

# Semi-active roll control

**BWI Group** has further developed the active roll-control system by combining a second-generation rotary actuator with a unique hydraulic system, allowing the stabiliser bar to be connected for on-road use, or disconnected for off-road use



Active roll-control (ARC) systems, implemented to improve vehicle ride comfort and increase wheel articulation while simultaneously providing vehicle roll stiffness and lateral support while cornering, have long been used by automotive manufacturers on their cars, trucks and SUVs. BWI Group has a long history with these systems, developing and manufacturing hydraulic ARC systems in both linear and rotary actuator packages for more than two decades.

For many years, engineers tasked with delivering on-road passenger vehicles with high or very high levels of off-road capability have been searching for ways to avoid the trade-offs associated with stabiliser bars. Indeed, a stiff stabiliser bar will be beneficial to on-road handling, but detrimental to suspension articulation, limiting wheel travel and reducing traction during off-road operation. Conversely, a soft stabiliser bar will allow large wheel displacements, maintaining good tyre-to-ground contact while off-roading, but it could lead to poor on-road handling with insufficient roll stiffness.

In order to minimise or avoid that trade-off, many different concepts have

been developed around mechanisms that allow a vehicle's stabiliser bars to connect or disconnect, either splitting the bar and adding an actuator in the middle, or devising some means to connect/disconnect the stabiliser bar end links. In principle, the design of such a device appears to be quite simple, but issues related to cost, mass and mechanisation have always been challenging.

BWI Group's engineers found a clever self-contained solution to this challenge. From the foundations set with ARC, they have combined a second-generation rotary actuator with a unique hydraulic system, a setup that allows the stabiliser bar to be either connected for on-road use, or disconnected for off-road use. This ingenious setup uses a combination of two solenoid valves and passive valve elements, as well as two pressure sensors installed onto the hydraulic rotary actuator. The result is compact packaging without the need for any pipework running underneath the car. The hydraulic 'latch/de-latch' stabiliser bar unit is controlled by an ECU, which commands the actuator to connect or disconnect the roll bar, based on driver demands or specific vehicle drive modes.

The main advantage of this device is

**ABOVE:** BWI Group's semi-active roll-control system enables the stabiliser bar to be connected for on-road use, or disconnected for off-road use

that the hydraulic and mechanical design ensures the bar will re-connect centred, even if the wheels are not levelled due to an uneven road surface. The system can allow the bar to be disconnected, even if high torque is present in the roll bar. This is particularly advantageous and allows the driver to de-latch the bar in difficult off-road situations.

When the actuator and roll bar are disconnected, the system provides roll damping, which leads to improved ride comfort and more composed roll movement over rough terrain. On such terrain, because the system relies on a hydraulic lock mechanism, the unit is impervious to failures caused by dirt intrusion. Extensive validation has demonstrated that durability, and BWI's robustness targets were achieved.

A further advantage is that, because the system is self-contained and does not require an external pump, power consumption is minimal.

This semi-active roll-control system represents a viable solution to OEMs who are looking at improving the on-road / off-road trade-off of their vehicles. 

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