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# Stochastic optimal preview control of a vehicle suspension

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**Abstract**

Stochastic optimal control of a vehicle suspension on a random road is studied. The road roughness height is modelled as a filtered white noise stochastic process and a four-degree-of-freedom half-car model is used in the analysis. It is assumed that a sensor is mounted in the front bumper that measures the road irregularity at some distances in the front of the vehicle. Two other sensors also measure relative velocities of the vehicle body with respect to the unsprung masses in the vehicle suspension spaces. All measurements are assumed to be conducted in a noisy environment. The state variables of the vehicle system are estimated using a method similar to the Kalman filter. The suspension system is optimized by minimizing the performance index containing the mean-square values of body accelerations (including effects of heave and pitch), tire deflections and front and rear suspension rattle spaces. The effect of delay between front and rear wheels is included in the analysis. For stochastic active control with and without preview, the suspension performance and the power demand are evaluated and compared with those of the passive system. The results show that the inclusion of time delay between the front and rear axles and the preview information measured by the sensor mounted on the vehicle improves all aspects of the suspension performance, while reducing the energy consumption.