

F2010-B-043

INNOVATIVE SUSPENSION WITH WHEEL-GUIDING TRANSVERSE LEAF SPRING

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KEYWORDS – suspension, glass-fiber reinforced plastics (GFRP), leaf spring, integration of functions

ABSTRACT

Tightened cost targets and increased requirements for handling and ride comfort were initial reasons for creating a new and innovative suspension concept for compact class vehicles with a higher degree of integrated functionality. An attractive concept with a wheel-guiding transverse leaf spring was developed based on the availability of new materials and a thorough analysis of existing suspension systems.

Functional integration is accomplished through a novel wheel-guiding leaf spring made of glass-fiber reinforced plastic (GFRP) that performs typical wheel control, spring and anti-roll functions. The leaf spring replaces an anti-roll bar with mounts, two anti-roll bar links, two control arms and two conventional coil springs, respectively. By specific design of the leaf spring cross-section and placement of the mounts, required properties such as precise wheel control and desired parallel and opposite spring rates can be met.

A hybrid multi-body model (i. e. a multi-body model with integrated finite element components) was developed to investigate kinematics, elasto-kinematics, load cases and full vehicle characteristics. Special care was taken with the non-linear finite element implementation of the composite leaf spring because of the elasto-kinematic effects of this part.

Parallel to the simulations, the concept was designed as a digital mock-up for packaging and clearance analysis. All components were optimized with regard to stiffness and strength and with consideration to manufacture it as well as to reduce costs.

After successful design completion, the rear suspension was prototyped and prepared for physical testing on a kinematics and compliance (K&C) test rig to validate the suspension targets. Subsequent to the K&C test, durability and vehicle driving tests are also performed to judge the potential of this innovative suspension system.

This concept fulfils the pegged requirements and demonstrates additional advantages, such as

- Economic efficiency facilitated by the integration of functionality based on substitution of parts
- Weight reduction through functional integration and innovative materials
- Optimized packaging as a result of part reduction
- Higher damping achieved by the use of composite leaf spring versus steel leaf spring