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Elastic and Plastic Impacts in Multibody Dynamics

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ABSTRACT

Many mechanical systems are subject to impacts modeled as unilateral constraints using the multibody system approach and the coefficient of restitution found from measurements. A multi-scale method is presented for the computation of the coefficient of restitution considering elastic wave propagation and plastic deformation which may occur simultaneously. Different models are presented for the impact period: a continuum model and a modal model with elastostatic Hertzian contact resulting in a boundary approach, a linear modal model with precomputed and concurrently computed finite elements in the contact region, and a completely nonlinear finite element model. In engineering, impacts are usually emerging from repeated processes with repeated collisions occurring on a previously deformed contact area. Therefore, the efficient modal models are extended for the evaluation of repeated impacts. The influence of the initial velocity prior to the impact as well as the shape and the yield stress of the bodies involved are investigated. For the experiments a special test bench is designed using Laser-Doppler-Vibrometers for velocity and displacement measurements on a fast time scale.

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