Model Reference Tracking Control of A 4WS Vehicle Using Single and Dual Steering Strategies

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Abstract

In this paper, control schemes and strategies of a 4WS vehicle are completely described and explained. The control schemes consist of single steering and dual steering schemes. Single steering scheme controls only the rear steering angle of vehicle while dual steering scheme controls both rear and front steering angles. The control strategies, used in this paper, are zero side slip (ZSS), zero yaw rate (ZYR) and model reference tracking strategies. Some model reference trackers are explained for a 4WS vehicle and a special model reference tracker, which improves vehicle transient response and maintain the steady state conditions regarding 2WS vehicle is finally proposed. The dynamic models are a 2DOF linear handling model for controller with yaw rate and lateral velocity as degrees of freedom, and a 3DOF nonlinear handling model for simulation with yaw rate, lateral velocity and roll as degrees of freedom and CALSPAN tire coefficients.

Simulation results show that single steering scheme is not useful for tracking both yaw rate and lateral velocity reference, while dual steering scheme can effectively control both essential state variables of vehicle, and make them track their references. It is also shown that the proposed reference model can be effectively used in vehicles and is able to improve the 2WS handling characteristics with the same steady state tracking behavior.

Key Words: 4WS Vehicle, Linear Modeling, Nonlinear Modeling, Model Reference Control, Dual steering Control

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