Nonlinear analysis of the two-mass-skate bicycle model

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A simplified model of bicycle, called two-mass-skate (TMS), was recently developed by Kooijmann et al. [3] to show that the self-stability of a bicycle does not depend on neither gyroscopic nor caster effects.

In this paper, we improve this model by revising its kinematics and by imposing no restrictions on the geometry of the rear and front frames, that is, we consider their distributed masses. Furthermore, we assume that the two point wheels have masses without moments of inertia, thus, the trail is always zero.

Taking the nonholonomic constraints on the velocities into account, we then derive the nonlinear equations of motion for the system from a geometric point of view [1], [2]. Further, studying the behaviour of this system, we analyze its stability, which exhibits some peculiar aspects due to the nonholonomy of the problem.

References

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