CDC from ZF – Continuous Damping Control for all Vehicles

- Refined concept with integrated sensors reduces number of components and assembly work
- Controlled damping system offer more driving comfort, safety and dynamics
- Approximately 18 million CDC dampers produced since 1994
- Rear axle CDC specially designed for subcompact cars and vans
- With motorcycles, CDC provides for more agility without reducing comfort

ZF Friedrichshafen AG has further optimized and extended its well-established electronic damping portfolio, the Continuous Damping Control (CDC): In the fourth generation, sensors have been integrated into the control unit. For the special requirements of subcompact cars and vans, the supplier has developed a pure rear axle system (CDC 1XL, i.e. "One Axle").

In comparison to both standard dampers and engageable systems on the market, which only permit fixed predefined settings, the CDC offers clear advantages: ZF technology provides uninterrupted adjustment of suspension damping to the respective driving situation in real time—smoothly, accurately and for each individual wheel. Thus, the CDC resolves the conflict of aims between comfortable-soft and dynamic-firm chassis tuning. This adjustment is made according to what is known as the "Advanced Skyhook" strategy. Its aim is to keep the vehicle body as stable as possible irrespective of the driving and road conditions, as if the vehicle were running along a track parallel to the sky.

Damping comfort of the fourth generation
In the CDC, sensors record data regarding road condition, vehicle speed, and driver's actions, and pass them on to the control unit. From this data, the electronics calculate the damping force...
necessary for the respective driving situation in fractions of a second. An electromagnetically regulated proportional valve in the damper adjusts this damping individually for each wheel. For example, the dampers facing the bend become rigid when cornering in order to minimize the roll; when braking, the front axle damping firms up and reduces undesirable pitching. And the driver can also choose between comfortable or sporty chassis tuning. The optimal damping of the CDC makes driving not only more comfortable and dynamic, but also safer: The extra stability is particularly noticeable when carrying out sudden evasive maneuvers or when the vehicle is fully loaded.

ZF has further enhanced the design of the CDC in its fourth generation: It used to be necessary to fit acceleration sensors to the vehicle chassis to record body movements. ZF has now integrated these directly into the control unit. The simplified system design reduces the number of components, weight, assembly work and installation space requirements of the CDC system. In particular, the wiring effort for the OEM is considerably smaller, and this makes using CDC technology even more cost-effective. Integration of the individual sensors into a cluster is further proof of ZF’s electronics expertise in chassis technology.

**CDC for all vehicle segments**

The ZF CDC was originally predominantly found in upper range vehicle categories, but now it has also become established in passenger cars in the middle and compact car range. Recently, ZF has also been targeting the price-sensitive subcompact car models, as well as vans, as active damping can offer significant advantages here: Passenger cars in this segment have a shorter wheelbase and a high payload compared to the empty weight. As a result, there can sometimes be extreme fluctuations in axle loads: If only the driver is in the vehicle, there is considerably more weight on the front axle. When fully loaded, this distribution in the subcompact car changes significantly and the rear axle carries up to two thirds of the load. Conventional, passive rear axle dampers constantly require compromises because the design is always focused on
driving safety (hard damping), which has a negative impact on comfort. This is where ZF's CDC 1XL comes into play: As an active damping system, it minimizes the effects of these strong variations of the rear axle load and, additionally, improves driving dynamics and comfort. It uses ZF's well-known and established damping technology—as well as the system design with an integrated sensor cluster as mentioned previously.

CDC also provides greater safety and driving dynamics for two-wheeled vehicles. For the first time, ZF is equipping motorcycles with the active damper system as well. Top of the range models from several manufacturers—including the Multistrada S models from Ducati—make the ride over uneven road surfaces even smoother. Features like the direct responsiveness of the suspension elements or accurate suspension feedback have been enabled by using CDC. The special tuning provided by the electronics in the CDC control unit balances out the highly dynamic changes in wheel load that are characteristic of motorcycles when braking and accelerating, and thereby ensures comfort at all times when cornering.

Thanks to ZF's systems expertise and its many years of experience in the field of regulated damping systems, the company is able to make use of the synergies between the automotive sector and motorcycle applications. Support from ZF Race Engineering for both segments rounds off ZF's competence and service portfolio in the field of regulated damping systems.

On the road in the millions
ZF's electronic damping has been winning over vehicle manufacturers since its market launch in 1994—and is still doing so with its fourth generation. The continuing increase in CDC production figures illustrates this; 2011 marked the temporary record high with more than 2.2 million dampers produced for Alpina, Audi, Bentley, BMW, Ferrari, Maserati, Opel, Rolls-Royce, Mercedes-Benz, Porsche and Volkswagen. About 18 million CDC systems have already come off the production line at ZF and
consistent expansion of the range has played a major role in this success. ZF expects an annual production of more than three million CDC units for passenger car applications by 2016. This does not include ZF systems for buses, trucks, agricultural machines and motorcycles.

Captions:
1.) ZF’s Continuous Damping Control (CDC) smoothly and accurately adapts chassis damping to the prevailing driving conditions resulting in increased comfort, driving safety and dynamics.
2.) With subcompact cars, the rear axle load varies. CDC 1XL avoids the conflict between lacking comfort (hard damping when the vehicle is empty) and unsafe handling (soft damping when fully loaded).
3.) With CDC 1XL (CDC One Axle), the adaptive dampers are only fitted to the rear axle. A control unit calculates the ideal damping stiffness for the driving situation in real time.
4.) The CDC in motorcycles resolves the typical conflict of aims between ride comfort and driving stability, it reduces the dynamic changes in wheel load, and provides for more driving stability when braking and accelerating.

Photos: ZF

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ZF is a worldwide leading technology company in driveline and chassis technology with 122 production companies in 26 countries. In 2014, the Group will presumably achieve a sales figure of more than €18 billion with about 72,000 employees. In order to continue to be successful with innovative products, ZF annually invests about 5 percent of its sales (2014: around €890 million) in research and development. ZF is one of the ten largest automotive suppliers worldwide.

In 2015, the company will celebrate its centennial. Originally named Zahnradfabrik GmbH, ZF was founded in Friedrichshafen in 1915 by Luftschiffbau Zeppelin GmbH among others. In its early years, the company developed, tested and manufactured aircraft transmissions. After 1919, the company's focus shifted to the automotive and commercial vehicle industry under Alfred Graf von Soden-Fraunhofen, the first general manager and later head of the company. In this sector, the company registered numerous patents for innovative transmission technology and established itself once and for all as a major technology supplier. ZF grew outside of Europe in 1958 with a location in Brazil, launching a globalization drive that still continues. In addition, through product innovations and acquisitions, ZF constantly expanded its range of expertise. In 1984, ZF acquired the majority share in Lemförder Metallwaren & Co. KG, a move that extended the product portfolio to include chassis technology. In 2001, ZF took over the former Mannesmann Sachs AG to strengthen its value added product offering with driveline and chassis components. It adopted the current name of ZF Friedrichshafen AG in 1992. Today’s product range includes driveline and chassis technology such as transmissions, driveline and chassis components, as well as complete axle systems and modules. ZF products are used in passenger cars, commercial vehicles, construction and agricultural machinery, rail vehicles and marine applications. The company also focuses on the wind power and electronic components business. In addition, ZF Services represents the company on the international aftermarket. In 2014, ZF announced its intention to acquire U.S. automotive supplier TRW.

The shareholders of ZF Friedrichshafen AG are the Zeppelin Foundation, administered by the City of Friedrichshafen, holding a share of 93.8 percent, and the Dr. Jürgen and Irmgard Ulderup Foundation, Lemförde, with 6.2 percent. "Motion and Mobility," ZF’s tagline, clearly states the company’s core mission: Right from its foundation, ZF has developed and manufactured innovative products for all people around the globe who want to move things reliably, comfortably and safely all while experiencing the ultimate in efficient mobility. Quality, technological leadership and innovative power have always defined the company’s identity – today as much as ever.

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