DAE Solvers for Large-Scale Hybrid Models

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Abstract

We present a strategy for DAE mode simulations of large-scale Modelica models with *state events*. DAE solvers can be orders of magnitudes faster than traditional ODE solvers when simulating models with large algebraic loops. Such loops are common in, for example, power grid models.

Central for our DAE mode approach is the accurate and efficient treatment of state events. Adapting, extending, and optimizing results known in the literature to the Modelica context resulted in a DAE mode implementation first released in Dymola 2019 and 3DEXPERIENCE 2019x.

The implementation is verified by efficiency experiments featuring the OpenIPSL power grid model *Nordic 44*. The run times are competitive with domain-specific, state-of-the-art simulation tools.

Table 1. CPU-times for the three Nordic 44 fault scenarios.

Fault scenario	*Rkfix2*	*Dassl*	
	ODE mode	*ODE mode*	*DAE mode*
Line	587 s	2 015 s	4.21 s
Bus 3100	270 s	7 810 s	33.7 s
Bus 5603	344 s	49 800 s	121 s