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dSPACE NEWS

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Products

dSPACE Simulator: New Developments in Electrical Failure Simulation

Customers

Continental Teves Develops ESP II

Raising Safety to New Levels

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dSPACE NEWS
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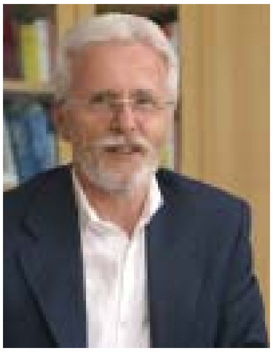
4 *Continental Teves speeded up the development of ESP II by using dSPACE Prototyper. The control design for active steering intervention was implemented in bypass mode.*

6 *ATENA Engineering develops safety-critical systems classified according to IEC 61508 SIL3. TargetLink is a key element in the implementation phase of the development process used.*

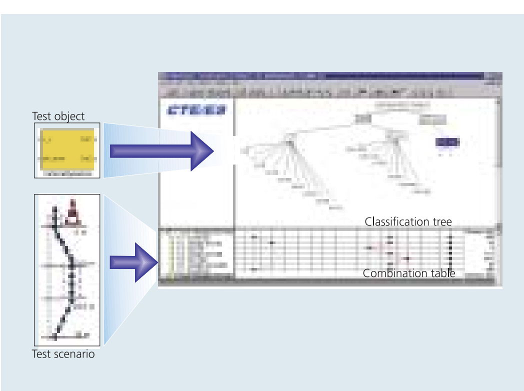


Weren't ABS and ESP great steps forward in automotive engineering? I have never actually experienced them in critical situations myself, apart from a couple of trials on a test track. Even before ESP cuts in, you feel sorry for your poor tires. And comments from passengers subjected to lateral accelerations as you exit from the expressway (or worse still, their offended silence) can also be hard to take. Still, it's reassuring to know that if things got really serious, the system could take it, computer-controlled and completely safe. And the story continues. ESP II has arrived, and that can even do some of the steering. I'm looking forward to trying this out.

Over the last few years, we've seen a lot of good ideas on x-by-wire technology being put on hold for the foreseeable future. However, some cautious steps are being taken in that direction. Small though they may be, they harness a lot of the potential – like Global Chassis Control, which uses mechanically safe, superposition steering (ESP II) instead of just electrical steering, and electrohydraulic braking, which is an intermediate step to electromagnetic braking.

Though test drives are made as safe as possible, these new developments still need development tools with maximum reliability. This particularly applies to anything that can't be done offline or that is used in the actual vehicle – rapid control prototyping, later production code generation and also calibration. As regards the last, dSPACE is once more maintaining a high standard of reliability. This has already been assessed in pilot projects. And as numerous customers know from experience, our rapid control prototyping and production code generation have long since proven their operational value. Restraint systems, electrohydraulic brakes, steering systems – you name it, dSPACE is involved. But we'll just have to wait a little bit longer before we can buy cars with joysticks replacing the steering wheel, accelerator and brake pedal.

Dr. Herbert Hanselmann
President



10 *MTest, a new addition to the dSPACE product range, supports systematic model-based testing, especially of software and function modules, in conjunction with Simulink® and TargetLink.*

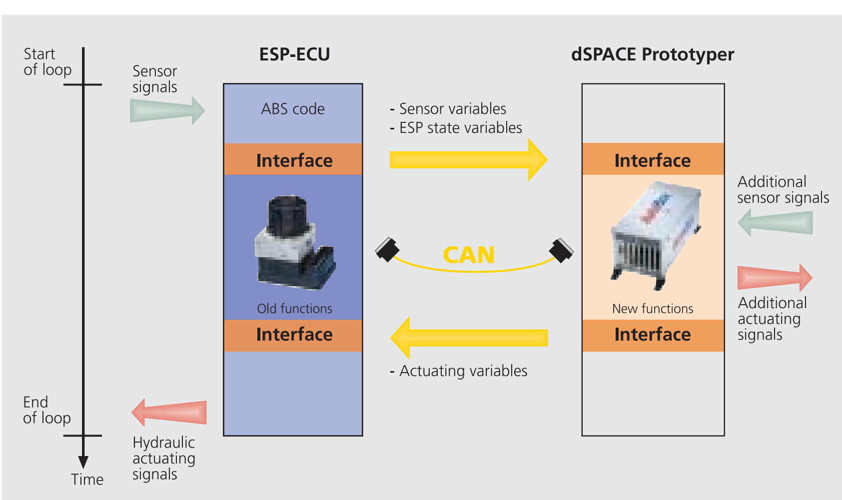
12 *New software makes electrical failure simulation with dSPACE Simulator even easier. A good reason to show you different hardware solutions in detail.*

ESP II – The Next Generation

- Vehicle dynamics control with active steering intervention
- Active driving safety and comfort with ESP II
- Control design with dSPACE Prototyper in bypass mode

Continental Teves has taken a major step towards supplying a completely networked chassis with global control. ESP II is a milestone in the pioneering Global Chassis Control project. Active steering intervention has now been integrated into the new electronic stability program by networking the braking and steering systems. This greatly improves safety, the pleasure of driving, and ride comfort. dSPACE Prototyper is used to develop and verify the control algorithms, working alongside the Continental Teves ECU in bypass mode.

The ESP II system consists of the braking, steering and optional suspension subsystems, together with their internal and external sensors. The electronic braking system used is a further development of today's ESP equipment. It has internal pressure sensors for redundant capture of the four wheel braking pressures and driver input, which are needed for some ESP II functions. All the software functions for sensor data evaluation and control of the brake hydraulics (analog pressure valves) are already implemented in the existing production ECU.
Another ECU in the network controls the most innovative component, a superposition steering system, whose basic function is to adjust the steering ratio to the vehicle speed, achieving a direct, sporty ratio lower than 12:1 or a more indirect ratio of up to 20:1. This makes the vehicle more agile to handle, yet at the same time, the driver feels safer.
In dynamic or critical situations, the superposition steering system allows an extra angle to be superimposed on the angle set by the driver at the steering wheel. This is done by a two-stage planetary gear driven by an electric motor and integrated into the steering column. The actual angle of the wheels, which affects the vehicle dynamics and the strength needed to steer, is therefore made up of the driver's steering wheel angle and the additional angle superimposed by the planetary gear.



▲ *Precise, loop-synchronous data exchange between the ECU and dSPACE Prototyper (AutoBox) is guaranteed in every control cycle.*

In the prototype vehicle, dSPACE Prototyper (AutoBox) is used to control the braking and steering ECU, while sensor data and actuating signals are physically exchanged between the networked devices via a private CAN. The extended ESP II algorithms are added to the functions that are already on the braking ECU (ABS/ESP) via a bypass. For greater flexibility and far shorter development times, the new ESP II functionality is being developed on the prototyping system first before being transferred to the target production system later, which will ideally be done by means of automatic production code generation.

Loop-Synchronous CAN Bypassing

Bypass technology is being used to develop all the new software functions on the prototyping system under MATLAB®/Simulink®, while continuing to use the software functionality of the existing production ECU. Because the ECU is a highly optimized development, tailored-made for ABS/ESP, it was an obvious step to use CAN as a simple means of implementing the bypass. In CAN communication, it must be guaranteed that the timing of all data exchange from the ECU to dSPACE AutoBox (sensors) and back (actuators) is absolutely accurate, in other words, it must be loop-synchronous. Working together with dSPACE Engineering Services, Continental Teves produced a completely trigger-controlled and watchdog-monitored Simulink model that fulfils this vital requirement. The entire ABS/ESP algorithm of the production ECU was ported to the AutoBox to implement the bypass. The control of drivers and sensor preprocessing were left on the ECU.

▲ *The prototype vehicle with ESP II handles the most difficult driving maneuvers in winter tests in North Sweden.*

Winter Tests in North Sweden

Braking maneuvers on a road surface with different skid potential on either side (μ-split braking: ice and asphalt) are a particularly vivid example of the effectiveness of ESP II. The yaw torque from the different braking forces (the braking force on the high-friction side is greater than that on the low-friction side) can be compensated by automatic fast countersteering in response to the situation. The driver can continue to steer in the direction he or she wants to go. Unlike today's ABS and ESP systems, where the driver has to countersteer, the steering wheel position in this new system is held in the desired direction. Moreover, depending on how great the difference in the friction coefficients is, and on how the conventional ABS/ESP is adjusted, braking distances can be reduced by up to 15%.

Because the steering system is integrated into the yaw control as well as the brakes, ESP II has an extra means of acting on horizontal vehicle dynamics compared with the standard ESP. The limits of critical vehicle dynamics are being pushed outwards. Critical situations are easier to handle, as ESP II automatically counteracts in oversteer situations. This intervention is not perceptible to the driver, so it can be performed earlier to avoid critical stability situations the moment they arise. If dynamic instability does arise, ESP II can intervene more effectively via the steering system, as this has more leverage than the braking system – the wheel base is greater than the track width. However, braking to reduce driving speed is still indispensable in these situations.

Summary

By integrating the steering system, and optionally also the chassis, ESP II not only boosts active driving safety and comfort, but also provides considerable savings potential in application effort compared with stand-alone systems. Using bypass technology in cooperation with dSPACE considerably speeded up control design for the basic ESP II project and customer projects. The prototyping approach that was chosen provides great development speed and flexibility.

Dr. Stefan Fritz
Dr. Ralf Schwarz
Advanced Engineering
Continental Teves
Germany

TargetLink for Safety-Critical Systems

- ATENA Engineering uses automatic production code generation
- Standards for software in safety-critical systems
- TargetLink embedded in a company-specific tool chain

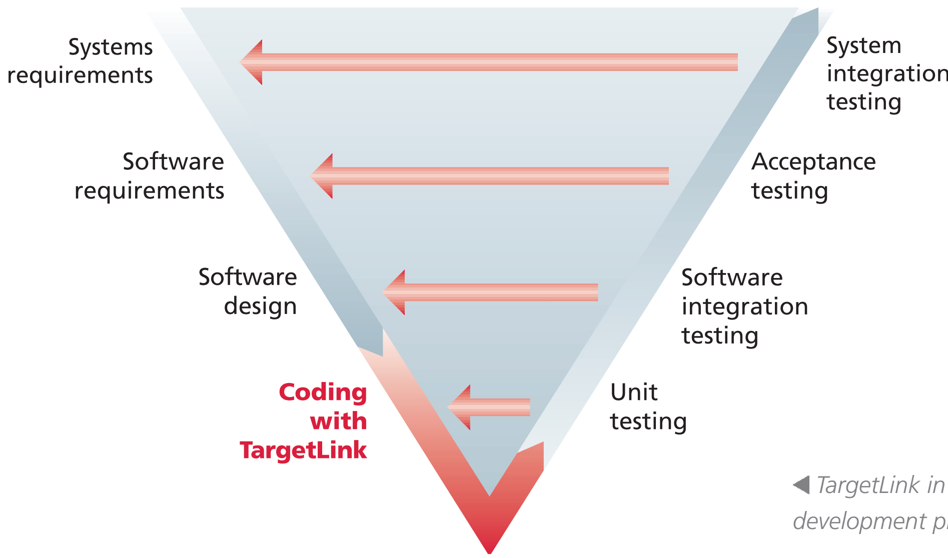
The vehicles of the future will contain more and more safety-critical electronics. Developing them will be a major challenge to the industry. ATENA Engineering is already in a position to offer automotive manufacturers and suppliers comprehensive expertise in developing safety-critical systems. The development process used for such systems at ATENA Engineering is based on the experience and standards in the aviation industry and uses dSPACE TargetLink for automatic production code generation.

Know-How for Safety-Critical Systems

The number of safety-critical systems in vehicle electronics is rapidly increasing. Just a few years ago, the worst that could happen if a system had an error was that a function failed. In future systems, it will be a safety hazard for the vehicle's occupants and other road users. The IEC 61508 safety standard for automotive electronics was set up to minimize the hazards of such systems. Complying with it poses a particular challenge to software development.

At ATENA Engineering, we have many years of experience in developing safety-critical systems in the aviation sector through close cooperation with our parent company, MTU Aero Engines GmbH. MTU Aero Engines GmbH develops and produces the engine controllers for a number of European aviation projects. The aircraft engine controllers are multichannel electronic control units (ECUs) with between 4 and 10 processors and have to meet tough safety requirements. The standard governing

▲ *ATENA Engineering uses know-how from the aviation industry for safety-critical automotive electronics.*



◀ *TargetLink in ATENA's development process.*

the development process for these controllers is RTCA DO178, a concrete form of the IEC 61508 safety standard that is suitable for the automotive industry. This means that ATENA is in a position to apply software development standards for safety-critical systems comprehensively in automobiles.

Because projects are often subject to frequent modification, we decided to use an automatic production code generator. Moreover, the software design is often available as an executable specification, which a production code generator implements with a far lower error rate than does handcoding. A production code generator is much more reliable. It does not make careless mistakes, and there are no misinterpretations in implementing the model.

ATENA Chose TargetLink

At ATENA we have defined and implemented a software development process for safety-critical systems using dSPACE's automatic production code generator TargetLink. TargetLink can be seamlessly integrated into MATLAB®/Simulink® and allows software designs that are available as Simulink/Stateflow® models to be reliably converted into C code.

Before deciding in favor of TargetLink, we evaluated the code generators available on the market in depth. The reasons for our decision were high product quality, especially the quality of the generated production code, and TargetLink's technical features. A vital factor is that TargetLink offers comprehensive configuration options that our process uses to meet the requirements of code in safety-critical systems.

Proven Development Process at ATENA

The software development process, whose implementation phase TargetLink supports, has now been in use at ATENA since November 2002. TargetLink is embedded in a project-specific tool chain. The tool chain ensures compliance with the quality criteria for safety-critical applications and also allows a high degree of automated implementation. We use it to develop safety-critical vehicle systems that are classified according to IEC 61508 SIL3 and whose software comprises up to 25,000 lines of code. Automatic code generation plays a very important part in all this. Using TargetLink, we have succeeded in automatically generating approx. 80% of the entire production code, including our hardware interfaces.

ATENA and dSPACE are cooperating closely to extend integration into our tool chain in future versions of TargetLink and to reinforce the support given to safety-critical aspects of code generation

Hermann Tauber
Team Leader, Electronics
ATENA Engineering GmbH
Germany

Michael Jungmann
MTU Aero Engines GmbH
Germany

Audi: Dynamic and Safe

- dSPACE Prototyper for Audi Dynamic Steering
- In-vehicle function tests using MicroAutoBox and AutoBox
- Production code generation with TargetLink

Audi Dynamic Steering is now close to production. This is a new superimposed steering system that will provide both more responsive vehicle behavior and increased safety. All the function prototyping for developing the system was done using MATLAB®/Simulink® and dSPACE Prototyper. TargetLink is used for automatic production code generation.

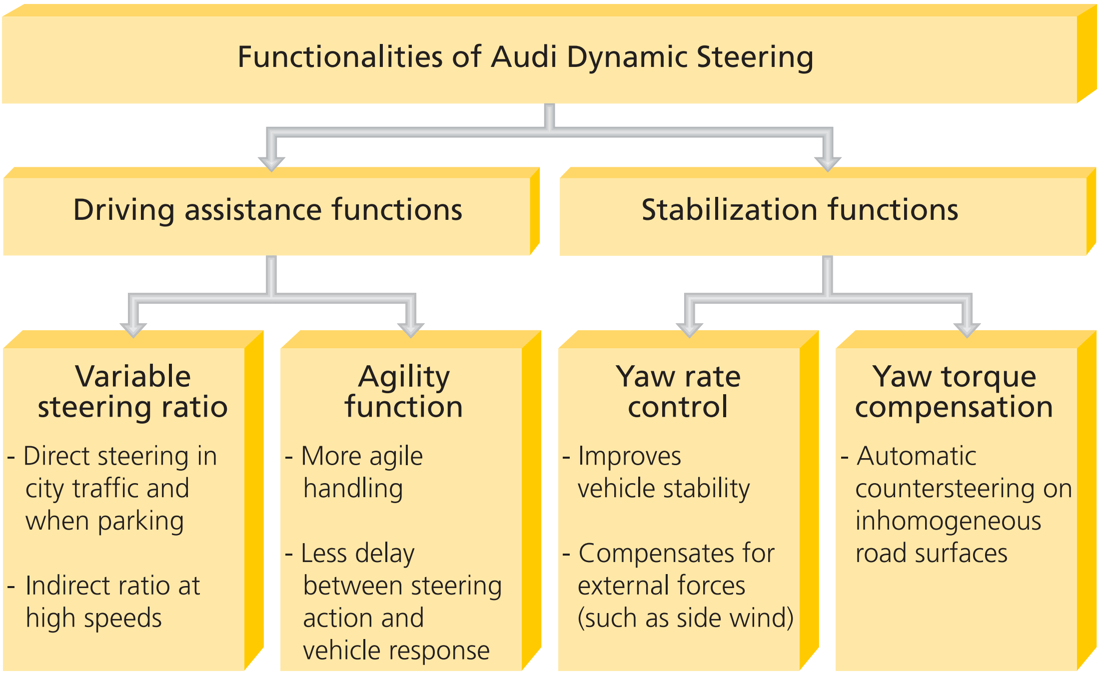
Audi Dynamic Steering

Audi Dynamic Steering, our new steering system based on a planetary gear developed by ZF Lenksysteme GmbH, allows an additional steering angle to be set via an actuating motor. The angle is computed according to the driver's steering angle and vehicle dynamics variables. For example, the steering ratio can be adjusted according to speed. The new steering system also offers drivers agility functions and extra stabilization functions in critical situations, greatly boosting both dynamics and safety. However, the new system required considerable changes in the development process. Previous steering systems had been developed more or less as stand-alone systems, but the new functions necessitated networking with other vehicle dynamics control systems such as ESP (Electronic Stability Program).

New Functions with dSPACE Prototyper

Implementing the new Audi Dynamic Steering system involved work in all fields of development, from plausibility checks on input signals, to the monitoring of driving states and the design of vehicle models, right through to control design. The functions for Audi Dynamic Steering were designed in MATLAB/Simulink, tested by software-in-the-loop simulation and finally tested and optimized in the vehicle using dSPACE Prototyper. Two vehicles were equipped with an AutoBox and one with a MicroAutoBox for this purpose.
Because the actuator was not yet available, to begin with the dSPACE hardware was used for measuring analog signals (such as those from the measurement steering wheel) and bus signals (CAN signals, yaw rate, lateral acceleration, gear position). This data was

▲ *Audi Dynamic Steering in a hardware package.*



▲ *Functional scope of Audi Dynamic Steering. The functions of the steering system allow sporty driving while at the same time providing greater safety in critical situations.*

used for initial parameterization of the vehicle models. Once the actuators and sensors had been installed in the vehicle, the controlled system was measured and the vehicle models adjusted accordingly. The basic functions supplied by ZF Lenksysteme GmbH were integrated into the Audi models as S-functions. All newly developed functions are always tested in a Simulink simulation first, and then thoroughly tested and refined in the vehicle using dSPACE Prototyper. To standardize software development at Audi, in-house style guides were used, for example, covering the naming of functions.

Automatic Production Code Generation Speeds Things Up

Automatic production code generation using TargetLink plays an essential role in meeting deadlines and fulfilling the software consistency required for Audi Dynamic Steering. To optimize the time, quality and cost factors, great importance was – and is – placed on a seamless tool chain throughout all development steps, from the initial design to production level, with MATLAB/Simulink providing the reference standard. For example, a seamless transition is guaranteed from function prototyping to automatic production code generation.

Looking Beyond the Steering Wheel

Audi Dynamic Steering is a taste of things to come. Future developments will focus more on integrated function design across several vehicle components, and not so much on functions for individual components. Steer-by-wire will mean an even greater degree of network integration, and unlike Audi Dynamic Steering it will have no mechanical backup system. The processes within the development workflow will also change, as an increasing number of suppliers offer intelligent actuators and sensors for shipment along with the basic functions. Audi itself will continue to develop high-level functionalities that give it the competitive edge.

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Mechatronics Development and Testing
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Germany

Goodbye to Trial and Error

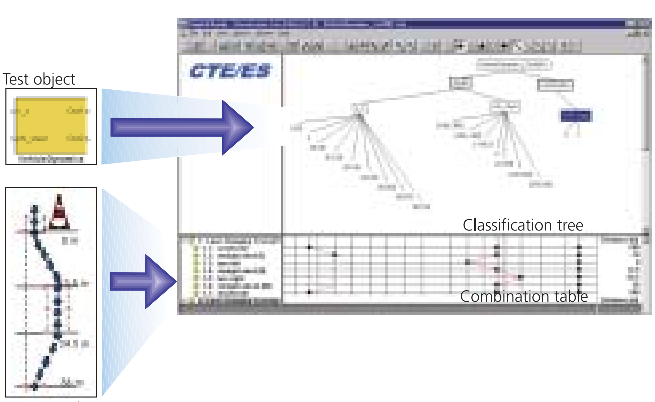
Today's electronic control units (ECUs) have software so complex that testing their behavior completely in every possible situation is a major challenge. Which situations need testing and which not? How many tests are necessary? To answer such questions, a systematic test approach is required. dSPACE has met this challenge by adopting a test method originally developed by DaimlerChrysler and implementing it as a new tool, known as MTest, in AutomationDesk.

MTest

MTest supports systematic, model-based testing, especially of software and function modules, in conjunction with Simulink® and TargetLink, dSPACE's production code generator. Within the function testing process, MTest provides a unified, integrated test environment for MIL (model-in-the-loop), SIL (software-in-the-loop) and PIL (processor-in-the-loop). It also ensures that data is reusable: Test vectors produced with MTest can also be used in a hardware-in-the-loop (HIL) system.

The Classification Tree Method

The classification tree method [1] is MTest's central feature, and together with CTE/ES, the classification tree editor also integrated into MTest, it provides a convenient way of finding test scenarios systematically and producing clearly structured documentation on them. Testers using the classification tree method first break down the possible inputs of a test object into classes according to various (disjoint and complete) criteria. Then the criteria and classes are represented as a tree, whose branches are extended vertically to form a combination table. The test scenarios themselves are formed by systematically combining the individual classes: Each row in the combination table describes one step in a test sequence. Each test step is defined by selecting some of the classes of the classification tree above it.
The simple example in the illustration shows the basic idea of the classification tree method.

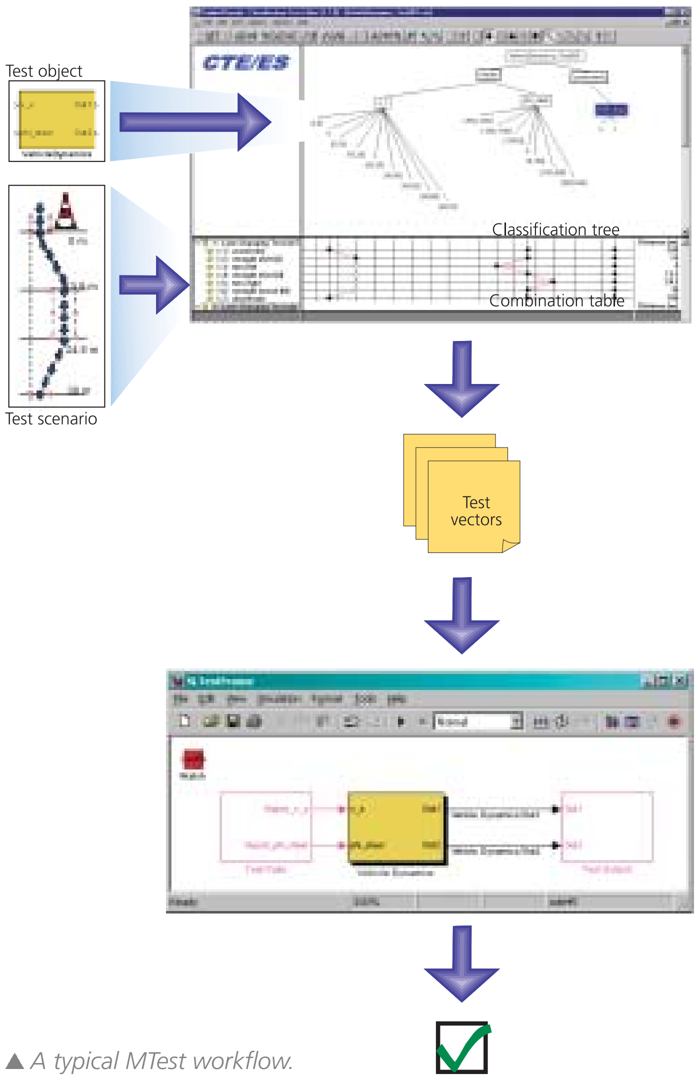


▲ *The basic idea behind the classification tree method: The value ranges of relevant input variables are clearly classified in tree form. Test scenarios are described by combining individual classes.*

The objective is to describe a test sequence for a change-of-lane test for a driving function. The relevant input variables and parameters, vehicle speed v_x, steering angle phi_steer and the ESP-active flag, are classified in the classification tree. Widely varying driving maneuvers can be described by suitably subdividing the individual value ranges. The example shows the combination table for the change-of-lane test underneath the tree.

Working with MTest

MTest gives developers a systematic approach and a high level of automation to support them throughout all the phases of model-based testing. A typical MTest workflow looks like this: First the test cases based on a test idea are found systematically and described briefly using the classification tree method. Then they are instantiated by concrete test vectors, i.e., the signal sequences needed to stimulate the model or software. Test drivers to stimulate the model or software are



Step1:
Formulate the test idea in the classification tree editor and define the test cases

Step 2:
Generate the test vectors

Step 3:
Create a test frame

Step 4:
Run the test

▲ *A typical MTest workflow.*

automatically generated from the test data sequences, after which the tests can also be run automatically. The data from the simulation is recorded in the test frame. In the test evaluation phase, the actual test results are compared with the expected values. When models are changed, the new model versions can be tested automatically with test scenarios that are already available, and the results can be compared with the reference values. The test vectors can also be reused elsewhere, for example, in HIL tests.

AutomationDesk and MTest

While AutomationDesk mainly focuses on graphical test description and the management of test projects, MTest provides a systematic approach to finding test cases and a seamlessly integrated test environment from MIL to SIL and right through to PIL. MTest's classification tree editor allows test cases to be found intuitively so that function models can be tested in Simulink® and TargetLink. Together, MTest and AutomationDesk support a systematic approach to testing.

[1] M. Grochtmann, K. Grimm: Classification Trees for Partition Testing. Software Testing, Verification and Reliability, 3, 63-82, 1993

G. Reiß, K. Lamberg, dSPACE GmbH,
I. Fey, M. Conrad, DaimlerChrysler AG,
Research and Technology
Germany

Failure Simulation with dSPACE Simulator

- **New developments in electrical failure simulation**
- **ControlDesk Failure Simulation**
- **dSPACE Simulator Mid-Size: Failure simulation now also on ECU inputs**

The dSPACE Simulator success story continues. In our last issue, we announced new features to come soon. We can now give you more details on simulating electrical failures with dSPACE Simulators.

How does a vehicle behave when a fault occurs in the electrical system? How do the electronic control units (ECUs) react? Can the driver still maneuver the vehicle if the yaw rate sensor fails? Does the engine go to fail-safe mode if the EGAS throttle valve actuator is short-circuited, to allow the driver to get out of the fast lane?

Hardware-in-the-loop (HIL) simulation with dSPACE Simulator has long been used to simulate such situations in the laboratory. dSPACE Simulator allows either individual or several interacting ECUs to be tested automatically in a simulation environment of any desired extent - the entire powertrain with all versions of engines and transmissions, test tracks with widely varying surface conditions, comfort and safety components, and so on. Efficient tools for electrical failure simulation are vital. So dSPACE has now integrated the software environment for controlling failure simulation hardware seamlessly into ControlDesk, the graphical user interface, making it even easier to use.

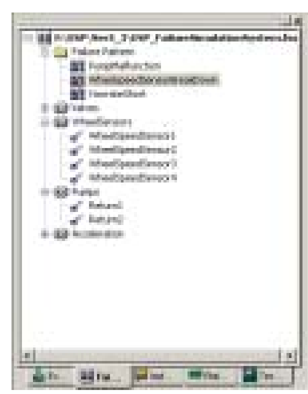
ControlDesk Failure Simulation

ControlDesk Failure Simulation is a new software component with a graphical user interface for simulating electrical failures in the ECU cable harness. The failure simulation hardware, failure patterns and ECU signal channels are all handled centrally via software. Electrical failures are also activated and deactivated centrally. When networked ECUs are tested, each ECU is displayed separately with its signal channels. As a further safety feature, failure simulation can also be limited to specific ECUs or signal channels.

ControlDesk Failure Simulation runs on existing Mid-Size (failures on ECU outputs) and Full-Size (failures on ECU inputs and outputs) dSPACE Simulators. It also works hand in hand with AutomationDesk, our test automation software.

The Failure Navigator provides easy access to all the elements of the failure simulation system:

- Connected ECUs – Access to all signal channels enabled for electrical failure simulation
- Failure patterns – Combinations of channel failures to be simulated at the same time



◀ *The Failure Navigator in ControlDesk Failure Simulation: Central handling of failure simulation hardware, failure patterns and all ECU channels.*

The Failure Pattern window visualizes failure patterns and the status of the failure simulation hardware, and allows the failure patterns to be edited and saved.

▲ *Failure Pattern window: Every failure pattern is shown in a layout.*

Failure Simulation Hardware for Different Simulator Variants

Failure simulation is possible with almost all the hardware variants of dSPACE Simulator. Powerful failure simulation hardware further boosts their functionality.

dSPACE Simulator Mid-Size

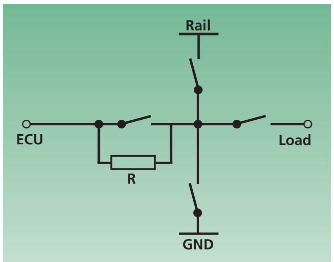
dSPACE Simulator Mid-Size supports the DS2210 HIL I/O Board; its standard version provides failure simulation on ECU outputs with disconnected loads. Each channel has an 8-A protection. The failure simulation hardware (DS749) is controlled via the host PC's standard RS232 interface. We recently introduced a hardware extension (DS789) that allows electrical failures to be simulated on ECU inputs as well. The host PC controls this hardware extension via the same serial interface as the outputs. The new failure simulation board can also be retrofitted to existing Mid-Size dSPACE Simulators.

dSPACE Simulator Full-Size (Step 1)

Failure simulation on dSPACE Simulator Full-Size supports the DS2210 and all the other digital and analog I/O boards from dSPACE. A lot of our customers are using this variant. The relay boards (DS291) for failure simulation can be used on their own or in conjunction with load boards (DS281). It is not possible to connect a load to ECU inputs. Each channel has an 8-A protection. The relay is controlled via a serial RS232.

dSPACE Simulator Full-Size (Step 2)

We have another failure simulation concept for special requirements. This approach uses a central relay switching matrix (DS293) for failure simulation on ECU inputs and outputs. Signal channels can be switched in on three different rails via load modules (DS282). Further features that can be connected include 5 different system potentials (for example, KL30, KL31, KL15), various measurement devices, and Rsim modules (DS289 for simulating real substitute loads). The failure simulation board is designed for 24 A (real load), so failures can also be simulated on several connected load module channels. All the components of this expanded version are controlled via CAN (for example, CAN CardX on the host PC).



▲ *Switchable failure types with dSPACE Simulator (depending on the hardware used).*

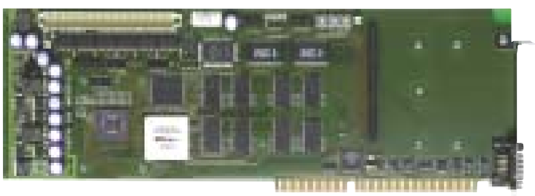
dSPACE Simulator

Failure Simulation System	Possible Failure Types
dSPACE Simulator Mid-Size (Step 1)	
n x DS749 FIU Module (up to 10, each boards features 10 channels)	On ECU outputs: ■ Cable break ■ Short circuit to ground ■ Short circuit to battery voltage
dSPACE Simulator Mid-Size (Step 2)	
n x DS789 Sensor FIU Module (up to 2 modules, 80 channels)	On ECU inputs: ■ Cable break ■ Short circuit to ground ■ Short circuit to battery voltage
dSPACE Simulator Full-Size (Step 1)	
n x DS749 FIU Module (each boards has 10 channels) n x DS281 Load Module	On ECU inputs and outputs: ■ Open circuit ■ Short circuit to ground or minus terminal of the battery voltage (KL31) with or without load (an ECU input is disconnected from a dSPACE output channel) ■ Short circuit to plus terminal of the battery voltage (KL30) with or without load (an ECU input is disconnected from a dSPACE output channel) ■ Short circuit to another ECU pin with or without load (via common rail)
dSPACE Simulator Full-Size (Step 2)	
■ 1 x DS293 Central FIU Module ■ n x DS282 Load Module (10 channels) ■ 1 x DS289MK Rsim Module (simulates a resistance in the range 1..131 kΩ in steps of 1 Ω)	On ECU inputs and outputs: ■ Open circuit with or without additional hardware (Rsim, MEAS or SOURCE) in series ■ Short circuit to another ECU pin directly or via additional hardware ■ Short circuit to 5 reference points (potential 0…4) directly or via additional hardware elements

More Power for High-Level Applications

- **DS1005 now has an 800-MHz processor**
- **Fully compatible with predecessor**

The proven DS1005 PPC Board, the basis for dSPACE's modular hardware, now has a powerful IBM PowerPC 750 FX processor. The processor frequency has been boosted from 480 MHz to 800 MHz. The new processor also has an integrated level 2 cache. So cache operations now also run at a processor frequency of 800 MHz, as opposed to the previous 240 MHz. The DS1005 PPC Board provides the computing power for your real-time system and also functions as an interface to the I/O boards and the host PC. Performance can be boosted even further by linking up to 20 boards in a multiprocessor system. This means that development systems can be tailored to specific customer requirements. When suitable I/O is added, developers have a powerful, turn-key system with top performance.



▲ *The new DS1005 board with an 800-MHz processor.*

DS1005 PPC Board

The new board is fully compatible with the old board versions and is supported from dSPACE Release 3.1. It can be used with all existing I/O boards without restrictions. Multiprocessor systems can mix old and new DS1005 boards without impairing performance. Programs or models compiled for the older version run on the new board without modifications.

As simulation models grow more complex, the requirement for computing power is constantly rising. So at dSPACE we are offering our customers upgrade options from old DS1003 and DS1005 boards to the new DS1005 board. Equip yourself for computing-intensive applications with the new DS1005.

User Conferences 2004

- **4th dSPACE User Conference now from October 21 to 22, 2004, in Stuttgart, Germany.**

dSPACE GmbH and The MathWorks have agreed on a long-term events policy. In future, the dSPACE User Conferences in Germany will be held in odd-numbered years, and The MathWorks will run its International Automotive Conference (IAC) in even-numbered years. The 4th German dSPACE User Conference will now take place from **October 21 to 22** in the Liederhalle Cultural and Congress Center in Stuttgart, Germany**.** For the first time, the User Conference will be a European forum where dSPACE users and product experts can meet and exchange ideas on using dSPACE systems to develop electronic control units. There will be papers in German and English. The German papers will be simultaneously translated into English.

▲ *The Conference will again be held in the Liederhalle in Stuttgart in 2004.*

US User Conference

As announced in the last issue of dSPACE NEWS, the US User Conference will be held in summer 2004.

Would You Like to Submit a Paper?

If so, please send us an abstract of 400-500 words describing your application, the dSPACE tools used in it and the results achieved.

- For the User Conference in the USA, address it to: Louise Hackett: *lhackett@dspaceinc.com* (Deadline November 30, 2003)
- For the User Conference in Germany, address it to:Bettina Henking: *bhenking@dspace.de* (Deadline February 9, 2004).

Please tell your colleagues of the new dates. The latest information on the conferences will be on our Web site soon, at:

http://www.dspace.de/goto?uc_stuttgart
http://www.dspace.de/goto?uc_detroit

Job Opportunities

Are you an engineer who is just graduating? Or are you looking for new professional challenges? Then come and join our team in Paderborn, Munich or Stuttgart, Germany; Paris, France; Cambridge, United Kingdom or Novi, MI, USA!
Due to our continuous growth, dSPACE is looking for engineers in

- Software development
- Hardware development
- Applications
- Technical sales
- Product management
- Technical writing

Events

EUROPA

MeasComp
September 23-25, Wiesbaden, Germany
Rhein-Main-Hallen, Hall 1
Booth #33/34

VDI – Elektronik im Kraftfahrzeug
September 25-26, Baden-Baden, Germany
Kongresshaus Baden-Baden

Aachener Kolloquium
October 6-8, Aachen, Germany
Eurogress Aachen

Mesurexpo
October 21-23, Paris, France
Paris Expo – Porte de Versailles, Hall 7/1,
Booth #J39

Training

Please check the corresponding field on your response card.

- dSPACE Systems
- ControlDesk
- AutomationDesk
- HIL Simulation
- TargetLink
- dSPACE Calibration System

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- Send us an e-mail at *dspace-news@dspace.de*

Your opinion is important. Please send your criticism, praise, or comments to *dspace-news@dspace.de* – thank you!

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