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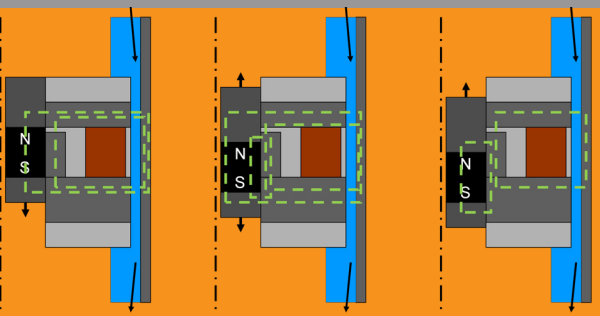

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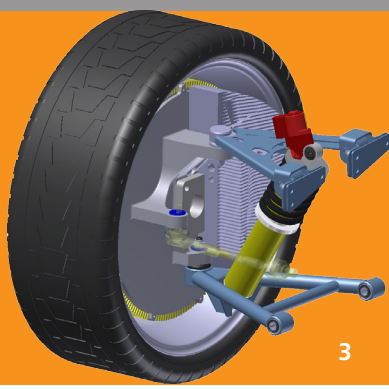
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1 *principle of the overlaid magnetic circuits*
2 *hybrid magnetorheological damper*
3 *CAD-model of the integrated damper*

HYBRID MAGNETORHEOLOGICAL DAMPER

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Fraunhofer LBF developed an energy efficient magnetorheological damper. An adjustable field generated by a physically moveable permanent magnet is superposed by a second field generated by a solenoid coil.

Magnetorheological fluids (mr-fluids) are suspensions of ferromagnetic particles in a nonmagnetic carrier fluid. If subjected to a magnetic field, the transferable shear stress correlates with the applied magnetic flux.

The hybrid magnetorheological damper uses this effect to adapt the damper stiffness to the actual boundary conditions. The stronger the magnetic flied, the higher the damping force. Possible applications are vehicles with wheel hub motors. With the integration of these motors into the chassis there is an increase of unsprung masses. The resulting exacerbated conflict between safety and comfort can be minimized with an adaptive damping force.

A new design of these magnetorheological dampers was developed at the Fraunhofer LBF. The magnetic field in the fluid gap is adjustable by current of a solenoid coil as well as the position of a permanent magnet (see Fig. 1). One benefit of using a permanent magnet is that energy is only needed for moving the permanent magnet and not for generating a magnetic field. For this reason this new damper concept is a promising alternative to standard dampers as well as to other adaptive damper systems for electrically powered cars.

For adjusting the damping force for slow changing boundary conditions (e.g. loading condition) mainly the moveable permanent magnet is used and for fast changing boundary conditions (e.g. at quick evasion manoeuvres) the solenoid coil is used.

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