INTERNSHIP OFFER
Ref : SE-STG-2018-PHYSICAL-MODELLING-DYNAMICS

TITLE: Modelling and Integration of Physical Models with SysML

Duration and period

6 Months

Context

Samares-Engineering delivers services in systems engineering and specially to support Model-Based Systems Engineering (MBSE). Samares-Engineering provides consulting and innovative solutions for design offices of different domains: avionics, space, energy, railway…

MBSE gets more and more importance in the industry, especially when consistent method is provided with tools. Indeed, modelling languages such as UML / SysML are only notations. Within Samares-Engineering, we are developing a SysML method that enable engineers to simulate their System-of-Interest at each step of the modelling process from system boundaries to architecture and design.

In current practices, the SysML models are used to define system architecture, and this architecture is also needed in models done by system specialists, i.e. Modelica models, Simulink models, AMESIM, etc.. Samares-Engineering would like to integrate such models in its UAV case study to complete current SysML model. In particular, flight dynamics models and turbulence models should be studied and modelled to be then integrated in SysML models for simulation purpose. Two approaches should be considered:

1. "Direct" integration of such physical models within SysML models. For instance, integration of Matlab/Simulink models or Modelica models in SysML.
2. "Indirect" integration of such physical models using the emerging FMI standard[1].

Some words about FMI:

Industry is interested in using FMI co-simulation standard to perform efficient co-simulation of complex systems. At each level of the design process, FMI may help to perform early verification and validation of the model. Indeed, FMI components (known as FMUs) can be composed and used to represent precisely a system or its environment. An FMU can be generated from simulation tools such as Matlab/Simulink, Dymola, or Open Modelica. To be co-simulated, an FMU embeds the needed solver. Therefore, an FMU is seen as an executable component that can be integrated in any modelling environment.

Goal and tasks

Goals: main goals are 1) to propose flight dynamics and turbulence models in a modelling and simulation language (Matlab/Simulink, Modelica, …), and 2) to integrate them in a SysML modelling framework for simulation.

Tasks

1. Understanding of the State-of-the-Art about the integration of SysML with physical simulation languages. Understanding of the State-of-the-Art about FMI.
2. Study and modelling of UAV flight dynamics and turbulence models.
3. Integration of physical models with SysML in a direct way: for instance, direct call to the Matlab/Simulink solvers.
4. Integration of physical models with SysML using FMI.
5. Comparison of the two approaches (pros and cons).
6. Final report: synthesis, recommendations, and suggestions of new features to be implemented.

[1] https://www.fmi-standard.org/

Note: time allocated to each task is not yet defined and will be established at the beginning of the internship according to the data already available to prepare each task. Some tasks might be updated during internship to be extended if needed or shorten if results are available before planned period. In addition, it may happen that a new task is requested if it can help improving topic. New task may come from intern, Samares-Engineering, or other partners.

Pedagogical goals

Intern will develop skills/knowledge in systems engineering and more especially in model based system engineering with focus on architecture modelling, model-driven engineering technologies, (distributed) simulation and co-simulation.

Technical and functional environment

For implementation, deep knowledge in Java language is required. Knowledge in C and C++ is also a strong asset.

Intern profile and expected skills

Engineering background and especially in physical simulation, knowledge in model based engineering and system engineering (modelling and simulation).
Motivation and serious, you are curious about learning new methods and tools and have some autonomy to find by yourself a first level of answers to your main questions. Consider that Samares Engineering will bring vision, context, regular guidance and support.

Location

TOULOUSE / BLAGNAC

Internship compensation

825 € / month

Contact

Please send your candidature to: contact@samares-engineering.com or by mail to
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