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THE HERTZ CONTACT MODEL ALGORITHMS AND THEIR IMPLEMENTATION ON MODELICA LANGUAGE

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ABSTRACT

The Hertz model of an elastic contact and its volumetric modification are analyzed in view of the proper implementation on Modelica language. The goal of the development of appropriate computational algorithms is to accelerate the simulation process and to improve its reliability.

The differential version of the algorithm tracking the surfaces of the bodies in contact is improved showing its accuracy high enough. Acceleration of simulation for the Hertz model is provided by computation of complete elliptic integrals using the known differential equations they satisfy and by proper replacement of the implicit transcendental equations with the differential ones. An analytic theorem on existence and uniqueness for the solution of the problem is proved.

An invariant, based on classic solution of the Hertz problem, form for the force function depending on the geometric properties of an intersection for the undeformed rigid bodies volumes is used. These properties are the following: (a) a volume of the bodies intersection, (b) an area of the spot of contact, (c) a perimeter of this spot. The volumetric model showed a reliable behavior and an acceptable accuracy.

Finally an implementation of the ball bearing model as an example of the contact models application is under consideration. The particular bearings being analyzed may be composed by various number of balls and different types of raceways. The bearing models created using the library of classes developed earlier [1]. Visually they look exactly like a mechanical constraints and behave in a certain sense similar to the revolute joints.

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REFERENCES

[1] I. I. Kosenko. “Physically oriented approach to construct multibody system dynamics models using Modelica language”. *Proc. of Multibody 2007, Multibody Dynamics 2007. An ECCOMAS Thematic Conf.*, Politecnico di Milano, Milano, Italy, June 25-28, 2007.