



Office on Wheels: ZF's Active Cabin Suspension and Enhanced Cabin Damping Improve Driver's Cab Comfort

- **ZF technology supports autonomous driving functions in commercial vehicles: transforming a truck driver's cab to function as an office on wheels**
- **ZF's active cabin suspension cCAB improves comfort in the driver's cab through an optimal balance between roll and pitch behavior**
- **Enhanced eCALM system enhances cabin suspension and damping**

Friedrichshafen. The more common autonomous driving functions become in commercial vehicles, the more change that will be seen in the way a driver's cab is used. One example is as an office on wheels: A mobile workstation where the driver performs other activities while the truck is in autonomous driving mode. This will require more efficient comfort systems, which is where ZF's new active cabin suspension system cCAB comes in. It balances the roll and pitch behavior of the vehicle as well as the upward and downward movement of the cabin. cCAB also creates outstanding work conditions for the drivers when the commercial vehicle is being driven manually. In addition, ZF's electronically controlled, pneumatic cabin suspension system eCALM makes the cabin more comfortable.

Good working conditions in commercial vehicles are not a luxury, they are a requirement for getting the driver, vehicle and goods to their destination safely. This applies especially to autonomous vehicles because the driver is no longer actively following what is happening on the road and may be surprised by sudden external influences on the vehicle.



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As a solution, ZF has developed the cCAB, the innovative active cabin suspension system. Cabin suspensions are usually passive systems that react to external influences, such as changes in road conditions, by absorbing and damping movements with springs. In contrast, ZF's electronically controlled active cCAB system can actively adjust the cabin, anticipating undesired movements and preemptively working against them. A special control unit which receives signals regarding the state of motion from the sensors calculates the respective optimal states within split seconds. It controls the four cCAB modules which optimize the cabin motion sequences.

ZF systematically enhanced the cCAB based on the company's successful CDC and CALM systems and added an electrohydraulic actuator. When cCAB is installed on the cabin's four bearing points, it is able to actively rotate the cabin around the longitudinal and transverse axis as required, to move it along the vertical axis and to dampen it simultaneously. The result is maximum ride comfort for the office on wheels, which enables the driver to do office work in the cab.

eCALM offers comfort and saves energy

ZF's successful Cabin Air Leveling Module, or CALM, also plays an important role as it combines the benefits of a hydraulic vibration damper with coaxially arranged air springs and an integrated, load-dependent height leveling system. ZF has now further enhanced the system. The new electronically controlled eCALM reduces air and consequently energy consumption in the pneumatic cabin suspension system, which saves considerable energy in the vehicle itself. This means that the entire air system (compressor, accumulator, drier) can be designed to be smaller and lighter in weight. The compressor can also be operated electrically by integrating it into the eCALM system, which means it actuates when needed.

eCALM comes with additional new features such as leveling, lowering and raising the cabin to different levels. Working together with its customers, ZF has raised the bar when it comes to effectively controlling cabin movements. eCALM, combined with ZF's semi-active



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CDC damper system, provides an ideal basis for maximum drive comfort in the office on wheels.

Captions:

- 1) The active cabin suspension system eCAB: ZF's electronically controlled system can actively move the cabin and preemptively prevent undesired movements.
- 2) When eCAB is installed on the cabin's four bearing points, it is able to actively rotate the cabin around the longitudinal and transverse axis as required, to move it along the vertical axis and to dampen it simultaneously.
- 3) The new electronically controlled eCALM reduces air and consequently energy consumption in the pneumatic cabin suspension system, which saves considerable energy in the vehicle itself.

Photos: ZF

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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



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its broad portfolio, ZF is advancing mobility and services in the automobile, truck and industrial technology sectors.

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