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On the Motion and Stability of a Cube Balanced on a Cylinder

ANDRE GUIMARAES, Sam Houston State Univ — This paper deals with different approaches of analyzing the motion and stability of the problem of a cube balanced on top of a cylinder. The problem is one thats first introduced to students in early classes of analytical mechanics.The purpose of this paper is to further explore the problem, both for self-teaching and educational purposes.
The problem is presented along with the generic approach used to describe its stability using energetics. The stability of the system is thoroughly explored, and the precision of different Taylor Expansions used to solve the non-linear equation yielded. There is an exploration of the ratio between the half-side of the cube and radius of the cylinder, to yield both no stability and continuous stability for a certain angle range. Secondly, the paper presents a derivation of the differential equation describing the oscillations of the cube on top of the cylinder using Lagrangian mechanics, and performs a numerical analysis on the movement, since the equation cannot be solved analytically.

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