Automotive Solutions
Systems and Applications
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For over 25 years, dSPACE has been providing solutions for developing and testing electronic control units. Solutions that are being used by thousands of automotive development engineers all over the world. Model-based development, rapid control prototyping, automatic production code generation and hardware-in-the-loop simulation are all integral parts of today’s development processes. The development tools provide crucial support, often for entire large organizational units, even ones spread across the globe. With their open interfaces, the tools are integrated into existing infrastructures, coupled with other tools, and enable distributed teams to work together.

With well thought-out approaches and technological depth, dSPACE has made great contributions towards shaping the embedded technology field from its very beginnings. The result is hardware and software solutions that are well-functioning, user-friendly and efficient. Products like MicroAutoBox and TargetLink have proven that they capably handle everyday use. The same applies to our wide range of HIL testing products, which covers every possible application, small or large, and has been expanded with the new SCALEXIO® product line to meet the needs of the future. New technologies and application areas such as driver assistance systems and vehicle electrification also spur on the further enhancement of the development tools. Important cornerstones are dSPACE’s support of standards such as ASAM, AUTOSAR and ISO 26262, and close cooperation with selected partners who add to dSPACE’s range of solutions with their own state-of-the-art products.

Does all of this give automotive software development what it needs to face the future? Listening to the response from this sector, the answer is clear: Without modern tools, the motor vehicle industry would not be where it is today. But the future has more major genuine challenges in store. One of these is how to manage the enormous volume of data that is generated and processed when development is underway. Without a doubt, this challenge is being caused by the fact that the level of in-vehicle software – developed with the right tools – has been increasing continuously over the years. The endeavors to use more virtual scenarios for vehicle development in order to cut back on development risks, time and costs will also increase the volume of data. This all means more simulation, more models, more parameters and more test data, all of which must be managed consistently throughout the entire development process: from its very beginning up to the end.

Both of these challenges – data management and virtual vehicle development – demand changes in organization and in the processes. dSPACE is doing its part by working closely with lead customers to develop the necessary tool support. Mastering the high level of variant complexity in automotive software development is particularly important to us, as is the intelligent handling of the specific data objects in model-based development.

In this new edition of our brochure you will find the first results of these development activities and get an overview of dSPACE’s portfolio of solutions and the wide variety of the application areas of our products.

Dr.-Ing. Rainer Otterbach
Director of Product Management
Working with dSPACE Products

dSPACE offers you a complete and integrated development environment for embedded control software. Our systems will save you valuable development time and money, whether you use them throughout the entire process or just in individual project phases. dSPACE systems support established development processes, particularly for electronic control unit (ECU) development, and also offer you ways to adapt your process chains to new challenging needs. With constant innovations, key technologies and standards, and dedicated service and support, dSPACE helps you achieve long-term success.
dSPACE systems let you perform demanding tasks such as system design, rapid control prototyping, automatic production code generation, hardware-in-the-loop (HIL) testing, virtual validation, and data management. Together with MATLAB®/Simulink®/Stateflow® from MathWorks®, dSPACE products provide a single, highly integrated tool chain for model-based development.

System Architecture
SystemDesk® simplifies and speeds up the planning, implementation, and integration of complex systems and software architectures. Working with formal descriptions of the software architecture helps you handle production projects and improves OEM/supplier processes. SystemDesk supports the AUTOSAR standard and can generate the AUTOSAR Runtime Environment (AUTOSAR RTE). Easy round-trip engineering with the production code generator TargetLink helps get software designs into production. You can also use SystemDesk to generate virtual ECUs, including components of the application and basic software. VEOS combined with SystemDesk can be used to verify the system behavior and function interplay in an early PC-based simulation.

Rapid Control Prototyping
dSPACE prototyping systems are flexible development platforms that let you develop and optimize your control designs without manual programming. With comprehensive and reliable software support, including first-rate MATLAB®/Simulink® integration, all our systems are ready-to-use and easy-to-run. Design faults are found immediately and corrections can be carried out on the spot. The product series is completed by a full range of signal conditioning and power stage modules to connect the prototyping system to sensors and actuators.
**ECU Autocoding**
Automatic code generation for the production ECU is a key development phase. The production code generator TargetLink generates highly efficient C code straight from MATLAB/Simulink/Stateflow and allows early verification through built-in simulation and testing. This drastically reduces the time needed for implementation, and results in systematic consistency between your specification and your production code. Changes on the model level are quickly transferred to code. TargetLink has been certified for use in developing safety-related systems according to ISO 26262, IEC 61508, and derived standards, and offers comprehensive support for the AUTOSAR standard. The new data management software SYNECT provides support for centrally managing ECU signals and parameters as well as MIL/SIL/PIL tests for all the different variants of your ECU software.

**HIL Testing**
When your ECU has been programmed, you can test its functions quickly and automatically by using dSPACE simulator hardware. It replaces the real environment, and you can execute your tests in any conceivable test scenario, systematically and reproducibly thanks to comprehensive test automation. dSPACE products cover the whole range from early function testing to large-scale ECU network tests. The comprehensive software support includes proven-in-practice “Automotive Simulation Models” (ASM) and convenient test automation support to increase the productivity in test development and test execution. The new data management software SYNECT with its test management module is ideal for managing test data and monitoring, analyzing and visualizing test results.

**Engineering**
dSPACE systems are easy to get up and running. However, if a project is more complex, if individual solutions are needed or if time pressure is high, customers can rely on dSPACE’s fast and competent engineering and consulting services. Our experienced engineers support customers with small-scale project aid and with complete turnkey solutions – with resident dSPACE engineers on-site if necessary.
New Product Areas and Technologies –
Innovation and Efficiency for Your Future Projects

Virtual Validation
Virtual validation lets you shift development, verification and validation tasks to early development stages. A wide range of new use cases is opened up by running models of controllers, ECUs, and parts of a vehicle, (the engine, sensors and actuators etc.) on a PC. VEOS® is the dSPACE platform for the PC-based offline simulation. It lets you simulate and test ECU functions and software before a real ECU prototype is available. VEOS even helps to prepare simulation models and test libraries on a development PC and reuse them on a hardware-in-the-loop system. VEOS is integrated in the dSPACE tool chain, working together with the established dSPACE tools for system architecture, rapid control prototyping, ECU autocoding, and hardware-in-the-loop simulation.

Data Management
Electronics and software is continuing to advance, producing an enormous amount of data. Managing this data is a growing challenge. The solution is dSPACE SYNECT, a data management and collaboration software with a special focus on model-based development and ECU testing. SYNECT helps engineers handle models, signals, parameters, tests and test results, including the dependencies, versions and variants, in connection with the underlying requirements throughout the entire development process. This gives you consistent data versions, complete traceability, and reliable and efficient reuse of data in other projects, by other users, or for new vehicle and ECU variants. SYNECT closely integrates with engineering tools such as AutomationDesk®, TargetLink®, and MATLAB®/Simulink®, and supports relevant standards.
Advanced Driver Assistance Systems

Increasing traffic density, higher safety requirements, stricter environmental regulations, and demographic changes are posing enormous challenges for the automobile industry. Driver assistance systems are making a considerable contribution to meeting these challenges. They support drivers in complex traffic situations, initiate procedures to avoid or mitigate accidents, and decrease fuel consumption as components in modern drivetrain concepts. Some typical examples of driver assistance systems are adaptive cruise control, automatic emergency braking, traffic sign recognition, lane departure warning systems and lane keeping assistants.

The basis of such driver assistance systems is reliable recognition of the vehicle’s surroundings and the traffic situation. The necessary information comes from radar, lidar, video and ultrasonic sensors. The environment that has to be evaluated reaches far beyond the vehicle’s immediate vicinity. One solution is to calculate predictive road data, the “electronic horizon”, from digital road maps and the vehicle’s current position and driving direction. This makes anticipatory driving possible. Another concept, called Car2x, relies on data exchange between vehicles, or between vehicles and the traffic infrastructure. dSPACE supports each and every development stage in developing and testing driver assistance systems – from architecture-based system design to block-diagram-based function prototyping, automatic production code generation, and the final ECU testing.

Electric Drives

The use of electric drives has been increasing steadily over the past few years. Not only in drive and automation technologies, but also in vehicles. They have numerous advantages and wide-ranging application potential in many areas. Electric motors can be very small and fit almost anywhere. They have very high dynamics and can provide high torque at lower rotational speed. Other advantages are improved energy savings due to power on demand, better controllability and easier maintenance. dSPACE provides exactly the right products and solutions for simulating electric drives, and for developing and testing their servos. From flexible dSPACE development systems and special hardware for electric drives to building complete systems, dSPACE will accelerate your drive to the future. In automotive applications, electric drives are increasingly being incorporated into several complex, basic, and safety-relevant vehicle functions. dSPACE products can accelerate the ECU software development for electric drive applications in many scenarios, such as for mild/full hybrid cars, electric vehicles, electric brake systems, powertrain actuators, electric power steering (EPS), auxiliary aggregates (oil pump, water pump), etc.
A complete electronic control unit (ECU) software system encompasses numerous software components and distributed functions with interactions between different ECUs. To keep track of such complex system architectures, developers need extensive tool support and well-structured procedures.

**Modeling AUTOSAR Software Architectures**

dSPACE SystemDesk is a software architecture tool that supports the development of distributed automotive electrics/electronics systems and subsystems. SystemDesk displays software components (SWCs) and their communication connections graphically to provide a clear view of how they interact, even in complex systems. AUTOSAR enables the components and their interfaces to be formalized, making it easier to distribute them to several different developers, and also to reuse them. Car manufacturers and suppliers can use SystemDesk to integrate their software modules into their overall systems after testing. This minimizes potential software risks and reduces development work.

**Interaction with TargetLink®**

SystemDesk works hand in hand with TargetLink, dSPACE’s production code generator. TargetLink is used to develop model-based functions and generate production code for the SWCs from SystemDesk.

**Generating and Simulating Virtual ECUs**

When individual SWCs have been modeled and integrated to make a system architecture, the SystemDesk V-ECU Generation Module is used to generate a virtual ECU (V-ECU) from them. Virtual ECUs can be created for connected SWCs that have several functions and also for complex AUTOSAR software architectures, including basic software modules. The overall simulation system can consist of a single V-ECU or an entire ECU network and its bus communication. Models of the controlled system can also be connected. Then the V-ECUs and systems can be simulated and verified directly on a PC by using VEOS®, dSPACE’s offline simulation platform. This means that the software can be tested and validated at an early stage of the development process.

**AUTOSAR-Compliant Development**

SystemDesk supports AUTOSAR, including the current release versions 3 and 4.
**Features at a Glance**

- Support of AUTOSAR R3.x and R4.0
- Developing software components
- Interaction with TargetLink
- Modeling software architectures and systems
- Formalizing hardware topologies and network communication
- Connecting to software configuration software
- Process support for importing and exporting ARXML files, scripting, connecting to requirements management systems, etc.
- Generating virtual ECUs for verification and validation
- Simulating virtual ECUs on a PC with dSPACE VEOS

**Further product information:**

www.dspace.com/go/SystemDesk-EN

**Success Stories using SystemDesk**

www.dspace.com/go/SystemDesk_Stories-EN

An example configuration for simulating virtual ECUs: The V-ECUs are generated with SystemDesk, simulated with VEOS and controlled with ControlDesk® Next Generation.
Rapid Control Prototyping – The Fastest Route to Validating New Ideas

Controller Design with MATLAB®/Simulink®
For the phase after designing control algorithms with MATLAB/Simulink, dSPACE offers a seamless integrated product portfolio that brings the controller design to life in a real environment. The portfolio contains scalable, powerful hardware, plus a software environment that is extensive and intuitive.

Rapid Control Prototyping Right from the Start
Over 20 years ago, dSPACE laid the foundation for rapid control prototyping (RCP) and revolutionized controller development. Building on this pioneering achievement, dSPACE systems evolved to become the reference class, and today thousands of them are in action at OEMs, suppliers and service providers all over the world. dSPACE’s ongoing commitment is to give customers at all times the best possible, highly qualified support and engineering services for their endeavors.

Comprehensive Application Coverage
dSPACE hardware presents a perfect match of standard components. It provides high processing power and extensive I/O with lowest latencies and fast boot times. In addition to a large number of universal products, dSPACE also offers dedicated solutions for specialized areas such as engine controls, driver assistance systems and electric drives. And because it uses next-generation, powerful technologies such as FPGA, Ethernet and embedded PC extensions, dSPACE hardware is ready to face any challenges the future may bring.

The Right Approach for Different Requirements
Whether you need to design an entire ECU application from scratch, or optimize or extend an existing ECU – the ECU can be completely replaced by an RCP system (fullpassing) or supplemented by it (bypassing). If the existing ECU has enough capacity and the necessary I/O, Simulink models can even be downloaded directly to the ECU hardware (on-target prototyping).

Fast I/O configuration directly in the Simulink model, and implementation on the real-time hardware with dSPACE RTI (Real-Time Interface).
Parameter adjustment and data acquisition during function development via the graphical instruments in dSPACE ControlDesk®.
From compact and robust to flexible and scalable, dSPACE systems can handle any challenge.

**Focus on Production Use**
Even if the design is not going into production yet: dSPACE’s continuous tool chain guarantees the greatest possible flexibility and seamless transitions. For example, dSPACE has issued modeling guidelines for using the production code generator TargetLink, and provides XCP and ASAP2 support plus the ability to integrate AUTOSAR software components. When a new design has to be deployed on an entire vehicle fleet, dSPACE ensures an easy transition from the RCP system to the existing fleet ECU or production ECU.

**Features at a Glance**
- Fast design iterations
- Intuitive handling
- Seamless integration into Simulink
- Extensive software support
- High computing power with low latencies
- FPGA programming from Simulink
- Large range of I/O
- Scalability and flexibility
- Robust solutions for in-vehicle use
- Off-the-shelf signal conditioning and power stages
- Standard products and custom solutions

**Further product information:**
www.dspace.com/go/RCP-EN

**Success Stories with dSPACE Prototyping Systems**
www.dspace.com/go/RCP_Stories-EN

Numerous hardware options for the lab and the vehicle, with high real-time processing power and comprehensive I/O.
TargetLink® –
Production Code Generation Directly from Simulink®/Stateflow®

TargetLink: A Success Story
In the development of software for automotive ECUs, model-based development and automatic production code generation have become standard industrial methods all over the world. Ever since its launch in 1999, TargetLink, dSPACE’s production code generator, has been a driving force behind this process. Today, TargetLink is the world’s number one production code generator and is used by virtually all major companies in the automotive industry. TargetLink generates production-ready ANSI-C code for ECUs straight from MATLAB®/Simulink®/Stateflow®. The list of TargetLink applications covers all areas of the vehicle, including the powertrain, chassis, driver assistance, comfort, and active and passive safety systems. TargetLink’s special strengths are the optimized code it generates, and its high reliability, process integratability and support of standards such as AUTOSAR, OSEK, ISO 26262, and ASAM MCD-2 MC (ASAP2).

Highly Efficient, Highly Configurable Code
TargetLink has been specifically designed for production-quality autocode generation. It can easily match the efficiency of human programmers in terms of memory consumption and execution speed – without compromising readability. The generated code can be fixed-point or floating-point, or a mixture of the two. Code efficiency is one of TargetLink’s great strengths, and code configurability is another. Whether users need to adapt the memory layout, or integrate legacy code or required function interfaces – thanks to its enormous range of configuration options, TargetLink can handle it all.

Integrated Verification and Validation Support
Although automatic code generation produces virtually flawless results when compared to manual programming, the generated code and the underlying specification still need to be tested. TargetLink provides powerful and intuitive functions for code verification. The generated code can be tested in the Simulink/TargetLink environment by comparing the simulation of the block diagram-based function model (model-in-the-loop simulation, MIL) directly with the simulation of the production code on a development PC (software-in-the-loop simulation, SIL). TargetLink makes it extremely easy to compare the results generated production code and description files from Simulink/TargetLink models.
of these simulations to determine whether the algorithm and the code have the desired behavior.

**Ideal for Developing AUTOSAR-Compliant Software**

One prominent example of TargetLink’s automotive focus is its native, integrated AUTOSAR support. TargetLink provides a wide range of functions for designing, autocoding and testing AUTOSAR-compliant software components. AUTOSAR round trips with other tools are particularly efficient thanks to the TargetLink Data Dictionary with its wide range of editing, diff & merge and import/export functionalities.

When TargetLink is combined with dSPACE SystemDesk, data is exchanged in component containers to provide yet another option for making the AUTOSAR-compliant development process easier, more transparent and more efficient.

**Certified for ISO 26262 and IEC 61508**

An increasing number of functionalities in modern vehicles are safety-relevant, and this makes specific demands on the tools used for development. TÜV SÜD, an independent German certification authority, has certified TargetLink’s suitability for the development of safety-related systems. After comprehensive testing, the TÜV experts confirmed that TargetLink can be used for software development according to ISO 26262, IEC 61508 and derived standards.

**Features at a Glance**

- Production code generation directly from Simulink®/Stateflow®
- Highly efficient fixed-point and floating-point code
- Comprehensive fixed-point support including auto-scaling
- Direct verification by MIL/SIL/PIL simulation with integrated data logging and display
- Support of modular, component-based development
- Efficient data management with the TargetLink Data Dictionary
- Powerful, integrated AUTOSAR support
- Certified for ISO 26262, IEC 61508 and derived standards

**Further product information:**
www.dspace.com/go/TargetLink-EN

**Success Stories with TargetLink**

www.dspace.com/go/TargetLink_Stories-EN

AUTOSAR support in TargetLink.
Hardware-in-the-loop (HIL) simulation is the trusted method to put ECU functions, ECU bus communication and integrated ECUs to the test. The tests are performed in a simulated environment, meaning that the HIL simulator makes the ECU "believe" it is located in a real vehicle driving somewhere. This way the simulator can test the ECU’s reaction to specific situations, and you can move tedious, expensive, and sometimes even dangerous driving tests from the actual vehicle into the laboratory.

Non-Stop in Action
The main advantage with HIL simulation is that critical driving scenarios can be executed safely and also around the clock, 7 days a week. The predefined test scenarios are executed automatically and the results are summarized in reports.

Tests as Soon as Possible
To make HIL tests possible even before all the ECU prototypes are available, some of the ECUs can be simulated by high-quality restbus simulation or as virtual ECUs (V-ECUs). Then the simulated ECUs are used together with real ECUs. The V-ECUs generated with dSPACE SystemDesk® can also be tested together with real ECUs in mixed operation.

From Small to XL
To meet all the different test requirements, dSPACE offers many different HIL hardware systems. From small systems for function tests to large integrated simulators that emulate complete virtual vehicles, dSPACE covers the entire range of tests and all the vehicle domains in the automotive industry.

Complementary Engineering
Our customers benefit not only from our wide range of software and hardware products, but also from our comprehensive engineering services. Over the years in numerous customer projects worldwide, dSPACE Engineering Services continues to provide proven support for setting up test systems, modifying test systems to fit existing work environments, designing project-specific developments and creating turn-key systems.

Modular Hardware
Our modular simulation hardware is put together specifically for each project and can be expanded whenever more requirements come along. From individual processor boards up to large systems, dSPACE covers everything.

Integrated Software Tools
dSPACE software tools work hand-in-hand to help you perform all your simulation tasks:

- Configuring hardware, implementing I/O functions: Real-Time Interface and ConfigurationDesk® act as the connection between dSPACE hardware and the modeling software (like MATLAB®/Simulink®/Stateflow® from MathWorks). These two tools configure the hardware, divide the models onto different cores, and implement the real-time code. They also let you configure applications graphically.

- Creating plant models: The several different dSPACE Automotive Simulation Models (ASMs) complement each other and can be combined any way you like. The models support a wide spectrum of simulations, starting with individual components like combustion
engines or electric motors, to vehicle dynamics systems, up to complex virtual traffic scenarios. The ASMs are parameterized and managed in ModelDesk.

- Visualizing simulations: To let you visualize specific individual parameters during a simulation, ControlDesk® Next Generation helps you create project-specific layouts, such as the representation of a vehicle dashboard. MotionDesk shows the vehicle’s movements in 3-D animation.

- Creating and automating tests: To get maximum use of a HIL simulator, you can create test scenarios with AutomationDesk® and run them overnight and on weekends.

- Managing tests, test systems and test models: When the HIL tests are being prepared and executed, all the teams involved need the high volume of data and information to be available to all of their team members. This is where dSPACE’s data management software SYNECT® comes into play, making consistent data management possible throughout the entire development process – handling everything for models, signals, parameters, tests with their results and data dependencies, versions, variants, and requirements.

Features at a Glance
- The world’s leading supplier of HIL simulators
- HIL test systems from small to large – from function tests of individual components up to integrated systems simulating entire vehicles
- Covers all fields of the automotive industry
- Complementary engineering services for everything from standard products to turn-key systems
- Longtime experience with customer projects

Further product information
www.dspace.com/go/HIL-EN

Success Stories for HIL Testing
www.dspace.com/go/HIL_Stories-EN
dSPACE Engineering Services –
Engineering and Consulting for All dSPACE Products

Wherever You Are
With closely networked facilities across the world, dSPACE ensures that projects run smoothly from start to finish – for local customers and international companies alike. dSPACE Engineering Services are provided worldwide by dSPACE headquarters and two project centers in Germany, three offices in Japan, and subsidiaries in France, the UK, USA and China.

“We go on giving support until everything is running smoothly.”

No-Worries Engineering Since 1988
Whether we’re providing products, support, or supplementary engineering services, our guiding principle is always this: We follow through. We go on giving support until everything is running smoothly. And we’ve been doing so for over 20 years, helping international customers from the automotive and commercial vehicle industry, aerospace, industrial automation and numerous other sectors to put their innovative ideas into practice. Providing fast, competent engineering and consulting services they can really rely on. This is vital, especially in complex projects in fields such as hybrid drives, advanced driver assistance systems, or combustion engine optimization. When you begin using dSPACE tools, our Engineering Services will get you off to a flying start, giving you all the first-hand product know-how you need.

Scalable Services
We respond sensitively to your precise requirements, giving you comprehensive engineering, advice, and training in any stage of development where you need them. Whether you’re integrating dSPACE tools into your development process or using new products and methods, running small projects or planning turn-key solutions. With engineering and advice from dSPACE, you can concentrate completely on your main tasks.
Our Services at a Glance

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<td>Tool introduction</td>
<td>dSPACE Engineering Services will provide all the information you need to ensure the long-term viability of your system. We can do feasibility studies, develop application scenarios, perform benchmarking, run pilot projects, provide custom training, etc.</td>
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<tr>
<td>Process consulting</td>
<td>We can help you optimize your development processes, combining dSPACE tools and third-party tools efficiently in one single tool chain.</td>
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<td>Turn-key solutions</td>
<td>dSPACE Engineering Services offer complete ready-to-use solutions even for complex application scenarios. If required, we can assist you throughout the entire dSPACE tool chain, with requirements analyses, implementation specifications, system delivery, on-site commissioning and more.</td>
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<tr>
<td>Maintenance services and life cycle support</td>
<td>To guarantee that your system works properly even if requirements change, dSPACE Engineering Services don’t stop after we deliver the system. They include software adaptations, interface extensions, hardware modification and expansion, and model adaptation.</td>
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Customer-Specific Training
Our specialists will provide a wealth of knowledge and experience to get your project moving: in our regular, standard training courses and in special courses tailored to your needs, even on site if you want.

Key Benefits at a Glance:
- Engineering and consulting available worldwide, the ideal supplement to dSPACE’s product range
- Custom hardware and software adaptations
- Fast response
- Experienced team of engineers
- Local and global projects, from small projects to complete turn-key solutions

Further product information
www.dspace.com/go/Engineering-EN

Success Stories with dSPACE Engineering Services
www.dspace.com/go/Engineering_Stories-EN
Automotive Standards

AUTOSAR
Founded in 2003, the AUTOSAR Development Partnership is a remarkable cooperation among international companies in the automotive industry, who are defining a standardized software architecture for automotive ECUs. The goal of AUTOSAR is to counter the growing complexity in the development of electric/electronic architectures. dSPACE is directly involved in these activities and is implementing AUTOSAR's broad-based specifications in a multitude of ways. dSPACE SystemDesk® helps create concrete AUTOSAR descriptions for the software architectures and prepare them for integration with the basic software, also for virtual validation of the ECUs.

dSPACE TargetLink® guarantees AUTOSAR-compliant code generation of individual functions in the model-based development process. The RTI AUTOSAR Package bridges the gap between AUTOSAR and rapid control prototyping. And last but not least, communication networks described according to AUTOSAR can be used in the configuration of HIL systems.

www.autosar.org

ADASIS
dSPACE is a member of the ADASIS Forum, true to our aim to provide a portfolio of tools for developing and testing ECU functions for map-based, predictive driver assistance applications. To help users develop ECU functions for these applications in fast iteration cycles, and directly experience the effects in a vehicle, dSPACE offers the ADASIS v2 HR Blockset, an adaptable ADASIS v2 Horizon Reconstructor Blockset for the rapid prototyping systems MicroAutoBox and AutoBox. This blockset provides access from within a Simulink® model to electronic horizon data that is transmitted via the ADASIS v2 protocol. Only a few mouse clicks are needed to select the predictive road data, connect it to the actual driver assistance function in the model, and generate the real-time code and load it to the development system. This means that function developers can give their full attention to implementing the actual application function, without having to spend a lot of time implementing the ADASIS v2 protocol themselves. In addition to the CAN bus, the dSPACE ADASIS v2 HR Blockset also supports Ethernet as a transmission medium.

www.ertico.com/adasisforum

FlexRay
Since its introduction into production in 2006, FlexRay has established itself as a de-facto standard for in-vehicle, time-triggered communication systems. dSPACE covers everything from hardware such as prototyping systems and I/O boards with FlexRay interfaces to software for the real-time simulation of models in FlexRay networks. The following dSPACE products support the FlexRay standard: MicroAutoBox II, DS2671 Bus Board, DS4340 FlexRay Interface Module, DS4505 FlexRay Interface Board, dSPACE FlexRay Configuration Package, RTI Bypass Blockset and ControlDesk Next Generation.

www.flexray.com
ASAM
ASAM e.V. was founded by leading European automotive companies in 1998 with the aim of creating standardized interfaces for data exchange and for manufacturer-independent compatibility of the software and hardware components used in vehicle development. As a founding member, dSPACE contributed its know-how to defining various standards from the very beginning, systematically implementing them in products and helping to spread the standard across the globe. Here are some examples: support for ECU descriptions (ASAP2, ODX), bus data exchange formats (FIBEX), communication protocols (CCP, XCP) and interfaces for remote-controlling development tools (MCD-3) in the dSPACE products TargetLink®, SystemDesk®, Real-Time Interface, ControlDesk® Next Generation and AutomationDesk®. More recently, dSPACE played a leading role in developing and establishing a standardized test exchange format (ATX) and a standardized interface for ECU testing (HIL API).

OPEN Alliance
The OPEN Alliance is dedicated to promoting Ethernet networks. One special focus is Ethernet communication via two-core, unshielded twisted pair (UTP) cables as a standard for in-vehicle applications. The OPEN Alliance SIG (special interest group) addresses industry requirements for improving in-vehicle safety, comfort and infotainment, while significantly reducing network complexity and cabling costs. dSPACE joined the OPEN Alliance in 2012 and is involved in tool support for Ethernet communication. Two of the products that dSPACE offers for this purpose are the Ethernet Configuration Package and the DS1006 Processor Board.

The ISO 26262 Standard
ISO 26262 is the new functional safety standard for E/E-systems in road vehicles up to 3.5 tons. It was derived from IEC 61508 and covers the whole product life cycle. Model-based development is specifically covered by ISO 26262-6, describing the product development at the software level. German certification authority TÜV SÜD confirms that TargetLink is fit for developing software according to ISO 26262. In the context of this certification, TÜV SÜD also approved the TargetLink Reference Workflow, which provides TargetLink users concrete advice on how to develop software according to ISO 26262.

The standard recommends HIL tests or test methods based on HIL simulation as suitable methods for testing components, single ECUs and ECU networks. The standard does not define the verification of the suitability of a HIL system. To verify this, dSPACE can advise customers and also offer a test service for initial and recurring verification.
Automotive Applications

Rapid Control Prototyping: Developing a new type of light system
An innovative new light function offers motorists more safety and comfort during night-time driving, using image sensors that detect potentially dangerous objects on the road and specially designed headlights that spotlight these objects. In field tests, conducted with a dSPACE RCP system, this marking light shows a whole new picture of the roads at night. (dSPACE Magazine 2/2011, Quick Link: 1582)

System Architecture: Seat belts tightened the AUTOSAR way
In a crash, seat belts have to respond fast, without tightening too extremely on the people wearing them. The solution is to use pretensioners, which tighten the belts during the very first fractions of a second. Active seat belts go one step further by using a gentle pre-tensioner that optimally softens belt impact. Its controllers use AUTOSAR-compliant software developed by using dSPACE SystemDesk. (dSPACE Magazine 1/2011, Quick Link: 1496)

Hardware-in-the-Loop Test: Testing lithium-ion battery management
For electrified vehicles, comprehensive ECU tests are more necessary than ever before. A dSPACE Simulator is used to develop functions and test ECUs for a battery management system (BMS) for lithium-ion energy storage. It simulates battery cells in real time, enabling developers to investigate whether the battery management system meets all requirements. (dSPACE Magazine 1/2010, Quick Link: 1240)

Production Code Generation: Developing power window controls
To provide maximum protection against power window injuries developers simulate, implement and test new functions with the help of dSPACE prototyping systems and the TargetLink production code generator. (dSPACE Magazine 1/2010, Quick Link: 1243)

Hardware-in-the-Loop Test: Efficient testing processes, featuring component testing and virtual vehicle testing
Simulators were used for individual ECUs, including body control and air-conditioning, and also for engine, transmission and all-wheel drive ECUs. For new car models a dSPACE virtual vehicle simulator takes over the efficient verification of all vehicle control functions. Now tests are performed that couldn’t even run before. (dSPACE Magazine 3/2010, Quick Link: 1429)

Rapid Control Prototyping: Active exhaust silencers in vehicle
The anti-noise algorithms for active exhaust mufflers are known and their advantages are clear, but so far it is not possible to produce electronic silencers for vehicles, except under ideal conditions in the laboratory. dSPACE MicroAutoBox takes these silencers out of the laboratory and onto the road. (dSPACE Magazine 3/2009, Quick Link: 1174)
Hardware-in-the-Loop Test: Function integration test for a hybridized powertrain

The electric drives, power electronics and traction battery of a brand new SUV model cause a significant rise in the complexity of the networked electronic systems. From function development to electronic control unit (ECU) release tests, the manufacturer systematically relies on hardware-in-the-loop (HIL) simulation with dSPACE Simulator and dSPACE Automotive Simulation Models (ASM) for functionality verification and quality assurance. (dSPACE Magazine 2/2010, Quick Link1: 1361)

Production Code Generation: Model-based development of transmission functions

To reach the goal of noticeably reducing the development time of prototypes and end products, innovative methods for developing embedded software are necessary. To meet this, a supplier relied on model-based development and production code generation with TargetLink for developing transmission electronic control units (ECUs) more efficiently. (dSPACE Magazine 2/2008, Quick Link1: 880)

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Hardware-in-the-Loop Test: Real-time-capable thermodynamic engine models

Variable valve systems improve the efficiency of modern gasoline engines. Testing the engine control units designed for them requires novel, detailed simulation models with high physical resolution. A combination of dSPACE prototyping and hardware-in-the-loop systems with dSPACE Automotive Simulation Models (ASM) is used to test engine control functions in very early stages when no control units are available. (dSPACE Magazine 3/2009, Quick Link1: 1170)
Commercial Vehicle Applications

Hardware-in-the-Loop Test:
Testing and Verifying Brake System Controllers in Trucks
Today’s modern heavy-duty trucks have to haul heavy loads safely on the roads. Operating reliably under all load, road and traffic conditions is a big challenge for the brakes. HIL simulation provides great help in testing and verifying the controllers of new brake systems in trucks. (dSPACE Magazine 3/2010, Quick Link1: 1430)

Rapid Control Prototyping, Production Code Generation:
Active Damping Control for Turntable Ladders on Fire Trucks
Higher, faster, further and safer – these are the requirements today’s fire engine turntable ladders face. The key is lightweight construction. But there is a problem: The new lightweight ladders are prone to bending vibration. Active vibration damping provides greater positional accuracy, quicker movement and higher safety. dSPACE’s tool chain guarantees fast algorithm porting to the ECU. (dSPACE Magazine 2/2009, Quick Link1: 1120)

Hardware-in-the-Loop Test:
Automated Testing with Virtual Buses and Trucks
Because of their many different sizes, configurations and uses, trucks are more complex than cars. This makes efficient variant handling a necessity. A new, innovative integration laboratory, based on dSPACE Simulator technology, offers many ways to test ECU networks efficiently and systematically. Consisting of 33 ECUs connected via CAN networks, the system makes it possible to verify the ECU communication, even when a multitude of test variants are used. (dSPACE NEWS 2008/1, Quick Link1: 793)

Hardware-in-the-Loop Test:
Verifying the Maturity of New E/E Architectures in Buses
The number of bus variants is high. There are variants for the different chassis types, the models, the comfort and safety systems, and even the number of doors. This diversification is reflected in the parameterization of the ECUs and the ECU variants. On a HIL test bench, you can switch between even the most different vehicle variants within just a short time. This gets virtual test drives up and running earlier and decreases the time required for development and testing. (dSPACE Magazine 2/2009, Quick Link1: 1112)
In modern tractors, gearboxes are being replaced more often by continuously variable transmissions which always operate in an optimal rotational speed range. With a hardware-in-the-loop system developed on the basis of a dynamic drivetrain model it is possible to test the drive control of new continuously variable transmissions under real conditions. Errors and hazardous situations can be tested extensively on the system, which improves safety. (dSPACE Magazine 1/2012, Quick Link\(^1\): 1675)

Rapid Control Prototyping, Production Code Generation, Hardware-in-the-Loop Test: Developing an Automatic 12-gear Transmission

A leading Chinese commercial vehicle manufacturer developed an automatic transmission that provides many advantages such as reduced fuel consumption, lower emissions, more comfort, and selectable driving modes. The function model was tested with MicroAutoBox in the vehicle. With the use of the production code generator TargetLink, the controller software was greatly improved and tested in a hardware-in-the-loop environment. (dSPACE NEWS 2007/2, Quick Link\(^1\): 559)

Rapid Control Prototyping, Production Code Generation, Hardware-in-the-Loop Test: Developing an Electronic Brake System for Heavy Agricultural Machines

With intelligent functions, electronic brake systems help drivers handle their tractors in all kinds of situations and on any kind of terrain. dSPACE tools make it possible to implement and validate electronic brake systems under the highest quality standards. TargetLink enables model-based design of the application software, and the hardware-in-the-loop (HIL) test bench allows the system software to be tested systematically with reproducible test sequences. (dSPACE Magazine 2/2011, Quick Link\(^1\): 1583)

Hardware-in-the-Loop Test: Validating and Analyzing a Safe-Speed Function for Trucks

Safe Speed is a safety system that automatically slows a vehicle down when it drives too fast. A hardware-in-the-loop simulator helps analyze and validate the safe-speed function. The test drivers use real vehicle controls and get feedback on the simulated truck behavior via a monitor. (dSPACE NEWS 2007/3, Quick Link\(^1\): 697)

Rapid Control Prototyping: Developing New Winch Electronics for a Snow Groomer

Snow groomers are equipped with a winch to handle steep grades. This winch lets the vehicle move on slopes with up to a 45° grade. The function of the traction control was developed with the help of dSPACE MicroAutoBox. In comparison to conventional programming methods, this gave a potential time savings of approximately 50%. (dSPACE NEWS 2007/3, Quick Link\(^1\): 690)

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