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DESIGN OF ANTI-ROLL BAR SYSTEMS

The improvement of roll dynamics is a relevant problem in vehicles with a high center of gravity. Several roll control systems have been developed which enhance the protection of cargo and improve roll stability. One of the most preferred roll control solutions is anti-roll bars, which increase the stiffness of the suspension system. In this control system, torsion bars connect the left- and right-hand-side suspensions on an axle. Active anti-roll bars are able to adapt to the current road conditions and lateral effects, while roll stability is improved. Several papers propose methods to reduce the chassis roll motion of road vehicles. Three different active systems are applied, such as anti-roll bars, auxiliary steering angle and differential braking forces. Active anti-roll bars commonly apply hydraulic actuators to achieve appropriate roll moment. In an active roll control system based on a modified suspension system is developed with the distributed control architecture. Active steering uses an auxiliary steering angle to reduce the rollover risk of the vehicle. However, this method also influences the lateral motion of the vehicle significantly, see The advantages of the differential braking technique are the simple construction and low cost, see In this case different braking forces are generated on the wheels to reduce the lateral force. Several papers deal with the integration of the above-mentioned systems. In the integration of the active anti-roll bar and active braking is presented. investigates the coordination of active control systems, which could be controlled to alter the vehicle rollover tendencies of the vehicle. The benefits of the integration of **anti-roll bars and the lateral control is presented in .Furthermore**, the control design of anti-rollbars for the articulated vehicles is a significant and novel topic in. An analysis of the snaking stability of a tractor –light trailer vehicle, where the trailer contains anti-roll bars is presented in. A special construction of semi-active anti-roll bars, which guarantees both ride and roll performances is shown down. The ride and roll performances for active anti-roll system using a PID control are analyzed here. The active system proposed in this paper integrates an electro-hydraulic actuator into an anti-roll bar. The system contains a high-level controller, which improves the roll dynamics of the chassis using active torque, thus the roll motion of the chassis is influenced. The high-level control strategy is realized by a gain-scheduling Linear Quadratic (LQ) controller. The actuator of the anti-roll bar is an oscillating hydromotor with a servo valve on the low level. The actuator control guarantees the generation of the necessary active torque and satisfies the input constraint of the electric circuit. The control design is based on a constrained LQ method. The goal of the paper is the control design of a multi-level control design of an anti-roll bar system. The paper is organized as follows. Section 2 presents the control-oriented formulation of chassis roll dynamics and the electro-hydraulic actuator using fluid dynamical, electrical and mechanical equations. Section 3 describes the architecture of the active anti-roll bar control system, and details the design methods of the vehicle dynamics and actuator controllers with demonstration examples. The actuation of the control system is illustrated by a simulation example in Section 4. Finally, Section 5 summarizes the contributions of the paper.

In this section the mechanical and hydraulic equations expressing the operation of the actuator are presented. The linear vehicle model, describing the roll dynamics of the chassis is modeled, which is enhanced by the active anti-roll bar system. The actuator for this system consists of a hydro motor and a valve. The four degree-of-freedom vehicle dynamical model is illustrated in Figure 1.

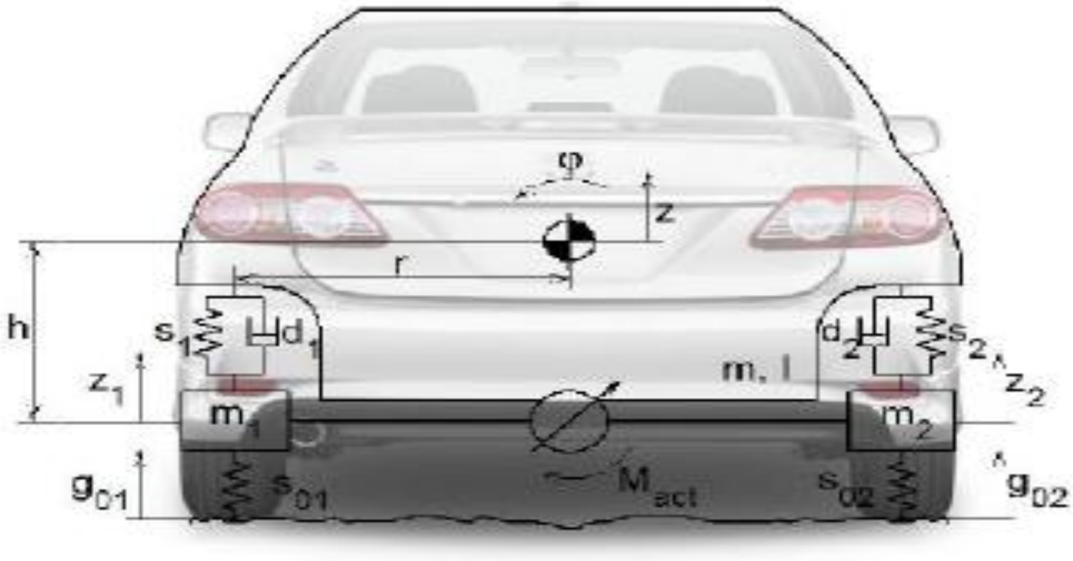

Fig. 1: Illustration of the vehicle model

Bibliography

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