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Integration of Collision Detection with the Multibody System Library in Modelica

Vadim Engelson

Linköping University Electronic Press
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Abstract

Collision detection and response is one of the most difficult areas in simulation of multibody systems. Two known approaches, the impulse-based method and the force-based (penalty) method, can be applied for multibody simulation in Modelica. The impulse-based method requires instantaneous modification of some variables, but such modification is not always possible in Modelica. The force-based method leads to stiff ODE, which can be handled by solvers used with Modelica. We suggest a new way to express the penalty coefficients. The force-based method, however, requires computation of penetration depth which is time-consuming.

We also suggest a method that combines the distance between bodies and the penetration depth into a single quantity used for force computation.

Calling external functions is a preferable method integrate collision detection algorithms with practical physical models, since body geometry is stored externally. We describe an interface with collision detection tool SOLID.

Keywords: Mechanical modeling, Modelica, Simulation, Collision detection.

Author's affiliation

Vadim Engelson
Department of Computer and Information Science
Linköping University
Linköping, Sweden

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