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Refining the Dynamic Modeling of Rocking Motion

Abstract.

Housner's pioneering study [1] established the dynamics of a rigid block subjected to an external impulse, revealing that Rocking Motion (RM)—despite its seemingly simple setup—can exhibit remarkably complex behavior. This complexity stems from the discontinuous transitions between rest and oscillation about different pivot points, as well as from the intermittent impacts with the supporting surface. More recently, [2] introduced a framework that reformulated the classical piecewise RM equations as a continuous system of differential equations and reinterpreted impact forces—originally modeled through a restitution coefficient—as a coupling mechanism generating instantaneous Dirac-type impulses. This regularized formulation also enables the study of broader classes of dynamical systems.

Starting from the system of central forces that describes Rocking Motion, where angular momentum is a conserved quantity, in our work we managed to generalize it into a singular system that admits a certain polynomial regularization. This allows to analyse the complete dynamics of the system and its corresponding 2-parameter bifurcation diagram.

Joint work with Jesús S. Pérez del Río and Francisco Prieto (University of Oviedo)

Referencias

[1] G. Housner The behavior of inverted pendulum structures during earthquakes, *Bull Seismol Soc Am* **53** (1963), 403–417.

[2] F. Prieto and P.B. Lourenço, On the Rocking Behavior of Rigid Objects, *Meccanica* **40** (2005), 121–133.