Context-based polynomial extrapolation and slackened synchronization for fast multi-core simulation using FMI

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The growing complexity of systems, together with increasing available parallelism provided by multi-core chips, calls for the parallelization of simulation. Simulation speed-ups are expected from co-simulation and parallelization based on models splitting into loosely coupled sub-systems in the framework of Functional Mockup Interface (FMI). However, slackened synchronization between the sub-models and associated solvers running in parallel introduces integration errors, which must be kept inside predefined bounds.

In this paper, context-based extrapolation is investigated to improve the trade-off between integration speed-ups, needing large communication steps, and simulation precision, needing frequent updates for the models inputs. An internal combustion engine, based on FMI for model exchange, is used to assess the parallelization methodology.

Keywords

FMI; parallel simulation; signal processing; polynomial extrapolation; real-time; context-based decision.