The INCOSE Italia Conference on Systems Engineering (CIISE 2018)

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Consiglio Nazionale delle Ricerche (CNR)
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"Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining 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, Disposal.

Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems Engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs"[1]

CIISE18, the INCOSE Italia Conference on Systems Engineering, with its three-days program, is the forth full-fledged event of this type organized by the Italian Chapter of the International Council on Systems Engineering (INCOSE), and it is set to become a recurring event.

The conference program has been structured to address the main elements of the INCOSE mission: share, promote and advance the best of Systems Engineering. In particular, the program is characterized by the following main elements: (i) four Keynote Speakers; (ii) five Paper Sessions (Systems of Systems Engineering; Model Based Systems Engineering; Systems Engineering in Aerospace and Defense; Project Management and Systems Engineering Integration; Industrial Methods and Application); (iii) four Tutorials on Systems Engineering ("Mini-School"); (iv) a session dedicated to the three AISE Working Groups (Verification, Validation, and Testing; PM and SE Integration; Operations and Maintenance); (v) a final Round-Table.

In particular, the following four keynote speakers addressed main conference themes: (i) *Grady Booch*, Chief Scientist for Software Engineering at IBM Research where he leads IBM's research and development for embodied cognition. His lecture was concerned with the implications for the system development lifecycle of the integration in software-intensive systems of components that are programed together with components that learn; (ii) *Alessandro Musumeci*, President of the Computer Management Club of Rome. The lecture presented some relevant experiences on the exploitation of Systems Engineering practices in public organizations and enterprises; (iii) *Michael Pennotti*, Distinguished Service Professor and the former Director of Systems and Software Programs in the School of Systems and Enterprises at Stevens Institute of Technology. The lecture called "Answering the Call for Technical Leaders" described how systems engineers' leadership emerges not from the processes systems engineers have developed but from the thought process through which they developed them; (iv) *Diego Perini*, leader of the mechanical design office in the engineering department at CERN, the European Centre for Nuclear Research. The lecture called "Complex systems and challenging mechanical structures for high energy physic experiments. Some

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[1]INCOSE.2015. Systems Engineering Handbook, version 4.0. San Diego, CA, USA: International Council on Systems Engineering (INCOSE). INCOSE-TP-2003-002-04.

examples from the Neutrino Platform" described some basic common characteristics of the equipment involved in the Neutrino platform and how these concepts are implemented in several experiments under design or construction to study the behavior of neutrinos.

The aim of the five paper sessions, with a selection of peer-reviewed works, was to provide Systems Engineering professionals, researchers and organizations to share knowledge and exchange and compare experiences and, ultimately, to create new opportunities for future collaborations and synergies. In particular, the:

– *Systems of Systems Engineering* session, focused on the challenges in managing the level of complexity of modern Systems of Systems. The following papers have been presented in this session:
  – *Modeling Information Systems as Systems of Systems*. Paolo Salvaneschi (Università di Bergamo);
  – *Using BPMN and HLA for SoS engineering: lessons learned and future directions*. Alberto Falcone, Alfredo Garro (Università della Calabria), Andrea D'Ambrogio (Università di Roma Tor Vergata) and Andrea Giglio (Università Guglielmo Marconi);
  – *A Tailoring of the Unified Architecture Framework's Meta-Model for the Modeling of Systems-of-Systems*. Lorenzo Fornaro (Leonardo), Lucio Tirone (Fincantieri), Emanuele Guidolotti (Aster).
– *Model Based Systems Engineering* session, mainly devoted to present experiences in using innovative model-based approaches for enabling systems design and analysis. The following papers have been presented in this session:
  – *Synopsis of the MBSE, Lean and Smart Manufacturing in the product and process design for an assessment of the strategy "Industry 4.0"*. Eugenio Brusa (Politecnico di Torino);
  – *Car Brake industrial design using MBSE and Trade-Off Analysis by executing SysML Model*. Carmelo Tommasi (NoMagic Italy);
  – *Application of the Model Based Systems Engineering Approach for Modern Warship Design*. Massimiliano Manfredi, Lucio Tirone (Fincantieri).
– *Systems Engineering in Aerospace and Defense* session, focused on the applications of systems engineering methods, tools and best practices in the aerospace and defense domains. The following papers have been presented in this session:
  – *A through-life, integrated and concurrent engineering methodology for the responsive development of large and complex space systems*. Luciano Pollice, Alberto Boschetto, Luana Bottini, Paolo Gaudenzi, Gianluca Palermo (Università di Roma La Sapienza), Michael Gschweitl (RUAG Schweiz AG), Marco Lisi (ESA - ESTEC);
  – *Reference Missile Functional Architecture, addressing design in a multinational Defense Company*. Giulio Telleschi, Andrea Caroni (MBDA Italy), Ed Willingham (MBDA UK) and Pierre-Henri Pradel (MBDA France);
  – *Virtual engineering of a naval weapon system based on the heterogeneuous simulation implemented through the MBSE*. Eugenio Brusa, Davide Ferretto and Jean Michel Cervasel (Politecnico di Torino);
  – *The exploitation of the COSMO-SkyMed Interoperability, Expandability, Multimission-Multisensor capabilities for the SIASGE System of Systems*. Luca Fasano, Giuseppe Francesco De Luca (Agenzia Spaziale Italiana);
  – *Promoting a-priori interoperability of HLA based Simulations in the Space domain: the SISO Space Reference FOM initiative*. Bjorn Moller (Pitch Technologies), Alfredo Garro, Alberto Falcone (Università della Calabria), Edwin Z. Crues and Daniel E. Dexter (NASA Johnson Space Center)
– *Project Management and Systems Engineering Integration* session, aimed to collects, experiments and apply new or existing methodologies, methods and techniques to support systems engineering programs. The following papers have been presented in this session:
  – *On the Importance of Simulation in Enabling Continuous Delivery and Evaluating Deployment Pipeline Performance*. Andrea D'ambrogio (Università di Roma Tor Vergata), Alberto Falcone, Alfredo Garro (Università della Calabria) and Andrea Giglio (Università Guglielmo Marconi);
  – *Assessment and Tailoring of Technical Processes: A practitioners experience*. Dr. David Ward, Harsha Vardhan Pichika (Flex Design), Dr. Monica Rossi, Brendan Patrick Sullivan (Politecnico di Milano);
  – *On the Performance Prediction Capabilities of the eBPMN-based Model-driven Method for Business Process Simulation*. Paolo Bocciarelli, Andrea D'Ambrogio, Emiliano Paglia (Università di Roma Tor Vergata) and Andrea Giglio (Università Guglielmo Marconi);
  – *BIM and Agent-Based Model Integration for Construction Management Optimization*. Francesco Livio Rossini, Gabriele Novembri, Antonio Fioravanti (Università di Roma La Sapienza).

– *Industrial Methods and Applications* session was mainly centered to share and promote experiences, issues and solution of industrial partners in the context of national and international research projects. The following papers have been presented in this session:
  – *How to build an IoT&Data Platform for transforming the insurance industry with connected cars*. Enrico Mancin (IBM Italia);
  – *Verification & Validation Plan - A Case Study of a Turbine Bucket Design Modification*. Marco Mariottini (BHGE);
  – *Design for affordability: preventive maintenance and spare parts management optimization in natural gas pipelines operating under variable conditions across the year*. Elisa Carlucci (BHGE);
  – *A concrete Return of Investment due to the Requirements Management Process Implementation*. Claudia Agostinelli, Francesco Inglima, Rodolfo Mazzei, Sergio Di Ponzio (Altran) and Salvatore Zazzaro (Hitachi Rail Italy);
  – *Manage Payload Data Ground Segment Validation and Operation using an hybrid MBSE approach*. Ivan Famoso and Stefano Tatoni (Rhea Group);
  – *Capturing Architectural Artefacts in a Configuration Management tool*. Vittorio Torroni (Serco Italia);
  – *Risks Management & Opportunity - NovaLT5 Product Revitalization*. Emiliano Caggiano (BHGE).

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, to stimulate the interest of students and practitioners participating to the Conference. In this session the tutorials have focused on the following topics: "Introduction to Systems Engineering" by *Lucio Tirone* (Fincantieri), "An overview of the INCOSE Handbook 4 – Systems Lifecycle Management" by *Davide Fierro* (INAF – Istituto Nazionale di Astrofisica), "An overview of the INCOSE Handbook 4 – Technical Processes" by *Vittorio Torroni* (Serco), "The INCOSE SEP Certification" by *David Ward* (Flex Design).

The AISE Working Group Session was dedicated to the presentation of the activities of workgroups operating at AISE-INCOSE Italia. In particular, the WG on "Verification Validation, and Test" was coordinated by *Carlo Leardi* (Tetrapak); (ii) the WG on "PM and SE Integration" was coordinated by *Davide Fierro* (INAF – Istituto Nazionale di Astrofisica); (iii) the WG on "Operations and Maintenance" was coordinated by *Vittorio Torroni* (Serco).

In the end, the purpose of the final Round-Table, and of the set of Invited Talks from representatives of Administration, Defence, Academic, Research and Industrial organizations, was not only to summarize the CIISE 2018 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.

This Proceedings volume contains the nine full papers and six industrial papers presented during the paper sessions and that have been selected through an anonymous peer-review process.

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 *CIISE18* whose joint efforts allowed this event to become real and made possible to realize such successful initiative. We are very proud of it and we consider it an important achievement for the INCOSE Italian Chapter.

The CIISE18 Organizing Committee
 Enrico Mancin (IBM Italia S.p.A)
 Alfredo Garro (University of Calabria)
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 Davide Fierro (National Institute of Astrophysics)
 Paolo Gaudenzi (University of Rome "La Sapienza")
 Albero Falcone (University of Calabria)

Biographies

Enrico Mancin is the CE Tech Lead and IoT Lead Architect Europe IBM Watson IoT. He is a former Business Solution Professional engineer first in the Industrial and then in the Public Sector of IBM Italy, where he was the lead systems engineer for some of IBM's development projects. On behalf of IBM, he has led client engagements in aerospace and defense, system development and IT enterprise architecture, helping clients transform their engineering organizations using IBM technologies, methods and tools. He has been a practitioner, consultant, author and speaker on systems engineering and software development methods for 30 years. While an engineer, project manager, chief architect in important Italian companies, his experience spans in project management, systems engineering, architectural modeling and requirements analysis. His current specialization includes model-driven system development, enterprise architecture, estimation methods and solution architecture. He is currently President of the Italian Association of Systems Engineering - INCOSE Italia Chapter.

Alfredo Garro has received a Ph.D. in Systems and Computer Engineering from the University of Calabria (Italy), where he is currently an Associate Professor of Computer and Systems Engineering with the Department of Informatics, Modeling, Electronics and Systems Engineering (DIMES). In 2016, he was Visiting Professor 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). 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: Multi-Agents Systems, 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 is the co-founder and director of 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 Vice-President/Next-president of the "Italian Chapter" of INCOSE (International Council on Systems Engineering). He was 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, coordinated by NASA. He is involved as a member in the activities of the IEEE Computer Society, IEEE Reliability Society and IEEE Aerospace and Electronic Systems Society.

Lucio Tirone is a Senior Systems Engineer at Fincantieri, and has been founder and Technical Director of Aster SpA and Past-President of the Italian Association of Systems Engineering (AISE) - INCOSE Chapter Italia. After graduating in Electronics Engineering in 1997, he specialized in the design of Microwave devices and antennas, and in the development of Object-Oriented software for the analysis of Electro-Magnetic propagation in urban and suburban environments. He then developed a wide multidisciplinary experience in the Conception, Design, Development and Testing of complex Systems in several technological domains, including Defence, Maritime, Aerospace, Transportation and Security. In 2012, first in Italy, he acquired the INCOSE CSEP certification, and is also a certified IBM Rational Systems and Software Engineering Sales Professional, and OMG-Certified Systems Modeling Professional. He is teacher of Systems Architecture / Design courses within several Master's Degrees in Systems Engineering, and is a member of the INCOSE Technical Leadership Institute.

Davide Fierro is the AISE Technical Director and the head of INAF (Italian National Institute for Astrophysics) Systems Engineering & Project Management Office (Ground Based Astronomy). He graduated in Mechanical Engineering at the University Federico II of Naples where he got also the PhD in Industrial/Management Engineering. Then he completed his SE-PM education at Luiss Business School and Bocconi School of Management. He has about 20 years' experience in PM and SE disciplines with his first role in 1997 as VST Telescope Deputy Project Manager. He spent about two years @ ESO Observatory Center in the Atacama Desert, Chile, where he was also responsible for the integrating and testing activities of the VST Telescope. Now, as head of INAF's Engineering Office, Fierro has chief technical/managerial responsibilities in several international projects as SKA, Square Kilometer Array, of which he is the Program Manager of the whole Italian Technical participation. He coordinates the INAF's involvement in the European SST (space surveillance and tracking) program in close

synergy with the Italian Space Agency and the Italian Ministry of Defense. He collaborates with various Universities in disseminating Systems Engineering discipline. As coordinator of the Italian INCOSE SE-PM Working Group he collaborates with the PMI in order to improve the synergy between SE and PM methodologies. Fierro is member of the Defense, Security and Space Committee of the PMI, of the TLI Technical Leadership Institute of INCOSE and of Boards of several International Projects, as SKA-LFAA. Fierro is INCOSE CSEP "Certified Systems Engineering Professional" and ISIPM, "Italian Institute of Project Management" certified.

Paolo Gaudenzi is the Director of the Mechanical and Aerospaace Department of the University of Rome "La Sapienza". He received the Laurea in Civil Engineering cum laude from the University of Rome "La Sapienza" in 1984. He got the PhD in Aerospace Engineering from the University of Rome "La Sapienza" in 1989. Visiting Scientist at Massachusetts Institute of Technology (USA) (1991-1992). Assistant Professor at "La Sapienza" since 1990, Associate professor since 1998, Full professor since 2000. Since 2002 he is Director of the Master in Satellites of "La Sapienza". Coordinator of the Section Aerospace systems and structures of DIMA Department. Founder and President (2012-2016) of SMART STRUCTURES SOLUTIONS Srl, a spin off company of "La Sapienza". Member of the Scientific Committee of the Italian Cluster for Aerospace CTNA. Author of more than 100 papers 60 of which published on international refereed journals. Author of the research book Smart structures, J. Wiley 2009. His main research topics are: aerospace structures and constructions, laminated and composite structures, active materials and intelligent structures, finite element modelling, satellites systems, cost engineering. Lecturer in different graduate and PhD regular courses of the University of Rome "La Sapienza", in some special courses for companies (Alenia Spazio and CSM-Tecnopolo) and in international courses (ASI-NATO). Responsible of research projects funded by the Italian Ministry for Research, the National Research Council, the Italian Space Agency, the European Space Agency and private companies. Expert in the evaluation of research projects for the Italian Ministry for Education, University and Reserch, the Italian Ministry for Industrial development, The European Research Council, the regions Lazio, Toscana, Veneto, Piemonte, Puglia. Chairman of the selection board for ENEA (National research body in the field of energy and power). Advisor of ESA-ESRIN Vega Project team for the critical reviews of the Vega launcher Programme. Editor of "Aerotecnica, missili e spazio", the Journal of aerospace science, technology and systems. Associate editor of the Int. Journal of Intelligent Material Systems and Structures (2000-2010). Associate editor of the IEEE Trans on Aerospace and Electronic systems (2008-2010). Member of the International board of the CEAS Space Journal and CEAS Aeronautical Journal. Member of the international editorial board of the Journal Computers and Structures. Promoter of the European Union/La Sapienza stage program EUROSPACESTAGES. Member of the Council for International Relationships of La Sapienza. Member of the Scientific Committee of the Italian Aerospace Cluster. Responsible for the Tecnological area of Structures and Mechanisms of the Italian technological platform for space SPIN-IT.

Alberto Falcone is a Postdoc Research Fellow at the Department of Informatics, Modeling, Electronics and Systems Engineering (DIMES) of the University of Calabria (Italy). In 2017 he holds a Ph.D. Degree in "Information and Communication Engineering for Pervasive Intelligent Environments" from the University of Calabria. In October 2017, he won the competition named "Le tesi nel mondo SE", 2017 edition of the Italian Association of Systems Engineering-International Council on Systems Engineering (AISE-INCOSE) Italian Chapter for the best Ph.D. thesis on Systems Engineering. From January to October 2016 he was a Visiting Scholar/Researcher at NASA Johnson Space Center (JSC) working with the Software, Robotics, and Simulation Division (ER). In 2013 he holds a Master's Course degree in "Expert in Designing and Developing Open-Source Software and Services in the Context of Smart Cities" from the University of Calabria (Italy) with final score 110/110 cum laude. He holds a Master's Degree in Computer Engineering with final score 110/110 from the University of Calabria in 2011. His main research interests include: Modeling and Simulation, Software Engineering, Distributed Simulation. Alberto Falcone is (co)author of many scientific papers published in international journals, books and proceedings of international conferences. He is a member of the Space Reference Federation Object Model (SRFOM) Product Development Group (PDG) of the Simulation Interoperability Standards Organization (SISO). He is a Member of the Executive Committee of the Simulation Exploration Experience (SEE) project as Student Team Coordinator.