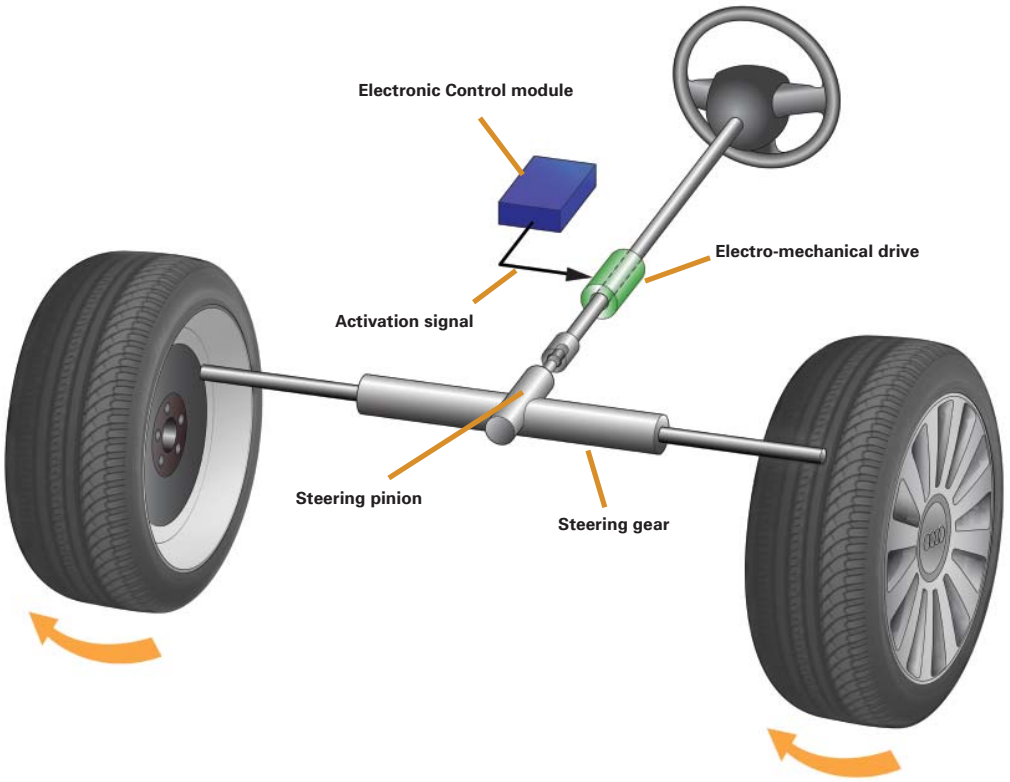
The variable characteristic curve is implemented by an additional electro-mechanical drive steering pinion, which is super-imposed on the driver's steering input.

In the event of a failure of this drive, the vehicle steering system functions exactly the same as a conventional steering system.



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However, the advantages of the dynamic steering system go far beyond that. Working in conjunction with the ESP system and associated sensors, the system also activates when critical driving situations are imminent.

The dynamic steering system assists the ESP at the dynamic stability limit through controlled adjustment of the front-wheel steering angle.

This has two key advantages. First, the overall stability of the vehicle is improved through simultaneous corrective braking and steering inputs. Active safety is significantly enhanced. This is especially true at speeds (greater than 60 mph [100 kph]), since at these speeds the dynamic steering system can take full advantage of its very quick reaction times.

The second advantage is that in less critical driving situations braking can be reduced or even eliminated, thereby allowing the vehicle to be stabilized more harmoniously and comfortably. By reducing the number of corrective braking inputs and relying more on corrective steering inputs, especially on road surfaces with a low friction coefficient (for example, snow covered roads) the vehicle moves with greater agility than a vehicle stabilized by braking only.

ESP utilizes the dynamic steering function in both oversteer and understeer situations, as well as under braking on road surfaces with different friction coefficients.

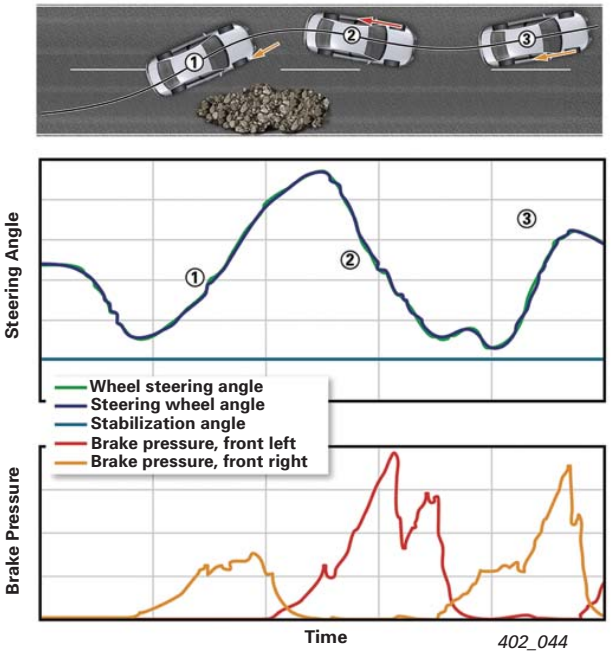
Oversteering vehicle

In an oversteer situation, ESP stabilizes the vehicle by integrating the dynamic steering system function. A controlled amount of counter-steer is automatically applied to prevent the rear of the vehicle from "fishtailing".

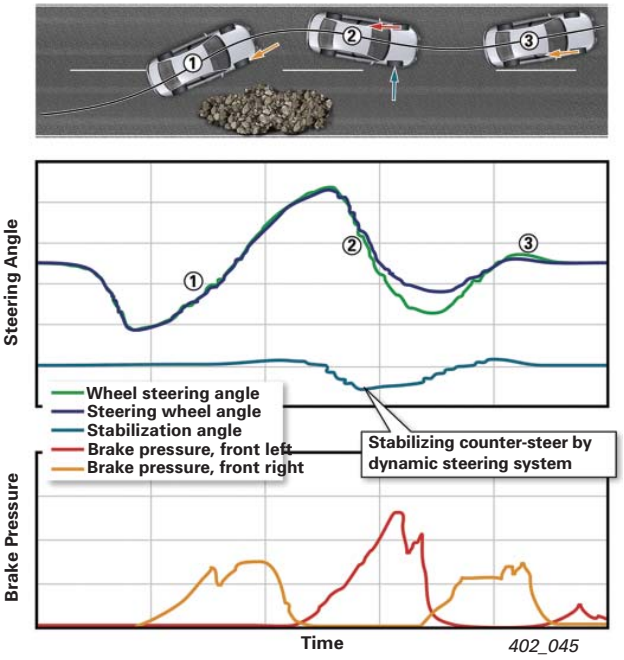
A typical situation which can easily cause the vehicle to oversteer is changing lanes quickly.

When steering back on the new lane, particularly at high speeds, the rear end may begin to slide sideways (fishtail). The driver is often too late applying the necessary counter-steer, or fails to do so at all.

Heavy corrective braking by the ESP system is the consequence.



Without Dynamic Steering



With Dynamic Steering

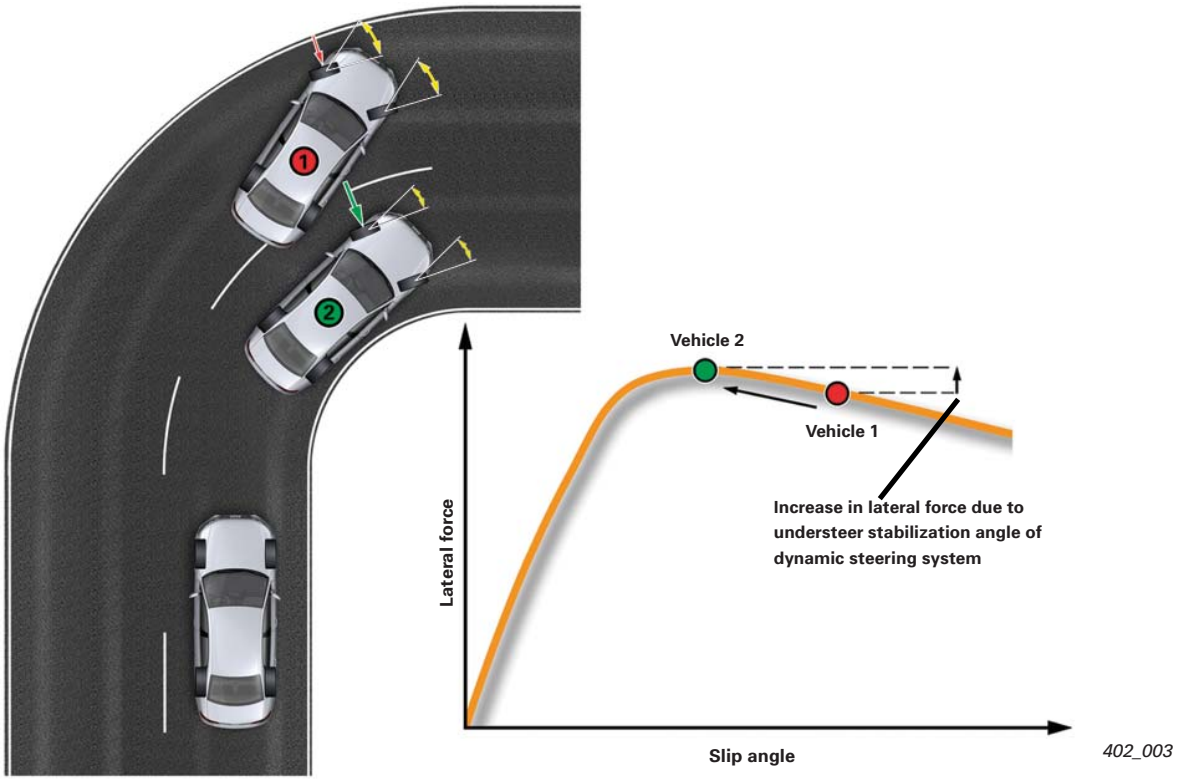
With the dynamic steering system, stabilizing counter-steer is applied automatically, without the driver noticing anything. This significantly reduces the steering effort required on the part of the driver. The driver need only apply the steering angle that would be necessary in a similar, stable driving situation.

There is also much less need for corrective braking by the ESP system. This translates to improved vehicle stability when changing lanes and higher lane-changing speeds.

Understeering vehicle

In an understeer situation, the vehicle veers towards the outside of the road when the front wheels are turned.

This driving state is characterised by decreasing lateral traction with increasing steering angle, with the result that the cornering radius becomes larger.



Most drivers react to this situation by applying more steering lock (vehicle 1). This reduces the available lateral friction between the tires and road surface. The static friction between the tires and road surface becomes sliding friction which causes the vehicle to lose control and leave the road. In this situation, corrective intervention by the ESP system will often be of no use.

The dynamic steering system takes corrective action before this happens. The dynamic steering system "counter-steers" the vehicle (vehicle 2). The actual angle which the wheels turn is less than the angle input by the driver via the steering wheel.

Lateral traction is preserved, and the vehicle travels along the shortest physically possible curve radius.

If this is insufficient, the ESP system applies corrective braking preferably to the wheels on the inside of the curve. Additional stabilizing counter-torque is produced around the vehicle's vertical axis.

The vehicle is thus braked and steered back onto the desired path.

Braking on road surfaces with different friction coefficients

It is possible for road surfaces to have both high and low friction coefficients simultaneously. For example, one side of the road may be dry asphalt while the other side is covered with water or ice.

This is the case, for example, when snow-covered or icy road surfaces are partially thawed or when wet leaves partially cover on an otherwise dry road.

Under braking, the vehicle "pulls" towards the side of the road with the higher friction coefficient where braking force is stronger.

To be able to maintain a straight line in a vehicle without dynamic steering, the driver must apply enough steering lock to compensate for the pull effect. In a vehicle with dynamic steering, the steering angle is automatically controlled by the ESP and dynamic steering systems. The driver does not notice anything and the steering wheel remains in the position corresponding to the desired direction of travel. Since ESP and dynamic steering are able to set the required steering angle more quickly and accurately than the driver, the additional use of dynamic steering in this driving situation provides, on average, shorter stopping distances than in vehicles without dynamic steering .