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## Exposee

for the Dissertation by Dipl.-Ing. Andreas Wagner from Günzburg, Germany

### **„A Method to Predict and Evaluate the Driver's Response under Side Wind Conditions“**

In his Dissertation Mr. Wagner has successfully treated a classical topic of automotive engineering. The car's behaviour under side wind conditions embraces both comfort aspects and safety considerations as was already known for quite a while. However, until now neither academia nor industrial practise was able to connect these two facets in such a way that the driver's subjective impression and rating can be derived from measurements or simulations of physical figures. This may be attributed to the fact that this field of engineering is difficult to allocate to industrial development practise, which - even today – still follows the logic of parts and components. Whereas driving dynamics is mainly associated to chassis and suspension development, aerodynamics is often related to body development or entire car development. A real responsibility for driving performance under side wind conditions often doesn't exist, as I learned from my own industrial practise. If a side-wind problem occurs, it only becomes evident during the prototype stage, not before. But then, efficient countermeasures are obviously excluded or at least very difficult to implement, as some cars revealed throughout the last years. Or, in contrast, they are improved on the expense of other car characteristics.

It is Mr. Wagner's merit not to have hesitated to approach such a very complex task that started as an internal IVK-Project without any external funding. Before he joined IVK, he graduated with excellence from the University of Applied Sciences (Fachhochschule) in Ulm. Due to his performance he was selected to participate in a special doctoral programme at the University of Stuttgart. However, before he was admitted to start with his PhD-Project, he had to pass two exams in automotive engineering and in fluid mechanics. In both subjects he performed excellent (1,0). Furthermore he had to complete a full five-month diploma thesis at IVK, which also was rated 1,0. Considering that he now finished all these tasks together with his PhD in only four years indicates his enthusiasm, eagerness and professionalism. It should

not be forgotten that during his time at IVK Mr. Wagner never hesitated to supervise student projects or to take part in other activities of the Institute, including industrial contract work. Amongst his colleagues and students he is very popular due to his politeness and helpfulness.

Mr. Wagner successfully and efficiently made himself familiar with automotive aerodynamics, wind tunnel measurements and measurement technique, as well as driving dynamics and control. He quickly identified the key role played by the driver in the oscillating system car-driver. As a “sensor” as well as an “actuator” the driver is part of the system. He evaluates the system – and thereby himself – by subjectively rating the “side wind sensitivity” of the car. Mr. Wagner succeeded in extending the well-known equations for the car dynamics by introducing a virtual driver into the system. Thereby, for the first time, a car’s side wind behaviour can be fully treated by simulation without necessarily carrying out experiments. This means, possible problems in driving under side wind conditions can be identified in the very early development phase, long before any hardware or prototypes are available. But not only problems can be identified. The method developed by Mr. Wagner may as well be used to compare drivers’ ratings from the previous car with those for the successor. Mr Wagner’s virtual driver will adapt himself to any car (or its numerical model) just like a real driver will perform differently when changing from a small car to a big car, or vice versa. In the meantime his method was successfully applied in industrial contract work. For his innovative method of predicting the driver’s rating of side wind comfort, a patent is pending.

The Faculty of Mechanical Engineering of the University of Stuttgart now has awarded Mr. Wagner the title “Dr.-Ing.” For his project and the final exam he received “1,0 mit Auszeichnung” which is the best possible rating.

Prof. Dr. Ing. J. Wiedemann