Semi-automatic Identification and Representation of Subsystem Variability in Simulink Models

Motivation

- Understanding how variability is handled in models can reduce maintenance efforts and facilitate bug detection early on.
- The creation of variability models allows for effective reuse of well-maintained models.
- Automating the process of variability modeling will greatly improve the efficiency of model development.

Variability Identification

- We performed clone detection on six open source sets of Simulink Models using the Simone Clone Detector tool.
- The results are a number of “Clone Classes” that group models with a certain similarity – 80% in this case.
- The initial clustering provided by Simone allowed for a manual inspection of the clone classes in order to determine the five variability operators described below.

Variability Operators

- **Block Variability**
- **Input/Output Variability**
- **Layout Variability**
- **Subsystem Name Variability**
- **Function Variability**

Tagging Variability

Common blocks are computed by a graph matching algorithm. First, the root block (red) is determined, then neighbouring blocks are recursively included first by strong match (blue) then by weak match (yellow).

Representing Variability

Through the use of Simulink Variant Subsystem Blocks, we are able to represent multiple variants of a given model within a single Simulink Model. This example shows the use of a Variant Subsystem Block to model the block variability demonstrated above.

References