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Brakes That Help You Steer

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Speed is known to be a critical factor in all road crashes. Driving is unpredictable and if something unexpected happens on the road ahead it is a driver's speed that will determine whether they can stop in time and, if they can't stop, how hard they will hit. That's why, reducing and managing traffic speeds is crucial to road safety.

In case of emergency braking, it is possible to lock one or several wheels of a car. So, the entire reserve on the wheel adherence is steered in the lateral direction. A locked wheel stops to perceive the lateral forces that hold the car on a given trajectory and slides over the road. The car loses handling and the small lateral force causes its drifting.

The anti-lock braking system (ABS) has a rather simple structure, it includes several basic elements such as rotation rate sensors, an electronic control unit and hydraulic ABS modulators.

Rotation rate sensors. These sensors determine the angular velocity of the wheel rotation and having received the information the electronic control unit decides to turn on the ABS. Today the principle of operation of the most common sensors is based on the Hall effect and for this reason simple induction sensors have become popular.

Electronic control unit. It is a computer, the "brain" of the entire system, it processes information from sensors and when a critical situation occurs, it activates actuators. Today a

single electronic unit is often used to control ABS, Automatic Slip Regulation (ASR) and other active safety systems.

Hydraulic ABS block. Usually the ABS includes a hydraulic unit that combines various components — valves, a pump, pressure accumulators, etc. Often this unit is called a hydraulic modulator because it creates a variable pressure in the system with a frequency of 15-20 times per second.

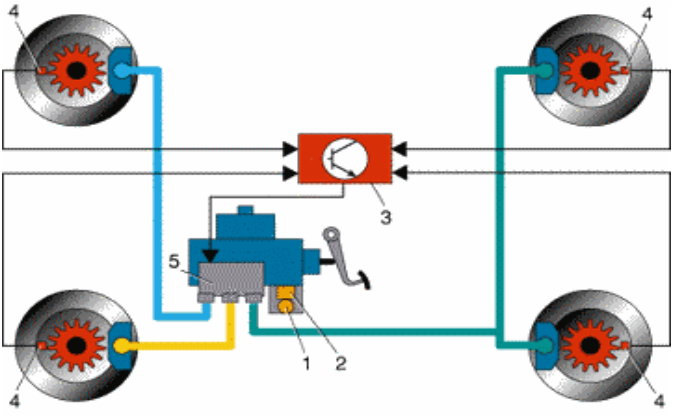

Fig.1 Anti-lock braking system

1) hydraulic pump; 2) pressure accumulator; 3) electronic control unit; 4) rotation rate sensors; 5) electromagnetic valve block

Principle of working. The work of the anti-lock system can be divided into three stages:

- The occurrence of a critical situation (the risk of wheel blocking) – the electronic unit makes a decision to turn on the hydraulic unit;

- The operation of the hydraulic unit - periodic increase and decrease in pressure in the brake system;

- The system turns off when the wheels are unlocked.

The ABS work principle is based on the measurement of speed and angular acceleration of the wheels, they are "one step ahead", i.e. a driver presses an accelerator pedal abruptly

and the system already "knows" that at the current speed brakes are likely to be locked and the system starts working. Nowadays, the development of modern anti-lock systems is aimed at improving the efficiency of its operation at all speeds.

How does the ABS work? In the event of a critical situation (the angular speed of the wheel is sharply reduced), an electronic unit turns on a hydraulic modulator, which first stabilizes the pressure in the wheel brake cylinder and then ensures the intake of pressure brake fluid. When the pressure drops (the exhaust valve opens, the brake fluid flows into the pressure accumulator) the wheel stops locking and turns at a certain angle, as the pressure raises the wheel slows down [1].

In conclusion, we can summarize that ABS is a system that prevents a vehicle from locking while braking. The main purpose of the system is to reduce the braking distance and ensure the controllability of the vehicle during the forced braking and to eliminate the possibility of its uncontrolled slip.

In most cases, the presence of ABS allows you to get a significantly shorter stopping distance than in its absence. In addition, the ABS allows the driver to maintain a vehicle control during the forced braking, i.e., it remains possible to perform quite sharp maneuvers during the braking process. The combination of these two factors makes the ABS a very significant advantage in ensuring the active safety of vehicles.

References:

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