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Smooth velocity approximation for constrained systems in real-time simulation. In K. Arczewski, J. Frączek, M. Wojtyra (eds.): Proc. of Multibody Dynamics 2009 (ECCOMAS Thematic Conference). - Warsaw, Poland, 29 June – 2 July 2009.

Abstract. The rapidly increasing complexity of multi-body system models in applications like vehicle dynamics, robotics and bio-mechanics requires qualitative new solution methods to slash computing times for the dynamical simulation.
Detailed multi-body systems are designed for accurate off-line simulation. For real-time applications or efficient long-term simulations simplified models are used. The presented quasistatic solution method focuses on accelerated computation of the low frequency parts of the solution of the nonlinear equations of motion by smoothing out the velocities of fast moving low-mass bodies. The high frequency parts are eliminated by neglecting some of the inertia forces and torques. This reduces numerical stiffness and allows larger step-sizes for the time integration.
The efficient and real-time capable combination with existing highly efficient algorithms for multi-body dynamics ($\mathcal{O}(N)$ multi-body formalisms) requires appropriate integration methods that are adapted to the special structure of the multi-body formalism and solve the non-linear constraints with a small, limited number of calculation steps.

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