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Abschätzung des aerodynamischen Verhaltens in der konzeptionellen Fahrzeugentwicklung

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Abstract:

In the last years the limitation of resources and rising environmental pollution at the same time caused a rethinking in society. Careful handling of raw materials gets more and more important. These circumstances in combination with more severe legislative boundary conditions have big influences on the automotive industry. The acceptance of vehicles with high fuel consumption decreases from year to year. ?Green? vehicles driven by alternative propulsion concepts reach increased market penetrations. Among other measures, the potential of aerodynamics has to be tapped to reduce the fuel consumption and the emissions of vehicles. Therefore detailed aerodynamic investigations are necessary already in the concept phase.
In the course of the present diploma thesis the process of conceptual aerodynamics development has been investigated concerning its possibilities for improvement. The results of this analysis were used as a basis for the formulation of an optimized, integrated process. In this way, suggestions have been developed, which make an efficient preparation of styling surfaces in a computer based engineering software (3D-CAD) possible. Furthermore, a parametric-associative 3D-CAD vehicle model has been developed, which allows the integration of prepared styling surfaces into full-vehicle models. For this purpose two methods for the creation of variable vehicle underbodies have been developed. In addition parametric suspension- and wheel models have been defined. A parametric motor compartment supports the creation of calculation models for the flow-through-simulation. The export of geometries from the 3D-CAD-environment as well as the import into Computational Fluid Dynamics (CFD)-programs have been investigated too. The implementation of a specific set of parameters and settings in the CFD-model with the target to achieve a considerable optimization of the calculation model leads to a reduction of the computing time of the CFD calculation. Moreover, macros for a partially automation of different sequences of work in the CFD-program have been prepared.
Besides the calculation of drag coefficients of new vehicle concepts, the presented methods enable the assessment and evaluation of ascertain trend statements regarding vehicles lift values and factors, which characterize the flow behavior in the motor compartment and the cooling system. In this way, the design tool which was developed in the present diploma thesis is able to support an efficient aerodynamic development, especially in the early phases.

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