

Sliding Velocity in Impact with Friction in Three-Dimensional Multibody Systems

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Abstract : This paper analyzes a single point rough collision in three dimensional rigid-multibody systems. A set of nonlinear different equations describing the progress and outcome of the impact are obtained. Specifically in case of the tangential, referred to as sliding, component of impact velocity is of great importance. Numerical methods are used to solve this problem. In this work, all these possible sliding behaviors during impact are identified, conditions leading to each behavior are specified, and an appropriate numerical procedure is suggested. A case of a four-degrees-of-freedom spatial robot that collides with its environment is investigated. The phase portrait of the tangential velocity, which presents the flow trajectories for different initial conditions, is calculated. Using the coefficient of friction as a control parameter, few phase portraits are drawn, each for a specific value of this coefficient. In addition, the bifurcation associated with the variation of this coefficient will be investigated.

Keywords : friction impact, three-dimensional rigid multibody systems, sliding velocity, nonlinear ordinary differential equations, phase portrait

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