M. Arnold, B. Burgermeister, S. Weber
Improved time integration of multibody system models using methods from singular perturbation theory. In: Proc. of The 1st Joint International Conference on Multibody System Dynamics, Lappeenranta, Finland, May 25–27, 2010.

Abstract. Small parameters in differential equation models may cause substantial problems in time integration. Singular perturbation theory interprets model components with such small parameters as singular perturbations of a constrained problem that results in the limit case setting the small parameters to zero. Singular perturbation theory gives insight in the influence of small parameters on the solution behaviour and allows furthermore the efficient computation of smooth solutions solving numerically the constrained system with vanishing perturbation parameters. In multibody system models, singular perturbations may result from stiff potential or damping forces and from small mass bodies in the system. In the present paper, we shortly summarize known results on singular perturbations caused by stiff forces in multibody system models and discuss in detail the strong interaction between singular perturbation theory and multibody formalisms in the dynamical simulation of multibody systems with small mass bodies. For small mass bodies with just one successor in the kinematic chain, a generic multibody formalism is extended to the limit case of bodies with vanishing mass. These technical considerations are illustrated by some planar test problems.

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