International Journal of Academic Pedagogical Research (IJAPR)
ISSN: 2643-9123
Vol. 5 Issue 5, May - 2021, Pages: 122-125

Analysis of Acceleration Slip Regulation System Used In Modern Cars

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Annotation: *In this work discusses the structure of the acceleration slip regulation system used in modern cars and the principle of its operation.*

Keywords: *transport vehicles, technical exploitation, technical condition, control.*

Introduction.

The Acceleration Slip Regulation (ASR) is also known as the Traction Control Regulation (TCR) and is part of the Electronic Stability Program (ESP). It is also one of the most active car safety systems. Regardless of how the road surface is paved during driving (smooth and soft surfaces i.e. ice, snow, water, gravel, wet piled stones and low friction roads) and how the accelerator pedal is depressed by the driver is a system designed to prevent the wheels from slipping, i.e. shattering. As soon as this system works, the engine's power consumption is reduced by adjusting the speed of the leading wheels. The system has its own special elements, each of which is equipped with wheel sensors. These sensors send information about the speed of rotation of each wheel to the electronic control system of the system. The same sensors are used for the anti-lock braking system (ABS) at the same time to prevent the car's wheels from getting locked in the brake pad [1]. These sensors send a signal to the control unit of the system that the steering wheel has started to crack. The electronic control unit automatically performs a function similar to the process used to reduce engine power and depress the accelerator pedal. That is, the rattling wheels brake automatically from time to time. As a result, the system elements ensure that the car gradually gets out of difficult road conditions. This process is associated with changes in the information signals coming from the car's wheel sensors. The driver can see the operation of this system through the flashing ESP, ABS and ASR lights on the control panel. In addition, the driver can turn the ESP and ASR systems on and off at will (manually) using the buttons. If the weather is good and the roads are dry, the driver can turn off the system and, if necessary, turn on the system [2].

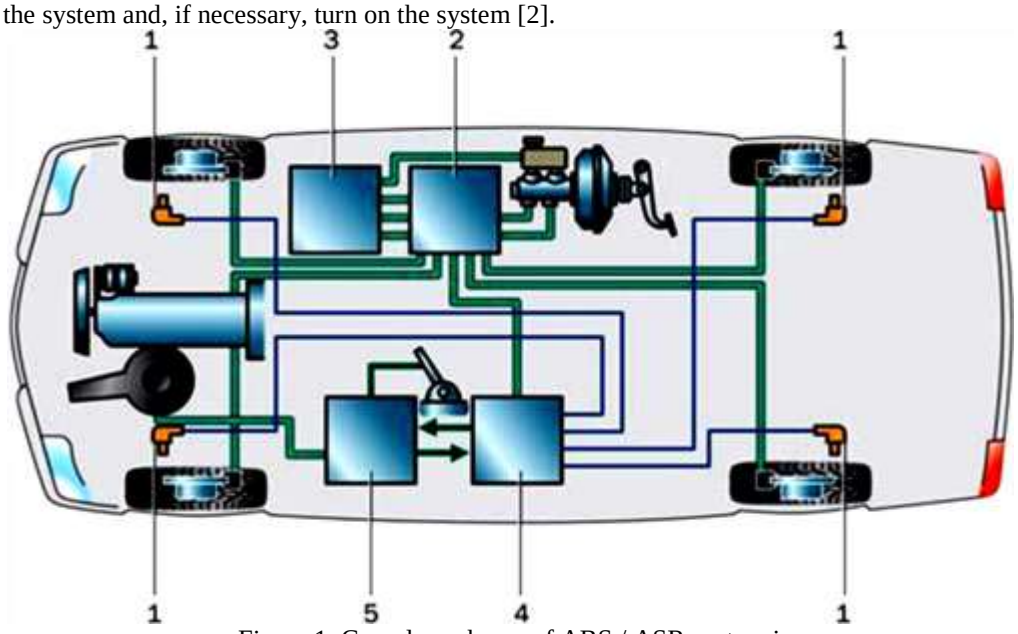

Figure 1. Complex scheme of ABS / ASR system in a car.
1-wheel speed sensor, 2-ABS modulator, 3-ASR modulator, 4-ABS electronic control unit, 5-ASR electronic control unit.

This system consists of the following components:

Wheel speed sensor. These wheel sensors are mounted on each moving wheel and send the following information about the speed of rotation of the wheels while the car is moving to the electronic unit of the system at a rate of 0.025 per second, for example:

Rotation speed and wheel angle acceleration;

— Vehicle speed;
— Lead wheel splitting;
— Traffic status.

It should be noted that these sensors are used not only to measure the angular velocity of the wheels, but also to compare the remaining data, such as the speed of rotation and the movement of the leading wheels.

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Electronic control unit. Currently, a single electronic control unit is used for ABS and ASR systems, through which each transmitted variable data, in the event of a catastrophe, the ASR system unit activates the actuators, and the system's electronic control unit with differential will start working in a continuous connection.

Executive mechanisms. The actuators work by controlling the engine and activating the brakes through a group of additional solenoid valves connected to the hydraulic modulators in the ABS system when the vehicle changes direction abruptly and when some of the wheels slip.

Methods.

The principle of operation of the ASR system is very simple, with the help of wheel sensors continuously sends information about the speed of rotation of the wheel to the electronic control unit of the ASR system to prevent accidents while driving, and the necessary measures using the electronic block is done. Typically, a sudden increase in wheel speed can increase the ability of the wheel to crack, as well as change the direction of movement of the vehicle.

Figure 2. Probable motion of a vehicle with a high-speed ASR system (blue) and a vehicle without (white).

In fact, based on the analysis adopted by the electronic control unit to prevent the accident, the orders given to the executive mechanisms based on safety requirements depend on the speed of the vehicle:

— Braking on the leading wheels at speeds of 40-80 km/h;
— Is achieved by reducing the torque by the engine at speeds above 40-80 km/h [3].

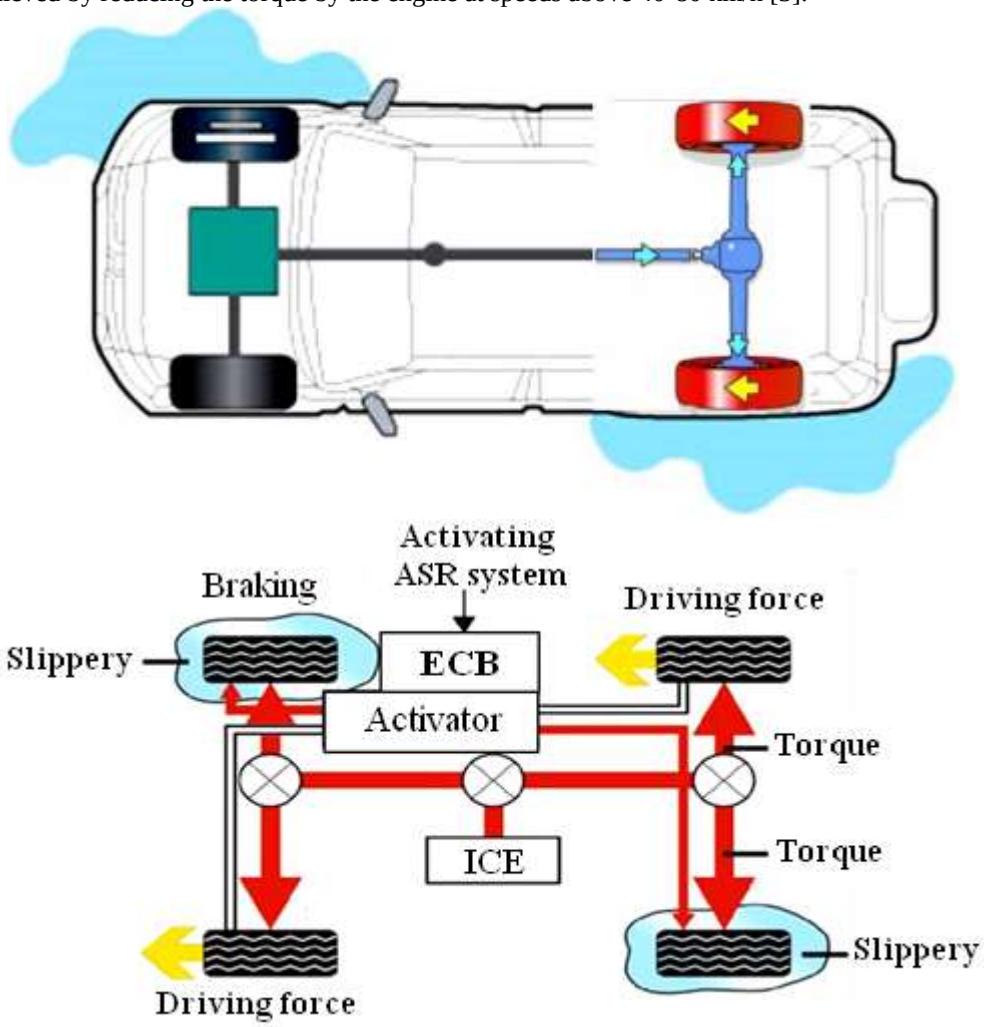

Figure 3. The principle of operation of the ASR system.

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Also, both methods can be used at the same time. For example, the torque applied to the braking wheels is based on a systematic process, such as the ABS system. In this process, the brake fluid creates a short brake on the brake wheel cylinders by the ASR module, thus the system controls the situation as much as possible and ensures that the car gradually exits the critical position, thus the leading wheels on the other side create a shift does.

Analysis. The speed and acceleration values of the power-generating wheels are compared with those of the non-power-producing wheels (Figure 4).

Reducing torque can be achieved in different ways with the engine, and the difference is that these systems from different manufacturers can often work as follows:

— Throttle valve control;
— Changing the timing of firing angles;
— Temporarily extinguish spark plugs on one or more cylinders;
— Turn off the fuel injector for one or more cylinders.

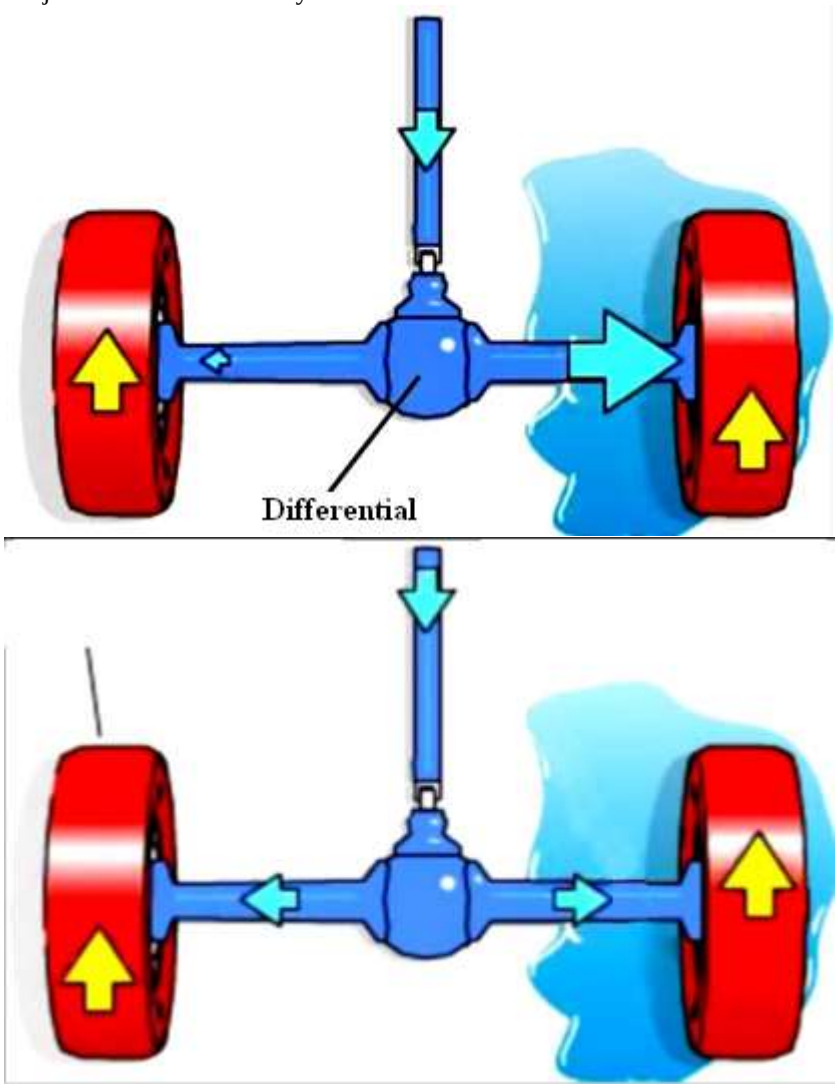

Figure 4. The process of distributing the traction force applied to the leading wheels of the ASR system

Discussion.

This system is one of the systems designed to improve the characteristics of the vehicle, aimed at preventing (reducing the likelihood of its occurrence), creating an active safety system for the structural safety of vehicles. Active safety occurs when the driver is able to change the nature of the movement of the vehicle (corresponding to the initial period of the accident).

Conclusion.

Therefore, the purpose of this system is to maintain the balance of the car, which serves to reduce and prevent road accidents caused by snow, rain and frost, as a result of which the active safety of the car is ensured.

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