The INCOSE Italia Conference on Systems Engineering (CIISE 2016)

Turin (Italy), November 14th-16th, 2016
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"Systems Engineering (SE) is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on a holistic and concurrent approach to understand stakeholder needs, exploring opportunities, documenting requirements, and synthesizing, verifying, validating, and evolving solutions while considering the complete problem, from system concept exploration through system disposal.[1]

It is centered on defining the customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem: operations, performance, test, manufacturing, cost & schedule, training & support, and disposal. It integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from system concept exploration to production and operation. Systems Engineering considers both the business and the technical needs of the customers with the goal of providing a quality product that meets the user needs."[2]

CIISE16, the INCOSE Italia Conference on Systems Engineering, with its three days program, is the second full-fledged event of this type organized by the Italian Chapter of the International Council on Systems Engineering (INCOSE) and the Italian Association on Systems Engineering (AISE), and it is set to become a recurring event.

The conference program has been structured to address the main elements of INCOSE mission: share, promote and advance the best of Systems Engineering. In particular, the program has been characterized by the following main elements: (i) four invited lectures; (ii) four Technical Sessions; (iii) five Tutorials on Systems Engineering ("Mini-School"); (iv) a Technical Leadership session; (v) three sessions dedicated to the Working Group of the INCOSE Italian Chapter (Verification Validation and Testing, PM and SE Integration, Operations and Maintenance); (vi) a Tool Vendor session; (vii) a Poster Session on Post Graduated Masters on Systems Engineering in Italy, (viii) a final Round-Table.

The four invited lectures have been held by the following keynote speakers: (i) *Osvaldo Brogi*, Italian Navy, Admiral Chief Inspector, Head of General Office for Design of Operating Systems UGEPROGESO. The lecture called "Modeling of Complex Systems Through in SysML In Italian Navy (ITN)" has included a presentation of modeling applied to defense systems given by C.C. (AN) *Nicola Cariello*, MARISTAT; (ii) *John Thomas*, founder and CEO at John A Thomas & Associates LLC, past Senior Vice President and Chief Systems Engineer at Booz Allen Hamilton, President of INCOSE from 2012 to 2014. His lecture "Critical Skills of the Future Systems Engineer" focused on the development of the role of the Systems Engineer in the next decade; (iii) *Jan Vollmar*,

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[1] SEBoK.2014. "Guide to the Systems Engineering Body of Knowledge" (SEBoK), http://www.sebokwiki.org/wiki/Systems_Engineering_Overview, accessed 06/10/2014
[2] INCOSE.2012. Systems Engineering Handbook, version 3.2.2. San Diego, CA, USA: International Council on Systems Engineering (INCOSE). INCOSE-TP-2003-002-03.2.

Siemens AG, Principal Engineer at Corporate Technology, R&D Unit of Siemens AG, held a lecture entitled: "A new approach to master complexity in Model Driven Systems Engineering"; (iv) *Aurelijus Morkevicius*, Object Management Group (OMG), Chair of UPDM/UAF group, Head of Solutions Department at No Magic Europe, presented "There's more than one way to skin a framework", focused on the state-of-the-art activities to align different Architecture Framework (MODAF, DoDAF, NAF, Zachman, TOGAF) in the definition of the Unified Architecture Framework 1.0.

The aim of the four technical sessions, with a selection of peer-reviewed papers, has been to provide Systems Engineering professionals, researchers and organizations with a setting to share knowledge, exchange and compare experiences and, ultimately, create new opportunities for future collaborations and synergies. In particular:

- the *Systems Engineering Methodologies* session aimed to collect experiments and apply new or existing methodologies, methods and techniques to provide support systems engineering processes. The following papers have been presented in this session: "Bringing model-based systems engineering capabilities to project management: an application to Prince2" by *Diana Coppola, Andrea D'Ambrogio and Daniele Gianni*; "Extending GOReM through the RAMSoS method for supporting modeling and virtual evaluation of the Systemic Risk" by *Simona Citrigno, Angelo Furfaro, Teresa Gallo, Alfredo Garro, Sabrina Graziano, Domenico Saccà and Andrea Tundis;* "Value Chain vs Life Cycle Approach for Product Extensions" by *Gaetano Cutrona, Andrea Margini and Cesare Fantuzzi*; "Designing a System Engineering Environment in a structured way" by *Anna Todino, Ivo Viglietti, Bruno Tranchero and Ruben de Juan Marín*.

- the *Safety and Reliability Engineering* session focused on important non-functional aspects that need to be even more considered when new Systems are conceived and defined in order to guarantees their dependability. The following papers have been presented in this session: "A BPMN Extension to Enable the Explicit Modeling of Task Resources" by *Paolo Bocciarelli, Andrea D'Ambrogio, Andrea Giglio and Emiliano Paglia*; "SySTEMA System Safety Tool for Executing Model-based Analyses" by *Alessio Costantini, Sergio Di Ponzio, Cristina Biagi, Rodolfo Mazzei, Francesco Inglima and Andrea Chiellini;* "A model based approach to design for reliability and safety of critical aeronautic systems" by *Candida Stigliani, Davide Ferretto, Claudio Pessa and Eugenio Brusa*.

- the *Systems Design* session has been mainly devoted to models integration and innovative approaches for enabling systems compositions and their analysis. The following papers have been presented in this session: "Demands on Virtual Representation of Physical Industrie 4.0 Components" by *Kristofer Hell, Robin Hillmann, Arndt Lüder, Hannes Röpke, Jacek Zawisza, Nicole Schmidt and Ambra Calà*; "Methodology for the Specification of Software Requirements for an integrated Logistic Platform" by *Lucio Tirone, Gaetano D'Altrui*; "An iterative and recursive Model-based System of Systems Engineering (MBSoSE) approach for Product Development in the medical device domain" by *Pierfelice Ciancia*; "How to adopt NAF and TOGAF concurrently – Experiences in C2IS architecture design. Description of a possible way to adopt NAF subviews as TOGAF ADM products in regards to Maritime C2IS architecture design" by *Sergio Funtò*.

- the *Case Studies and Industrial Applications* session has been centered on the presentation of experiences, issues and solutions of industrial partners in the context of national and international research projects. The following papers have been presented in this session: "Aircraft Division needs for integrated Systems Engineering: the CRYSTAL user experience" by *Bruno Di Giandomenico, Claudio Pessa, Laura Valacca, Elena Valfrè and Ivo Viglietti;* "Deploying Model-Based Systems Engineering in Thales Alenia Space Italia" by *Elvira Calio, Fabio Di Giorgio and Mauro Pasquinelli; "*Verification Validation and Testing: Passion and Deployment challenges in the Italian Eco-System" by *Sara Ricciardi, Carlo Leardi and Luca Stringhetti*.

A further element, the Tutorials on Systems Engineering ("Mini-School"), had the purpose to provide a brief introduction to the main concepts of Systems Engineering and, taking advantage of the Conference location in an University campus, to stimulate the interest of students and practitioners attendees. The tutorials focused on the following topics: "Systems Thinking" by *Enrico Mancin* (IBM Italia), "Architectures" by *Lucio Tirone* (Aster), "Model Transformation: the Automation Booster for MBSE" by *Andrea D'Ambrogio* (University of Rome Tor Vergata), "Formal Requirements Modeling for Simulation-Based Verification: from Theory to Practice" by *Alfredo Garro* (University of Calabria), "Heterogeneous simulation and interoperability of tools applied to the Design, Integration and Development of Safety Critical Systems" by *Eugenio Brusa* (Politecnico di Torino).

Moreover the Technical Leadership Session has been dedicated to the INCOSE activities related to the promotion of technical leaders to embrace the true spirit of Systems Engineering. In particular, contributions came from *Vincenzo Arrichiello* (AISE/INCOSE Italia) who held a talk named "Systems Engineer: the ultimate phronetic

leader?" and *Davide Fierro* (National Institute of Astrophysics) who held a talk named "The Cynefin Framework and the Technical Leadership Model".

The Working Group Sessions has been dedicated to the activities of working groups operating at AISE/INCOSE Italia. In particular, the WG on "Verification Validation, and Test" has been coordinated by *Carlo Leardi* (Tetrapak), and *Luca Stringhetti* (National Institute of Astrophysics), the WG on "Operations and Maintenance" by *Vittorio Torroni* (Serco) and the WG "PM and SE Integration" by *Davide Fierro* (National Institute of Astrophysics).

The Poster Session aimed to promote the Post Graduated Masters on Systems Engineering in Italy and to disseminate the possibility of attending high level education courses on Systems Engineering provided by University of Rome Tor Vergata (4th edition from 2012) and Distretto Ligure delle Tecnologie Marine (La Spezia)/University of Genoa (2nd edition from 2014).

The Tool Vendor session allowed two of the key providers of software tools which allow the practical implementation of the systems engineering methodologies (IBM Watson IoT and The Reuse Company), to present the latest editions of their applications.

In the end, the purpose of the final Round-Table, involving representatives of Administration, Defense, Academic, Research and Industrial organizations, has been not only to summarize the CIISE 2016 event, but also to identify future action items. In particular, highlight the strategic role that Systems Engineering can play in supporting the economic growth and competitiveness enhancement of Italy "country system" but also to encourage governmental and industrial support for research and educational programs that will improve the systems engineering process and its practice. Moreover, awards for Best Paper, Outstanding Contributions to the Chapter, and Work Groups Promoters have been announced.

This Proceedings volume contains the 14 full papers that have been selected through an anonymous peer-review process and presented during the technical sessions. Moreover, this volume contains the extended abstracts of the 3 Tutorials on Systems Engineering given in the context of the "Mini-School", as well as 2 extended abstracts of the Technical Leadership sessions and 4 extended abstracts related the invited keynote speakers.

Last but not least, the Organizing Committee would like to thank all the authors of the scientific contributions and demos, the reviewers, and the sponsors of *CIISE16* whose joint effort made possible to realize such a successful initiative. We are very proud of it and we consider it an important achievement for AISE, the Italian Association on Systems Engineering / INCOSE Italia Chapter.

The CIISE16 Organizing Committee
    Eugenio Brusa (Politecnico of Turin)
    Andrea D'Ambrogio (University of Rome "Tor Vergata")
    Alfredo Garro (University of Calabria)
    Lucio Tirone (Aster)
    Andrea Tundis (University of Calabria)

Biographies

Eugenio Brusa is full professor of Machine Design at the Politecnico di Torino, Italy, where he graduated in Aeronautical Eng. (1993) and received the Ph.D. in Mechanical and Machine Design (1997). Since 2002 to 2008 he was associate professor at the University of Udine (Italy) and technical director of the Master on Project Management and Systems Engineering (2005-2007). At the Politecnico di Torino he was instructor of Fundamentals of Strength of Materials (B.Sc.), while nowadays he teaches Fundamentals of Machine Design and Drawing (B.Sc.), Machine Design (M.Sc.) and Tools and Applications of Systems Engineering (Ph.D.). He is currently Coordinator of the B.Sc. and M.Sc. degrees in Mechanical Engineering at the Politecnico di Torino. He is active within the Structural mechatronics (rotors, vehicles, MEMS); Design of Industrial Equipment and Machine (aerospace, manufacturing, steelmaking) and leads a group focused on the 'Model-Based Industrial Systems Engineering'. He taught 'Structural Mechatronics and Micromechatronics' as an invited lecturer at TU Delft (2000), TU Helsinki (2002), Univ. "Blaise Pascal", Clermont Ferrand (2005), CNRS, Paris (2007), Ecole EPF, Sceaux (2007, 2010), TU Munich (2009), Institut Marie Curie, Paris (2010), University of Toronto (2016), being also instructor at the Int. School of "Microsystem Mechanical Design", CISM, Italy (2004) and "1st Eur. School on Mechatronics and Microsystems", TU Braunschweig (2006). He was deputy chair first (2010-2014) then chair (2014-2015) of the Italy Section of the American Society of Mechanical Engineers (ASME). He is author of about 180 publications and some patents.

Andrea D'Ambrogio is associate professor of computer science at the Department of Enterprise Engineering of the University of Roma "Tor Vergata" (Italy) and director of the post graduate Master degree in "Systems Engineering", established at the University of Roma "Tor Vergata" in 2012. Andrea D'Ambrogio's research interests are in the systems and software engineering field, specifically in the areas of system performance and dependability engineering, model-driven systems and software engineering, business process management, and distributed simulation. In such areas he has participated to several projects at both European and overseas level and has authored more than 100 journal/conference papers. He is general chair of the 49th Summer Computer Simulation Conference (SCSC 2017), general co-chair of the Summer Simulation Multiconference (SummerSim 2017), and has been general chair of the SCS/ACM/IEEE International Symposium on Theory of Modeling & Simulation (TMS 2014) and of the IEEE International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE 2008). He has served as program chair and/or member of the program committee of various international conferences, among which IEEE WETICE, SCS/ACM/IEEE SpringSim, SCS/ACM SummerSim, IEEE/ACM PADS and INFORMS/ACM Winter Simulation Conference. He started the IEEE International Workshop on Collaborative Modeling and Simulation (CoMetS) in 2010 and the SCS/ACM/IEEE International Symposium on Model-driven Approaches for Simulation Engineering (Mod4Sim) in 2011. Andrea D'Ambrogio is associate editor of the Transactions of the Society for Modeling & Simulation International (SIMULATION journal), member of the editorial board the IAENG International Journal of Computer Science (IJCS) and has been member of the editorial board of the Simulation Practice and Theory (SIMPAT) journal. He is member of the management committee of the ICT COST Action on "Multi Paradigm Modelling for Cyber Physical Systems" (MPM4CPS). He is member of IEEE, IEEE Computer Society, ACM, SCS and INCOSE.

Alfredo Garro is associate professor of Computer and Systems Engineering at the Department of Informatics, Modeling, Electronics and Systems Engineering (DIMES) of the University of Calabria (Italy). He was Visiting Professor (from January to October 2016) at NASA Johnson Space Center (JSC), working with the Software, Robotics, and Simulation Division (ER). From 1999 to 2001, he was a researcher at CSELT, the Telecom Italia Group R&D Lab. From 2001 to 2003, he worked with the Institute of High Performance Computing and Networking of the Italian National Research Council (CNR). On February 2005 he received the PhD Degree in Systems and Computer Engineering from the University of Calabria. From January 2005 to December 2011, he was an Assistant Professor of Computer and Systems Engineering at the DIMES Department (formerly DEIS) of the University of Calabria. His main research interests include: Modeling and Simulation, Systems and Software Engineering, Reliability Engineering. His list of publications contains about 100 papers published in international journals, books and proceedings of international and national conferences. In 2014, he founded the Departmental Research Laboratory "System Modeling And Simulation Hub Lab (SMASH Lab)". He is vice chair of the Space Reference Federation Object Model (SRFOM) Product Development Group (PDG) of SISO. He is the Technical Director of the "Italian Chapter" of INCOSE (International Council on Systems Engineering). He is a member of the Executive Committee and National Coordinator for Italy in the MODRIO European Project. He is the Technical

Leader for UNICAL in the Open Source Modelica Consortium (OSMC). He is a Member of the CINI National Lab on Cyber Security and of the Technological District on Cyber Security (DCS). He is the Faculty Advisor and Member of the Executive Committee of the Simulation Exploration Experience (SEE) project. He is involved in the activities of the IEEE Computer Society, IEEE Reliability Society and IEEE Aerospace and Electronic Systems Society.

Lucio Tirone is technical director at Aster S.p.A., he has over 18 years of field experience, the first part of which spent consolidating his Electromagnetic background, in the development of object oriented software for the computation of e.m. propagation in microwave components as well as in complex urban/non-urban environments. Since then he has been involved in Systems Engineering activities for the analysis, design, implementation and validation of major technological projects, such as Cosmo SkyMed in the Space domain, SAMP/T (Middle Range Surface to Air Terrestrial System) in the Defence domain, VTMIS Algérie (Vessel Traffic Management and Information System) and Kuwait CSS (Coastal Surveillance System) in the Maritime and Security domains, and Riyadh ITS (Intelligent Transport System), in the Transportation domain. He served as Teacher of the Systems Architecture and Design courses within the Master Degrees in Systems Engineering delivered by several Italian academic entities (civil and military): the Italian Joint Armed Forces Telecommunications School (Chiavari), the University of Tor Vergata (Rome), the Liguria District of Marine Technologies (La Spezia). Further, he has provided training courses in Systems Engineering, Preparation to the INCOSE CSEP Certification, Development of Software with UML using IBM Rhapsody, and Management of Architectures through Architecture Frameworks, to several entities including Leonardo/Finmeccanica, Italferr, Vitrociset and the European Defence Agency in the framework of a contract for the implementation of the EDA Architecture Repository. He has been recently selected for the 2nd Cohort of the INCOSE Institute for Technical Leadership, a two-year development program for the improvement of leadership skills, organized by the International Council on Systems Engineering (INCOSE) in collaboration with the Stevens Institute of Technology, the Worcester Polytechnic Institute and the University of Bristol. Certified INCOSE CSEP since 2012, and OCSMP since 2015, he is currently President of the Italian Association of Systems Engineering - INCOSE Italia Chapter.

Andrea Tundis is research fellow at Department of Informatics, Modeling, Electronics and Systems Engineering (DIMES) of the University of Calabria (Italy). He received the Laurea Degree in Computer Engineering from the University of Calabria (Italy) in 2009, a Master title in Industrial Research from the same Institution in 2010, and, on February 2014, a Ph.D. Degree in Systems and Computer Engineering from the University of Calabria where he is currently a research fellow. He is Member and IT Technical Responsible of the Italian Association of Systems Engineering (AISE) - INCOSE Italia Chapter. His main research interests include the definition of model-based methods for the reliability and safety analysis of systems as well as models for the formalization and traceability of non-functional requirements. He worked at the Programming Environment Laboratory (PELAB) at Linköping University (Sweden) on the extension of the Modelica language for the modeling of system properties in the context of the MODRIO (Model Driven Physical Systems Operation) ITEA 3 Project. He is currently working at the Telecooperation Lab (TK) at Technische Universität Darmstadt (Germany) on Resilient Networks and Cyber-Physical Systems Security.