Highly-integrative Lightweight Car Body Concept

The car body concept “Functional high integration”, developed within the scope of the joint project of the Volkswagen AG Group Research and the Technical University of Braunschweig, describes a cost-effective integrative lightweight car body. In this paper the approach for laying the new car body structure concerning its stiffness will be explained, along with presenting the component and function integration on the basis of the floor pan components.
1 Introduction

In the automobile industry increasing demands on the vehicle as a whole concerning safety, comfort, driving performance and environment-friendliness lead more and more to goal conflicts which cannot be solved with conventional car body concepts in an economical way. In addition to that, the customer seeks individuality and diversification which leads to an increasing line of models and car bodies. Along with a stagnant number of models sold this also results in a decreasing number of sold car bodies per model. The investment per model, for pressing tools for instance, remains on the same level independently from the number of lots. This results in a demand for new car body concepts for small and medium-sized series with comparatively low investment and production costs in order to also economically cover versions with lower lots as well. This calls for ways of construction and material concepts which are at least self-financing in spite of higher material costs and a lower number of sold lots by reducing expenses of facilities and resources.

Based on this the project “Fascination car body construction” was initiated by the company research of the Volkswagen AG in cooperation with the TU Braunschweig. Within the scope of this project, two new car body concepts for passenger cars were developed. The idea for the following concept of “Functional high integration” was to develop a cost-effective integrative lightweight car body.

2 Introducing the Concept of “Functional High Integration”

The concept of “Functional high integration” describes a car body construction mainly based on extruded aluminium sheaths and large brass components featuring component and functional integration in the area of supporting structural components.

Compared with conventional ways of construction, this structure consists of a heavily reduced number of components. In combination with an optimised force transmission along with a manufacturing method chosen accordingly, this approach results in a weight reduction as well.

Figure 1 shows first ideas for function integration.

The goals compared with a standard car body are:
- Reducing weight of floor modules with function and component integration by approx. 15%
- Reducing the number of components needed for the floor module by at least 40% (number of parts < 50)
- Reducing costs for the floor module in spite of switching from steel to aluminium (savings done through a simplified manufacturing method of the supporting structure)
- Getting the same mechanical characteristics (stiffness, crash performance) as a comparable standard car has made with a steel shell construction by cleverly arranging the components and a support orientated design

Especially extruded aluminium profiles, compared with deep-drawing components, feature relatively low tool costs being one or two scales below the costs of pressing tools.

Apart from the reduced investments the number of manufacture and mounting operations are to be cut down through a consequent function integration (and the component reduction connected with it) which also results in saving costs. Especially when constructing car bodies the chosen concept can significantly cut down the number of geometry and welding points.

Figure 2 shows the breakdown of the car body concept into the segments of...