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A COMPUTATIONAL MODEL FOR MULTIPLE COLLISIONS OF RIGID BODIES: AN EXTENSION OF A-CD^2 METHOD

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The A-CD^2 method [1] gives a mechanical description for instantaneous collisions between rigid bodies. This method considers a solid moves with constant velocity in the intervals $[t_1, t_c[$ and $]t_c, t_2]$, see Figure 1. The contact points at t_c are computed with the current position and the new velocities, due to the collision at t_c, are calculated by means of a constrained optimization problem. A couple of applications have used this method [2, 3]. Despite of the description made in this method, when the solid is governed by a free torque motion, the velocities are not necessarily constants, because depend on the moments of inertia. This behavior is not included in the A-CD^2 method, since constant velocities are considered. An extension includes the use of the Euler equations for modeling the angular velocities, when the body is torque free. Therefore, non constant angular velocities are obtained when the moments of inertia are different.

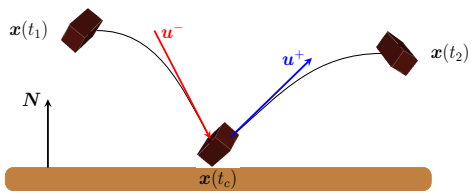

Figure 1: Motion of a rigid body.

An important result is the reduction in the computational complexity of the original algorithm, from $\mathcal{O}(N^2)$ to $\mathcal{O}(N)$, mainly an improvement is made in the contact detection stage. This reduction allows to handle problem 20 times larger than the original. Numerical simulations for granular layers motion are presented.

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