

Co-Simulation Through Exchange of Time-Series Data Applied to an Energy System Model and Detailed Ground Heat Exchanger Model

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Abstract

In recent years, building energy systems have become an important area of application for Modelica. However, few components, such as ground heat exchangers, remain difficult to implement in Modelica, and thus require co-simulation with an external model. We present a method for coupling a building energy system modeled in Modelica with an external ground heat exchanger model. The so-called waveform relaxation method (WRM) realizes co-simulation by exchanging arbitrary time-series data, instead of constant/polynomial values, as currently possible with the FMI standard. This may allow for performance improvement compared to FMI under certain conditions. A major advantage of this method is the applicability to simulation tools that do not yet support FMI. First, we briefly explain the energy system model (implemented in Modelica) as well as the ground heat exchanger model (implemented in external software DELPHIN). Next, we present different implementations of the WRM coupling method and their results. Finally, we discuss the performance of WRM under certain conditions and compare it to the FMI-co-simulation approach.