



“We’re now more efficient than before by a factor ranging between two and three”

The networking of vehicle systems has become increasingly extensive in recent years and a change in this trend is not on the horizon. Elektronische Fahrwerksysteme GmbH (EFS), a joint venture with Audi AG, was seeking a solution to virtually validate ESC (electronic stability control) systems and to thus enable a significantly more efficient development process. We talked to Christoph Kossira and Dr. Paul Spannaus about the successful switch to a new toolchain that was accomplished based on the open integration and test platform CarMaker.

At Apply & Innovate 2016, you gave a presentation on the benchmark of simulation solutions. Could you provide a brief outline of this once more?

Kossira: We reported about the establishment of a new toolchain in our presentation because three years ago we were commissioned by Audi to virtually validate ESC (electronic stability control) systems. The toolchain that existed at the time was past its prime, so there was a need for us to make some changes.

Spannaus: The idea was to develop our desired test environment using an example project with an example test scope and to subsequently run tests in these diverse simulation worlds utilizing the tools.

How did you proceed following the kick-off?

Kossira: After an initial evaluation, it was clear that we needed a professional software solution with test automation capability. This resulted in our creation of a new toolchain, taking existing tools within the [Audi] Group into account, which enabled us to adapt to respective interfaces. We compared three tool providers based on diverse evaluation criteria: How fast will I be with the tool? How easy will it be for me to learn its operation? How stable will it run and how good is the provider's support?

To what extent did Audi as a frequent client play a part in the considerations concerning specifications or existing tools?

Kossira: Obviously, you have to agree some specifics with the OEM and say: This is what we're planning to do. Some things, such as the HIL systems or measuring technology, were specified due to existing solutions. The advantage of this is that you simply have to accept these aspects as givens and have specific requirements. The disadvantage is that there is no instantaneously available solution that satisfies all demands. However, the OEM provided us with a lot of latitude

which made it possible for us to develop a modern toolchain.

How much time did you plan for this project, especially for the example test?

Kossira: We had an evaluation phase of more than one year for the entire development of the toolchain – involving two people – and that was indeed a rather elaborate effort. In addition, we carried out a usability test with the tools by migrating test catalogs from the previous to the new tool. What we totally underestimated was the analysis and redefinition of criteria.

Spannaus: However, we managed to remedy this situation by transferring as many things as possible from the old tool in an automated process in advance.

In your presentation you reported about the implementation of maneuver catalogs to validate ESC functions. That was some time ago – what has happened since then?

Kossira: Now, we're additionally dealing with new ESC systems that operate differently, such as systems for electric powertrains with special functionalities. At the moment, we are in the process of establishing an electronic chassis platform environment that will enable us to test functionalities such as those of a damping control system.

Spannaus: In addition, we cover connected functions, which makes it possible to integrate a second or third control unit.

From individual tests to virtual approval – what elements do you accomplish with virtual test driving?

Kossira: We take care of the process steps that by and large are no longer carried out in the vehicle. Clearly, our goal is to perform more and more maneuvers from previous real-world road testing with virtual test driving. This also includes making recommendations for approval by means of virtual testing. Here's a case in point: In the area of

stopping and deceleration management, there are tests which are only feasible in the virtual world because a vehicle's response cannot be controlled with accuracy down to twenty milliseconds in real-world road tests.

Spannaus: In any event, we need virtual tests for validation because this is the only way in which we can truly test all scenarios reproducibly. Naturally, a lot of things are still done using real-world test drivers. They must have the requisite skills so that driving maneuvers can be carried out identically in each test.

How do you view the collaboration between automotive OEMs and suppliers?

Kossira: This isn't always easy, especially when it comes to the exchange of the current states of vehicles.

Spannaus: Our goal is to have a solution in the future that can be used externally so that a tier-1 in Ingolstadt will be able to access the total solution as well. There it must be defined if the supplier will have permission to carry out the entire number of available tests or just a specific number of them – of course under the conditions of non-disclosure.

This rather sounds like a type of test house you're developing, is that the case?

Spannaus: We want to see how the utilization of the toolchain develops. However, demands by suppliers that would like to have access to vehicles with all the systems under test do exist.

What does the process of parameterization look like to create such a virtual vehicle?

Spannaus: We use two possible methods. One way is to model the vehicle in a strictly virtual way by utilizing all the information that's available at an early development stage. Multibody simulation of the vehicle serves as the basis for this and by now a high quality of the virtual models is available to us. The second approach includes more

data, from a real-world vehicle as well. Here we draw on the expertise and the data from various departments for the individual components such as tires, damper elements or engine mounts. We gather this information for overall parameterization, which results in a virtual prototype. At the very end, when it's put on the belt, the virtual vehicle must fully correspond to the real-world vehicle.

How do you assess this for the area of ADAS? Is it absolutely necessary to have validated virtual prototypes in this field?

Kossira: It depends on what you want to do. For a classic ACC, it's probably not absolutely necessary. However, as soon as it comes to functions such as emergency braking and collision avoidance, vehicle dynamics must be properly modeled. This is also about providing developers with turnkey models, in other words virtual prototypes, with exactly the required level of detailing. It must be possible to adapt the model to the task.

You've done a lot of work in the area of ESC – in what fields do you see potential going forward?

Spannaus: Clearly, trailer stabilization would be a great simulation topic for me. I could also imagine testing rollover maneuvers really well.

Do your projects exclusively result from customer contracts or do you initiate any yourself as well?

Spannaus: Virtual endurance testing is an example of a self-initiated project. In Sweden, we logged route and friction data in order to be able to run such tests irrespective of weather conditions in August as well. Clearly, our general goal is to handle the strategically important projects for Audi but, in addition, projects like this one, too. That's why we're also going to reposition ourselves over and over.

How is your relationship with the competition?

Kossira: Our philosophy is that our first step is to be good and the second one to become better. Obviously, this entails knowing what others are capable of and what they're doing. Naturally, you never know this precisely, but publications in trade magazines and events like Apply & Innovate help us see where others stand and where they encounter difficulties. It's always helpful to talk to people directly.

So we'll see you again at the next Apply & Innovate event?

Spannaus: Absolutely. That totally changed our perception because we can see that all of us are actually working on the same challenges.

In other words, you're now viewing yourself as a provider of methods, tools and your professional know-how?

Kossira: What describes us in essence is that we always say, 'we'll find a solution.' For instance, by means of validation workshops with other suppliers we succeeded in inspiring confidence in the quality of our models even though we initially met with a lot of skepticism. And with that confidence, we're perfectly prepared for taking the next steps.

Especially in the field of automated driving there is still a relatively large number of open issues. In your view, what are the key issues to focus on?

Kossira: The area of automated driving is extremely extensive. I believe that those who will be able to validate this entire area will be the winners. However, at the moment, no-one is able to fully validate it. Everyone knows about the infinitely large variety of events. But who defines the events that are important? No matter what, this will require a departure from manual labeling and increasingly happen by means of automation. The ability to validate such driving functions will still pose a truly great challenge to all of us.

How will this topic continue to develop from your perspective?

Kossira: It plays an increasingly important role day after day. Due to diverse inquiries, the focus becomes sharper because they result in specific requirements. Fully automated driving across the board will not become feasible at a moment's notice. Just imagine some of the European roads that suddenly widen from three to five lanes. By contrast, road traffic in other countries is managed in completely different ways, or with respect to the pace in the Asian region for instance, I can imagine that lanes specifically dedicated to autonomous vehicles might be built.

A large number of people in your operation began to work with CarMaker relatively soon. How did you perceive the software in terms of intuitive use?

Spannaus: Our experience has been that people familiarize themselves with the tool in a very short period of time. This was one of the key results of our evaluation in comparison with two other tools when we set up three test benches as well. The speed at which an employee is able to efficiently operate the product was the highest with CarMaker. Its operation is intuitive, from the creation of the maneuvers to the execution of the tests.

How much consultation with our customer support did such an extensive project entail?

Kossira: Naturally, in case of questions, we initially have an internal point of contact for our employees, although we clearly refer to IPG Automotive's customer support as well. In many cases, we received feedback very quickly but in others the responses took longer because we'd obviously arrived at greater depths of CarMaker and, accordingly, had more complex questions. But when the first support inquiry took longer than a day we were rather proud of the level we'd achieved by that time.

Did you encounter any specific challenges during the conversion process?

Spannaus: Error handling in the automation of the entire processes posed the greatest challenge. Ultimately, we rarely use CarMaker as a stand-alone, which results in diverse requirements relating to the interaction with the other tools.

How does your customer Audi view this whole topic of simulation?

Kossira: Audi was seeking to clearly address this topic, which, naturally, is also driven by issues when suppliers are no longer able to deliver thousands of control units in prototype quality

anymore. With real-world prototypes you simply reach a system limit because the approach is very, very costly and takes a long time. This realization is becoming increasingly prevalent and conducive to intensified utilization of simulation solutions.

This means that, in your view, simulation is gaining more and more recognition?

Kossira: Yes, it's gaining more and more recognition. Plus, simulation is clearly better than it used to be. You no longer have to be an expert to be able to operate something like this. Even laypersons can learn it relatively fast. The results you obtain are relatively comprehensible, good and comparable.

In retrospect: Would you say that your project was a total success?

Spannaus: Yes, on closer reflection: We're now more efficient than before by a factor ranging between two and three – and with the same number of employees involved.

Kossira: I agree. It's a success for our internal mindset as well. Our claim is to look ahead. We seek to implement ever new technology. In retrospect, we can definitely say that now we're capable of a lot more than we were last year.

Thank you very much for this candid interview and exciting insights.