Active Kinematics Control by ZF Provides Steering Impulses from the Rear for Passenger Cars

- By flexibly modifying the toe angle at the rear axle, Active Kinematics Control (AKC) provides an intelligent steerable rear axle
- ZF innovation enhances safety as well as driving pleasure, and improves maneuvering comfort
- Two different AKC versions can be integrated into virtually any vehicle model – like in the new Audi Q7 and in various Porsche 911 models

If the rear wheels actively assist the front steering angle, a passenger car enjoys enhanced agility, stability, and comfort when changing direction. The steering movements of the rear trigger electronically controlled active track actuators – either one central actuator in the middle of the rear axle or two smaller actuators in the suspension of each rear wheel, depending on the specific vehicle requirement. This paves the way for new chassis technology options across virtually all passenger car segments and for disparate models – current models showcasing this technology include various Porsche 911 sports cars and the latest generation of the Audi Q7.

“It has been a major success for us that shortly after the market launch of AKC, two renowned premium manufacturers are already fitting our chassis innovation for passenger car rear axles as standard,” says Uwe Coßmann, Head of the ZF Car Chassis Technology division. “Decisive measured values from on-road testing and the Vehicle Dynamics International Award 2015 show that ZF’s rear-axle steering is an important system for enhancing passenger car agility, stability, and comfort.”

Limits redefined
Porsche installs ZF’s AKC ex works at present in its 911 Turbo models such as the 911 GT3 and 911 GT3 RS. Due to the tight installation space conditions – the engine sits flat and low between
the rear wheel suspension on the 911 models – Porsche opted for the AKC version with two actuators: One actuator is integrated directly in the left and right independent suspension respectively. These length-adjustable toe links replace the conventional rigid versions. Configured as a mechatronic plug-and-play system together with the control electronics, the system alters the toe angle as necessary while driving. Where necessary, even for each individual wheel in this dual actuator variant. The result is a rear steering angle of up to five degrees, which effectively assists the front wheels with all cornering tasks.

**Big, but nimble**
However, the AKC configuration with a central actuator proved the ideal solution for the new generation of the Audi Q7 in light of the vehicle, drive and axle concept: Here a single, hence slightly larger electromechanical actuator is used, which is located centrally between the rear wheels. The basic design focus also differs from the sports car configuration: “In the new Audi Q7, AKC is not primarily geared to new best lap times, but rather allows a large SUV to set new standards in terms of maneuverability and agility; without compromising on dynamic, safe top speed stability,” explains Coßmann. Anyone driving the four-wheel-drive vehicle, measuring around five meters in length, through crowded city centers or tight parking garages, for instance, finds life easier thanks to AKC. A closer look at the basic control strategy of the ZF innovation illustrates why.

**Intelligently helps steer**
At speeds below approximately 60 km/h, the ZF system turns the rear wheels in the opposite direction to the front steering, which is akin to virtually shortening the wheelbase. This substantially increases agility and maneuverability: Parking maneuvers – whether manually by the driver or using electronic aids – can usually be completed forward and backward in a single move, effortlessly and rapidly. The turning circle is reduced by up to 10 percent and even quick turning maneuvers can be negotiated effortlessly. Consequently, AKC substantially enhances comfort
across a wide range of segments in all vehicles fitted with the system.

AKC also comes into its own with regards to driving safety: “At higher speeds, in other words from around 60 km/h depending on the situation, the system steers the rear wheels in the same direction as the front wheels, thus improving directional stability as well as driving dynamics,” stresses Coßmann. Control systems such as ABS and ESP networked with AKC must therefore only intervene much later on, if at all, in certain situations. AKC likewise provides this stabilizing effect for μ-split braking maneuvers, in other words braking on road surfaces with varying grip on the left and right side.

These improved handling characteristics thus promote driving pleasure of agile, sporty cars – and all the more, the tighter and more frequently the turns come. AKC provides extremely fuel-efficient driving pleasure: The electromechanical track adjustment responds using the power-on-demand principle, thus only consuming energy when the actuators are actually operating.

The fact that AKC is a by-wire system, which can interact perfectly with other electronic driver assistance systems, is another compelling argument. The ability to master and drive forward these kinds of technologies is becoming increasingly important, not least as we move toward automated driving.

Complete and flexible down to the smallest angle
Automotive manufacturers benefit from the basic modular concept of the AKC system, which can be implemented, with relatively little effort, for many different passenger car applications as a customized version. Before the end of the year, ZF expects to see other vehicle manufacturers premiering the AKC application.
Captions:
1.) The AKC principle: The ZF system provides various responses depending on the road speed – to increase passenger car driving safety, comfort/convenience, maneuverability, and driving dynamics.
2.) The AKC system is used in the Porsche 911 Turbo models as a dual actuator version with one actuator for each side of the rear independent suspension.
3.) With the central actuator variant of the AKC system, the electromechanical track actuator is located in the center of the vehicle.

Photos: ZF, Porsche

Press contact:
Corina Dreher, Technology and Product Communications,
phone: +49 7541 77-8238, email: corina.dreher@zf.com

Thomas Wenzel, Head of Technology and Product Communications, phone: +49 7541 77-2543,
email: thomas.wenzel@zf.com