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Simulation of an Active Suspension Using PID Control

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ABSTRACT

The suspension is the automotive system that connects the vehicle sprung mass the unsprung mass relative to wheels and tires. Its main proposal is to improve passenger comfort and increase safety in operation, providing a better tire-road contact. A vehicle suspension can be classified as passive, active or semi - active. Passive suspensions have come longtime ago being widely used on automotive industry. The properties of mechanical components cannot be modified in real time via external signals, the vibration is controlled only storing or dissipating the energy associated with the movement through its main components such as springs, dampers and masses. The principle of active suspension is to install an actuator between the sprung and unsprung masses in addition to a spring and a damper, or replacing both of them. Sensors are placed at different points of the vehicle to measure the vibrations. The information gathered by sensors is sent to a controller that calculates in real time the actuator force magnitude that must be applied. In semi-active system suspensions, damping properties and stiffness can be changed in real time by a control signal. In this work a quarter car suspension model is simulated in order to study an active suspension with an automatic PID controller. This automatic control can be divided in proportional, integral and derivative controls or alternatively a combination between them. Results are compared to passive suspension considering different road surfaces. A good performance is achieved with the PID active suspension reducing vibration amplitudes what improves ride comfort.