The INCOSE Italia Conference on Systems Engineering (CIISE 2017)

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"Systems Engineering (SE) is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on holistically and concurrently understanding 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 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]

CIISE17, the INCOSE Italia Conference on Systems Engineering, with its three-days program, is the third 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) three Keynote Speakers; (ii) four Paper Sessions (Safety and Reliability Engineering; Systems Design; Program Management and Systems Engineering Integration; Industrial Applications); (iii) four Tutorials on Systems Engineering ("Mini-School") and three tutorials for Ph.D students; (iv) a Tool Vendor session; (v) a session dedicated to the three AISE Working Groups (Verification, Validation, and Testing; PM and SE Integration; Operations and Maintenance); (vi) a Poster Session on Master Thesis on Systems Engineering; (vii) a final Round-Table.

In particular, the following 3 keynote speakers held the following topics: (i) *Massimo Claudio Comparini*, Chief Executive Officer of e-Geos, and former Chief Technical Officer of Telespazio. His lecture was concerned with the implementation of the Architecture approach, based on the Model Based Systems Engineering paradigm; (ii) *Massimo Bandecchi*, Head of Systems and Concurrent Engineering Section (TEC-SYE) Directorate of Technical

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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.

and Quality Management, ESTEC – European Space Research & Technology Centre. The lecture, called "ESA CDF: Concurrent Engineering for the benefit of Systems Engineering and Project Management", was focused on the integration of the processes related to SE and PM, in the challenging environment of the CDF facilit; (iii) *Suja Joseph-Malherbe*, Professional Development Manager of Project Performance International, current President of INCOSE Chapter South Africa, and former member of the Board of Directors INCOSE. The lecture called "The leadership imperative and cultivating it" described how leadership skills can enable team effectiveness across diverse organizational, physical and cultural boundaries, and allows educating systems engineers on the ability to influence people with no formal authority.

The aim of the 4 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:

−   *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:
    −   *Service Reliability and Availability model with Petri Nets: a new hybrid approach for service availability*. Lucrezia Palummo, Rachele Meriggiola, Emanuele Guidolotti (Aster), Damiano De Luca (Telespazio);
    −   *Model-based Reliability and Safety Analysis, fosters Agility in Design of Mission-Critical Systems*. Carmelo Tommasi, Nerijus Jankevicius, Andrius Armonas (NoMagic);
    −   *Functional Human Reliability Analysis: A Systems Engineering Perspective*. Fabio De Felice, Federico Zomparelli (University of Cassino and Southern Lazio), Antonella Petrillo (University of Naples "Parthenope").
−   *Systems Design* session, mainly devoted to models integration and innovative approaches for enabling systems compositions and their analysis. The following papers have been presented in this session:
    −   *Integrated Requirements Baseline Management for Complex Software Systems*. Sergio Funtò (Engineering Ingegneria Informatica);
    −   *Methodology for the definition of the preliminary architecture of a Smart Energy System (SES)*. Gaetano D'Altrui, Lucio Tirone, Rosa Esposito (Aster), Marco Massenzi, Giuseppe Lentini (GALA S.p.a);
    −   *Application of the Unified Architecture Framework for the Definition of a Generic System Architecture of a Combat System*. Lucio Tirone, Claudia Agostinelli, Paolo Petrinca, Emanuele Guidolotti (Aster), Lorenzo Fornaro, Manuela Nardini, Simeone Maria Solazzi (Leonardo Company);
    −   *Formal modeling of system properties for simulation-based verification of requirements: lessons learned*. Francesco Aiello, Alfredo Garro (Università della Calabria), Yves Lemmens, Stefan Dutré (Siemens PLM Software).
−   *Program 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:
    −   *Can VVT capabilities mitigate programs implosion? How to sustain complexity increase by VVT capabilities*. Carlo Leardi (Tetra Pak Packaging Solutions);
    −   *The Square Kilometre Array: An international project to realize the world's largest radio telescope*. Corrado Trigilio (INAF- Osservatorio Astrofisico di Catania);
    −   *The Cynefin Framework and the Technical Leadership: How to Handle the Complexity*. Davide Fierro, Stefano Putino (INAF – Istituto Nazionale di Astrofisica), LucioTirone (Aster).
−   *Industrial 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:
    −   *Fleets Management of Cooperative Connected Automated Vehicles in Manufacturing Processes*. Marco Di Vaio, Guido Guizzi, Alberto Petrillo, Stefania Santini (Università di Napoli "Federico II");
    −   *A Cloud-based Service-oriented Architecture for Business Process Modeling and Simulation*. Paolo Bocciarelli, Andrea D'Ambrogio, Emiliano Paglia, Tommaso Panetti (Università di Roma "Tor Vergata"), Andrea Giglio (Guglielmo Marconi University, Rome);
    −   *On the architecture scheduling problem of Industry 4.0*. Guido Guizzi, Silvestro Vespoli, Stefania Santini (Università di Napoli "Federico II").

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* (Aster), "An overview of the INCOSE Handbook 4: Systems Lifecycle Management and Technical Processes" by *Vittorio Torroni* (Serco), "The INCOSE SEP Certification" by *David Ward* (Flex Italia). A set of tutorials has been dedicated to Ph.D. students: Architectural Approach to MBSE by *Lucio Tirone* (Aster); Reliability analysis through simulation by *Alfredo Garro* (Università della Calabria); Verification, Validation and Testing by Carlo Leardi (Tetra Pak Packaging Solutions); Project Lifecycle e Integrazione PM-SE by *Davide Fierro* (INAF – Istituto Nazionale di Astrofisica).

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), and *Luca Stringhetti* (National Institute of Astrophysics); (ii) the WG on "Operations and Maintenance" was coordinated by *Vittorio Torroni* (Serco); (iii) the WG on "PM and SE Integration" was coordinated by *Davide Fierro* (National Institute of Astrophysics).

The Poster Session aimed to promote master thesis on Systems Engineering; the following three theses were selected by the program committee and awarded:
- Distribution, Reuse and Interoperability of simulation models in heterogeneous distributed computing environments. PhD. Thesis of Alberto Falcone (Università della Calabria);
- Operational Scenarios of the EarthCARE Mission. Master Thesis of Elisabetta Giuliani (Università di Roma "Tor Vergata");
- Formal modeling of system properties for requirements verification through simulation: an integrated solution and its exploitation in the aerospace domain. Laurea degree Thesis by Francesco Aiello (Università della Calabria).

Furthermore, a poster along with a short paper has been presented related to: Systemic Risk analysis through SE methods and techniques by Andrea Tundis (Technische Universität Darmstadt), Alfredo Garro (Universitá della Calabria), Teresa Gallo (Universitá della Calabria), Domenico Saccá (Universitá della Calabria), Simona Citrigno (CC ICT-Sud), Sabrina Graziano (CC ICT-Sud) and Max Mühlhäuser (Technische Universität Darmstadt).

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 2017 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 13 full papers plus 1 short paper presented during the paper sessions and that have been selected through an anonymous peer-review process as well as 3 extended abstracts that summarize the content of 3 PhD and Master Thesis.

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 *CIISE17* 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 CIISE17 Organizing Committee
> Davide Fierro (National Institute of Astrophysics)
> Alfredo Garro (University of Calabria)
> Guido Guizzi (University of Naples "Federico II")
> Lucio Tirone (Aster)
> Andrea Tundis (Technische Universität Darmstadt)

Biographies

Davide Fierro 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.

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 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 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.

Guido Guizzi is researcher in Industrial Plants at University of Naples "Federico II" - Department of Chemical, Materials Engineering and Operations Management. He teaches Project Management at Mechanics Engineering master degree and Production Systems of Goods and Services at Engineering Management master degree. He has a PhD in Aerospace, Naval and Quality Management Engineering. He received a master degree in management engineering from the University of Naples "Federico II". His research field is related to project management, risk assessment, logistics, operations management (smart factory, industry 4.0) using simulation techniques. He is author of several works presented at international conferences and issued on international journals of industrial engineering.

Lucio Tirone is co-founder and Technical Director of Aster SpA, and 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.

Andrea Tundis is Senior Researcher at Department of Computer Science at Technische Universität Darmstadt (TUDA) and member of the Telecooperation Division (TK). He joined TK in 2016 where he is currently involved in a Horizon 2020 European Research project on "Organized Crime and Terrorist Networks", called TAKEDOWN. He works on the definition of models and methods for supporting the identification process of terroristic activities and criminality as well as on Security Engineering aspects on Cyber Physical Systems. He received the Laurea Degree in Computer Engineering from the Department of Informatics, Modeling, Electronics and Systems Engineering (DIMES), University of Calabria (Italy) in 2009, as well as 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. Further 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 Member and IT Technical Responsible of the Italian Association of Systems Engineering (AISE) - INCOSE Italia Chapter, as well as IEEE Member.