Performance Optimization in Four Wheel Independent Steer-by-Wire Vehicles using Slip Angle Control

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Abstract

Vehicle stability and performance have always been an active area of research for the automotive industry. The steering system is one of the key elements that determine the handling of a vehicle. A better understanding and modelling of tyres along with advances in techniques to actively determine the tyre characteristics has made it possible for a designer to better exploit the tyres capability. A four wheel independent steer-by-wire system is a system where all four wheels of the vehicle can be steering independently by separate actuators responding to computer generated signals. It has been shown in this work that in case of a vehicle with four wheel independent steer-by-wire system, the individual steady state slip angles of the four wheels can be directly controlled by an active system in the steady state. This can be used to help conserve tyres at off-limit cornering manoeuvres and boost maximum cornering speeds at on-limit cornering.

Keywords: Vehicle dynamics, steer-by-wire, four wheel steering, independent steering, tyre dynamics, slip angle control.

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