

A NOVEL HYPERBOLIC TANGENT SLIDING MODE OBSERVATION OF VEHICLE LATERAL FORCE FED BACK BY LONGITUDINAL FORCE ERROR

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Abstract

The tire lateral force control is crucial to vehicle lateral stability. Vehicle side slip and out of control can be prevented effectively by observing accurately the lateral force. Thus, a novel hyperbolic tangent sliding mode observation algorithm (NTSMO) is proposed. The algorithm adopts the longitudinal tire force error as feedback considering vehicle parameter uncertainties and without a complex tire model. First, the on-line verification of the algorithm was carried out by dSPACE to using the experimental data of the real vehicle linear acceleration and deceleration conditions, and comparison of experimental output with different observation algorithms. Furtherly, the simulation under emergency obstacle avoidance conditions and the double-line shifting conditions were conducted to verify the accuracy of the algorithm respectively. Simulation results show that the percentage errors between the tire lateral forces from the proposed NTSMO and the actual data are less than 5.35%, and the prediction accuracy of the NTSMO by 38.78% is higher than that of the sliding mode observation(SMO), which indicates that the NTSMO is superior to the SMO.

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