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DAE time integration for real-time applications in multi-body dynamics. - Z. Angew. Math. Mech.. - 86:759–771. - 2006.

Abstract. The equations of motion of multi-body systems with kinematically closed loops are given by differential-algebraic equations (DAE). Real-time applications like hardware-in-the-loop testbeds or driving simulators require appropriate integration methods that can solve the non-linear constraints without exceeding an a priori fixed number of calculation steps.
Partitioned linear-implicit Euler methods can be extended by appropriate stabilization techniques to keep the error in the constraints bounded for arbitrary time intervals. These methods need a fixed low number of operations for each time step. One simplified Newton step for the projection onto the constraint manifold can prevent the drift-off for arbitrary time intervals if the stepsize is sufficiently small.
Selected methods were successfully implemented in the commercial vehicle simulation package veDYNA to improve substantially the simulation capabilities for vehicle-trailer coupling.

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