the same bond graph. It is also shown how methods for active surge control can be classified using energy flow in terms of upstream energy injection or downstream energy dissipation. A model of a compression system with recycle flow is derived in this work.

Thrombectomy Aspiration Device model based on the blood clots platelet composition and altherome plaque existence by using the Bond Graph technique

Gregorio Romero, Joaquin Maroto, MLuisa Martinez, Gillian Pearce

The World Health Organization estimate that 17 million people die of cardiovascular disease, particularly heart attacks and strokes, every year; coronary heart disease kills more than 7 million and strokes kill nearly 6 million people, occurring mostly in developing countries. Consequently stroke is one of the major causes of mortality world-wide. Most strokes are caused by a blood clot that occludes an artery in the cerebral circulation and the process concerning the removal of this obstruction involves catheterisation. Some studies concerning the analysis, design and optimization of one experimental device developed in the UK - GPTAD - has been analyzed by the authors in other papers, but this model includes a more realistic blood clot - wall adhesion force, introducing and analyzing the different and necessary parameters and changes into the model to make it more realistic. Once fully developed, the GPTAD may provide a means of clot removal from vessels in the human arterial system e.g. the cerebral vessels. The modelling that we present in this paper, taking into account the catheter, the probe, artery, blood clot and adhesion forces, may assist with the optimisation of the design of the GPTAD probe . In the model used for the simulation both mechanical and hydraulic aspects have been considered with the purpose of combining the effect of the fluid-blood transmission for the different sections of the vein, altherome plaque and the catheter.

True Bond Graph Model of the Thermodynamics of a Compressed Gas Accumulator

Wolfgang Borutzky

An accumulator with a gas filled flexible bladder is a device often used in hydraulic systems. The paper presents a true bond graph model that accounts for the energy exchange between the hydraulic oil stored in the device and the trapped compressed gas. The model does not rely on one of the usual assumptions that the process is either adiabatic or isothermal and is verified by simulation. Results obtained for the polytropic case are compared with those in the adiabatic case. The new true bond graph model accounting for the entropy flow between the oil filled chamber and the gas filled rubber bag easily integrates into bond graph representations of usual hydrostatic models. Thus, it proves useful in practical engineering models of hydraulic systems.

Dynamic Model of an Oilwell Drillstring with Stick-Slip and Bit-Bounce Interaction

Mejbahul Sarker, Geoff Rideout, Stephen Butt

Oilwell drillstrings sometimes vibrate severely and can twist off in hard rock drilling. Controlling vibrations is essential to improving the efficiency and minimizing the cost of drilling. A bond graph model of a drillstring has been developed that predicts axial vibration, torsional vibration, and coupling between axial and torsional vibration due to bit-rock interaction. Axial and torsional submodels use a lumped-segment approach, with each submodel having a total of 21 segments to capture vibration of the kelly, drill pipes, and drill collars. In addition, the model incorporates viscous damping, hydrodynamic damping, and hydraulic forces due to drilling mud; an empirical treatment of rock-bit interaction, and top drive motor dynamics. The model predicts the expected coupling between weight on bit (WOB), bit speed, and rock-bit interface conditions; and their effect on stick-slip. Mitigating open-loop measures used in the drilling industry (increasing rotary speed and decreasing WOB through changing derrick cable tension), when applied to the model, successfully eliminate stick-slip. A linear quadratic regulator (LQR) controller has been implemented which controls stick slip and eliminates bit bounce.

Evaluation of Dynamic Performance of Nonspherical Parallel Orientation Manipulators through Bond Graph Multi-Body Simulation

Taufiqur Rahman, Geoff Rideout, Nicholas Krouglicof

Dynamic performance of a parallel orientation manipulator requiring a small form factor is primarily determined by the dynamic response of the corresponding actuators. Hence, identifying a suitable kinematic architecture for such a manipulator is constrained by the choice of the actuator, which is based on several application-specific requirements such as dynamics, compactness, positioning accuracy, etc. The kinematic topology of each of the two architectures that can accommodate a prospective voice coil linear motor consists of three identical closed loops. These two candidate architectures are compared, one of which requires the actuator bodies to rotate, thereby introducing inertial effects that impact performance. This paper quantifies the performance improvements when no such inertial effects are present. Through dynamic simulation of the multi-body systems resulting from the candidate architectures, the architecture that provides superior performance in terms of settling times and expended energy in a random robotic maneuver can be identified. For this purpose, the multi-body models of the candidate architectures were developed and subsequently a Monte-Carlo performance benchmarking study was conducted. This study identified the architecture in which the actuator bodies did not rotate to be more desirable, as indicated by lower settling times and lower expended energy in executing a set of random maneuvers.

Analysis of a Singularly Perturbed LTI System: A Bond Graph Approach

Gilberto Gonzalez, Noe Barrera, Noe Villa

A bond graph model for a singularly perturbed system is presented. This system is characterized by fast and slow dynamics. In addition, the bond graph can have storage elements with a derivative and integral causality assignments for both dynamics. If we apply the singular perturbation method to analyze a muti-time scale system, the fast dynamic diffreential equation degenerate to an algebraic equation, the real roots of this equation by using another bond graph called Singularly Perturbed Bond Graph (SPBG) can be determined. This SPBG has the characteristic that storage elements of the fast state and slow state have a derivative and integral causality assignment, respectively. Thus, a quasi steady state model by using SPBG is obtained. A Lemma to get the junction structure from SPBG is proposed. Finally, the proposed methodology to two examples is applied.

A bond graph representation of p-n junction diode using VHDL-AMS

Chung-Chieh Lin and Chin-Ming Hong

This study focuses on the p-n junction diode modeling and simulation using bond graphs and VHDL-AMS. The bond graph modeling technique has been given an accommodated model for the interaction of power between elements on a system. The power flow is briefly sketched in the bond graph and the state equations are formulated directly from this graphical representation. Bond graph modeling is largely employed nowadays, and new techniques for structural analysis, model reduction as well as a certain number of software packages using bond graph have been developed. The bond graph methodology is a way to get a p-n junction diode model with important parameters to know the performance. VHDL is a modeling language which dedicates the discrete description to digital electronic hardware. Its extension VHDL-AMS allows modeling analogue subsystems and describing signal flow on a functional level. VHDL-AMS can be used as a unified modeling language for combined discrete-continuous system simulation. Once bond graphs are established, they can be easily described in VHDL-AMS. It will be possible to implement those models in any VHDL-AMS simulator. The system modeling yields equations, i.e. algebra and differential equations, and these equations have to be implemented into a reference simulator. The model is developed and simulated with the VHDL-AMS language under Dolphin SMASH environment.

Bond Graph Modeling of a Non-linear Buck Converter using a Linear Graph Approach

Noe Villa-Villaseñor, Gilberto Gonzalez-Avalos, Jesus Rico-Melgoza

In this paper a buck converter whose switching device is a bipolar junction transistor BJT) is presented. This BJT is also modeled according to the non-linear Ebers-Moll model. The derivation of the system equations is performed through a mixed approach that exploits advantages of both Bond Graph and Linear Graph techniques. Due to the non-linear nature of the switching device, the resulting mathematical model is a differential algebraic equation (DAE) that is simulated in order to prove the validity of the model.

Simulation of the dynamic behaviour of catenary cables using the Bond-Graph technique

José Antonio Lozano, Jesús Félez, José Manuél Mera, Juán de Dios Sanz

The use of cables as a means of transport has been common for a long time; for ropeways, cranes, the transport of electrical energy, etc. The mechanical or electrical problem can be solved using various classical methods or by applying finite element-based techniques. This work puts forward another way of solving the mechanical problem by applying the Bond-Graph technique to a length of continuous cable without any need to divide it into finite elements. The first step is to make an analysis and description of the physical or mechanical phenomena that occur when a length of cable is supported at its ends. Then the general mechanical problem needs to be approached in order to develop the Bond-Graph models to be applied. The second step is to perform different computer simulations of the problems affecting real cables that are subjected to static and dynamic conditions. Starting with a simple case of a cable suspended between two points, some specific dynamic cases will be solved that consist in tensing and slackening the cable, variations in the load conditions and variations in the cable length as a result of changes in temperature, etc. By analysing the simulation results the developed Bond-Graph models will be validated and compared with the results obtained from applying Classical Mechanics. Finally, the most important conclusions of the work will be set out.

Extension of Simulation Software for Thermodynamic and Other Systems Including Energy-Based Modeling

Forbes T. Brown

The author's Simulation Package for Thermodynamic Systems, which is freely downloadable from the internet, was specially designed to accommodate convection bond graphs, although it also handles conventional and hybrid bond graphs. Several new backward-compatible features have been added to this simulation package to enhance the flexibility of its non-thermodynamic parts, such as electromechanical components. First, multiport compliances, particularly nonlinear ones, are treated when the user merely inputs expressions for their potential energy, making otherwise more extensive and awkward pre-analysis unnecessary. Second, the user is prompted how to input nonlinearities and time-dependencies of the non-thermodynamic components of a model. Third, activated bonds are accommodated. Finally, the former need to avoid certain zero initial conditions in certain cases is eliminated. The result is a general-purpose simulation package that has some advantages over alternatives even when no thermodynamics is involved, although it retains its special role as the most practical way to simulate systems with flowing fluids that undergo temperature and volume changes.

Discontinuities in Physical Modeling: Bond Graph Models of Impact in Multibody Systems

Vjekoslav Damic, Majda Cohodar, Drazen Damic

Mechanical impacts encompass verity of complicated dynamic effects. The problems are not easy to analyze because the impacts are accompanied by fast transient processes. The responses often contain structural vibration and induced wave propagation. The contacts typically occurs intermittently, during which the systems rapidly change the states. The time scales of the processes are different resulting in multi-time scales problems. Examples of such problems are bouncing ball problems, impacts of flexible beams to constraining bodies, and the others. The problems have a long history. Thus longitudinal impacts with plane contacts and wave propagation are studied by Bernoulli, Navier and Poisson. The experimental analyzes were conducted as well. To solve such class of problems different approaches were used. In this paper a general bond graph method is used which allows application of impulse-momentum balance equations. Also different modes of the body motion during the impacts are modelled in order to offer a fairly general model of the impact. An important role plays the integration methods as well. The mathematical model of the problem is generated in the form of differential-algebraic equations (DAEs). The equations are solved using a general integration method based on backward differentiation formulae (BDF), which assures a high level of stability during the intermittent contacts. The results are illustrated by two examples.

Port-based pendulum modeling from a didactic point of view

Peter Breedveld

This paper is focused on the didactic aspects of port-based modeling of simple planar mechanisms represented by bond graphs. The relation between energy-based equation derivation techniques like Lagrange's and Hamilton's methods and Newton-Euler based techniques will be explained by modeling variations on a pendulum model with an emphasis on obtaining insight and preparing for the framework of port-based modeling of spatial multi-body mechanisms. Even though final results may be equivalent, the intermediate bond graph representation of these approaches will show that some methods are superior to others, depending on the purpose and desired flexibility of the model. The approach is also motivated by the fact that many consider 'bond graph modeling' as an alternative to other modeling approaches,

while the bond graph representation may be used to give a graphical interpretation of all sort of modeling approaches which facilitates their comparison, as long as they have some relation with an energy-consistent approach, which is a requirement for a sound description of physical phenomena.

Reduced order Luenberger observer design for switching systems -Bond graph approach-

Naima Hadji and Ahmed Rahmani

In this paper, we propose a reduced order observer design in order to reconstruct the continuous part of switching linear systems. The proposed method allows showing that the bond graph approach can be used as a tool for modelling, for structural analysis and for formal calculus. In this method only one bond graph model of the observer is used to calculate the gain matrices for all the modes. On the other hand, the choice of the Lyapunov function rather difficult with conventional methods is easier.

Bond graph modeling of a mecanum wheeled robot

Yang Qian, Ahmed Rahmani, Qiang Zhan

Mecanum wheels are used when omni-directional motion of a vehicle is desired. The omni-directional driving is useful to drive in narrow space. It should be more widely used as a kind of robot for intelligent wheelchairs or vehicle robots for indoor applications by making the best use of its unique features. For achieving the motion it is important to build a model of this omni-directional platform, especially if the platform is used by an autonomous robot. The objective of this paper is to propose a bond graph model of this Mecanum wheeled robot. After a description of Mecanum wheel is presented, we provide the modeling process for the whole robot with four wheels.

A new structural approach for ARRs generation from linear & linearized bond graphs

Kamel SIA, A. NAAMANE, N. K. M'SIRDI

This paper presents a new structured approach to generate the Analytical Redundancy Relations (ARRs) for Fault Detection and Isolation of the detectors of the linear and linearized bond-graphs; these latter may include information bonds. This innovative approach leads to fully exploit the bond-graph calculus capabilities to enhance classical procedures of ARRs, which require the state structural observability in order to be able to eliminate the unknown variables by using the derivation w.r.t. time.

Bond Graph Based Modal Decomposition of Systems with Non-proportional Damping

Loucas S. Louca

Modal analysis of lumped parameter and continuous dynamic linear systems is extensively used to study their dynamic behavior and controller design. In both cases, a reduction of the model size that does not degrade accuracy is often necessary for the efficient use of these models during the design process. Previous work by the author addressed the development and reduction of modal representations using the bond graph formulation. That work introduced a methodology, based on the activity metric, which reduces the model complexity by eliminating entire or partial modes. This approach has many advantages, however, it is limited to systems with proportional damping. The goal of the current work is to propose a new methodology such that a similar modal decomposition can be developed for systems with non-proportional damping. In this case, modes are coupled through damping elements, which can lead to various levels of coupling. It is proposed that weak coupling can be quantified using the activity metric. Coupling elements with low activity can then be eliminated from the model in order to decouple the modes. An illustrative example is provided to demonstrate the proposed modal decomposition methodology for real systems and how the importance of coupling elements can be quantified.

Study of a valveless planar micropump system - a modeling attempt by bond graphs

Abdennasser Fakri

This work concerns a bond graph modeling of a valveless single-chamber planar micropump. Bond graphs methodology (BG) has become popular and is employed nowadays as efficient graphical description of multi-domain dynamic systems. The functioning principle of the valveless micropump is analysed and the BG approach is used to establish a dynamic model delineating the functional parts. The corresponding mathematical model is extracted in terms of state space differential equations. Simulation results illustrating the pressure in the chamber and the volume flow rate through the two different types of nozzle/diffuser micropump elements. This paper is also aimed at providing good support for the academic field on multi-domain dynamic systems modeling using the BG methodology approach and bloc diagram transfer.

Automated Generation and Simulation of Component-Based Generalized Bond Graphs

Siyuan Dai and Xenofon Koutsoukos

The concept of causality presents a problem for component-based modeling of bond graphs, the uncertainty of the causality of each interaction bond. As a result we use generalized bond graphs instead, which is mathematically represented by its Dirac structure. Through the use of generalized bond graphs we can represent each component as a causal computational model (hybrid-input-output representation) or as an acausal computational model (kernel representation). Our contribution consists of developing a method which exploits the Dirac structure of a generalized bond graph component, and generates both a causal and acausal computational model for that component. A case study, with subsequent simulation results, is used to showcase both methods and help compare and contrast both computational models.

Modeling and Analysis of the Dynamic Performance of a High Speed Selective Compliant Assembly Robotic Arm (SCARA) on a Compliant Support

Migara Liyanage, Geoff Rideout, Nicholas Krouglicof

A Selective Compliant Assembly Robotic Arm (SCARA) manipulator has been developed with rotary hydraulic actuators for industrial automation. The robotic arm is mounted on a vertical column which has an 'I'-shaped cross section. A bond graph model has been generated for the servo valve, rotary actuator, and links. A lumped-segment torsional vibration model has been generated for the support column. During high speed movement of the manipulator this column vibrates torsionally. This deflects the actual position of the end effector (EE) from the desired position. The rotary joints of the manipulator are driven by double vane rotary hydraulic actuators fitted with rotary encoders to give relative angular positions. Currently, this arm is controlled using simple joint controllers. Since this controller uses the angular displacement of the joints with respect to (w.r.t.) the manipulator links it does not address the issue of external disturbances such as the effects of base vibration. A novel method has been proposed to compensate for EE vibration. This method uses the angle of twist of the vertical column to estimate the deflection and to modify the set point of the joint controller. The results of the analysis show that the proposed method produces a much accurate tracking performance compared to the existing conventional joint control strategy even at high manipulator speeds such as 5.5 m/s.

Bond graph model of electromechanical actuation system of a dry dual clutch

Vladimir Ivanović, Joško Deur, H. Eric Tseng

The paper proposes a bond graph model of dry dual clutch actuation system based on an electromechanical actuator. The model consists of two components: (i) dual clutch assembly and (ii) electromechanical actuator itself. Mathematical model equations are derived based on the developed bond graph model, and methods applied for modeling of nonlinear effects such as friction are explained. The model is validated against experimental results collected by developed full dual clutch transmission test rig indicating a good modeling accuracy. The model is based on physical principles and is therefore suitable for various simulation studies aimed at model-based analyses, component optimization, and control system design.

A Bond Graph Approach to Rotordynamics

Eilif Pedersen

Rotor dynamic modeling using the bond graph approach has not been discussed in great detail in the literature although some few references can be found. The standard rotor dynamic models, implemented using the finite element method, are also most often presented as stationary rotational speed versions. Rotor transient models which enables the analysis of spin-up and stopping operations are not as extensively investigated. In this paper a continuous shaft-disc system is modeled as a rotating Euler-Bernoulli beam supported by flexible bearing supports. The continuous shaft-disc system with imbalances is described with kinetic and potential energies which includes translational and rotatory inertia and also gyroscopic coupling. The shaft model developed here is based on the finite-mode approach for representing distributed systems and this is combined with more standard rigid body disc model to form a complete rotor model. The equations of motion are derived using a Lagrange approach and the model is presented as a bond graph model. Simulation examples are included for simple rotor configurations demonstrating both the Jeffcott and Stodola-Green rotor phenomena together with more complex rotor dynamics features.

Bond Graph Support in SystemC AMS

Torsten Maehne and Alain Vachoux

SystemC AMS is a simulation framework, which is used for the hardware/software co-design of heterogeneous systems on chip. The increasing integration of digitally-assisted multiphysical components into these systems makes the bond graph formalism an excellent candidate to augment the modeling capabilities of SystemC AMS to enable the description of their energy-conserving behavior. Bond graphs integrate well with the block diagram formalism to describe continuous-time non-conservative behavior. The latter formalism also facilitates a seamless interaction with models using the Discrete Event (DE) and Timed Data Flow (TDF) models of computation of SystemC AMS. Therefore, both formalisms have been implemented into a dedicated Bond Graph (BG) model of computation for SystemC AMS, which architecture and usage is presented. The system model of a vibration sensor and its digital front end serves as an example how the diff erent models of computation can be used in parallel to describe the individual component behaviors in a well adapted way.

Bond Graph Modeling and Power-flow Analysis of Range Extended Electric Vehicle Transmission

Mihael Cipek, Joško Deur, Joško Petrić

The bond graph method is used to analyze the power flow in the recently introduced Plug-in Hybrid Electric Vehicle (PHEV) known as Range Extended Electric Vehicle (REEV). The REEV's transmission includes an internal combustion engine, two electric machines, and three clutches. Depending on the clutch status and electric machine control action, the transmission can operate in various operating modes ranging from the electric-vehicle and series-hybrid modes to the series-parallel mode. The paper demonstrates that the bond graph method can conveniently be used to analyze and visualize the transmission power flow in different operating modes, thus facilitating understanding of the transmission behavior and development of related control strategies.

Modeling Chemical Reactions Using Bond Graphs

Jürgen Greifeneder and Prof. François E. Cellier

This article offers a general methodology for modeling basic chemical reactions and carries forward a series of papers on modeling thermodynamic behavior using true rather than pseudo-bond graphs. In order to make processes of heating and expansion within the mixture visible, our approach does not deal with one overall volume and the overall entropy –as would be normal for classical chemistry– but rather with separated entities, one for each compound. Furthermore, assumptions of quasi-stationary or equilibrium conditions are minimized to ensure the largest possible degree of generality in the conclusions reached. It will be shown, that chemical reactions can be modeled as transformative behavior, which makes their external behavior linear and therefore allows for superposing several chemical reactions. While the mass flows (respectively molar flows) are assumed to be determined directly from Arrhenius' equation and the underlying stoichiometry, the determination of entropy and volume flow processes needed a more extensive discussion. A bondgrapher's Modelica model of the HBr-synthesis based on the assumption of ideal gas serves as an example of the presented theory of chemical reaction dynamics.

The Bond Graph Method for Dynamic Analysis of the Autonomous Morpheus Planetary Lander

Jose Granda, Louis Nguyen, Brett Touey

A new era of space exploration is beginning with new space vehicles being developed. This paper discusses the new Planetary Lander from NASA and the preliminary engineering analysis behind it to understand the dynamics of a vehicle loaded with consumable fuel. Several methods of computer modeling and simulation are explored to understand and predict the vehicle behavior once in flight. In order to achieve that two three distinct methods and software were used. One of those is the bond graph modeling approach. A bond graph model of the vehicle and consumable fuel is presented. This means a nonlinear model with time dependent parameters. CAMPG (Computer Aided Modeling Program) was used to produce the models in state space symbolic form. This allowed the generation of a computer model with time varying inertias which represent the mass changing as the fuel is consumed. Another alternative is to use multi-body modeling software in two dimensions like Working Model 2D which produced results that were compared to those of the bond graph models. Finally, a third alternative was to use three dimensional models produced with SOLIDWORKS that generated a prototype in three dimensions whose data base was used in analysis software like NASTRAN4D or SOLIDWORKS MOTION. This paper concentrates in presenting the model generation process and analysis using the bond graph method.

Bond Graph Modeling of a Multibody Wave Energy Converter

Oyvind Ygre Rogne and Eilif Pedersen

This paper deals with the mathematical modeling of a multibody wave energy converter (WEC), with particular emphasis on rigid body dynamics and bond graph representation. The device consists of one freely floating soft moored central platform hinged to several smaller buoys, where the energy is extracted from the relative angular velocity in the hinges. In this study, the power take-off is represented by a linear damping model. The emphasis is on formulation of the generalized mass and Coriolis-Centripetal

matrices using the Lagrangian equation for quasi-coordinates and the Newton-Euler equations of motion with eliminated constraint forces, and to lesser extent on the hydrodynamical aspects.

Modelling of Wave Energy Converters Using Bond Graph

Adi Kurniawan, Eilif Pedersen, Torgeir Moan

This article summarizes recent works by the authors on the modelling of wave energy converters (WECs) using the bond graph method. Generic models for two categories of WECs, viz. oscillating bodies and oscillating water columns (OWCs), are presented. Oscillating-body WECs utilise relative motion between a moving body and a fixed reference, such as the sea bed, or between several moving bodies. On the other hand, oscillating-water-column WECs utilise the motion of a mass of water relative to a fixed reference, or relative to a moving body. A generic model of self-reacting multibody WECs, one subcategory of the former, is presented here for the first time. Finally, as a case study, we model a particular type of floating OWCs known as the backward-bent duct buoy, and present some simulation results. To accelerate simulations, the wave radiation forces are modelled using state-space approximations, instead of convolutions used in an earlier work.

Bond Graph Model-Based Machine Diagnostic with Information Theory Health Metric

Michael Bryant, Lalit C. Karlapalem, Jeremy T. Murphy, Rodrigo Ruizpalacios

Presented is a model and information theory approach to diagnostics. Simulations from detailed models of a machine were compared to measurements of the real machine. The models' parameter values were varied until simulations closely emulated behavior. Changes of parameters from nominal values located faults. To assess machine health, a machine was likened to a communications channel, wherein a transmitter sends information across an imperfect channel. The receiver must extract the information in the received signal, despite noise added by the channel. For the machine communications channel analogy, a component processes `signals' from upstream elements (transmitters) via the component's functionality, and passes the `signals' to downstream elements (receivers). Faults that disrupt functionality change these signals, adding `noise'. With this analogy, Shannon's theorems of information, which established limits on noise for error free communication, were applied as a health metric to quantitatively assess a machine's ability to function.

Bond Graph Elements and Structures for Tribology

Michael Bryant

Tribology, the interdisciplinary study of contact, friction, lubrication, and wear, often involves coupled dynamics between several disciplines. For these problems, bond graphs are a natural fit. Machine systems employ tribology components to facilitate and guide moving parts such as bearings, gears, brakes, and lubricated devices. These devices involve surfaces in contact and/or relative motion, which feature dynamics from multiple physics disciplines. Of interest to bond graphers are the unusual dynamic structures that arise from the device constitutive laws. Contact devices have constitutive laws which lead to unusual multi-port bond graph elements, such as a multiport RC element, that both stores energy and dissipates power. This paper considers the dynamics of stick slip processes (such as the dynamics that result in squeaky shoes or brake squeal), journal bearings, and gear contacts.

Bond Graph Modelling for the Analysis of Fault Scenarios in Hybrid Systems

Wolfgang Borutzky

The paper briefly surveys the bond graph modelling of hybrid systems and presents the author's bond graph approach to the analysis of fault scenarios in hybrid systems by means of some illustrative examples. The presentation concludes by considering aspects such as the generation of system mode dependent adaptive thresholds for fault indicators that help avoid missing or false fault detections which is essential for a correct fault diagnosis.

Pedestrian Simulation for Urban Traffic Scenarios

Jörg Dallmeyer, Andreas D. Lattner, Ingo J. Timm

Simulations are widely used formodeling, analysis, planning, and optimization of traffic flows and phenomena. Every human moving in a city participates at least to some extent as a pedestrian in urban traffic. Nevertheless, pedestrians usually are not part of traffic simulations. This work presents a model for pedestrian movement, taking into account interactions with other road users and among pedestrians on pedestrian crossings. The components of the model are evaluated separately and in a city scenario with an accumulated road length of about 550km. Experimental results indicate an influence of pedestrians on urban traffic. This leads to the finding, that the consideration of pedestrians in urban traffic simulation may lead to a gain of knowledge.

Implementation of the Preisach Model in MATLAB

Norbert Franz, Bernd Güde, Andreas Meyer, Tobias Kipp, Hans Peter Oepen, Dietmar P.F. Möller

In the Preisach model a ferromagnetic structure is divided into magnetic domains, each switching between two different states. The hysteresis for a single domain is a rectangular-shaped hysteresis loop with an upper switching point α and a lower switching point β. The hysteresis of the whole ferromagnet is the superposition of all loops involved. The Preisach model comprises a weighting function μ(α,β) for every pair (α,β) that needs to be determined for every hysteresis curve from experimental data a priori. From a physicist's point of view the Preisach model could be employed for studying ensembles of ferromagnetic particles. The model can serve as a link between theory and experiment in order to describe a microscopical system by a macroscopical measurement. From an engineer's point of view a mathematical model for hysteresis could serve as a compact description of a ferromagnetic device in an electrical circuit. The case study presented here shows how the weighting function μ(α,β) is determined for given values of (α,β). The investigation is carried out within the development environment MATLAB. It is a standard that is available for many researchers in academia and industry and conveniently provides all necessary functionality.

Scholarly Communication of Reproducible Modeling and Simulation Research using e-Portfolios

Levent Yilmaz

As the use of computer simulation is increasingly becoming central to scientific enterprise, lack of proper documentation, validation, and distribution of models and experiments may hamper reproducibility and hence cause a credibility gap. Building on prior research requires ability to reproduce simulation experiments and to further extend models to address increasingly challenging problems. Strategies and potential mechanisms are delineated to enable authors, publishers, funding agencies, journals, and the broader scientific community to cooperate and establish a sustained model-base, simulations, experiments, and documentation, so that scientists can build on each other's work and achievements.

Fuzzy Logic-based Battle Field Mobility Prediction Method in War-game Simulation

Yong Beom Ma, Tae Young Kim, Jae Kwon Kim, Jong Sik Lee

War-game simulation models the situation of a battle field and has been used for analyzing the operation or the occupation of a troop. It is necessary to develop a fast and accurate mobility prediction method of a weapon or equipment with mobility in a battle field. However, communication resources are limited and links are frequently disconnected. A mobile node moving in war-game simulation is greatly influenced by various environmental factors. This paper proposes a fuzzy logic–based battle field mobility prediction method in war-game simulation in order to predict the mobility of a mobile node and provide accurate location information with mobile nodes according to change of location. A base station communicates with mobile nodes and detects their locations. In this study, we use fuzzy logic control and perform a velocity inference on the basis of a number of rules by assigning an intelligent agent to each base station. The location error associated with FLMP is lesser than that with existing models such as the mobile distance-based mobility prediction model and the mobile velocity-based mobility prediction model. Experimental results indicate that the proposed method improves the efficiency of mobility prediction in hybrid wireless network.

Catchment Basin Optimized Management using a Simulation Approach within DEVSimPy Framework*

Jean François Santucci and Laurent Capocchi

This paper deals with simulation based optimization of the management of a catchment basin involving dams, electrical power station, pumping station, valves, etc. We explain how an iterative process allows us to integrate optimization algorithms into a discrete event simulation. This process has been implemented using the DEVSimPy framework. The obtained results points out the feasibility of the proposed approach. Furthermore this software is actually used by the Corsican Water Agency in order to efficiently manage the South East water network.

Time-domain simulation for marine propulsion applications

M. Altosole, M. Figari, M. Martelli

The propulsion system dynamics is a key aspect of the overall behavior of a ship, for safety as well for commercial aspects. However, despite its great importance, numerical methodologies for deep investigations about the marine propulsion dynamics are not widely covered in public literature. This paper presents an overview of the simulation methodologies, developed by the authors in recent years
with the support of colleagues and technicians from Genoa University and marine industry, to design marine propulsion plants and their control systems. The aim is to point out the importance of the dynamic aspects that cannot be neglected when studying ship propulsion matters.

Rapid Virtual-Human-in-the-Loop Simulation with High Level Architecture

Stefan Puch, Martin Fränzle, Jan-Patrick Osterloh, Christoph LäscheCarl von Ossietzky

Connecting different simulators, and setting up a distributed simulation is a complex and expensive task. Especially in research projects, where rapid results are desired, this is a task that is often too time consuming. Therefore the use of standards and existing frameworks can be helpful. The IEEE 1516 \hla (HLA) is a well-established concept for distributed simulation, whereas HLA is not well suited for rapid prototyping. In this paper, we describe how we use HLA in a virtual-human-in-the-loop simulation, as well as the framework we developed in order to allow to rapidly connect new simulators. Finally, we present an evaluation of our framework, which shows that an open source RTI in our context of research may compete well with a commercial RTI implementation.

A Simulation of an ERP Implementation with Informal Processes

Andrew Greasley and Yucan Wang

This paper presents a discrete event simulation study to examine tenancy service performance in a shopping centre. The study aims to provide an understanding of how informal management mechanisms could enhance existing ERP systems. The research shows the potential benefits of combining the traditional strengths of ERP in providing better performance in terms of efficiency with the ability to react with flexibility to customer's requests.

Quantitative Analysis of Time and Value Discretization in RF Phase Detectors

Christopher Spies, Pongyupinpanich Surapong, Manfred Glesner, Harald Klingbeil

In a particle accelerator, many signals of interest are high frequency harmonic signals with a narrow bandwidth. Phase synchronisation between different signals is very important, and digital phase control loops are employed to that end. In the present paper, we model different digital phase detectors in detail and quantify the discretization errors introduced by finite sampling intervals and data precision. Based on our results, we arrive at a more abstract yet sufficiently precise model of a phase detector that is suitable for system-level modeling.

A Federated Tooling Framework for Formal Analysis of Simulation Models

Ufuoma Bright Ighoroje and Mamadou Kaba Traore

This paper presents an integrated tooling framework for the formal analysis of simulation models based on the DEVS-Driven Modeling Language (DDML). DDML, a graphical modeling language inspired by Discrete EVent System Specification (DEVS), defines models at three levels of abstractions and the operational semantics adopts the DEVS simulation protocol. To increase the quality of DDML models, a formal semantics is given by multiple levels of denotational translations to different formal methods (each corresponding to the different levels of abstractions). In these semantic domains, we can take advantage of already existing tools to perform analysis for verification, validation, and accreditation. We present the formal framework of DDML and the methodology for tools integration to automate formal analysis of simulation models. The federation methodology is based on model-driven techniques.

Waveform-Level Time-Domain Simulation Comparison Study of Three Shipboard Power System Architectures

James Langston, Mischa Steurer, Jonathan Crider, Scott Sudhoff, Yonggon Lee, Edwin Zivi, Roger Dougal, Yucheng Zhang, Robert Hebner, Abdelhamid Ouroua

Detailed waveform-level modeling and simulation of three alternative shipboard power system architectures is presented herein. The three system architectures are based on conventional 60Hz medium-voltage ac (MVAC), higher-frequency 240Hz medium-voltage ac (HFAC) and medium-voltage dc (MVDC) technologies. To support the quantitative assessment and comparison of these three different power system architectures, each technology was modeled using a common representative, notional baseline ship. The baseline ship represents a multi-mission destroyer fitted with an 80MW next generation integrated power system (NGIPS). Modeling of each power system architecture is set forth along with simulation studies for three fault scenarios. Each of the three power system architectures was implemented within the MATLAB/ Simulink environment. Continuity of service was evaluated for each architecture along with a fault scenario using an operability metric. After a brief description of the three power system architectures and the operability metric, quantitative results are presented.

Supply Chain Building Blocks – Development of an Agent-Based Platform for Generic Supply Chain Modeling

Mayolo Alberto Lopez Castellanos and Wolfgang Kersten

The aim of this paper is to present the development of an agent-simulation named Supply Chain Building Blocks (SCBB) and to position it as a platform for generic supply chain modeling and holistic performance assessment. Complementing existent supply chain agent-simulation frameworks, mainly focused on partial analyses and not on the complete system, SCBB abstracts the supply chain across its system structural levels: network, interactions and processes. Supply chain participants are modeled as agents with configurable processes and policies, which interact and communicate within the supply chain environment. The agent's processes are aligned with the Supply Chain Operations Reference (SCOR) framework and the sub-processes with the supply chain management inter-functional perspective. The platform integrates geographical information for emulating realistic transportation lead times between globally located supply chain participants. In the model, lead times affect the decisions of inventory, production-management and procurement sub-processes. SCBB enables simulating supply chains with different network configurations, participants' characteristics and process parameters for the performance analysis across the system's structural levels. Thus, SCBB agent-based modeling platform supports the supply chain stakeholder's decision-making process by holistically analyzing the performance of generic supply chains characterized by different structural designs and behaviors.

Simulation Modeling Approach to Maritime Container Terminals: A State-of-the-Art Review

Aida Huerta[1], Francesco Longo[2], Giovanni Mirabelli[2]

An overview of relevant literature is conducted on research focusing on the applicability of simulation modeling approach in the solution of port container terminals' decision problems. The container terminals' decision problems have been dominantly addressed by Operational Research discipline based on its two main approaches math modeling and simulation. Extensive container terminals' research has been addressed by using Discrete –Event Simulation, but the literature review suggests that Agent-Based Modeling and Simulation is now emerging as a more suitable approach for studying operations container terminals, but this still needs to be verified by more deployed systems. A general conclusion from our study is that is necessary to increment the use of Agent-Based Modeling and Simulation tools in the container terminals modeling to provide more adequacies in the modeling and simulation activity.

Combining Traffic Simulation with Bayesian Networks for improved Quantification of Accident Risk Index

Andreas Andreas Gregoriades[1], Kyriacos Mouskos[2], Harris Michail[3], Konstantinos Katzis[1]

Traffic phenomena are characterized by complexity and uncertainty, hence require sophisticated information management to identify patterns relevant to safety and reliability. Traffic simulation methods have emerged with the aim to evaluate traffic congestion and improve road safety. However, assessment of traffic safety and congestion requires significant amount of data which in most cases is not available. This work illustrates an approach that aims to alleviate this problem through the integration

of two mature technologies namely, simulation-based Dynamic Traffic Assignment (DTA) and Bayesian Belief Networks (BN). The former generates traffic flow data, utilised by a BN model that quantifies accident risk. Traffic flow data is used to assess the accident risk index per road section and hence, escape from the limitation of traditional approaches that use only accident frequencies to quantify accident risk. The development of the BN model combines historical accident records obtained from the Cyprus police and data generated from the DTA simulation.

Complex Industrial System Modeling: A Multilevel Methodology

Aida Huerta and Mayra Elizondo

The evolution of industrial systems operations suggests the evolution on modeling methodologies. Traditional modeling methodologies use one approach to modeling all aspects of a system, consider just operational aspects isolated from the rest, and search a single solution. At the present, with the changes in our society, our environment, and in our economy, it is mandatory to consider also socioeconomic and environmental aspects at different levels in the modeling process. The enterprises have not operations just at local or national level. Instead, the enterprises have operations at regional and global level and for their operations must take in account the global multi culture and language, the implications of technology, the impact of global sustainable operations, and the balanced growth of manufacturing across the globe. Based on this, a new modeling methodology is proposed to support the challenges as adaptation, change and novelty of 21st-century industrial systems.

Subsidy cut and its effect on Tehran Electricity Company: A System Dynamics Approach

Erfan Mehmanchi and Sahar Zahedi Fard

In recent years, subsidy payment has been made a main challenge for governments due to growth of population and energy price in global markets. Targeted subsidy plan has been implemented in Iran since last year, and this article discusses its effects on costs and revenues of Tehran Electricity Company as one of the major subdivisions of Iran's electricity industry. In the new system, structural changes have been made in electricity tariffs, so it is not possible to predict the future trends in electricity consumption only based on the past consumptions. In order to model the decision making structure in the recent conditions, a system dynamics method is applied. In addition to modeling the revenue and cost system of the company, the division of production, i.e. power plant is elaborated by means of state-flow diagram. That is because the company cannot affect consumer's behavior directly and is only able to control the costs for mitigating the problems of instabilities. Based on the obtained results, not only the company faces increased costs in production sector at the beginning of plan implementation, but also the increase will be more significant in the years after the fifth year of plan implementation.

Simulating Land-Use policies with the use of CPN formalism

miguel mujica and miquel angel piera

The FUPOL project aims in a better way of fostering e-participation through the use of several tools and the social networks which will make the citizens participate in the decision-making process in a more active way. The modelling and simulation of social activity is one WP of the project which is in charge of developing multi-agent systems capable of simulating the different actors that participate in the policy process. The novel methodology presented in this paper codifies the rules that govern the behaviour of agents using the causal-modelling approach available with the coloured Petri net formalism. Its characteristics allow a better understanding of the causal relationships present in systems and in particular in the case of policy process it allows to face the simulation of policy domains taking into account the causes instead of the traditional approach which normally uses data trends or regressions to forecast the future outcomes.

Intelligent Agents for Simulation of Civil Military Cooperation and Psychological Operations

Agostino Bruzzone

This paper proposes the development of conceptual models to be used in a simulator for supporting planning and training in Civil Military Cooperation and Psychological Operations. The authors present a new generation of CGF (Computer Generated Forces) driven by IA (Intelligent Agents) able to consider the human aspects as well as the impact of social networks on this context. The research represent an application of their IA-CGF. In this paper the authors propose the conceptual models as well as the general architecture and the development process.

Modelling & Simulation to Support NATO Crises Management Exercise

Francesco Mastrorosa, Agostino Bruzzone, Raniero Castrogiovanni, Luca Sacco, Giuseppe Lorusso, Francesca Madeo

The research is focused on the investigation of the Modeling & Simulation (M&S) use for supporting NATO military training with major attention to Crises Response Training, that is one of the main concerns of North Atlantic Treaty Organization (NATO) Defense College (NDC) which hold the Senior Course twice per year. Modelling & Simulation is considered one of the most powerful approach to achieve the NATO transformation process. Academy and Industry are improving their interest about this matter and the same process is ongoing by Governments. NATO Modelling & Simulation Centre of Excellence (NATO M&S COE) doesn't want to lose the opportunity to improve its Subject Matter Experts (SMEs) knowledge in the Crises Management Training in which the environment is not Operational as the military scenarios are used to be and where the human real-dimension has to be virtualized carefully. The paper provides a survey of tools and techniques for decision-making training and education and it highlights the benefits of modeling and simulation and other Information Technologies (Its) in term of time saving and interaction and information sharing improvement.

A model of a finite buffer shared by queues with batched Poisson arrivals.

Miron Vinarskiy

We study a model of a finite buffer shared by M[x]/M/1 queues. Customer arrivals in each queue are modeled as a batched Poisson process with an arbitrary batch size distribution. The model is a generalization of the Kamoun and Kleinrock model of a packet switch buffer memory shared by M/M/1 queues. A sufficient condition is found, involving quite general buffer sharing policies, for equilibrium state probability distribution to have the product form. For the special case of the geometrically distributed batches and complete sharing buffer policy, we obtain closed form solutions for the normalization constant. The solutions emerge from a few system load configurations and lead to efficient computational procedures for the performance characteristics.

Traffic Merging for Energy-Efficient Datacenter Networks

Alessandro Carrega, Suresh Singh, Roberto Bruschi, Raffaele Bolla

Numerous studies have shown that datacenter net-works typically see loads of between 5% – 25% but the energy draw of these networks is equal to operating them at maximum load. In this paper, we propose a novel way to make these networks more energy proportional – that is, the energy draw scales with the network load. We propose the idea of traffic aggregation, in which low traffic from N links is combined together to create H < N streams of high traffic. These streams are fed to H switch interfaces which run at maximum rate while the remaining interfaces are switched to the lowest possible one. We show that this merging can be accomplished with minimal latency and energy costs (less than 0.1W) while simultaneously allowing us a deterministic way of switching link rates between maximum and minimum. Using simulations based on previously developed traffic models, we show that 49% energy savings are obtained for 5% of the load while we get an energy savings of 22% for a 50% load. Hence, forasmuch as the packet losses are statistically insignificant, the results show that energy-proportional datacenter networks are indeed possible

A Fast-Converging TCP-Equivalent Window-Averaging Rate Control Scheme

Shih-Chiang Tsao

Smooth rate control schemes are necessary for Internet streaming flows to use available bandwidth. To equally share the Internet bandwidth with existing Transmission Control Protocol (TCP) flows, these new schemes should meet TCP-equivalent criterion, i.e., achieve the same transmission rates as TCP under the same network conditions. However, when the available bandwidth oscillates, many of these schemes fail to meet this criterion due to their slow increasing rate. This study proposes a window-averaging rate control (WARC) scheme to send packets at the same average rate as a TCP flow over a fixed time interval. Considering the TCP rate only over a fixed interval allows WARC to forget the historical loss condition more rapidly than other schemes, thus achieving a faster increasing rate when additional bandwidth becomes available. When the available bandwidth drops dramatically, WARC uses a history-reset procedure to converge its rate to the new steady rate immediately after a specified number of losses. The analysis and simulations in this study show that WARC not only achieves the same bandwidth as TCP, but exhibits faster convergent behaviors and has a smoother rate than existing schemes.

Maximum Throughput Computation of an Application in a Multi-tier Environment

Subhasri Duttagupta

Performance projection of an application for large number of users involves predicting the maximum throughput that the application can achieve and the maximum number of users it can support. Factors affecting the maximum throughput can include both hardware and software resources of each of the servers associated with the application. In a multi-tier environment, the number of resources can be quite large. As soon as any of these resources is bottlenecked, i.e., the resource utilization reaches close to 100%, the rate of increase of throughput drops. Further increase in the number of users results in reduction in throughput. For any enterprise application that intends to cater to a large number of users, it is desirable to know the maximum throughput it can achieve. This paper proposes a systematic technique for analyzing maximum throughput of any application that can be used irrespective of the test environment or production environment. Our technique computes maximum throughput with more than 95% accuracy in most scenarios. This technique can be useful in reducing the load testing effort and time.

Traffic Optimization for TCP-based Massive Multiplayer Online Games

Jose Saldana, Luis Sequeira, Julián Fernández-Navajas, José Ruiz-mas

This paper uses a traffic optimization technique named TCM (Tunneling, Compressing and Multiplexing) to compress the traffic of MMORPGs (Massively Multiplayer Online Role-Playing Games), which use TCP to provide a real-time service. In order to optimize the traffic and to improve bandwidth efficiency, TCM can be applied when the packets of a number of players share the same link, which occurs in some scenarios, as e.g. the traffic between proxies and servers of game-supporting infrastructures. First TCP/IP headers are compressed by the avoidance of repeated fields; next, a number of packets are included into a bigger one and finally, they are sent using a tunnel. The expected compressed header size has been obtained using traffic traces of a real game. Next, simulations using a traffic model have been performed in order to estimate the expected bandwidth savings and the reduction in packets per second. The added delays are shown to be small enough so as not to impair players' experienced quality.

Reliability and Survivability of Vehicular Ad hoc Networks

Dharmaraja Selvamuthu, Resham Vinayak, Xiaomin Ma, Kishor Trivedi

Vehicular ad hoc network (VANET) is a technology that enables communication amongst the vehicles by creating mobile Internet. The primary purpose of VANET is road safety and security. Hence reliability and survivability of the network become matters of prime concern. Reliability and survivability of the network is immensely dependent upon the hardware and channel availability. In this paper, we analyze the reliability of the vehicles and RSUs, using reliability block diagrams. Further, survivability of network, in terms of message lost due to unreliable hardware or channel unavailability, is explored for two types of communication in VANET namely, vehicle-to-vehicle and vehicle-to-roadside communication. The technique of hierarchical modeling is followed for the same.

Evaluating the Impact of Energy Consumption on Routing Performance in Opportunistic Networks

Annalisa Socievole and Floriano De Rango

Opportunistic networks are challenged wireless networks where most of the time contacts are intermittent and link performance is typically highly variable. In this kind of environment, an end-to-end path between the source and the destination may only exist for a brief period and may change quickly. Long propagation and variable queuing delays might be introduced and conventional routing protocols for mobile ad hoc networks are inappropriate to deliver messages between nodes. Different routing protocols for opportunistic networks have been proposed in the literature. In most cases, authors evaluate the performance of their protocols considering metrics like delivery ratio and delivery latency, disregarding the importance of energy consumption constraint. In this work we present a performance comparison of the Epidemic, Spray and Wait, PROPHET, MaxProp and Bubble Rap routing protocols with respect to energy consumption. We evaluate how the energy consumption impacts the routing performance and how the different forwarding algorithms for opportunistic networks affect the energy usage in the mobile devices.

Directing Requests and Acquiring Knowledge in a Large-Scale Grid System

Konstantinos Karaoglanoglou and Helen Karatza

This paper proposes two resource discovery mechanisms (the Upgrading and the Re-routing one) in a large-scale Grid system, in which the categorization of resources plays a crucial role. Through a simple matchmaking framework, each resource is identified as being part of a certain category, using its technical specifications (i.e. disk, and memory). Each Virtual Organization (VO) acquires only partial/limited knowledge of the availability of resources controlled by other VOs in the system. The goal is to discover a suitable resource for a request, and then effectively direct this request to the specific VO that controls locally the appropriate resource. During the satisfaction of requests, the VOs are supported and enhanced by the proposed resource discovery mechanisms in order to gain better knowledge of the Grid resource availability. As the creation and satisfaction of requests progresses, the VOs manage to acquire an adequate knowledge of the Grid resources, enhancing the overall system's well-function. Finally, this paper presents the performance evaluation for both of the proposed resource discovery mechanisms by providing a number of simulation tests.

Deriving Test Procedures of Low-Rate Wireless Personal Area Networks

Marina Eskola, Tapio Heikkilä, Pirkka Tukeva

Low-Rate Wireless Personal Area Network (LR-WPAN) technologies are more widely applied in industrial applications, posing additional challenges for reliability due to harsh conditions. Efficient and manageable testing methods and tools to support building and maintaining reliable communication are inevitable though currently not so well existing. We take an approach for systematic testing of Low-Rate Wireless Personal Area Networks (LR-WPAN). Our goal is to define a common test procedure, from which specific targeted test sequences can be derived. We define a set of faults and disturbances and a set of metrics indicating impacts of these. Further on we define Test Procedures for deriving specific targeted test sequences for detecting specific faults and disturbances, like detecting device failures or harsh traffic conditions. We also present some test examples and measurement results from field tests.

MILP Formulation for Squeezed Protection in Spectrum-Sliced Elastic Optical Path Networks

Karcius Assis, Raul Almeida, Helio Waldman

In Spectrum-Sliced Elastic Optical Path Networks (SLICE), the lightpath bandwidth is variable and can provide a finer granularity when compared to that of current optical path networks. Therefore, the virtual topology overlay on a physical topology must be designed considering new constraints and requirements to optimize the spectrum utilization, which has been recently investigated as a solution to a Mixed Integer Linear Program (MILP). In this paper we propose a mechanism that can provide both traffic survivability and efficient spectral utilization in SLICE networks by employing the spectrum flexibility and the novel concept of bandwidth squeezed. A MILP formulation is presented that uses these new concepts to efficiently route the traffic in the network, while satisfying a committed bit-rate in the event of a failure. Cases studies are carried out in order to analyze the benefits of the proposal as well as the basic proprieties of the formulation.

A New Markov-Based Mobility Prediction Scheme for Wireless Networks with Mobile Hosts

Peppino Fazio and Salvatore Marano

Recently, mobile communications need to benefit a good level of Quality of Service (QoS), since communications guarantees are mandatory during active flows. Passive resources are used to ensure service continuity when mobile hosts are moving among different coverage cells. In this work the attention is focused on wireless services in cellular networks, where the hand-over effects need to be mitigated, through an appropriate reservation policy. The whole considered system is modeled through a distributed set of Hidden Markov Chains (HMC) and the related theory is used to design a mobility predictor, as the main component of the proposed idea, which does not depend on the considered transmission technology (GSM, UMTS, WLAN, etc.), mobility model or vehicular scenario (urban, suburban, etc.). MRSVP has been used in order to realize the active/passive bandwidth reservation in the considered network topology and many simulation campaigns have been carried out in order to estimate the correctness of the proposed algorithm, also in terms of CDP and CBP.

Wireless Sensor Network deployment using DEVS formalism and GIS representation

Poggi Bastien and Antoine-Santoni Thierry

Wireless Sensor Network (WSN) deployment appears like a crucial point for phenomenon monitoring. In this case it is important to define a real strategy to deploy the sensor nodes. Actually the works focus only on the Area of Deployment (AoD) and its representation. However the proposed methods don't allow a real representation for a non specialist. In this paper we try to bring some solutions to allow a better a representation of WSN deployment on a geographic information system (GIS) using Discrete EVent Specification (DEVS) formalism. We present the first results of developed software.

Servload: Generating Representative Workloads for Web Server Benchmarking

Jörg Zinke, Jan Habenschuß, Bettina Schnor

Web server benchmarking has two main purposes, comparing different hardware platforms or server configurations, and testing the scalability of a given system. For the first purpose, the capability to replay given workload traces is needed. For the second purpose, also the capability to generate increased representative workloads is needed. Scalability tests are of special interests for ISPs to estimate performance numbers for SLA

contracted to customers. Depending on the setup and the implemented web application the required scalability may vary from a few requests per seconds up to a waste amount of requests. This paper presents a web server benchmark called servload which generates modified workloads from given traces keeping similar characteristics. Servload is generic in the sense that it is not dedicated to a special application field. It can process traces from different application fields for example banking, e-commerce or collaborative wikis. The different workload generation methods of servload are discussed and evaluated. In the presented experiments servload shows good replay capabilities.

Two-Level Scheduling Algorithm for Different Classes of Traffic in WiMAX Networks

Zeeshan Ahmed and Salima Hamma

The IEEE 802.16 standard is one of the most promising broadband wireless access (BWA) systems. The standard incorporates a QoS architecture that supports both realtime and non-realtime applications. To provide QoS three data schedulers are furnished by the architecture. However, the working of the schedulers are not defined by the standard. Some researchers have attempted to fill this gap by providing different scheduling schemes. However, no scheme has yet been adapted by the standard and the area is still open for new research. In this article we propose Two-Level Scheduling Algorithm (TLSA) that ensures QoS for all service classes, while avoiding starvation of lower priority classes. Furthermore, it ensures fair resource allocation among flows of the same class. The simulation results prove that the algorithm is effective and efficient.

Research on VoIP Traffic Detection

Muhammad Mazhar Ullah Rathore and Tahir Mehmood

VoIP usage is rapidly growing due to its cost effectiveness, dramatic functionality over the traditional telephone network and its compatibility with public switched telephone network (PSTN). Internet service providers (ISPs) and telecommunication authorities are interested in detecting commercial usage of VoIP to either block or prioritize it. In this paper we propose taxonomy of existing VoIP detection techniques. Basic 4 types of techniques are used to detect VoIP traffic i.e. Port-based techniques, signature-based techniques, pattern-based techniques , and statistical analysis-based techniques. This paper mainly focuses on the basic methodology, usage, advantages and disadvantages and comparative study of these techniques.

Capacity Planning of Enterprise Information System through Simulation

Sara Saleem, Paulvanna Marimuthu, Sami Habib

Enterprise information systems (EIS) nowadays experience the problem of over maintenance and increased operational costs due to the installation of many independent servers to accommodate either new or existing projects/applications. Most of the servers are underutilized, consumed more electrical power due to operations and cooling, and increased operative and administrative expenses. In this paper, we propose a server consolidation approach to improve the servers' utilization, whereby the lowest utilized servers in the EIS are removed and their clients are rerouted to the remaining servers with acceptable utilization and network delay. We have utilized two random distribution schemes to select the servers for distributing the clients: single nearest server at random and multiple servers at random. We have validated our proposed server consolidation approach by simulating the enterprise information network using OPNET Modeler and analyzing the utilization of servers before and after the servers consolidation. The simulation results demonstrate that the multiple server distribution approach shows better performance with improved utilization ranging from 27% to 37% and with 16% reduced annual operational cost.

Enhancing the Oakley key agreement protocol with secure time information

Pawel Szalachowski and Zbigniew Kotulski

Message freshness and time synchronization are nowadays essential services in secure communication. Many network protocols can work correctly only when freshness of messages sent between participants is assured and when internal clocks protocol's parties are adjusted. In this paper we present a novel, secure and fast procedure which can be used to ensure data freshness and clock synchronization between two communicating parties. Next, we show how this solution can be used in cryptographic protocols. As an example we apply our approach to the Oakley key determination protocol providing it with time synchronization without any additional communication overhead.

Smart Proxying for Reducing Network Energy Consumption

Rafiullah Khan[1], Raffaele Bolla[1], Matteo Repetto[2], Roberto Bruschi[2], Maurizio Giribaldi[3]

Many network-based applications require full time connectivity of the hosts for fate sharing and responding to routine applications/protocols heart-beat messages. Past studies revealed that network hosts are most of the time unused or idle but still kept powered on just to maintain network connectivity. Thus, significant energy savings are possible if the network hosts can sleep when idle. Unfortunately, present low-power sleep modes cannot maintain network connectivity and results in applications state loss, thus preventing users from enabling power management features. A proxy-based solution was recently proposed in the literature that allows network hosts to sleep and still maintain their network standings over Internet while requiring minor changes to applications/protocols. The Network Connectivity Proxy (NCP) can handle some basic network presence and management protocols like ICMP, DHCP, ARP etc on behalf of sleeping hosts and wake them up only when it is truly necessary. This paper addresses NCP generic architecture and its requirements, main NCP responsibilities, different NCP types and their characteristics and some possible solutions to preserve open TCP connections for the sleeping hosts. It also describes key challenges in the design and implementation of NCP and proposes possible solutions. NCP can result in significant network energy savings up to 70\% depending on the hosts time usage model.

An Optimal Scheduling Policy for a Multi-flow Priority Queue with Multiple Paths

Essia Hamouda

We consider a path-scheduling problem at a resource constrained node A that transmits two types of flows to a given destination through alternate paths. Type-1 flow is assumed to have a higher priority than type-2 flow thus, it is never rejected upon arrival. Type-2 flow, on the other hand, may be denied admission to the queue. Once accepted to the system, a packet joins queue 1 and is guaranteed service independent of its type. Instead of being rejected from service, packets have the option to be served at
a slower server behind a second queue (queue 2) at node A. The slow server is intended mostly to serve low priority packets, therefore, type-1 packets are charged a switching cost in the event they are sent to queue 2. Transmitted packets receive a reward depending on which queue they were served at. The reward represents the resources saved for making that decision. A good path-scheduling policy at node A can reduce resource consumption at node A, extend the life of the efficient path,

maximizes the service of both flows and guarantees the service of at least the high priority flow to the full extent. We propose and solve the path-scheduling problem for node A, which maximizes the average reward of successfully transmitting flows to a given sink, by dynamically assigning packets to one of the queues based on the packet type, the instantaneous queue lengths and the average reward for the associated path. We formulated the path-scheduling problem as a Markov decision process and show that the optimal policy is threshold-type.

A Error Concealment Technique and Learning Web Design

Yuan-Chen Liu and Ming-kuan Lee

This paper proposes a new error concealment technique for the motion vectors, which are lost in error propagation. Experimental results demonstrate that the performance of proposed method is better than Decoder Motion-Vector Estimation, and much better than the algorithm obtained by conventional temporal concealment.

Traffic-level Community Protection in Telecommunication Networks under Large-Scale Failures

Víctor Torres-Padrosa, Marc Manzano, Eusebi Calle, Josep L. Marzo

Large-scale failures in telecommunication networks make the preservation of the connections inside a community a challenging task, being traditional approaches focused on the preservation of the global connectivity. To achieve this goal, a new concept of community is proposed, which combines not only the topological information of the network but also the traffic-level interaction. Moreover, six novel community-based strategies to determine best node candidates to be protected according to a limited budget are assessed. The proposed strategies have been tested over four different types of networks and compared to other well-known immunization or protection methods. The obtained results show that, depending on the network topology, either an improved intra-community or global traffic preservation can be achieved w.r.t. traditional approaches.

MAP/SM/1/b Model of a Store and Forward Router Interface

Krzysztof Rusek, Zdzisław Papir, Lucjan Janowski

The model of a router interface with a buffer limited to a fixed number of packets (regardless their lengths) is discussed. The interface is described as a finite FIFO queuing system with a Markovian Arrival Process (MAP) and semi-Markov (SM) service times. The new analytical results for the loss ratio, the local loss intensity or the total number of losses are developed. All results are suitable either for a transient or a stationary analysis and it is possible to extend them beyond the loss process.

Multi-Direction Motion Vector Prediction Algorithm and Learning System

Yuan-Chen Liu and Wei-Chun Hsu

In this paper some traditional algorithms and algorithms using prediction values are investigated, including DS (diamond search), HEXBS. The mechanism of search pattern based on multi-direction motion vector prediction algorithm is proposed to develop a fast algorithm based on motion estimation and combining search patterns and directions. At the moment, we just speed up the encoding time and perform better high PSNR values in the proposed algorithm. But that is very similar with MDS or SPS, and the factors of software and hardware like the selection of algorithms or frame number and the phase of early termination or the difference of hardware are not discussed. So the future work is that adds the factors we discussed to speed up the performance like PSNR or encoding time.

Social and Dynamic Graph-Based Scalable Routing Protocol in a DTN Network

Floriano De Rango and Filippo Monteverdi

In this paper we consider the DTN routing problem in networks where the links between nodes are not stable, but tend to change over time. In these cases, the classical algorithms are not adequate, so new protocols inspired to social networks are needed to deliver the highest number of messages, trying to limit the amount of messages transmitted in the network. We propose a new algorithm, S-Grasp, whose foundations are found in other works already presented in the literature, but in some cases it improves their performances. Finally we will show, through simulations, that although the success rate in data forwarding is close to the optimal value, the number of retransmissions is reduced by at least 50% compared to that of other algorithms analyzed.

Opportunistic Estimation of Television Audience Through Smartphones

Igor Bisio, Alessandro Delfino, Giulio Luzzati, Fabio Lavagetto, Mario Marchese, Cristina Frà, Massimo Valla

Television audience estimation is an important task for advertisement placement. In this paper we present a system based on a client-server architecture able to recognize a live television show. The clients are implemented throughout smartphones, thus a well-known audio fingerprint algorithm has been modified to fit smartphone needs. To reach this aim, the optimization of an ad-hoc cost function has been introduced. Server and client are generally far from being synchronized, due to the variety of broadcasting media (aerial, satellite or streaming over the Internet) leading to different and unpredictable delays. For this reason, we present a new likelihood estimate designed to overcome the lack of synchronization.

ATRC: A Swarm-based Robot Team Coordination Protocol for Mine Detection and Unknown Space Discovery

Floriano De Rango and Nunzia Palmieri

In this paper, we consider the problem of exploring an unknown environment with a team of robots to detect and disarm mines. The goal is to minimize the overall exploration time and to disarm all mines in a landscape. We present two approaches for the coordination of robots. An indirect communication, stigmergy, inspired to biology is used to help robots to cover the overall area in a minimum time. In this way the robot simultaneously explore different regions of their environment. Moreover, a new coordination protocol called Ant-based Task and Robot Coordination (ATRC) is proposed to recruit robots and disarm mines in a minimum amount of time. This approach has been implemented and tested extensively in a simulation environment. The results showed the best convergence time of proposal in term of space discovery in comparison with a well-known algorithm such as the Vertex Ant Walk (VAW). Moreover the effectiveness of proposed protocol is evaluated varying network parameters in the simulation.

Creating and Using Key Network-Performance Indicators to Support the Design of Change of Enterprise Infocommunication Infrastructure

Muka László and Muka Gergely

Nowadays, an increasing number of organisations have to make decisions about the change and optimization of their enterprise infocommunication infrastructure. The usual approach of performance (using QoS, SLA) is not user (enterprise) centred and complex enough to help ICT (Information and Communication Technology) experts to support management decisions. The paper proposes a strategic management inspired, user centred and complex method of creating KNPIs (Key Network-Performance Indicators) for the measurement. In the paper, a case study is introduced to illustrate the creation and the use of KNPIs: alternatives are generated for the change, and using KNPIs, the feasibility, capacity, quality and financial aspects – integrating also the business impact and the influence of user experience – of the change of the enterprise infocommunication infrastructure are examined and compared. In the case study, to the analysis and prediction of the necessary enterprise network capacities, network traffic simulation is used. Financial modelling is also applied in comparing the alternatives.

Exposing Resources as Web services: a Performance Oriented Approach

Ravishankar Kanagasundaram, Shikharesh Majumdar, Marzia Zaman, Pradeep Srivastava, Nishith Goel

This paper focuses on exposing resources including computing and database resources as Web services for providing inter-operability among clients and servers that uses diverse technologies. A systematic performance analysis of two technologies, the RESTful Web Service and the SOAP-based Web service used for exposing resources as Web services is reported. A novel Hybrid Web service that combines the advantages of both RESTful and SOAP-based Web services is proposed and analyzed.

Empirically Characterizing the Buffer Behaviour of Real Devices

Luis Sequeira, Julián Fernández-Navajas, Jose Saldana, Luis Casadesus, José Ruiz-Mas

All the routers include a buffer in order to enqueue packets waiting to be transmitted. The behaviour of the routers' buffer is of primary importance when studying network traffic, since it may modify some characteristics, as delay or jitter, and may also drop packets. As a consequence, the characterization of this buffer is interesting, especially when real-time flows are being transmitted: if the buffer characteristics are known, then different techniques can be used so as to adapt the traffic: multiplexing a number of small packets into a big one, fragmentation, etc. This work presents a preliminary study of how to determine the technical and functional characteristics of the buffer of a certain device, or even in a remote Internet network node. Two different methodologies are considered, and tested on two real scenarios which have been implemented; real measurements permit the estimation of the buffer size, and the input and output rates, when there is physical or remote access to the system under test. In case of having physical access, the maximum number of packets in the queue can be determined by counting. In contrast, if the node is remote, its buffer size has to be estimated. We have obtained accurate results in wired and wireless networks.

Modelling Packet Capturing in a Traffic Monitoring System based on Linux

Luis Zabala, Armando Ferro, Alberto Pineda

The need to monitor and analyse network traffic grows with the deployment of new multimedia services over high speed networks. Predicting the overall capturing performance is crucial to know if the traffic monitoring system will be able to cope with all the traffic packets, or if it needs more processing power. In this paper, we present an analytical model based on a Markov chain to study the efficiency of the Linux network subsystem. Improving the capturing stage of Linux has been an extensively covered research topic in the past years. Although the majority of the proposals have been backed by experimental evaluations, there are few analytical models. We identify the softIRQ process as the main element in the Linux capturing stage and we have built a model that represents the different steps in the softIRQ and the computational cost for each one of them. The goodness of the model is checked by comparing analytical results with practical ones obtained from a real traffic monitoring system. Prior to obtaining the theoretical performance results, it is necessary to introduce some input parameters for the model. These initial necessary values are also extracted from experimental measurements, making use of an appropriate methodology. The results of all this process indicate us that the behaviour of the system performance depends on the network traffic rate and this has become our work in progress.

Impact of intermittent connectivity for telemetry server applications of vehicular embedded systems in agribusiness: study and modeling of hi-performance architecture.

Daniel Mezzalira and Luis Carlos Trevelin

The management of multiple systems such as machine tools, vehicles, aircraft, among others, results in a very intense flow of data between the server and embedded systems, using wired and/or radiofrequency structures, demanding performance and interest in real time systems. The objective of this study is to propose a low cost scalable architecture for embedded applications, using pools of personal computers for high performance storage, retrieval and processing of information through the study of traces and real solutions for companies operating in this niche market and demonstrate the impacts of the intermittent connectivity for agribusiness applications.

An experimental evaluation of server performance in Networked Virtual Environments

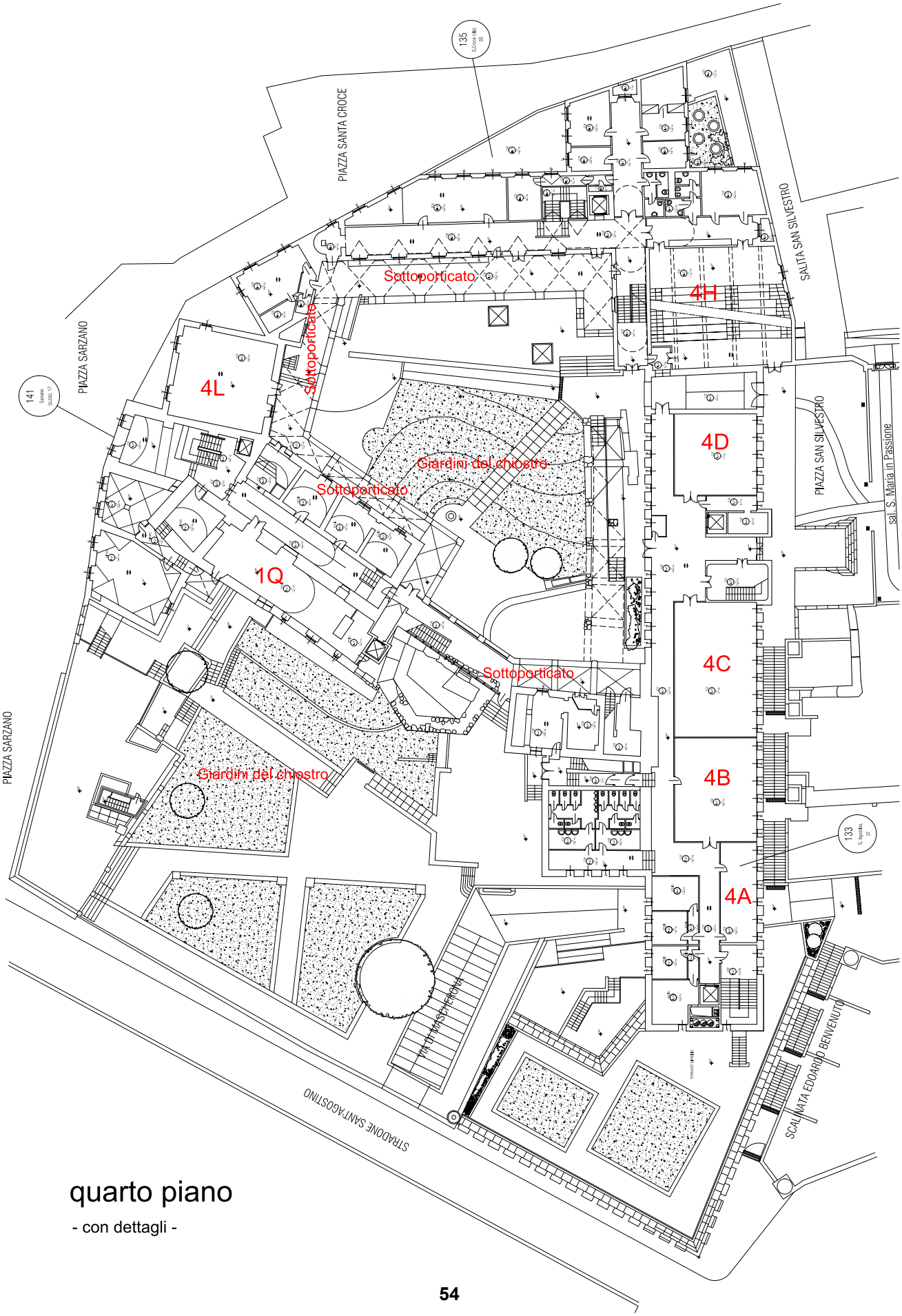
Juan Luis Font, José Luis Sevillano, Daniel Cascado

Several works in the literature have recently addressed the study of different Networked Virtual Environments (NVE) due to their increasing popularity and widespread use in fields ranging from entertainment to e-Health. Open Wonderland is one of these NVEs which has been the subject of several studies mainly focused on the client side. This paper aims to cover the server-side performance issues to provide complementary results that can be useful for properly sizing Open Wonderland systems according to the number of expected users. An experimental testbed is used, which provides real data that shows that CPU and outgoing bandwidth are the most critical parameters when the number of clients increase.

PHISON: Playground for High-level Simulations On Networks

Marc Manzano, Juan Segovia, Eusebi Calle, Jose L. Marzo

Network simulation has become crucial in the study of telecommunication networks. In this paper we present PHISON (Playground for High-level Simulations On Networks), an easy-to-use discrete-event simulator whose features facilitate the study of diverse phenomena on path-oriented telecommunication networks. A key differentiation feature of PHISON is that it considers the dynamic aspects of such networks at a higher level than previous proposals. Hence, our proposal does not consider protocol data units nor user data packets. Its design considerations and implementation details are presented and, finally, two examples illustrate some of the functionalities of the network simulator.



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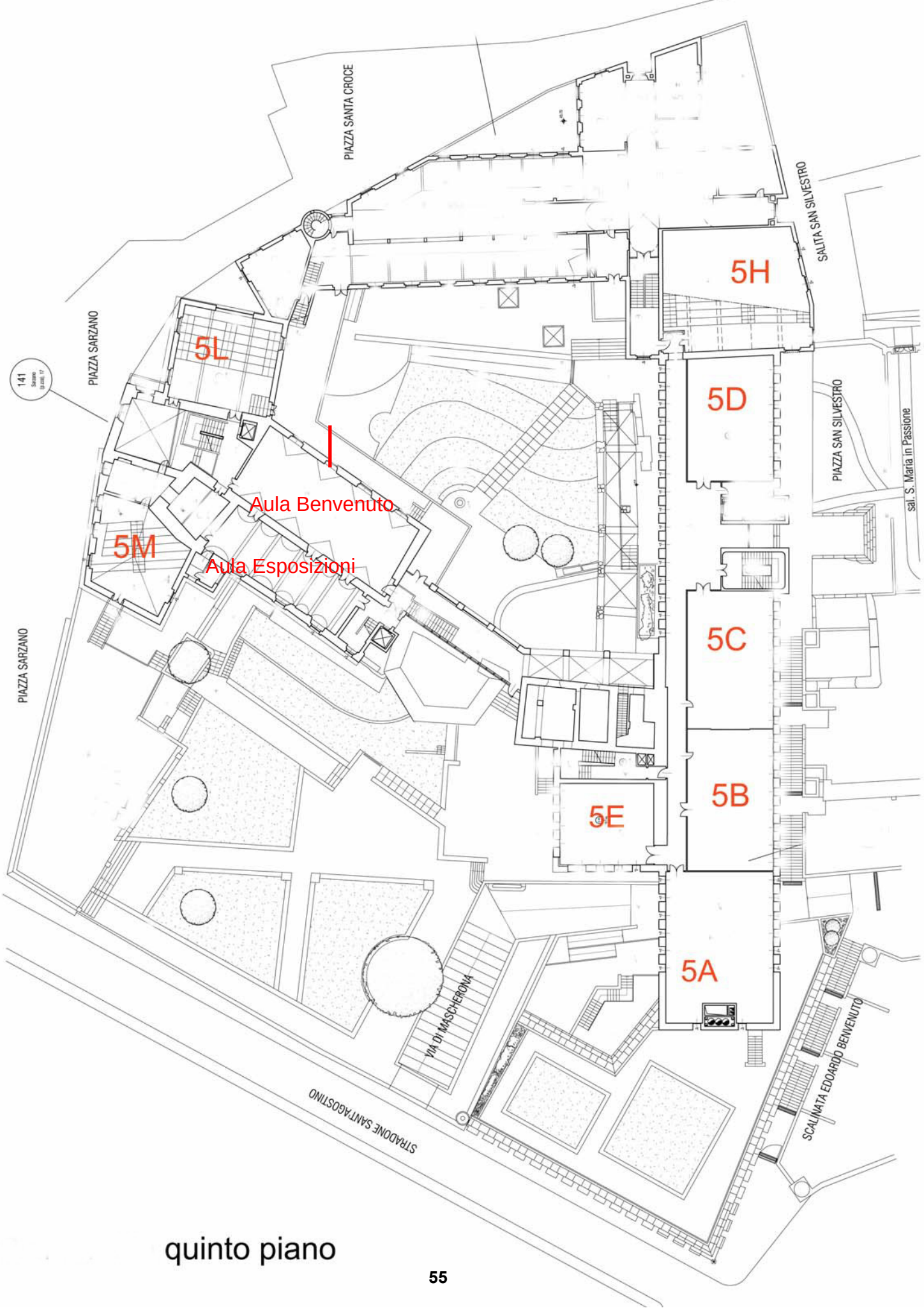

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Genoa Area Map & Conference Location

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