Integrated simulation processes to drive geometry and simulation parameters in engineering model

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About the topic

Conventional engineering model includes standalone or slightly integrated simulations. Need for simulations in multi-physics and multi-scale systems placed the emphasis on organized simulations which are defined in organized experiments. This new situation basically changed the innovation process for generic modeling of engineering structures. In the context of this topic, phrase engineering structure is applied for multidisciplinary system-based experimental engineering configuration.

Aims of research

This research topic is aimed to make research in integrated and coordinated simulations for multi-physics, multi-scale system. Purpose of research is to conceptualize and define models for complex simulation processes, physics connections methods, and parameter driving of simulations. Results are awaited to provide better understand of multi-physics, multi-scale system related contextual simulations.

Research task

Analyze simulations in multi-physics and multi-scale systems. Reveal relevant existing research results and define plan of own research work. Study the modeling capabilities in 3DExperience platform for the relevant roles (See: "Laboratory software" below). Propose method for tuning systems parameters considering multiple criteria and multiple cases. As new own contribution, develop models for processes, physics connections methods, and parameter driving of simulations in accordance with the own research plan. Define mathematical optimization criteria using simulation results. Develop experimental engineering model which is appropriate for verification the above results using capabilities available in the 3DExperience.

Benefits at application of the awaited research results
Research in this topic is motivated by industrial problem solving related research capabilities available at the 3DExperience platform. In this way, results can be validated in industrially eligible model and they are potentially suitable for industrial problem solving. At the same time, this means joining to the recent trend for integration of theory and practice.

Laboratory software
Modeling capabilities are available for this student research at the Laboratory of Intelligent Engineering Systems in the 3DExperience platform from cloud for the relevant researcher roles below. Basic modeling capabilities are also available for the development of the experimental engineering model in integration with role related capabilities.

> *Simulation Process & Optimization (SPI)* to integrate simulations into re-usable and deployable processes to power research.
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> *Multiscale Experiment Creator (SWR)* creates, executes, explores, monitors, and evaluates collaborative simulation for multi-physics, multi-scale system experiments. Definition coupling schemes between physics is available.
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> *Multiscale Systems Analyst (MCO)* ensures Dymola Behavioral Modeling where collaborative simulation experiments require Dymola. Compliant with the open Modelica language and includes domain specific Modelica libraries for modeling and simulation of multi-physic systems.

Literature

Recent actual and time-honored classical publications about relevant research results should be surveyed. The planned research should be placed in former published results of others to prove its novelty.