

# Novel PHM concept for future use in safety relevant electronics for harsh environment

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## ABSTRACT

Electronic systems are and will be the major factor that will increase the safety on the road. According to the World Health Organization up to 2020 it is expected that number of accidents will be reduced by 50%. This will be realized through introduction of more advanced safety relevant systems that will slowly take control as well as responsibility for steering the car. As of today the safety relevant systems such as ABS/ESP saved only in Germany 8500 lives, and prevent 260000 accidents. Rear-end collisions that are among the worst, can be reduced by 72% due to the emergency braking system. In the urban traffic, up to 40 km/h the Bosch emergency braking system can completely prevent collisions with stationary vehicles. It is expected that autonomous driving will completely revolutionize the transportation system that will finally lead to 0 casualties in 2050.

In order to fulfill social expectancy, the safety relevant electronics systems that will be used in future automotive industry must be more complex. The future ECUs used in self-driving cars will be typically smart systems of the 3rd generation, which will perform human like operations. The 3rd generation smart systems will act independently in respect to control and decision making. In addition, these systems will be able to self-testing, self-calibration and self-healing.

Last but not least, the concept of Internet of Things will bring the components that are traditionally developed for consumer electronic market under the engine hood. All these aspects will required new approach regarding reliability and quality assurance. It is already observed that the lifetime requirements for embedded electronics used in automotive increases from 15 towards 25 years and for avionics systems towards 35 years. At the same time the time of qualification test is expected to be reduced by 30% with the cost of reliability tests to be reduced by 25%.

All these challenges and requirements can be realized by development of the new reliability concept that is strongly supported through numerical simulation and product optimization at the very early development stage. In the seminar I will present the novel approach for reliability assessment of the future electronic control units and smarty systems. I will present concept of simulation driven design that we are using during the development phase as well as the application of the hybrid prognostics and health management concept for the future safety relevant electronic control modules.