Mechanical time-integrators for hybrid multibody systems

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Abstract:

The present talk deals with a unified approach to the discretization of hybrid multibody systems in an energy-and momentum conserving sense.
Hybrid systems consist of rigid and flexible components. The rigid body motion is described using a rotationless formulation, which is beneficial for the design of mechanical time-integrators.
Vital for many practical applications is the incorporation of rotational coordinates (e.g. for the application of torques). Therefore we present an augmentation technique, incorporating rotational degrees of freedom into the rotationless formulation. This augmentation is also the cornerstone for the subsequently presented enhancements of the basic rigid body scheme. Since the rotationless formulation leads to a set of differential algebraic equations (DAEs), features like the incorporation of control constraints to handle fully and underactuated control problems or the incorporation of nonholonomic constraints can be implemented straightforwardly. Both features will be addressed and demonstrated by representative examples.
The underlying DAE structure of the discrete equations of motion also facilitates the straightforward connection of flexible and rigid components leading to a hybrid multibody system, where once again the set of DAEs will be solved using mechanical time-integrators leading to a unified approach for hybrid systems. Again the performance of the hybrid scheme will be demonstrated by representative examples.

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