Active Chassis System for Better Driving Dynamics and Enhanced Small Overlap Crash Performance

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Oliver Deisser, Michael Schaeffer, Marco Muenster, DLR – Institute of vehicle concepts, Germany

1. The difficulties of a sustainable body design for a full electric vehicle

1.1 Motivation: Lightweight Design is still important

1.2. New mass distribution & package situation for electric vehicles
- 250kg additional weight in the floor for battery
- Frontal structure without motor results in less stiffness

1.3. Current regulations and lack of crash compatibility in reality

1.4. Principle of deflection and existing solutions

2. The new suspension concept of the NGC-UMV

2.1. Next Generation Car - Urban Modular Vehicle

a. Space model for topology optimization
b. Topology optimization for global load path finding
c. Final body in white

2.2. The orbital wheel concept

2.3. Active two axis independent steering system

Advantages of wheel independent steering:
- Reduced energy consumption
- Better driving performance
- High active safety potential
Potential of integration of a simple camber actuator; thus:
- Better grip
- Enhanced cornering stability

2.4. GFRP transverse leaf spring and final chassis

Advantages of a GFRP leaf spring:
- More durable, due to higher fatigue strength than steel
- Possibility to change kinematics by change of fiber layup
- Weight reduction
- Function integration

Final chassis:
- Easy activation of individual toe and camber angle possible

2.5. Activation of the system for enhanced crash performance

Need for sensors:
- Prediction if crash is inevitable for sufficient protection
- Today sensors are sufficient
- 0.5s detection is advance is enough for turning the wheel to use it as a shield

2.6. The wheel as deflection shield is enough for an improvement in passive safety

3. Conclusion and outlook

- New crash test scenarios like the IIHS small overlap crash test and new all electric vehicle concepts demand new safety solutions
- NGC-UMV suspension concept with its two axis steering system is a promising answer
- Proved feasibility by first static and dynamic simulations
- Next steps are to dimension the needed torsion moments of the two axis steering system, to detail the concept and to design the transverse leaf spring

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