UNIVERSITY OF WATERLOO

TECHNOLOGY SUMMARY

Vehicle Rollover Control using Pulsed Active Steering Control Strategy

Background

Vehicle rollover crashes, particularly with the increasing popularity of Sport Utility Vehicles (SUVs), continue to be a serious safety and liability problem for auto manufacturers. Various rollover and yaw control strategies have been attempted including, active steering control, differential braking control, and integrated control (using both of the previous strategies) but have only provided limited success in addressing this problem. For instance active steering systems, which have been only implemented in high end luxury cars, are based on the application of a DC motor and a sophisticated linear control method for adjusting the driver steering input to improve vehicle stability. However the control strategy fails to account for the nonlinearity of real-world driving conditions and thus isn't robust enough to handle all speeds, road conditions, and mass variations. Simulations performed by the University of Waterloo using a complex nonlinear 4 DOF vehicle yaw/roll model, as well as a complex nonlinear tire model, show that all three conventional control strategies have limited abilities to prevent rollover maneuvers.

Description of the invention

To address the aforesaid nonlinearity challenge, the University of Waterloo developed a pulsed active steering control strategy which shows better simulation results than the conventional control strategies and is able to prevent rollover maneuvers for all designated test tracks under all vehicle models considered. The University's invention uses a pulse generator to generate special steering pulsation by measuring the rollover coefficient and the actual vehicle yaw rate and comparing the measurement with the rollover threshold number and expected yaw rate based on the steering wheel angle. In general, the amplitude, frequency, and duty cycle of the pulses affect the level of stability improvement. The most important factor is the duty cycle of pulses which can be controlled easily and modulated to the driver steering input.

Advantages

The new pulsed active steering controller has proven its efficiency for vehicle stability control under nonlinear vehicle model in many simulations. It has also been shown that the method is easy to implement with a much lower cost compared to current techniques and can achieve vehicle stability control under any vehicle condition. This new method can provide affordable active stability control for all cars.

Reference

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Patent status

U.S. Patent 8,762,004
Available for licensing

Stage of development

The University intends to build a prototype controller and test it in a vehicle under varying driving conditions

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