

Affine nonholonomic rolling on the plane

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Abstract

We introduce a class of examples which provide an affine generalization of the nonholonomic problem of a convex body that rolls without slipping on the plane. These examples are constructed by taking as given two vector fields, one on the surface of the body and another on the plane, which specify the velocity of the contact point. We investigate dynamical aspects of the system such as existence of first integrals, smooth invariant measure, integrability and chaotic behavior, giving special attention to special shapes of the convex body and specific choices of the vector fields for which the affine nonholonomic constraints may be physically realized. We also discuss some remarkable behavior occurring when the body is a homogeneous sphere and the vector fields have discontinuities with specific symmetries. This is joint work with Mariana Costa-Villegas.