Mechanical Engineering Thesis Defense

Non-overshooting Model Predictive Control (MPC) for the Vehicle Lateral Stability

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Abstract

Advanced driving assistance systems (ADAS) are one of the latest automotive technologies for improving vehicle safety. An efficient method to ensure vehicle safety is to limit vehicle states always within a predefined stability region. Hence, this thesis aims at designing a model predictive control (MPC) algorithm with non-overshooting constraints that always confine vehicle states in a predefined lateral stability region. To consider the feasibility and stability of MPC, terminal cost and constraints are investigated to guarantee the stability and recursive feasibility of the proposed non-overshooting MPC. The proposed design is first verified by using numerical examples of linear and nonlinear systems. Finally, the non-overshooting MPC is applied to guarantee lateral vehicle stability based on a nonlinear vehicle model for a cornering maneuver. The simulation results are presented and discussed through co-simulation of CarSim® and MATLAB/Simulink.

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Zoom Link: