Lightweight Design By Functional Integration Using Magnesium Castings

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The history of terrestrial transport systems on the road has always been influenced by material-related developments. These developments gave rise to various construction methods, taking into account the different requirements that transport systems had to fulfil and provides new approaches. A major motivation for the development of new vehicle structures apart from the reduction of fuel consumption is to decrease emissions which affect the climate. The urgency of the CO_2 problem will result in alternative power trains also establishing themselves on the market, in turn giving rise to new requirements and possibilities in the field of vehicle construction over and above the established light weight design.

Two research examples illustrate new possibilities of light weight design. One example is an innovative and cost attractive magnesium A-pillar solution. By using the topology optimisation a new design idea for the A-pillar area was found. This new design concept offers the possibility to integrate additional functions. The new design shows expedient crash behaviour. A developed solution has a weight benefit of more than 50% compared to a steel reference structure. Because of its functional integration the magnesium part is very cost attractive. The second example will be the lightweight concept of the front module developed by the Institute of Vehicle Concepts (DLR) in the European research project SuperLIGHT-CAR (SLC). By using aluminium in the front structure and a high pressure magnesium die-casting strut tower, the concept has a weight benefit of 32 % compared to a steel reference structure. The methodology for reaching targets and requirements such as weight reduction, crash performance and cost targets will be explained.