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Editorial of INSIGHT Special Issue

AFIS Doctoral Symposium: New challenges and Advances in Systems Engineering at French Universities

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This special issue of INSIGHT section is dedicated to the eighth edition of the French Systems Engineering Academia-Industry meetings, organized by AFIS (Association Française d'Ingénierie Système), the French chapter of INCOSE, and supported by French universities as a regular series, usually every two years. This edition was held in Nancy in December 2018.

These meetings, which is composed of workshops and plenary lectures, provides the opportunity for both academics and industrials to:

- debate on systems engineering practices, education and competences development for professional situations,
- develop and promote research in systems engineering.

The first article of this special section, by Eric Levrat, Eric Bonjour, David Gouyon, Pascale Marangé, Frédérique Mayer, Hervé Panetto and Jean-Claude Tucoulou, is dedicated to a presentation of the events that occurred during the meetings: a pre-forum, a forum, conferences, workshops, a doctoral workshop, the AFIS thesis price, and the celebration of the 20th anniversary of AFIS.

Among these events, a major one for AFIS is the RobAfis Challenge, which occurs each year since 2006. The article by Jean-Claude Tucoulou and David Gouyon aims at presenting the 13th edition of RobAfis, and results. An originality of this edition is the consideration of the footprint of the solution: the system platform had to be based on material or product with a low ecological footprint, reused or recycled, and had to be recyclable itself. Among other novelties of this edition, the Alain Faisandier prize was initiated, for the best quality of the development document and implementation of systems engineering processes.

The other articles of this special issue concern the main contributions presented in another major event of the forum, the doctoral workshop that have held during the meetings, aiming to provide an overview of the French research in the domain of Systems Engineering. For this issue of INSIGHT, doctoral students and their supervisors have been invited to submit an extended version of their presentations in order to emphasize the research aspects of Systems Engineering. Eleven research papers have been selected to be included in this edition in order to promote research on systems engineering approaches.

The first research paper, by Mourad Harrat, Elaheh Maleki, Farouk Belkadi and Alain Bernard, is entitled *Extended Enterprise model for PSS within a Systems Engineering perspective*. It focuses on the representation of the organizational capabilities as part of the Product-Service Systems (PSS) enabling systems. Two UML diagrams are proposed to clarify the structure and to characterize the collaborative processes behind this virtual organization.

The proposed modeling framework is to be used as a background for the design and management of collaborations along the PSS lifecycle.

In the second paper, entitled *Management of the Design process: Human Resource Allocation and Project Selection in Factories of the Future*, the authors Guangying Jin, Séverine Sperandio and Philippe Girard propose a human resource allocation methodology and project selection methodology to help project managers to effectively manage the design process in the factories of the future, especially for the collaboration and communication problem in candidate design groups.

Factories of the future are also the subject of the paper by Concetta Semerano, Hervé Panetto, Mario Lezoche, Michele Dassisti and Stefano Cafagna : *A Monitoring Strategy for Industry 4.0: Master Italy s.r.l Case Study*. The goal of this paper is to present and to analyze the monitoring strategy adopted in a design for the digital transformation of a real Italian SME company. This monitoring strategy is a hybrid approach between the life cycle analysis and the exergetic analysis based on the evaluation of the mass balance and the energy balance.

Safety aspects are considered in various papers. The first one, by Tchoya Florence Koné, Eric Bonjour, Eric Levrat, Frédérique Mayer and Stéphane Géronimi, focuses on the *Challenges for Autonomous Vehicles (AVs) engineering: Safety validation of functional performance limitations*. It considers that the engineering of AVs cannot be limited to the classical safety validation issue, which consists in ensuring the functional safety of the vehicle. It faces a new safety validation challenge, which is about the guarantee of the functional performance of these new types of vehicles. This paper presents some reflections about this validation issue and concludes with some questions that need to be addressed deeply.

In particular, the link between systems engineering and dependability is the subject of the paper by Anthony Legendre, Agnès Lanusse and Anthoine Rauzy: *System Engineering and Dependability: Methodology of Model Synchronization between System Architecture Models and Risk Analysis*. It proposes a collaborative approach to set-up adapted modeling and methodological practices in the enterprise, taking into account the studied system context, applied processes, applied methods and viewpoint produced by engineers.

Model-based Systems Engineering is indeed currently a main research topic, as proved by the following papers. The paper by Maxence Lafon, Vincent Chapurlat, Jean-François Milot and Cyril Moitrier proposes *A model based approach to design, organize and monitor dismantling and decommissioning of nuclear facilities*. The method consists of three steps: formalization and specification of the entire set of requirements; structure, checking, and then demonstration of the coherence and feasibility of the project from both the technological and organizational points of view; re-evaluation of the dismantling and decommissioning (D&D) strategy and the management of its products, depending on the possible evolution of the D&D projects.

As these modelling activities must result in clear and traceable models to benefit from model advantages like improvement of communications, system understanding and knowledge share and reuse, the paper by Freddy Kamdem Simo, Dominique Ernadote and Dominique Lenne focuses on *On the mastering of modelling activities development in engineering*. The contribution of the authors is the introduction of a MODEL-based Federation of systems of modelling (MODEF) and its supporting framework with its principles, theoretical and practical arguments for the understanding, modelling, analysis, monitoring and ease of MA

development and operation considered as a project-product system. Freddy Kamdem Simo was awarded for the prize for the best PhD thesis work in Systems Engineering 2017-2018.

The adoption of Model-Based Systems Engineering is in the purpose of the paper by Quentin Wu, David Gouyon, Sophie Boudau and Éric Levrat: *Towards a maturity assessment scale for the Systems Engineering assets valorization to facilitate Model-Based Systems Engineering adoption*. The main hypothesis of the paper is that, to facilitate MBSE adoption, a prerequisite is the capture of engineering assets and their valorization through reuse. The aim of this article is to propose a scale to evaluate the maturity of the valorization of Systems Engineering assets. In this way, it will be possible to assess the margins for progress and therefore to estimate the necessary efforts to improve their maturity through a corresponding action plan. This work was winner of the Best Poster Award during the doctoral workshop of the meetings.

The paper, by Abdourahim Sylla, Elise Vareilles, Thierry Coudert, Michel Aldanondo, and Laurent Geneste, focuses on agreement processes. It proposes an *Evaluation of systems contractor's ability to deliver a solution to offer during an Engineer-To-Order bidding process*, by the use of two confidence indicators and their evaluation method. These indicators aim at evaluating the future ability of a company to deliver a solution to offer during a bidding process. A way to use these confidence indicators during a design process is also presented. Abdourahim Sylla was also awarded for his PhD thesis.

The last paper, entitled *Coordination of multi-underwater drones: towards an integrated object-oriented methodology in an Open-source environment*, is proposed by Hoang Anh PHAM, Thierry SORIANO, and Hien Van NGO. It presents a framework for studying the coordination of multi-underwater drones, specifically the formation control, that is based on a real-time object-oriented paradigms in an Open-source environment. The objective is to capture the whole development lifecycle of the system, from the requirements specification to testing out the simulation and realization models.

We are grateful to the authors for their impressive contribution and to the reviewers for their valuable assistance to the scientific relevance of this issue of INSIGHT.

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The Editors

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Dr. Hervé PANETTO is a Professor of Enterprise Information Systems at University of Lorraine, TELECOM Nancy. He teaches Information Systems modelling and development, and conducts research at CRAN (Research Centre for Automatic Control), Joint Research Unit with CNRS where he is managing a research project on the use of ontology for formalising models related to the interoperability of production systems, and mainly their enterprise information systems. He has been elected member of the Academia Europaea in 2018.

He received his PhD in production engineering in 1991. He has strong experience in information systems modelling, semantics modelling and discovery, and database development. His research field is based on information systems modelling for enterprise applications and processes interoperability, with applications in enterprise modelling, manufacturing processes modelling, furniture data modelling. He is working in ERP and MES integration from a Business to manufacturing perspective. He is expert at AFNOR (French National standardisation body), CEN TC310 and ISO TC184/SC4 and SC5. He participated in many European projects including IMS FP5-IST Smart-fm project (awarded by IMS) and the FP6 INTEROP NoE (Interoperability Research for Networked Enterprises Applications and Software). He is editor or guest editor of books and special issues of international journals. He is author or co-author of more than 150 papers in the field of Automation Engineering, Enterprise Modelling and Enterprise systems integration and interoperability. He is member of INCOSE and the AFIS French Chapter on Systems Engineering. He is Chair of the IFAC Coordinating Committee 5 on “Manufacturing and Logistics Systems” since 2014. He received the IFAC France Award 2013, the INCOSE 2015 Outstanding Service Award and the IFAC 2017 Outstanding Service Award. He is co-organiser of the yearly OTM/IFAC/IFIP EI2N workshop on “Enterprise Integration, Interoperability and Networking” and General Co-chair of the OTM Federated conferences.