On Non-Smooth Multibody Systems

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Abstract

In the meantime it is well known that multibody systems including multiple contacts, either as phenomena with contacts and detachment or with stick and slip or with both, represent a combinatorial problem of very high dimensions. The solution of this problem started in the eighties and nineties with the application of the complementarity idea, numerically solved for example by the Lemke algorithm, and it continued, especially on the numerical side, by using time stepping schemes, today in connection with the Augmented Lagrange concept and applying prox-functions from convex analysis. The introduction of projection methods connected with the prox-functions at the beginning of the nineties by Alart and Curnier and their application to large technical systems was one important break-through with respect to the numeric of really large systems.

With respect to the field of non-smooth mechanics with the "fathers" J.J. Moreau and P.D. Panagiotopoulos in the seventies and eighties, extensive research activities have taken place during the last 30-40 years concerning all areas, from sophisticated mathematical-theoretical foundations to more practically oriented problems including numerical and experimental treatment. All these efforts have led to a rather high degree of saturation offering a large variety of tools for considering non-smooth phenomena. Many scientific work concentrate now more on good algorithms for large systems and on suitable formulations for such cases.

In industrial practice we have a large variety of mechanical systems operating with contacts of all kinds, combustion engines, drive trains, manufacturing equipment, CVT-gears or vibration conveyors, to name only a few. We shall give some examples and discuss some practical results of measurements and simulations. And we shall demonstrate the best way from the engineering point of view how to deal with such problems.