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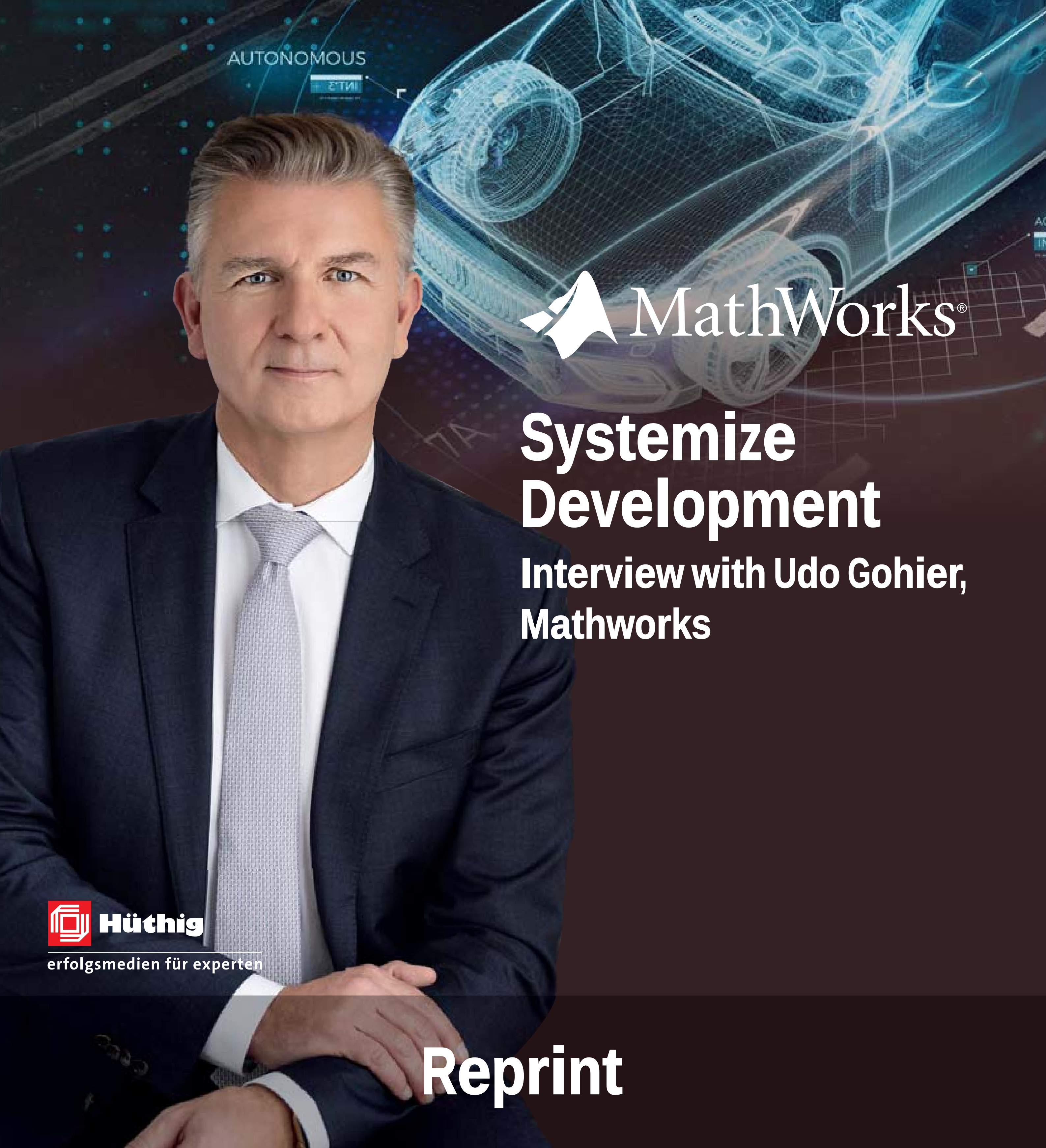

MathWorks®

Systemize Development

Interview with Udo Gohier, Mathworks

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Reprint

INTERVIEW with Udo Gohier, Country Manager Central Europe at Mathworks

Systemize Development

For engineering students, the Mathworks products Matlab and Simulink are as omnipresent as office software and email programs, but what is the company's strategy in the automotive sector? AUTOMOBIL-ELEKTRONIK spoke with Udo Gohier, Country Manager Central Europe at Mathworks, about the market, challenges, where special efforts will be needed in the short term, virtual testing, software-defined vehicles, tool chains and much more.

The interview was conductred by Alfred Vollmer

Mr. Gohier, how is business going?

Udo Gohier: Basically, Mathworks is doing very well, because increasing levels of digitalization are driving our customers to intensify their use of our products. Over the past 15 years, the proportion of electronics in vehicles has increased, and I think it's fair to say that we have played a very large part in this. The more a vehicle's software comes to the fore, the more our customers become involved with our products. To put it in a nutshell: We're doing very well in the automotive sector.

What does that mean in figures?

Udo Gohier: Currently, Mathworks has more than 6,000 employees worldwide and sales of around 1.25 billion U.S. dollars. The automotive industry is a very important and influential market for us in many countries. We have a strong presence in Europe and especially here in Germany.

So what has boosted Mathworks' automotive business in recent years?

Udo Gohier: As early as the late 1990s, the first Matlab and Simulink products helped ensure that mathematical calculations to perform control, signal processing, and other engineering functions were correctly designed and implemented on ECUs (electronic control units), but of course the complexity has now multiplied. We saw our opportunity in this rapid increase in complexity and aligned our products accordingly. We also entered into an intensive dialog with our customers at a very early stage. In the 1990s, we held workshops on the transition from pure hardware to an embedded hardware-software system. The workshops were prompted by companies such as Daimler, Toyota, Bosch and Ford.

These early workshops evolved into the so-called Mathworks Automotive Advisory Board, MAAB, which continues to this day. These meetings allow us to maintain very close contact with the customer base to determine exactly what the engineers are working on and what the major issues are. The feedback that we collect there is then incorporated into the further development and optimization of our products – not only in terms of functionality, but also compatibility, interoperability, speed, and real-time or faster-than-real-time simulations, which we now provide in virtually every product.

Later on, we migrated the Advisory Board format to other industries, and exchanges with customers from the aerospace, semiconductor and mechanical engineering industries – as well as financial companies with their big data challenges – have led to important product enhancements for automotive engineers as well.

With MAAB, we also moved forward in introducing programming and development standards by listening, and also trying to exert influence over some of the largest automotive companies. It became clear very early on that we would find it extremely difficult if everyone developed proprietary Daimler, Ford, Toyota, Volkswagen standards, and so forth. This would have meant having to support countless modeling guidelines or code standards, and the efficiency of our development platform, and hence the customer's efficiency in system development, would have been significantly impacted. At this point, it became clear that software development requires modeling and standardization, the systematization of all development workflows.

> *There is no safety without security*
>
> **Udo Gohier, Mathworks**

And that was also effectively the origin of model-based development, where we tried to provide the engineers with suitable models as a kind of design and programming aid that they could use for simulations and with which they could try out and test their ideas. The increasingly consistent use of models and simulations then made it possible to cope with the complexity of entire systems.

We have been closely linked with the academic sector for years, and that has also helped us a great deal in the automotive sector. Because students already use our software during their studies, budding engineers, researchers, and computer scientists come

Udo Gohier (right, in an interview with AUTOMOBIL-ELEKTRONIK Editor-in-Chief Alfred Vollmer): "The challenge lies in the rapidly increasing number of systems working and interacting simultaneously, which together have to perform at least as well or better than a human being.... Different approaches to software development, such as model-based and agile, must be merged and automated to achieve results faster than ever before."

well prepared for their first commercial projects. Through our approach to academic licensing, we also assist academic users so that they can use our tools in teaching, research, and projects – and that includes support from us.

Please describe your company's products in one sentence

Udo Gohier: The wide range of our products is probably best explained by our company motto: „Accelerating the pace of engineering and science" – the acceleration of progress in all fields of technology and research, which we enable by systematizing development. Our flagship products are Matlab, a programming and numeric computing platform for technical computation, algorithm development, data analysis and visualization, and Simulink, a block-diagram-based development environment for simulation and model-based product development.

Risks must be avoided by means of consistent continuity in the tool chains

Udo Gohier, Mathworks

What technical challenges do you see at the moment?

Udo Gohier: There are diverse technical challenges in the development of the software-defined vehicle. The transition to an all-electric powertrain requires new approaches for control and comprehensive vehicle-related energy strategies. At the same time, battery technology and battery management must remain at the leading edge.

Then there is the challenge of real-time communication, both within the vehicle and from vehicle to vehicle and with the traffic infrastructure. Here, the focus is not only on the communication technology itself; functions using that communication must be designed that truly enhance the driving experience and are reliable.

For autonomous driving, a coordinated set of ADAS (Advanced Driver Assistance Systems) applications must be provided and integrated within the vehicle. For future development, care must be taken to ensure that the applications can be expanded in the direction of full autonomy. Then there are challenges related to cybersecurity. They are central to all applications and must therefore be incorporated throughout the entire development process. To achieve consistent security and confront dynamic threat scenarios, the functionality must be able to adapt very quickly. At the same time, the integrity of the entire system must not be compromised.

In addition, these challenges concern the integration of the individual technical approaches into a uniform development process and the coordination of processes and methods of all teams involved that this necessitates.

Electromobility is just one of the endeavors that we are mastering. What about connectivity and cybersecurity?

Udo Gohier: The challenges facing the automotive industry have skyrocketed exponentially. Electrification is one thing, connectivity is another. It's also about making good use of these gigabytes of data and thereby generating added value. In addition to classic methods for data evaluation and reduction, AI methods such as machine learning and deep learning are increasingly being used here. And for this we offer various solution paths that do not stop at data interpretation, but also ways in which AI models can be integrated into an overall system. The path to autonomous driving makes fundamentally different demands on data and E/E (electrical/electronic) architecture than was the case five to ten years ago.

Cybersecurity is another extremely important area, because there is no vehicle safety without security. We have made huge progress in recent years regarding features and solutions for functional safety, and we can transfer some of these solution approaches to the cybersecurity area. A good example is the buffer overflow problem, which we have been working on in the safety area for years; now this problem is making headlines in the security area. Among other things, we have developed appropriate tools for greater security with our Polyspace products – motivated by safety issues. We have underpinned ISO 26262 with a reference workflow since as long ago as 2010, and are also involved in working groups for standardization, e. g. the working group for ISO 21434 on the cybersecurity standard.

The familiar and established V-model should be matched with agile software development methods and the DevOps approach for continuous modifications.

Udo Gohier, Mathworks

How do you support testing in the virtual world?

Udo Gohier: We have been enabling simulations for more than 30 years – in various levels of fidelity and for various domains. In the past, however, the focus was often on individual components, vehicles, or a single system and its functionality.

In terms of autonomous driving, the context is much broader. Here, it is also necessary to create a virtual representation of the world in which the vehicle is driving. This includes pedestrians, incidents, etc. in various scenes and scenarios. So we go far beyond a singular functional test, because the entire autonomous vehicle and all dependent subsystems must be simulated against this background, together with traffic participants.

These days, the term used to describe this consistent shift toward the domain of simulation is 'shift-left'. This means nothing other than that testing the overall safety framework can be brought earlier into the simulation stage. Simulations can be used to check requirements and discover integration problems, and they help us understand how a system behaves in unexpected situations. Virtual testing such as this can be automated on a large scale using Matlab and Simulink, leveraging high-performance computing and cloud resources and using huge amounts of data as input for the simulation.

What are the challenges of system development?

Udo Gohier: The challenge lies in the rapidly increasing number of systems working and interacting simultaneously, which together have to perform at least as well or better than a human being. On the one hand, this entails a dramatic increase in development requirements. This can only be countered with a trio consisting of a Model-Based Design approach and comprehensive, high-precision simulation supported by industry standards. On the other hand, the ever-growing complexity gives rise to an increasing risk of failure. This risk can only be minimized through early validation and verification, whereby testing and verification is continuously performed throughout the development process.

Different approaches to software development, such as model-based and agile, must be merged and automated to achieve results faster than ever before. For Mathworks, these are the fundamentals of a state-of-the-art, systematic development process. The result for the customer is measurably better software quality in less time.

What is currently the hottest topic in the industry?

Udo Gohier: One of the hottest topics is the migration of the development process to the engineering cloud. This means not only that the data resides in the cloud, but also calculations and simulations are carried out in the cloud and that, ideally, continuous integration is already carried out with a connection to the cloud. Why is that? The requirements for the degree of automation are constantly increasing; complex systems and shorter innovation cycles require agile development methods. The steadily increasing amount of data from development and design documents, simulation, processes, and operation must be made usable so that it can become part of a feedback mechanism for continuous product and service improvements.

Everything is aimed at making the software-defined vehicle a safe, affordable, and sustainable product. This technology must

The path to autonomous driving makes fundamentally different demands on data and E/E architecture than was the case five to ten years ago.

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also be open to highly automated adaptation, development, simulation, and testing. One aspect of this is also the implementation in the hardware, whether that means embedded microcontrollers, FPGAs, DSPs, or other options such as containers. For engineers ought be free to choose, not having to decide on a specific hardware solution before the algorithms have even been developed.

Costs measured in terms of time naturally play a decisive role in this context. That's why we are especially pleased to hear from our customers that they achieve time savings of 20% to 40% by using our tools compared to non-model-based development.

What are the challenges on the path to the software-defined car?

Udo Gohier: The challenges are manifold. Let me address the following areas: Software and hardware development must be decoupled, because they follow different cycles. But that doesn't obviate the need for intensive exchanges.

The second point concerns cooperation between people in different areas of responsibility. Systems engineering and software engineering staff must learn to understand each other and work together. So-called domain skills, i. e. cross-domain knowledge, have to be nurtured, and the existing wealth of experience must be maintained through upskilling and reskilling. New synergies then emerge through direct exchange and collaboration between developers from different domains.

Thirdly, the applied methods come into play. The familiar and established V-model should be matched with agile software development methods and the DevOps approach for continuous modifications. Of course, only to a reasonable extent. Within Mathworks, we coined the term automotive-grade DevOps. This ensures that, in addition to an agile way of working, safeguarding the digital thread is given the necessary priority in development.

And fourthly, standards need to be looked at to address efficiency within the industry, to be able to follow legislative regulations for functional safety or cybersecurity topics, and also to remain compatible with AUTOSAR (AUTomotive Open System ARchitecture) specifications. These standards must be comprehensively supported by the tool chain as much as possible.

How are tool chains changing?

Udo Gohier: One problem that is increasingly occurring concerns the proliferation of non-interoperable development tools over the years. In some cases, we see 200 or 300 isolated tools in use in a development series. This prevents a continuous, manageable and automatable workflow. Interoperability is not guaranteed, and manual reworking is often required. As a result, the quality of the software suffers to the point of dysfunction; efficiency goes by the board. These risks must be avoided by means of consistent continuity in the tool chains.

What is the significance of the AEK, the Automobil Elektronik Kongress in Ludwigsburg/Germany, for you?

Udo Gohier: It is where the transformers of the automotive industry and the decision-makers come together to exchange information about the latest developments. My experience is that the significant and urgent topics are addressed and discussed there. ■

This interview was conducted by
Alfred Vollmer
Editor-in-Chief of AUTOMOBIL-ELEKTRONIK


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