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Mathematical Models and Simulation of Stick–Slip Processes in a Car Steering System

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Problems of “stick–slip” phenomenon in car-steering systems are still important but rarely taken into account in the literature. Original luz(...) and tar(...) projections are useful for modeling and simulation of stick-slip. The model: A multi-body car dynamics model has been treated as a coupling of two partial models – steering system model and vehicle motion model. The model of steering system mechanism includes dry (kinetic and static) and viscous friction, elasticity of elements, and also the gear freeplay. It bases on the luz(...) and tar(...) projections. The vehicle model takes into account tire, independent suspension, drive, rolling resistance and aerodynamic drag. Simulation: Elaborated models were used for digital simulation studies (as well as sensitivity and bifurcation analyses) concerning open-loop tests of a passenger car. The paper presents results of simulation of three manoeuvres taken in series: step input on the steering wheel, steady state cornering and sudden release of steering wheel.

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