Collaborative Discussion Forum 1: Modelling Tools -> Initial Post

SysML models are valuable for delineating the configuration and functionality of intricate engineering systems, however they lack direct executability. Executable models are models that can be simulated and examined using external tools, such as MATLAB, Simulink, or Modelica. Executable models facilitate the assessment of design options, validation of system constraints, examination of system functionality, and simulation of system behavior.

Converting SysML models into executable models is a complex undertaking. There are numerous obstacles associated with this procedure, including: The absence of an established and uniform set of meanings for SysML poses challenges in determining the rules for mapping and executing simulations on various platforms.

The SysML models can be extensive and diverse, consisting of various types of diagrams, elements, and notations. These models may also need varied levels of abstraction and detail for simulation purposes. The diversity and compatibility of simulation tools, which might vary in terms of formats, languages, and functionalities, and may necessitate distinct inputs, outputs, and interfaces for integration with SysML models.

A few potential strategies to tackle these difficulties include:

The objective is to create a method for converting SysML models into executable simulation models using a declarative approach. This method will be based on the QVT-R standard, which enables the definition of transformation rules in a high-level and platform-independent manner.

1. Creating a domain-specific language (DSL) for executable SysML models that simplifies the language schema of SysML and offers precise semantics for a subset of SysML components that are necessary for specifying system structure and behavior.

2. The objective is to provide a framework that can simulate SysML models by integrating them with various simulation tools and platforms. The framework will also generate executable simulation models and code.

3. The objective is to provide a foundational executable SysML (fSysML) that offers a formal and executable meaning for SysML. This system will also facilitate the verification and validation of SysML models through the use of formal methods.

References:

G. -D. Kapos, A. Tsadimas, C. Kotronis, V. Dalakas, M. Nikolaidou and D. Anagnostopoulos, "A Declarative Approach for Transforming SysML Models to Executable Simulation Models," in IEEE Transactions on Systems, Man, and Cybernetics: Systems, vol. 51, no. 6, pp. 3330-3345, June 2021, doi: 10.1109/TSMC.2019.2922153.