Error estimation and communication step size control in modular time integration

Tom Schierz (Martin Luther University Halle-Wittenberg), Martin Arnold

Co-simulation is a rather general approach for the simulation of coupled technical systems and coupled physical phenomena in engineering with focus on instationary (time-dependent) problems. From the mathematical viewpoint, co-simulation results in a class of time integration methods for coupled systems which are described by time dependent ordinary differential equations (ODE) or differential algebraic equations (DAE) and are typically composed of subsystems. In time integration the data exchange between subsystems is limited to discrete communication points. In a communication step between two communication points the time integration is done separately in the different subsystems (*modular* time integration).
The communication step size has a strong influence on efficiency and accuracy of modular time integration. Reliable and efficient algorithms for the automatic selection of appropriate communication step sizes in co-simulation (communication step size control) may improve the simulation results. The selection of optimal communication step sizes is based on suitable estimates for the local error in one communication step. In this talk we discuss different methods for the estimation of this error and demonstrate the successful application of the communication step size control algorithm for a rather simple practical benchmark problem.