Developing Properties for Driver Assistance Systems by means of an Innovative, Constant Development Process

In recent years; AUDI has extended successfully its product range and is planning to increase the number of models from 25 now to about 40 in the coming years following the so-called “strategy 2015” to become the most successful premium manufacturer.

Apart from the design, the typical AUDI driving properties provide the crucial buying criteria for customers. During the development, these properties are, figuratively speaking, also “designed”. Several hundreds of these target properties, which are defined according to the AUDI brand values sportiness, sophistication, and progressiveness, are validated not only in driving tests, but also in simulation.

These target properties have also been applied to the design of new driver assistance functions like the ACC plus and Audi Side Assist functions in the Audi Q7 or the Audi Braking Guard and Audi Lane Assist in the Audi A4 and A5. As the first OEM worldwide, the AUDI AG set the benchmark with these driver assistance functions in the respective vehicle classes. Already when choosing the appropriate sensor concept, its suitability for achieving the Audi target properties has to be kept in mind.

The considerably increasing complexity of the vehicle, propelled by the rising use of driver assistance systems and control systems and their integration into the vehicle, the growing variety of variants as well as the higher degree of individualization would no longer be possible in the desired quality without simulation support. The availability and quality of simulation methods and their process integration thus becomes an essential condition and, in addition, a pivotal competition factor [1].

To make the complexity in the car industry controllable, new simulations methods and their optimal tuning in product development are imperative. Therefore it is important for the development of driver assistance systems to have a constant tool chain available consisting of the already familiar methods or those developed at AUDI respectively:

- Software in the Loop (SIL),
- Hardware in the Loop (HIL),
- Vehicle in the Loop (VIL), and
- Real test.

With the development of the vehicle in the loop, a novel test and simulation environment for driver assistance systems is presented, combining the advantages of a real test vehicle with the safety (for human and machine) and the reproducibility of driving simulators. By means of an “Optical See Through Head Mounted Display”, the virtual outside traffic, road demarcation, or other simulated objects are visualized to the driver realistically and with analogous contact while driving. Thanks to the concept of the virtual outside traffic, new possibilities open up especially for testing active driver assistance systems [2].

The above mentioned development methods SIL – HIL – VIL – Real test have to be perfectly tuned, but their range of application must also be clearly distinguished (see Figure 1). By using a correct specification and standardized interfaces, an optimal applicability and interaction between the tools is guaranteed. This constant engineering process facilitates the exploiting of synergies between the two development methods, and thus furthers the achievement of the AUDI target properties.

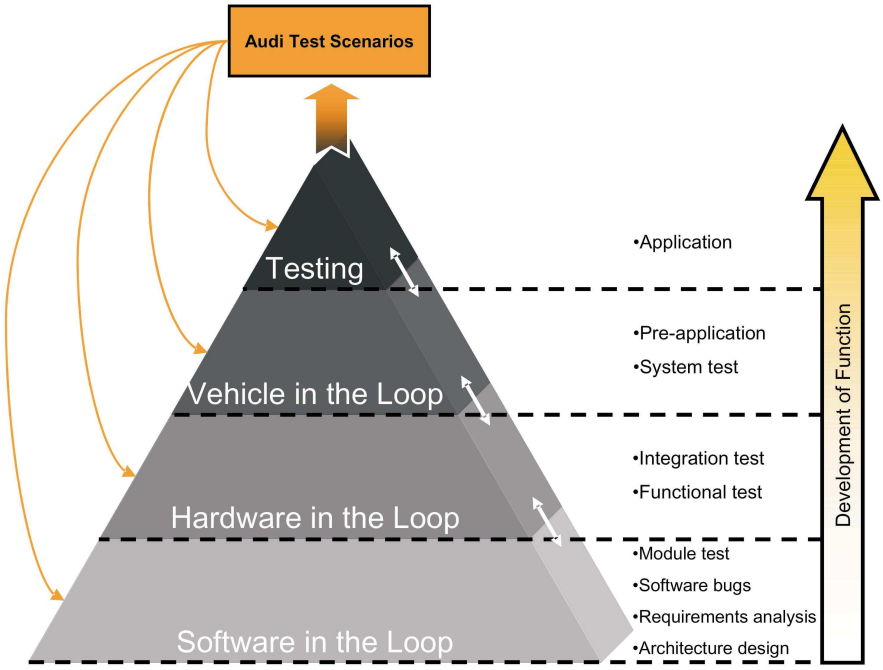

Figure 1: Linking the development methods: SIL – HIL – VIL – Real Test

To sum up, the virtual development will not replace the hardware altogether, but it is used in addition and in support. The sensible complementation of virtual and physical models and methods, integrated into the product process, is therefore the challenge for developing properties in current vehicles. “The best of two worlds” is thus a critical success factor for an efficient, transparent and qualitatively good product process (cf. Figure 2).

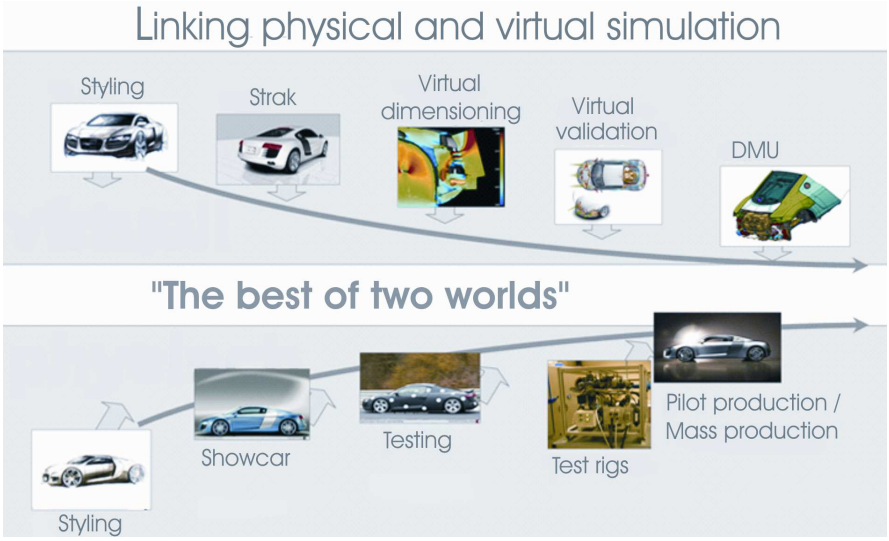

Figure 1: Linking virtual and physical testing as a success factor [3]

[1] Bock, T., Maurer, M.; van Meel, F.; Müller, T.: Vehicle in the Loop – Ein innovativer Ansatz zur Kopplung virtueller und realer Erprobung. Automobiltechnische Zeitschrift (ATZ), Vieweg Verlag, Ausgabe 01/2008

[2] Bock, T.; Maurer, M.; Färber G.: Validation of the Vehicle in the Loop (VIL) – A milestone for the simulation of driver assistance systems. IEEE Intelligent Vehicles Symposium, Istanbul, Türkei, 2007.

[3] Dick, M.; Binder, T.; Bock, T.; Müller, T.; Kriegel, T.: Virtuelle Produktenstehung für Fahrzeug und Antrieb im KFZ. In: Vieweg Handbuch Kraftfahrzeugtechnik, edited by Braess H.-H.; Seiffert, U., edition 2008.