

Simulative Study of the Influence of Degraded Twin-Tube Shock Absorbers on the Lateral Forces of Vehicle Axles

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Abstract : Degraded vehicle shock absorbers represent a risk for road safety. The exact effect of degraded vehicle dampers on road safety is still the subject of research. This work is intended to contribute to estimating the effect of degraded twin-tube dampers of passenger cars on road safety. An axle model was built using a damper model to simulate different degradation levels. To parameterize the model, a realistic parameter space was estimated based on test rig measurements and database analyses, which is intended to represent the vehicle field in Germany. Within the parameter space, simulations of the axle model were carried out, which calculated the transmittable lateral forces of the various axle configurations as a function of vehicle speed, road surface, damper conditions and axle parameters. A degraded damper has the greatest effect on the transmittable lateral forces at high speeds and in poor road conditions. If a vehicle is traveling at a speed of 100 kph on a Class D road, a degraded damper reduces the transmittable lateral forces of an axle by 20 % on average. For individual parameter configurations, this value can rise to 50 %. The axle parameters that most influence the effect of a degraded damper are the vertical stiffness of the tire, the unsprung mass and the stabilizer stiffness of the axle.

Keywords : vehicle dynamics, vehicle simulation, vehicle component degradation, shock absorber model, shock absorber degradation

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