



ZF drives the By-Wire Future of Mobility

- **ZF's vehicle motion control portfolio and systems expertise across braking, steering and active suspension uniquely positions the Group to realize fully automated by-wire vehicle control**
- **New by-wire steering system completes ZF by-wire suite and creates new level of design & engineering freedom**
- **ZF Group leads the way in steer-by-wire industrialization with multiple OEM awards in all major regions and production starting next year**

Friedrichshafen / Jeversen, Germany. As vehicles become increasingly electrified, automated, and software controlled, ZF is at the forefront of developing and industrializing advanced chassis systems with the industry's most comprehensive offering of by-wire technologies that no longer require a mechanical connection or system fluids. A primary example is ZF's steer-by-wire solution. ZF revealed that it has been awarded significant volume contracts by multiple major car manufacturers that will launch in all major regions as of 2023.

"ZF's smart by-wire systems end the era of mechanical connections and enable a new era of vehicle control," said ZF's CEO Wolf-Henning Scheider. "ZF's steer-by-wire technology enables new safety and comfort features, like autonomous emergency evasive maneuvers or parking in very confined spaces. It marks a breakthrough on the way to fully self-driving cars and trucks by adding new design and engineering freedom."

For example, ZF steer-by-wire systems enable fully autonomous vehicle control for shuttles and robotaxis. For personal passenger vehicles it also offers unique capabilities like retractable steering wheels for fully automated driving modes, fully adaptable steering control reducing the handwheel angle for parking or low-speed maneuvers and enhanced crash safety through the removal of the steering column. By-wire represents the perfect fit for future electric and automated vehicles.



PRESSE-INFORMATION
PRESS RELEASE

Page 2/4, July 20, 2022

ZF Group: leading the steer-by-wire transformation

Today, ZF premiered its advanced steer-by-wire system to international media and announced that this technology will be launched with industrial scale by a major global automaker within the next year.

And ZF has procured additional customer contracts in all major regions for its steer-by-wire systems for series production, establishing itself as a leader in this technology field. Similarly, on the braking side of the equation ZF is the global leader in the production of its Integrated Brake Control system that is also primarily controlled using by-wire technology.

Thanks to its complete portfolio, ZF is very well positioned to capture further significant market share in the growing by-wire chassis systems field and expects a significant share of the steer-by-wire market by 2030.

“ZF is actively shaping the clean and autonomous future of mobility by launching advanced suspension-, steer-, and brake-by-wire systems that will become more commonplace due to the many advantages they offer. And ZF’s software and high-performance computing platforms such as cubiX and the Vehicle Motion Domain Controller complete the picture and together create a new level of system performance. This is a perfect demonstration of how much ZF has changed into a tech company by understanding digitalization and decarbonization as opportunities for its development,” Mr. Scheider concluded.

Driving the by-wire future

ZF is a leading developer and produces a full range of by-wire systems that do not require a direct physical connection:

- Steer-by-wire including rear wheel steering
- Brake-by-wire with Integrated Brake Control
- Electronically controlled active suspension

These technologies are being combined to yield system solutions that offer enhancements greater than they can alone. Here software and



PRESSE-INFORMATION
PRESS RELEASE

Page 3/4, July 20, 2022

combined E/E architectures play a key role in adding value. By-wire systems offer greater degrees of vehicle control offering shorter stopping distances, more degrees of freedom in maneuvering, better stability at high speeds and greater range and efficiency.

With by-wire technologies the amount of steering assist or brake torque can be tuned to mimic the typical feel that drivers expect but can also be instantly adjusted to enhance brake force to reduce stopping distances or steer around an obstacle more expertly than drivers can do themselves.

ZF's brake-by-wire IBC braking system enables regenerative braking and energy recuperation that helps recharge the batteries of electric vehicles – highlighting how chassis and eDrives can work together to enhance motion control, extend range and offer more compact system packaging.

Captions:

1) Extensive by-wire portfolio by ZF

No mechanical connections, no system fluids: With its comprehensive by-wire technology portfolio, ZF takes a pioneering role in the development of modern chassis systems.

2) By-wire product range by ZF

As vehicles become increasingly electrified, automated, and software controlled, ZF is at the forefront of developing and industrializing advanced chassis systems with the industry's most comprehensive offering of by-wire technologies that no longer require a mechanical connection or system fluids. A primary example is ZF's steer-by-wire solution.

3) Front axle lateral dynamics with steer-by-wire

Steering system of the future: ZF's steer-by-wire technology ensures fully adaptable steering and for example, not only reduces the handwheel angle when parking, but also enhances crashworthiness through elimination of the steering column.

4) Transverse dynamics rear axle with steer-by-wire



PRESSE-INFORMATION
PRESS RELEASE

Page 4/4, July 20, 2022

ZF's active rear axle steering AKC (Active Kinematics Control) steers the rear wheels as well, thus reducing the vehicle's turning circle at low speeds and improving driving stability at higher speeds.

5) Longitudinal dynamics with brake-by-wire

More braking force, shorter braking distance depending on the driving situation, the brake-by-wire system with integrated brake control realizes comfortable, smooth deceleration and enhanced stopping power for automatic emergency braking and evasion assistants through the interaction of brakes, sensors and electronic control.

6) Vertical dynamics with sMOTION by-wire

Active damping eliminates the trade-off between stability and comfort, enabling new, future functions. The sMOTION by-Wire damping system adjusts the damping force precisely to the corresponding driving situation.

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About ZF

ZF is a global technology company supplying systems for passenger cars, commercial vehicles and industrial technology, enabling the next generation of mobility. ZF allows vehicles to see, think and act. In the four technology domains of Vehicle Motion Control, Integrated Safety, Automated Driving, and Electric Mobility, ZF offers comprehensive product and software solutions for established vehicle manufacturers and newly emerging transport and mobility service providers. ZF electrifies a wide range of vehicle types. With its products, the company contributes to reducing emissions, protecting the climate and enhancing safe mobility.

With some 157,500 employees worldwide, ZF reported sales of €38.3 billion in fiscal 2021. The company operates 188 production locations in 31 countries.

For further press information and photos, please visit: www.zf.com