MOSIM'18

Toulouse, France
27-29 juin 2018

Invited session

Modelling, Simulation, Proof techniques and tools for Early Verification and Validation in System Engineering:

How demonstrating and justifying a designed system meets systems' and stakeholders' values and requirements?

Organized by

Vincent Chapurlat (IMT Mines Alès), Nicolas Daclin (IMT Mines Alès), Patrick Estève (AFIS), Carlo Leardi (Tetra Pak Packaging Solutions S.p.A., AISE)

Support

AFIS Association Française d'Ingénierie Système

INCOSE International Council on Systems Engineering AFFILIATE

Abstract

Systems Engineering (SE) aims to make available complex systems. This complexity must be managed in confidence involving all requested stakeholder (customers, users, business actors) in a collaborative and iterative way. The purpose is to design and realize a successful System of Interest (SoI) that meets stakeholders' requirements in a high quality, trustworthy, cost and schedule compliant manner. In this way, SE is first a processes-oriented approach. These processes guide stakeholders during the SoI's design and realisation phases taking consideration of its life cycle. Various processes are identified and focus on requirements or architectures engineering, on design verification and validation (V&V), on system integration, on system V&V after integration, on project management or else, on SoI configurations management. Second, SE promotes and argues the use of a Model Based Systems Engineering (MBSE) approach. Lastly, SE forms the basis of methods and tools that support systemic principles, modelling, V&V of models, requirements and architectures.

This session looks for early V&V processes and activities during the SoI design. Indeed, it is today crucial to demonstrate and justify with a high level of confidence, as early as possible and in collaboration with stakeholders that the SoI, as it is modelled or supposed without models (e.g. operational scenarios can be validated) by the designers, meets all specified requirements. In other words, early V&V is currently a crucial objective to reduce costs and efforts due to late detection of errors or unexpected behaviours.

Early V&V aims to 1) work early and closely with stakeholders to be more agile, 2) reduce the number of expensive, time consuming or destructive or dangerous tests and tries during the SoI realization phase, and 3) provide demonstrations, justifications with a very high level of quality. For that purpose, modelling, simulation and proof principles, techniques and tools must be enriched and optimized to gain confidence (e.g. modelling SoI's environment to make appear unexpected behaviours, or establishing a proof of concept by adapting formal methods).

From these considerations, this session focuses on early V&V and aims to gather state-of-the-art, research results and case studies, to explore trends, approaches, techniques and experienced usages of modelling, simulation and proof to support early V&V activities.

List of topics

We invite authors to submit high quality, significant, original and unpublished contributions. The topics of interest include, but are not limited to:

- **Early V&V**: trends, future and feedback, needs, issues.
  - Early V&V for product, services and lines of products engineering (products family design)
  - Early V&V for MBSE, Model-Based Safety Assessment (MBSA) and for non-functional requirements based system engineering (e.g. resilient systems engineering, Interoperable systems engineering…)
  - Early V&V of business processes and development strategies (e.g. IVV strategy modelling and optimisation)
  - Early V&V Strategies vs. usual V&V strategies
  - Early V&V tools: how to use new methodologies and technologies for improving modelling, simulation and proof acceptance and use? How these tools, and technologies are promising considering the system nature (Complex technical System, System of Systems, System of Services…)? Internet of Things, Connected Objects, HPC (High Performance Computing or Computers) systems, Cloud, UX
  - Early V&V as a service (V&VaaS)
- **Modelling**: Lacks and opportunities for a more relevant and efficient early V&V.
  - Stakeholders' values, Usages and Practices modelling
  - Human factors, Human behaviours, Attitudes and Usages representations
  - Transforming Virtual Model to Reality.
  - Models composition and federation techniques and advances for simulation
  - Digital mock-up design, usage and return of feedbacks
  - Heterogeneous models management and interoperability to describe SoI as a whole: FMI/FMU standards, HLA…
- **Simulation**: Simulation for early V&V in confidence, with reduced costs and efforts
  - From Stakeholders' expected values to Systems Values: how to evaluate? How to justify?
  - From classical simulation tools and techniques (e.g. centred on flows simulation, on behavioural simulation, or on performances evaluation) to a global simulation: how simulating the SoI as a whole?
  - Augmented reality, Virtualization and modelling for a realist SoI's environment simulation or emulation
  - Qualification or accreditation of models and simulations
- **Proof**: Enrichment of formal methods to facilitate their adoption for an early V&V in confidence, with reduced costs and efforts.
  - Formal approaches for non-functional requirements modelling, proof and evaluation
  - Advances for realistic model checking and theorem proving

Keywords

Verification, Validation, Early Verification and Validation, Simulation, Modelling, Evaluation, Systems Engineering, Services-systems Engineering, System of Systems Engineering