Press release

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thyssenkrupp presents developments in steering technology

- Electric steering systems set new standards for energy efficiency and handling
- Steer-by-wire systems open up new possibilities for vehicle architecture
- Hardware/software developments for chassis control for autonomous driving

Modern cars are digital platforms on wheels. As a chassis specialist, thyssenkrupp delivers products that are integral to the overall car system. In recent years the company has developed into a leading supplier of electric powered steering (EPS) systems.

Electric steering systems set new standards for energy efficiency and handling
By contrast with conventional hydraulic steering systems, in EPS systems the driver's steering movements are supported by an electric motor. This reduces fuel consumption as the electric motor is only activated when the driver actually needs it to help with steering. Compared with conventional hydraulic steering systems, in which oil pressure has to be maintained permanently to deliver the required oil flow, electric steering systems use less energy – saving up to half a liter of fuel for every one hundred kilometers driven. EPS systems also enhance driving safety, as they are an important prerequisite for electronic driver assistance systems such as park assist, lane assist and distance warning systems.

"The development of EPS systems is a highly customer- and model-specific process. The perfect interaction of hardware and software is key to providing the required drive dynamics and feel," says Kristof Polmans, head of development for thyssenkrupp's steering business. Electro-mechanical steering systems comprise more than 400 parts and almost 300,000 lines of software code. Today thyssenkrupp produces all common versions of this steering technology for customers in Europe, North America and Asia.

Steer-by-wire systems open up new possibilities for vehicle architecture
The next technological step for these electronic power steering systems is steer-by-wire. These systems have no mechanical link between the steering wheel and the wheels. Steering commands are transmitted electronically, like in airplanes. A sensor on the steering wheel senses the driver's steering movement and transmits it via a cable to a control unit and an electric motor which carries out the steering command. As there is no mechanical link, a feedback actuator simulates the feedback from the road and transmits it to the steering wheel for the driver.

Steering by data cable permits entirely new vehicle architectures. The elimination of mechanical components means OEMs have greater flexibility when designing the car interior. Steer-by-wire is suitable for all vehicle classes and will result in greater standardization and thus shorter development periods. For example, steer-by-wire means that different variants for left- and right-hand drive models are no longer so important for vehicle development and assembly. The omission of the steering shaft also enhances passive safety in the event of a crash.

“Steer-by-wire opens up a wealth of new opportunities when it comes to steering feel and vehicle response – but it also poses new challenges. Our steer-by-wire developments are focused on designing a natural steering feel and on error-tolerant and redundant safety functions. It’s essential that the car can still be maneuvered safely even if the electronic data transfer is interrupted or there is a partial system failure,” says Polmans.

That’s why thyssenkrupp’s steering specialists are working on secondary systems within the steering system, such as integrating a second steering motor. If one of the motors fails, the other ensures that steering is still possible. They are also developing fallback solutions outside the steering system. For example, the drive and brake systems of an electric car can be used to steer the front wheels by varying the amount of power or braking force applied to the individual wheels; in this way they can take over the steering function in an emergency and ensure the vehicle can be maneuvered safely.

Steer-by-wire systems will also provide greater comfort and allow new interior architectures in increasingly autonomous vehicles. When in the future the car switches to autopilot on longer drives, the lack of mechanical components in the steer-by-wire system means the steering wheel can be moved out of the way until it is needed again, providing additional space the driver can use for other things. For this purpose thyssenkrupp’s developers have designed a stowable steering wheel that allows the vehicle interior to be put to alternative uses.

Hardware/software developments for chassis control for autonomous driving
As part of the transition to autonomous driving thyssenkrupp is also developing new steering concepts. “We’re working intensively with the data captured by cameras and sensors. We are particularly interested in the interface at which information from the environment detection system is transmitted from the central control unit to the chassis, i.e. the steering system, brakes and dampers. This interface is our starting point for the development of integrated control systems to improve autonomous driving,” says Polmans.

The company’s chassis engineers have fitted various production vehicles with this control technology to test the interplay between the various chassis components in autonomous maneuvers such as lane changing, swerving to avoid obstacles and emergency braking.

"The increasing electrification and connectedness of cars and the move towards autonomous driving will have an impact on the interplay between powertrain and chassis systems. The intelligent integration and control of these systems will allow key functions of the car to be completely rethought. Using our experience in chassis and powertrain we want to work with our customers to play a key role in shaping this development," says Polmans.

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