ZF's sMOTION Fully Active Chassis System Enhances Driving Dynamics

- **sMOTION can eliminate most car body movement in passenger cars**
- **Intelligent individual actuator forces on each wheel help enhance safety and dynamics**
- **Fully active chassis system releases occupants from driving positions for autonomous driving**

Friedrichshafen. ZF's new fully active chassis system, sMOTION, can reduce unwanted car body movements caused by potholes, bumps or bends. With sMotion, the advantages of highly automated and autonomous driving can be realized – allowing vehicle occupants to work or relax mostly undisturbed while travelling. In addition to increasing comfort, sMOTION can help to enhance handling and safety. An intelligent actuator actively controls individual wheels, capable of adapting suspension movement for each traveling situation and road condition. sMOTION also offers vehicle manufacturers modular scalability as well as component dimensions and interfaces, making it easy to tailor and integrate the system into vehicle designs.

"When it comes to the development of highly automated and autonomous driving, the chassis plays a key role," says Dr. Holger Klein, head of the Car Chassis Technology Division at ZF. "By the time the autopilot takes over the wheel, all passengers want to be completely relaxed and unaware of the vehicle's movement, regardless of what is happening on the road. Our sMOTION fully active chassis system can help fulfil this desire."

Floating along

As every passenger knows, if your attention is not on the road, you are much more aware of car body movements - causing motion sickness in some people. Eliminating this movement represents an enormous

ZF Friedrichshafen AG
Global Corporate &
Marketing Communications
D-88038 Friedrichshafen
Germany

challenge to the ideas of mobile offices or lounges. After enhancements to safety, these are considered to be key drivers for autonomous driving.

With ZF 's intelligent sMOTION shock absorbers, it is possible to eliminate nearly all annoying motion and vibration from the roadway surface. "Passengers have the sensation of floating over bumps and hollows," says Dr. Klein. ZF's innovation not only eliminates shocks caused by large potholes or unevenness but is equally effective against the pitching forward or back during deceleration and acceleration or the rolling and tilting when cornering or changing lanes.

Bouncing movement under control

The sMOTION chassis system features a very compact, external electric-motor pump unit with integrated electronics, which works as a bi-directional actuator on each wheel. This actuator can actively raise and lower the piston rod on each wheel individually - a function that is unique in today's market. This ZF technology enables improved control over all low-frequency car body movement: When cornering, for example, the two inner wheels can be retracted and the outer ones extended enabling the car to remain virtually horizontal. The same applies to long stretches of road bumps – which have different characteristics on the left and right or occur only on one side.

Networked with environmental sensors such as cameras, the sMOTION system can even detect road conditions in advance, such as potholes, and prepare the actuators (predictive control): When travelling over the detected road depression, this innovative technology actively keeps the affected wheel at the height of the road surface instead of allowing it to drop, as would be the case with a conventional shock absorber. sMOTION also features dynamic ground clearance for each specific axle or side as well as for the entire undercarriage. sMOTION also showcases a second unique technology: a separate hydraulic control path. This feature compensates for higher-frequency bumps caused by minor unevenness in the road surface, such as manhole covers, transverse joints, rough asphalt or gravel.

ZF Friedrichshafen AG
Global Corporate &
Marketing Communications
D-88038 Friedrichshafen
Germany

sMotion builds on the company's Continuous Damping Control (CDC) technology with independent compression and rebound staging. This technology is designed to actively and continuously vary the characteristic compromise between hard (stability-oriented and dynamic) and soft (comfort-oriented) ride and handling.

The shock absorber unit as a networking and warning tool

The innovative spirit of sMOTION is also prominent in terms of sensor technology and networking. Vertical dynamic data can be recorded either directly within the actuator units or via sensors in the vehicle. This information comes together in a central control unit that controls the actuators. The integrated electronics of the actuator, serve to activate the electric motor, pump and CDC to produce the least amount of body movement possible.

Transferred to the cloud, the shock absorber data can be used to inform vehicles following behind, or enable infrastructure warnings about dangerous road surface damage. In addition, sMOTION is designed for networking via ZF's cubiX system, an integrating, modular and scalable control algorithm that coordinates all active and semi-active actuators in the car. This means sMOTION can operate in conjunction with ZF's electric power steering, integrated brake control (IBC), rear axle steering (AKC) and the electric axle drive system (eVD).

Captions:

1.) As if potholes had simply disappeared: ZF's new fully active chassis system, sMOTION, can eliminate most road disturbances required for fully automated and autonomous driving.
2.) For improved longitudinal and transverse dynamic comfort, safety and agility: ZF's sMOTION enables cars to actively raise and lower each wheel, virtually eliminating the impact of even major road unevenness on the occupants.
3.) Intelligent networking: sMOTION accomplishes integration with advanced vehicle systems and functions, such as braking, steering and predictive damping

ZF Friedrichshafen AG
Global Corporate &
Marketing Communications
D-88038 Friedrichshafen
Germany

4.) Modular as well as tried-and-tested: ZF implements sMOTION as a scalable modular system based on the innovative development of the company's established CDC damping system.

Images: ZF

Press contact:
Jennifer Kallweit, Technology and Product Communications,
tel.: +49 7541 77-969441, e-mail: jennifer.kallweit@zf.com

Robert Buchmeier, head of Technology and Product Communications,
tel.: +49 7541 77-2488, e-mail: robert.buchmeier@zf.com

ZF Friedrichshafen AG
ZF is a global leader in driveline and chassis technology as well as active and passive safety technology. The company has a global workforce of 146,000 with approximately 230 locations in some 40 countries. In 2017, ZF achieved sales of €36.4 billion. ZF is one of the largest automotive suppliers worldwide.

ZF allows vehicles to see, think and act. The company invests more than six percent of its sales in research and development annually – in particular for the development of efficient and electric drivelines and also in striving for a world without accidents. With its broad portfolio, ZF is advancing mobility and services in the automobile, truck and industrial technology sectors.

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