BDF and Newmark-Type Index-2 and Index-1 Integration Schemes for Constrained Mechanical Systems

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Various methods for solving DAE systems, e.g. constrained mechanical systems, are known from literature. Here, an alternative approach is presented using intermediate time points. The idea of the method is inspired by a co-simulation technique recently published in [1]. The approach is very general and can basically be applied for arbitrary DAE systems (mechanical or non-mechanical DAE systems with higher-index). In this talk, implementations of this approach are presented for BDF and Newmark-type integrator schemes. We discuss index-2 formulations with one intermediate time point and index-1 implementations based on two intermediate time points. A direct application of the approach for BDF or Newmark-type integrators yields a system of discretized equations with larger dimensions. Roughly speaking, the system increases by factor 2 for the index-2 and by factor 3 in case of the index-1 formulation. It is possible to reduce the size of the discretized DAE system by using simple interpolation techniques. Examples are presented, which demonstrate the straightforward application of the approach.

References

[1] Meyer, T.; Li, P.; Lu, D.; Schweizer, B.: "Implicit co-simulation method for constraint coupling with improved stability behavior", Multibody Syst Dyn (2018), doi.org/10.1007/s11044-018-9632-9.