Reduction of Computation Time by Parallelization Incorporating Co-Simulation Techniques

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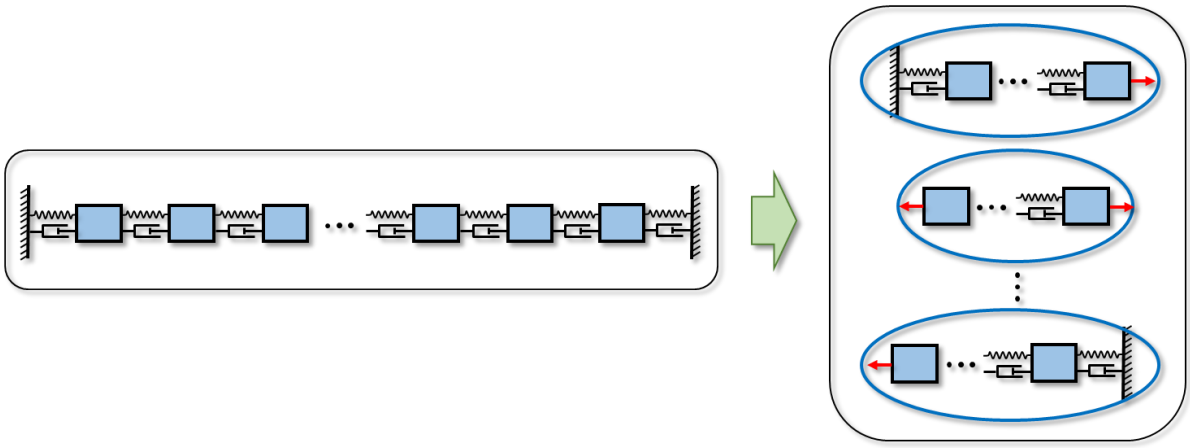
ABSTRACT

Besides the wide range of potential applications in the field of multidisciplinary simulations [1], co-simulation techniques may also be utilized to parallelize large monodisciplinary models. This paper focuses on the reduction of computation time that can be achieved in mechanical models by partitioning a monolithic model into a variable number of coupled subsystems. The connection between the subsystems can be described in various ways. One possibility is the formulation of constraint equations, i.e. the coupling by reaction forces/torques (constraint coupling) [2]. Another way, which is used in this work, is to couple different subsystems by nonlinear constitutive equations (applied-force coupling) [3]. Interchange of coupling information takes only place at defined macro-time points. The crucial point is that the subsystems are integrated independently of each other within the macro-time steps. Therefore, all subsystems can be solved in parallel.

To demonstrate the application of different explicit and (semi-)implicit co-simulation approaches, a test model consisting of a large series of 1D oscillators connected by nonlinear spring-damper elements is used. With this test model, different numeric studies are carried out in order to examine the influence of the number of subsystems and the size of the subsystems on the computation time.



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