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VEHICLE HANDLING DURING EMERGENCY BRAKING

Vehicle handling is the car response and reaction to the inputs of a driver in particular keeping or changing direction with minimal physical energy consumption, as well as emergency braking at minimal time for maneuvering.

The main problem of handling during emergency braking of a vehicle is also the avoidance of wheel blocking and the loss of tire-to-surface friction coefficient, regardless of the road and climatic conditions. This problem is relevant and is being considered by leading car manufacturers, starting with the modernization of modern vehicle design, the production of various types of tires according to the season and the introduction of adaptive systems and electronic-mechanical modules of brake drives.

First of all, we analyze the use of different types of tires, that can provide high-quality tire-to-surface friction, its aquaplaning and high-quality point contact. Modern manufacturers of automobile tires produce summer, winter and all-season tires for various vehicles. These tires differ in rubber composition and tread pattern types, as an additional option friction and studded tires are used for the winter season. As a rule, winter rubber is softer. It allows implementing tire-to-surface friction coefficient qualitatively in sub-zero temperatures.

Secondly, modern vehicle manufacturers use active braking systems that work with changing emergency braking algorithms such as Active Brake System (ABS) and Brake-Assist. These systems allow avoiding complete blocking of the car wheels during emergency braking by the driver especially under “mixt” conditions — conditions of not even tire-to-surface friction, which leads to an unregulated skidding.

I suggest analyzing the basic principles of ABS. Regardless of the hydraulic or pneumatic brake drive, the essence of the work is as follows: the brake system has individual electromagnetic sensors on each wheel that constantly scan the angular speed of the wheels, a vehicle speed sensor, a pressure modulator and an electronic control unit. In turn, the electronic control unit analyzes the input data from all sensors and when the wheel is blocked, issues a signal to release the pressure modulator. The decreasing pressure of the working fluid in the brake chamber thereby releases the wheels, forcing them to roll on the surface of the road instead of skidding.

When ABS is in operation, the deceleration efficiency of the car, in addition to the fact that the control does not get out of the control of the driver, remains higher than when braking with a skid [1]. Tests have shown that on slippery surfaces, the braking distance of a car equipped with ABS can be 15% shorter than that of a conventional car. Besides, the mileage of the tire tread when using ABS increases by 5 — 7%.

References

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