

T.4.31 Modularization of the Simulation/Solver Run-time for the purpose of integrating new solvers such as Sparse-Matrix-DAE/ODE Solvers (DE: BR, XRG; EU: LIU)

In cooperation with LIU an object-oriented software architecture for the simulation runtime of the OpenModelica Compiler was designed.

The architecture was designed with respect to the design-criteria

- maintainability ,
- extensibility,
- configurability.

In figure 1 the structure of the C++-Simulation-Runtime is sketched.

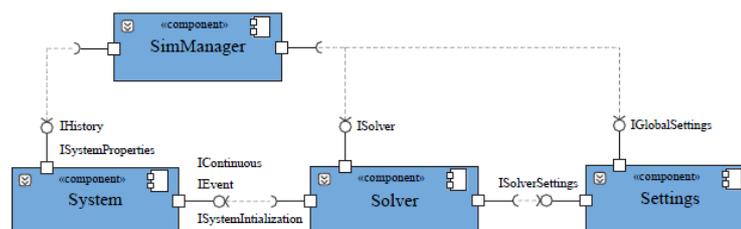


Figure 1: Structure of the C++-Simulation-Runtime

The solver-component consists of a set of integration methods, e.g. CVode from the Sundials library. The SimManager-component controls the simulation. Besides standard-tasks like starting and stopping of the simulation, the SimManager is able to synchronize different systems and solvers and hence allows for co-simulation. The settings-component is used to configure the simulation, e.g. set solver-tolerances.

The system-component represents the DAE and therefore includes the Modelica-System class. This class is generated by a new code-generation module inside the OpenModelica compiler. As mentioned above the solver-component is separated from the system-component and thus interfaces are used (see figure 3).

Due to the extensibility it was possible to integrate real-time capable solvers for WP6 as well as the Sundials-library. A concept for event-handling was elaborated with UBiele and integrated into the C++-Simulation-Runtime.

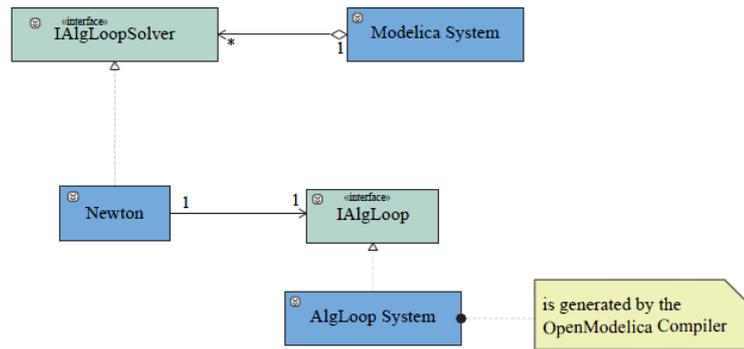


Figure 2: Structure of the C++-Simulation-Runtime

In case that the OMC returns algebraic equation systems, an instance of the AlgLoop-System class is created for each equation system (as shown in figure 2). Once again, the Algloop-System class provides a method which allows to choose an adequate numerical solution method.

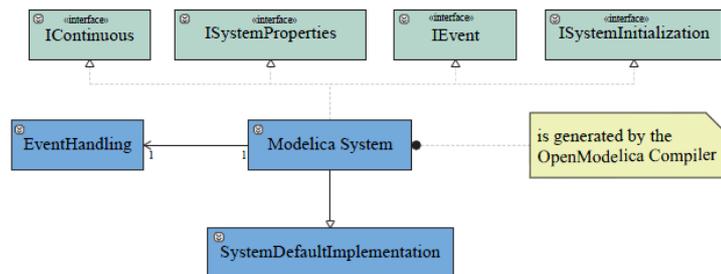


Figure 3: Interfaces of the Modelica system

In cooperation with UBiele and XRG a sparse-matrix solver was integrated into the C++-Simulation-Runtime.

The results were published at the Modelica conference 2012 (L. Mikelsons, N. Worschech. *A Toolchain for Real-Time Simulation using the OpenModelica Compiler*)