How One Can Introduce Compliance into Computer Models of the Multibody Dynamics Using Features of Object–Oriented Modeling

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ABSTRACT

A lot of methods for describing a structure of the multibody system using different graph approaches are known [1, 2]. Usually multibody system is assumed to consist of rigid bodies. Note that in frame of the bond graph approach a background of energy exchanges is used. Either directed or undirected graphs are used depending on the problems to be resolved for implementing the multibody structural analysis based on the force interactions.

In some particular cases the graph can have a special structure, like it takes place for holonomic constraints composing the system of tree structure. In general case the situation is more complicated, especially if non-holonomic constraints are used. In any way one has to take into account equations of constraints being attached to dynamical ODEs. One can mention that there exists a background for building up models of types enumerated above using: algorithms, modeling languages, and compilers. To describe the model of the multibody systems under consideration we start from: (a) an object-oriented paradigm on one hand, and (b) so called physical principles of modeling on the other one.

Dynamics of the multibody system is simulated in a most universal way in case of contacts having a compliance property. This latter case is implemented usually by elasticity / viscosity along the direction normal to the rigid body outer / inner surface and by friction along its tangent direction. The Hertz model is one of the most popular elastic contact models for engineering applications. Object-oriented approach for building up the multibody dynamics model simulating compliant contacts is under development in this paper. A technology for constructing classes-templates is applied to build up contact objects in the dynamical model. The Hertz contact model is under consideration as a simplest example. Note, that for the friction model we use numeric implementation of the so-called Contensou – Erismann approach [3]. There exist different approximate models for friction forces in this case. We use some of them for verification purpose.

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