

Requirements on Simulation for Virtual Assurance of Highly Automated Vehicles

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Abstract

The homologation of highly automated vehicles to be used on public roads poses several challenges. One of them is the complexity and heterogeneity of the operational design domain. The intricacies of the automation system itself add to this. This leads to a huge, difficult to describe test space, which is impossible to cover sufficiently well by real-world tests. So, virtual techniques, ie. simulation, will constitute a necessary ingredient of any test-based assurance method. The talk discusses challenges and some solution concepts, addressing validity, range, contribution types, and application procedures of simulation.

First: If its results shall contribute factual evidence for the safety of a system in an application scenario, the most basic requirement on simulation concerns the validity of single runs. Ideally, the simulated scenario would deviate only marginally from its real counterpart. How can this be achieved, and, if accomplished, how can this be proven? These questions raise both methodological and practical questions.

Next, there is the problem of a potentially limited range of applicability of simulation. These bounds must be clearly delineated, and will require additional, complementary techniques extending the scope.

Then, simulation must be flexible enough to answer questions of different types on several levels of abstraction: Both queries of more discrete nature (eg., whether a decision taken by the driving function is correct) and of complex hybrid nature (eg., where precise modeling of driving dynamics become relevant) are to be processed. And the huge test space makes it necessary to use simulation resources economically.

And also, simulation will not be performed for a fixed set of concrete scenarios. But it will have to explore huge scenario spaces to compute verdicts which can be relied upon, where computing resources will only permit to run only a small fraction of the scenarios.

The problems sketched above will certainly need thorough research and development endeavors in the years to come, and will be in the scope of the new SafeTRANS working group intended to be formed. But of course, already today there are some approaches to this complex of challenges. For each of the listed aspects, solution ideas, concepts, and preliminary or even promising constituents are presented. In particular, contributions to this area coming from the ongoing collaborative large research projects SET Level (setlevel.de/en) and VVM (www.vvm-projekt.de/en) are shown.

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