Dynamics Modeling and Control for A Riderless Bicycle System

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ABSTRACT

This thesis is to develop the mathematical model of a riderless bicycle. The six coordinates for the position and orientation of the vehicle body, the rolling angles of front and rear wheels, one steering angle of the fork are used. The equations of motion for the system are derived from Euler-Lagrange equations in quasi coordinates. The pure rolling constraints between ground and wheels are also considered in the dynamical equations of the riderless bicycle system. The symbolical mathematical software Maple is used to derive the equations of motion. The Matlab programs are written to solve the differential-algebra equations(DAE). The simulation study is the control for riderless bicycle system. From different initial values of steering angle of fork, the system can be controlled steadily without falling down. The equations of motion developed are verified by energy conservation and constraint equations. Finally, the thesis develops control scheme for riderless bicycle to stabilize its dynamics.

Keywords : Riderless bicycle, Dynamics, Control.

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