基于滑模观测和模糊推理的车辆侧翻实时预警技术　　Real-time Rollover Prediction for Vehicle Based on Principles of Sliding Mode and Fuzzy Inference System

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关键词： 车辆 侧翻预警 扩展3自由度车辆模型 滑模观测器 模糊推理系统

摘　要： 提出一种实时的车辆侧倾状态观测器和侧翻预警算法。建立一种考虑轮胎力非线性特性的扩展3自由度车辆模型，并使用非线性最小二乘法拟合轮胎模型的参数。在车辆模型的基础上设计了基于超螺旋理论的滑模观测器，实时观测车辆的侧倾状态。侧翻预警算法依据当前车辆状态参数及变化趋势，通过构造模糊推理系统计算车辆侧翻指数，综合评价车辆侧翻的危险程度。使用车辆动力学仿真软件veDYNA进行的虚拟道路试验验证了观测器的观测精度和预警算法的预警效果。　This paper presented a real-time rollover prediction algorithm based on roll state estimator.　An extended 3-DOF vehicle model considering tire nonlinear characteristics was firstly proposed, the parameters of the tire model were obtained by using nonlinear least square method. Vehicle roll state was estimated using sliding mode(SM) observer based on the super twisting algorithm. A rollover critical index(RCI), which indicated the risk of rollover, was developed by a fuzzy inference system (FIS) based on current vehicle state and its trend. The veDYNA dynamic simulation software was used to verify the performances of roll state estimator and roll motion prediction.

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