2/2006

dSPACE NEWS

FACTS · PROJECTS · EVENTS

Products

ControlDesk Meets FlexRay

Customers

RapidPro on the Bosporus

Business

New Subsidiary in Japan

Opel's Fuel Cell – Simulating Alternative Drives

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4 *To produce the production-ready function code for a distributed, FlexRay-based controller system, the BMW Group used a development process automated by TargetLink.*

12 *In a joint project, the Technical University of Braunschweig and Micromotion GmbH developed the control for PARVUS the miniature robot using a dSPACE prototyping system.*

I love it when I see our products are also helping engineers in nonautomotive fields. After all, dSPACE began as a developer of mechatronics tools, and not even half of our original applications at the university were automotive. For the first few years, it was the same with our sales.

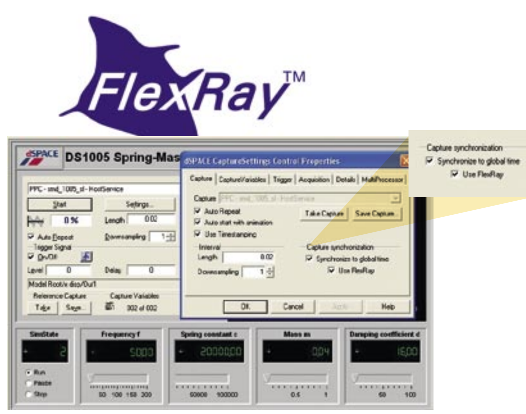
So this issue includes a fascinating application for helicopters and another for motion control in mini-robotics – good solid mechatronics.
There have always been nonautomotive applications aplenty in dSPACE NEWS. They have involved control systems for a blood pump, paper positioning in a printing machine, the hydraulics in a flight simulator, the mirror in a space telescope, an artificial wrist, hard discs, cabin air pressure in passenger airplanes, linear drives for railway cabs, a gyroscope simulator for an astronomical experiment, a cable winch for space freight, and combustion optimization in gas turbines. I could go on and on.

I might add there are two applications from the early 1990s that I have always liked a lot, though they were never reported on in these pages. Both were in Japan. One was for controlling hydraulic earthquake counterbalancers for the tops of skyscrapers (Penta Ocean was the customer), the other for active noise compensation in the space between the glass panes in double glazing, for apartments located right beside and over highways – as many Tokyo apartments are (Nippon Sheet Glass was the customer). Both applications were unusual, but of great practical value.

Mechatronics are also fun to work on, and they cross-fertilize applications in the automotive sphere. We've often been there when general mechatronics found their way into vehicles. Electrical drives in hybrid vehicles, for example, are old friends of ours. Control systems for electrical machines have always been a dSPACE field. As has simulating electrical machines to test inverters and associated systems – since before we produced our first locomotive simulator for Adtranz (now part of Bombardier) in 1996.

80% of our worldwide sales are now in the automotive industry, so that is clearly where we focus a large part of our energy. But our interest in general mechatronics, drives technology, and aerospace applications continues.

18 *Future technology under control: dSPACE systems are the basis for simulation-aided test methods in developing the electronics of fuel cell vehicles at Opel/GM.*



23 *The new version of ControlDesk, the test and experiment software, allows different capture services to be synchronized to a global time base. Ideal conditions for FlexRay.*

BMW: Production Code for Distributed Controller

- New damper control at BMW Group
- TargetLink used in the automated development process
- Time saved and quality increased

Active suspensions greatly enhance ride comfort – for example, by reliably damping the movements of the vehicle body. The BMW Group has developed a new damper control for dynamic stabilization, based on a distributed controller consisting of a central electronic control unit (ECU) and satellite ECUs. Production code for the extensive function model was generated with TargetLink in a largely automated development process. Other tools equipped with FlexRay were also used.

Suspension Control System

Controlled damping systems ensure that in all situations, modern cars have the ideal combination of comfort and safety. Conventional suspensions can only compromise between the two. The BMW Group's new damper control keeps car body movements, wheel load variations, and disturbances all under control. The complex control system consists of several sensors and actuators, and a total of five ECUs.

▲ *Modern damper controls from BMW ensure comfort and safety.*

Distributed Controller

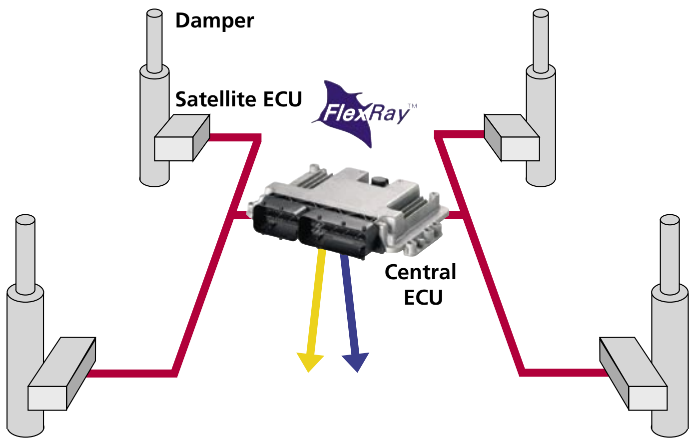
The controller was designed as a system comprising a central ECU and intelligent satellites. The four satellites are located close to the wheel suspensions and communicate with the central ECU via the FlexRay bus. The ECU evaluates the vehicle states captured by the acceleration pick-ups and calculates the general control strategy. The satellites then directly control the active dampers. In addition, a large volume of operating data is captured in the vehicle and fed in.

Using a distributed controller allows the use of system-independent control models that can be partitioned across the ECUs involved. The advantage: All the control algorithms are created in a single Simulink® model and can therefore be simulated as a whole.

Tool Chain and Processes

The software development process was designed to meet several requirements. One of these was that the development of several systems in one single model had to be supported. Rapid prototyping, code generation, and hardware-in-the-loop (HIL) simulation all had to be served by the same model. Model conversion and code generation had to be seamlessly automated and versionable. The tools Simulink® and TargetLink were integrated into a largely automated tool chain for model conversion and code generation. A sequence control with its own user interface automates various work steps, facilitates data handling, and ensures modular versioning and management. The model was constructed from over 50

> *"On the basis of TargetLink, the production code generator, we have set up a seamless, automated development process, thereby achieving greater efficiency in development."*
> ***Tobias Schmid***



▲ *The control system has a distributed design. The intelligent satellites communicate with a central ECU via the FlexRay bus.*

subsystems. The subsystems can be individually selected and versioned in the user interface, and then translated into production code by TargetLink. This enabled us to achieve the goals of simplifying the modeling process, reproducing tests more easily, and streamlining the entire process. The tool chain meets the requirements of the BMW development process.

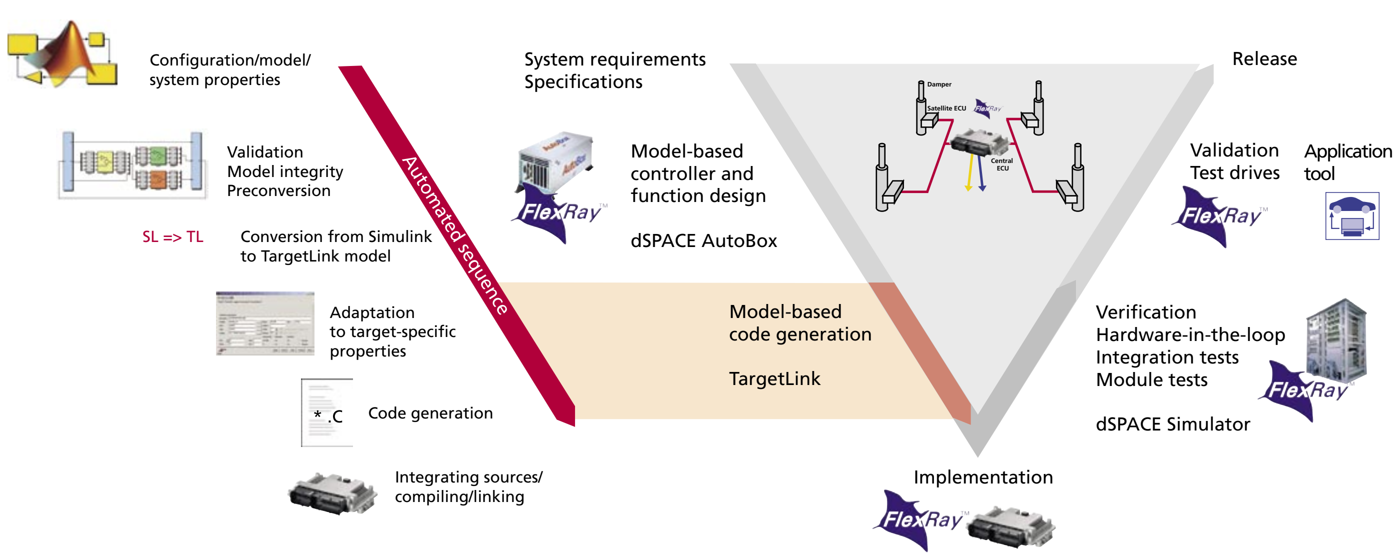
Prototyping and Implementation

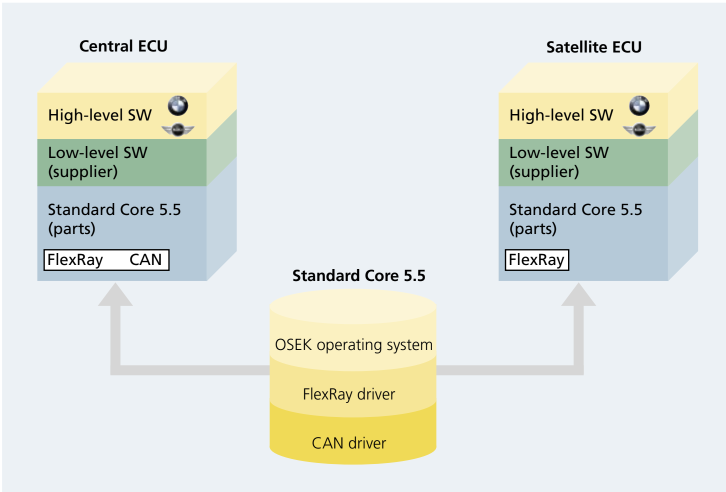
The function algorithms that were developed with Simulink were first tested with a dSPACE AutoBox connected to the FlexRay bus. The tested model was then used directly for production code generation and implementation. To prepare implementation on the target processors, a model-in-the-loop (MIL) reference simulation of the essential functional units was produced and then in the next step compared with TargetLink code by means of the software-in-the-loop (SIL) procedure. This allows problems such as fixed-point effects in the satellites to be detected and solved. One particular challenge was that the satellites had Star 12 (HC12S) fixed-point processors, while the central ECU was equipped with the floating-point processor MPC 565, so very specific methods are required for generating production code from a model. Processor-in-the-loop (PIL) simulation was used to test the algorithms and the resource requirements directly on the target processors before the ECUs were parameterized. This has the particular advantage that problems with memory management and execution times are detected during early development phases. These are evaluated with the support of TargetLink's diagnostic functions. The TargetLink code generated for the subsystems was integrated into the BMW Standard Core Software. The BMW Standard Core Software comprised low-level functions from various suppliers, drivers for FlexRay and CAN, and an OSEK operating system. The overall function model was modeled from 12,000 blocks, from which 100 KB of code was generated for the central controller and 11 KB each for the satellites.

Verification and Validation of Controller Functions

The ECUs were tested in a hardware-in-the-loop test environment based on a network of dSPACE Simula-

▼ *The development process follows the V-cycle and is automated in parts. The design tools used have FlexRay interfaces.*





▲ *The components to be implemented are an operating system from the BMW group, low-level software from the ECU suppliers, and the high-level software generated by BMW.*

tors. This simulated the entire system and performed fault simulation tests on it, from component tests on the individual ECUs right through to network tests. Finally, AutomationDesk was used to verify the damper control against the function model. The model simulation (MIL) was compared with the results of the real system (HIL) using the same stimuli.

> *"Using TargetLink, we were able to generate production-ready code for the system-independent function model of our distributed controller that meets the high requirements of the BMW Group."*
> ***Florian Büttner***

Results

By implementing this damping control, the BMW Group has succeeded in considerably improving comfort and safety. For example, body movements were greatly reduced, in each driving situation, compared with the predecessor systems.

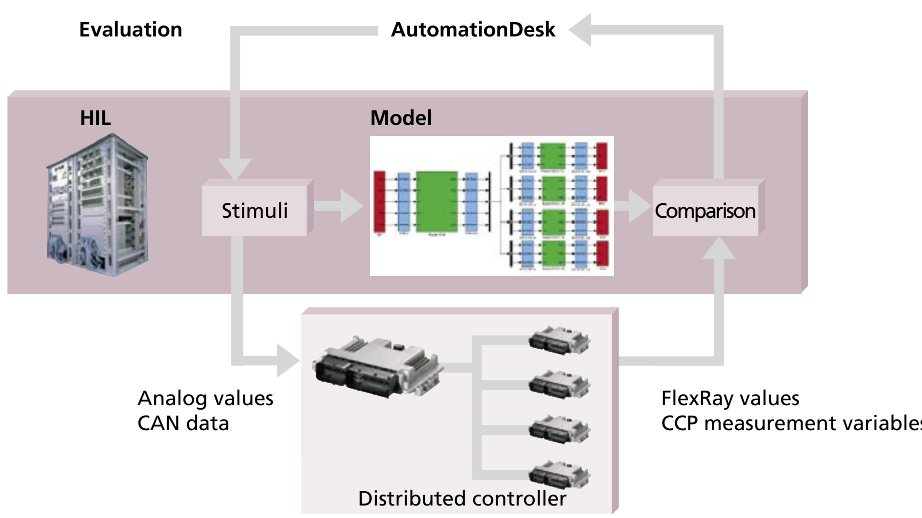
The tool chain that was set up, with its largely automated procedures, makes the process to a large extent seamless and ensures very good reproducibility. This considerably reduced the time needed for controller development and also enhanced the quality of the code that was produced, and greatly facilitates the development and implementation of control systems.

The design tools from dSPACE proved a complete success, from the prototyping phase to implementation and right through to release tests on the ECUs. Using FlexRay, the brand-new bus system, requires powerful, well coordinated tools, and dSPACE was able to provide us with these.

Project Status and Outlook

The system is currently undergoing in-vehicle tests and the generated code is being calibrated. Meanwhile, improvements are also being made to the development process. Further tests (code coverage, static code check) are being integrated, and data handling and exchange are being improved. A method of reusing the acquired scaling information in conversion from Simulink to TargetLink is also under development. Further production projects with TargetLink are being planned on this basis.

Florian Büttner,
Tobias Schmid
Department EF-63
BMW AG
Germany



▲ *Following software implementation, the behavior of the system in an HIL environment is compared with the simulation of the function model in order to verify controller functions.*

Anti-Noise Flaps

The noise produced by helicopters, particularly as they come into land, is far from pleasant, and their vibrations also affect the pilot. Both are caused by the air currents in the plane of the rotors. Eurocopter Germany is working on producing piezoelectrically controlled flaps for the rotor blades that will considerably reduce noise and vibrations. The control system for the flaps is being implemented with the aid of a dSPACE prototyping system.

- Noise reduced by piezoflaps in the rotor blades
- Control via dSPACE prototyping system
- Noise and vibrations reduced

Air Vortices Cause Noise

The noise arises when one rotor blade collides with the vortex trail of the rotor blade in front. But noise is not the only problem: helicopters also vibrate continuously. The vibrations are largely due to the air flow striking the blades asymmetrically, as typically happens in helicopters. This means that an advancing rotor blade has greater lift than the rotor blade opposite it, which is moving towards the tail. As a result, the dynamic forces are not in overall balance – and the helicopter vibrates.

The Solution: Additional Flaps in the Rotor Blades

By using controlled deflections of additional, piezoelectrically controlled flaps in the rotor blades, we can considerably reduce both the noise and the vibrations. The flaps perform two tasks: First, they divert the air vortex leaving one rotor blade away from the next rotor blade. Second, their deflections generate additional forces that decrease the imbalance of forces in the helicopter, thereby reducing the vibrations. Controlling the approx. 35 flap deflections per second is the task of the dSPACE prototyping system, which is based on a DS1103 board. The control system "hears" the collision between blade and air vortex via a microphone on the landing skids and a pressure sensor in the rotor blade, and uses the acoustic behavior to calculate the optimum control for the piezoflaps. To calculate useful control signals for the piezoflaps, we have to sample the acoustic behavior at frequencies of up to 5 kHz.

Noise and Vibrations Reduced

The piezoflaps considerably reduce the noise and the vibrations. The piezo-controlled flaps are far faster and more compact than the first version, which was hydraulic (see dSPACE NEWS 2/2003). We regard this system as an important step towards production level. It is even conceivable that the piezoflaps might later be used not only for noise reduction, but also for the primary steering of the helicopter – which would make control rods and swash plates unnecessary.

Dieter Roth
Eurocopter GmbH
Germany

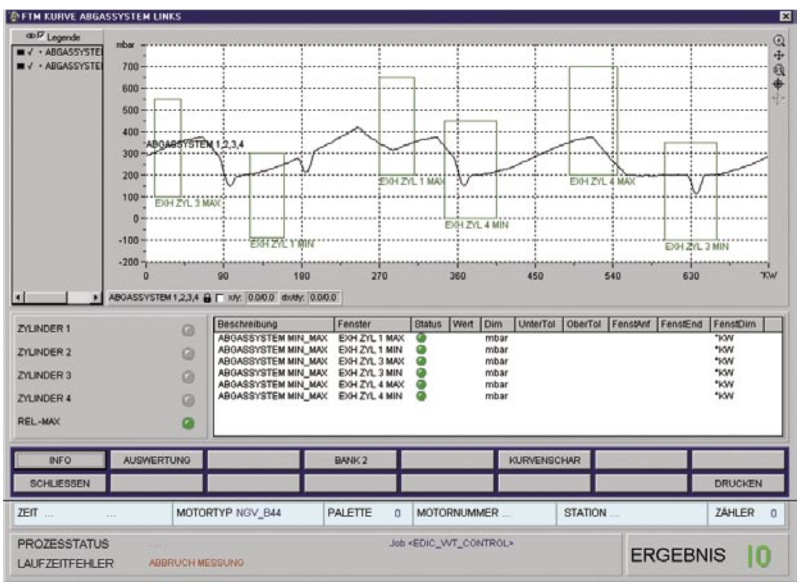
The dSPACE prototyping system in action in the helicopter. It causes additional flaps in the rotor blades to perform defined deflections, thereby minimizing noise and vibrations.

Cold-Test Bench

- BMW Group simulates cold-test bench
- dSPACE Simulator used
- Optimizing cold-test routines

The BMW Group has used a dSPACE Simulator to construct a virtual "cold-test bench". This uses a real-time simulation model to check the testing and diagnostics routines used in the cold test. The dSPACE Simulator's job is to help optimize the testing process and increase efficiency. As a result, the test cycle was reduced by 5%.

All individual engine components are tested meticulously before assembly. Yet after assembly, some engines fail to run completely smoothly. This can be caused by glitches in the assembly process, such as dirt or handling errors, or by awkward combinations of tolerances. To meet customers' high expectations, a 100% end-of-line test is performed on all engines. Engines in large-scale production undergo cold testing, and racing and custom engines are hot-tested.



▲ *Virtual test cycle for engine checks.*

Cold Tests on Engines

Cold-testing of every single engine is a major part of this quality assurance procedure. The unfired engines are pulled by an electrical asynchronous machine and tested for correct functioning at predefined engine speed profiles. The tests cover the engine assembly itself, the wiring harness, and the connected sensors and actuators. Compared with hot tests, in which the engine runs on fuel, cold tests cost a lot less in terms of ventilation, exhaust scavenging, cooling, fire prevention, and noise protection. A cold test takes only 20% of the time needed by a hot test. This boosts efficiency and cuts production costs.

Virtual Laboratory Test Bench

Cold tests are a firm fixture in the engine production process, so test procedures and processes are monitored continuously in the search for optimization potential. In cooperation with dSPACE, a virtual cold-test bench was constructed with hardware-in-the-loop (HIL) simulation technology to investigate and improve the testing and diagnostics routines used in the cold test.

The engine electronic control unit (ECU) and the host PC on the test bench are the only real components interacting with the Simulator.

The remaining test bench sensors, test bench drive, and combustion engine are provided by the simulation environment.

This allows both the processes and the test station software to be tried out and optimized before going into production. Appreciable savings in cost and time are the result.

dSPACE Simulator

The real-time simulation model runs on two DS1005 PPC Boards in a multiprocessor system. These calculate the model of an unfired engine,

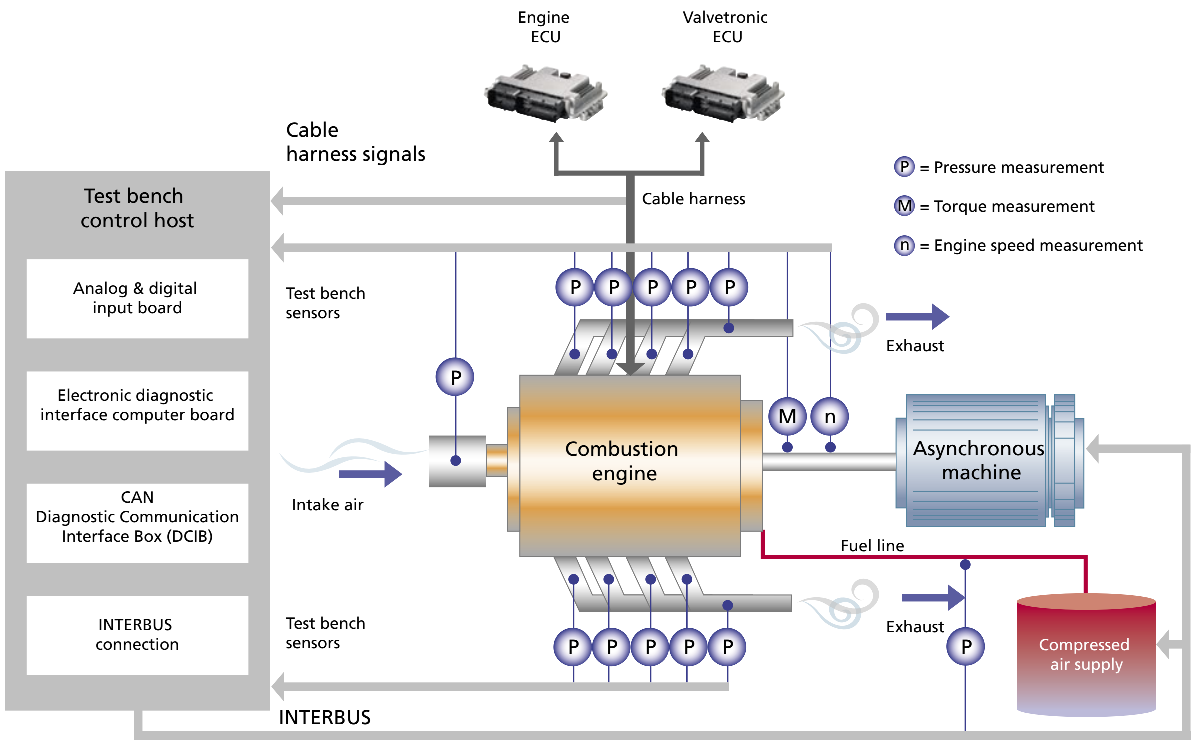
which includes the internal friction and the effect of ambient air flowing through the engine. Two DS2211 HIL I/O Boards measure and simulate the necessary input and output signals.

The effect of the asynchronous machine on the engine in unfired operation is also simulated. The IP Carrier Board DS4501 is equipped with an INTERBUS module and provides direct access to the INTERBUS network used to send the rotational speed of the asynchronous machine to the measurement processor.

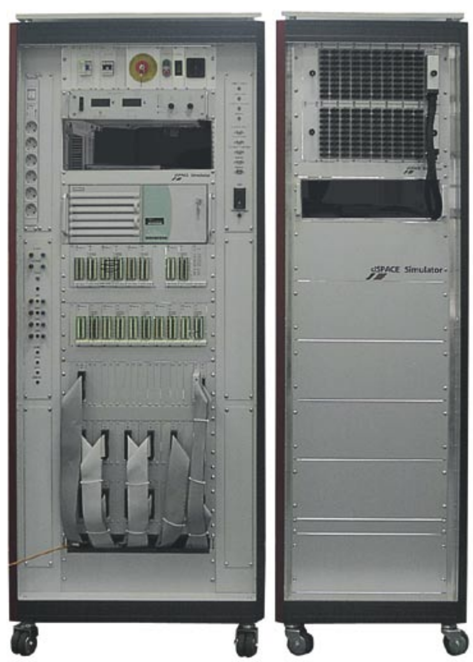
The actuators are simulated partly by substitute loads and partly by real loads.

Optimizing the Test Process

dSPACE Simulator is used not only to simulate the engine cold tests, but also to check the communication between the individual interfaces. The engine model



▲ *Schematic of the laboratory cold-test bench.*



▲ *dSPACE Simulator for the virtual cold-test bench.*

is manipulated systematically to mimic assembly and component faults, so that the effectiveness of the cold test routines and the diagnostics in the ECU can be verified. Testing time was cut by 5% by improvements in efficiency. New interface boards and their drivers can also be tested easily. All these studies can be performed under laboratory conditions and do not have to be done at the end of the assembly line during ongoing production.

Source:
AUTOREG 2006
„Hardware-in-the-Loop-Simulation zur Entwicklung und Verifikation von Prüfroutinen in Motorsteuergeräten für Bandendetests in der Motormontage"

Glossary

Valvetronic –
Variable valve timing system with continuously variable intake valve lift.

Cold test –
Function test on engines without firing up.

INTERBUS (process field bus) –
Standard for field bus communication.

End-of-line test –
Function test on engines when they reach the end of the assembly line.

Ford Otosan: Active Chassis Control

- RapidPro and MicroAutoBox at Ford Otosan
- Ford Transit Connect with active chassis control
- Industry-university cooperation

A Ford Transit Connect equipped with continuous damping control (CDC) dampers and a double pinion active steering system is being used by Ford Otosan (Turkey) for research on active chassis control. The dSPACE system (MicroAutoBox and RapidPro) is used for implementing the active chassis controller. The research vehicle has a semi-active suspension controller that works in coordination with the steering controller for improved ride and handling characteristics. The dSPACE system allows easy modification of the control algorithms being tested.

Semi-Active Suspensions

Passive suspensions require a compromise between the requirements ride comfort and handling performance. Active suspensions allow the best of both worlds at a relatively high cost. Semi-active suspensions are the intermediate, lower cost solution. Semi-active CDC dampers were used to improve ride comfort without compromising the handling performance of the Ford Transit Connect research vehicle. Skyhook, groundhook and hybrid CDC control algorithms were tested using the MicroAutoBox and RapidPro system for implementation and rapid controller prototyping (RCP). Testing was conducted at the Ford Otosan grounds, on a four-poster and on a test road with different levels of surface irregularities.

▲ *The Ford Transit Connect with semi-active suspension controller is being tested on a four-poster.*

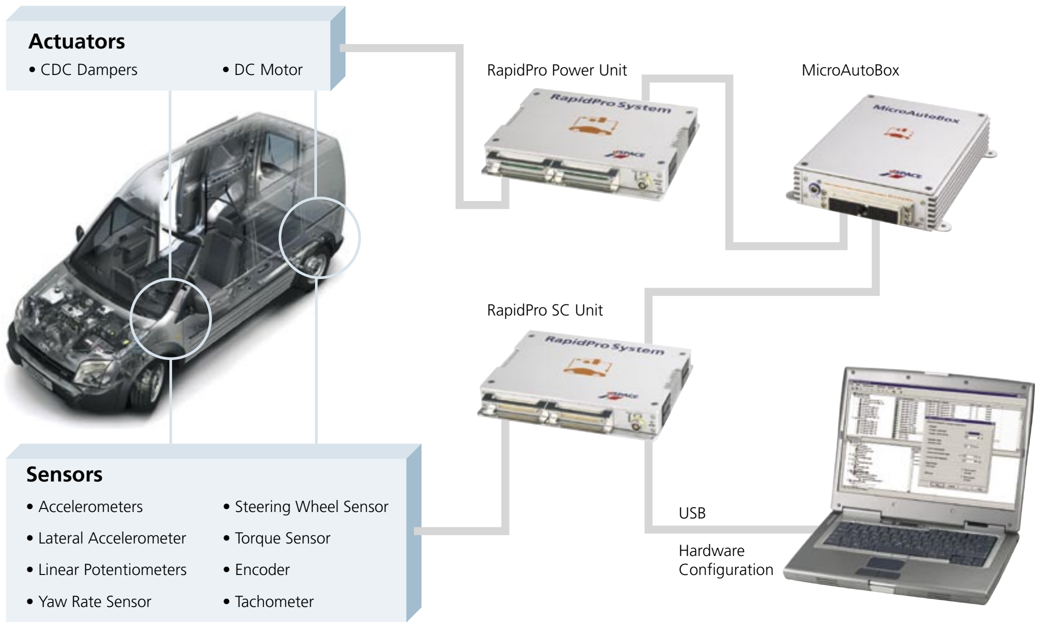
Active Steering

A double pinion active steering system was designed and installed on the same research vehicle. The active steering actuator was first used to implement electric power steering. This steering either mimics the original hydraulic steering behavior of the Ford Transit Connect or works as a programmable, compliant steering system. The driver can program the steering wheel stiffness dynamically and schedule changes according to velocity. The steering wheel is soft during low speed and parking maneuvers. It stiffens as velocity increases. The use of the active steering system in testing a yaw stability controller is in progress.

> *"This was the first dSPACE system that we used in a research vehicle in our division. We were satisfied with its performance and have begun using dSPACE MicroAutoBox and RapidPro systems in other research vehicle control applications."*
> ***Asst. Mng. Mustafa Sinal, Ford Otosan***

Active Chassis Control and Instrumentation

In active chassis control, the semi-active suspension and active steering controllers work in cooperation. The CDC dampers are adjusted to reduce undesired body motion transients during handling maneuvers and when the yaw stability controller is active. Each suspension has two accelerometers and a linear potentiometer. The active steering system has one moment sensor, one tachometer, one encoder, one steering wheel angle sensor and a yaw rate sensor. It also reads



◀ *The dSPACE MicroAutoBox and RapidPro combination is used for controlling both the semi-active suspension system and the active steering system.*

vehicle speed. PWM drivers are needed for driving the CDC dampers and the active steering electric motor. The RapidPro and MicroAutoBox combination with its software programmable signal levels, large variety of I/O choices and rapid controller programming feature have facilitated research vehicle implementation.

Hardware-in-the-Loop Tests

The research vehicle described above has been built as part of a joint research effort by Ford Otosan and the European Union Framework Programme 6 funded center of excellence on Automotive Control and Mechatronics Research (Autocom) at Istanbul Technical University. Instrumentation of the research vehicle including the dSPACE systems, control algorithm development and implementation are carried out by the teams provided by Ford Otosan and the Autocom center. An active steering hardware-in-the-loop (HIL) test system at the Autocom center is used for steering controller designs before the test vehicle implementation phase. This HIL test system has the same hardware as the research vehicle. A quarter car semi-active suspension control HIL test setup is being built at the Autocom center for developing the CDC controllers before research vehicle testing.

> *"We had been successfully using different dSPACE products including the MicroAutoBox in our labs. So when Ford Otosan asked us to work on this research project, we recommended the MicroAutoBox and RapidPro combination. The RapidPro system proved to be a very useful tool."*
> ***Prof. Levent Güvenç, Istanbul Technical University***

> *"The RapidPro system supplies power to all our sensors, provides the required large number of analog sensor inputs and allows us to adjust analog input levels by software."*
> ***Assist. Prof. Bilin Aksun Güvenç, Istanbul Technical University***

Asst. Mng. Mustafa Sinal
Chassis Division, Product Development
Ford Otomotiv Sanayi AŞ
Kocaeli, Turkey

Prof. Levent Güvenç
Assist. Prof. Bilin Aksun Güvenç
Istanbul Technical University
Istanbul, Turkey

PARVUS – The Little Giant

- Miniature robot for precision assembly
- Control via dSPACE prototyping system
- Desktop assembly line

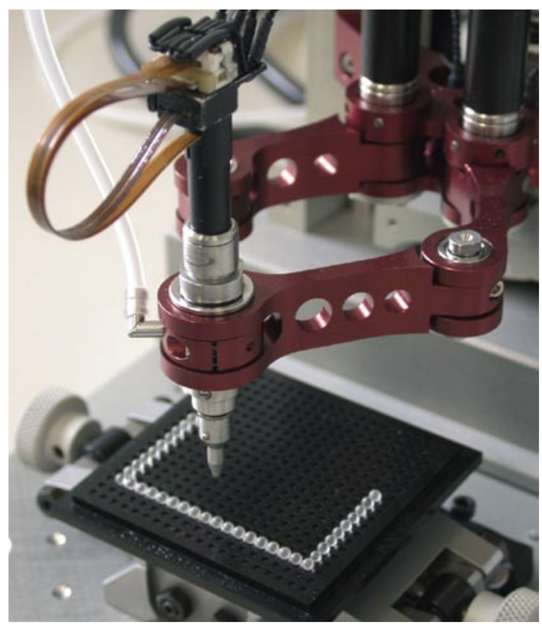
The trend to miniaturization that started with electronics has now reached the world of mechanical engineering, where it can also help to save on energy and materials. Machines for the precision assembly of very small parts are a typical example. A joint endeavor of the Institute of Machine Tools and Production Technology (Technical University of Braunschweig, Germany) and Micromotion GmbH produced a control system for PARVUS, a miniature robot that works just as precisely as conventional assembly robots, though these are often several times larger and more expensive. A dSPACE prototyping system was used in the project.

PARVUS the Miniature Robot

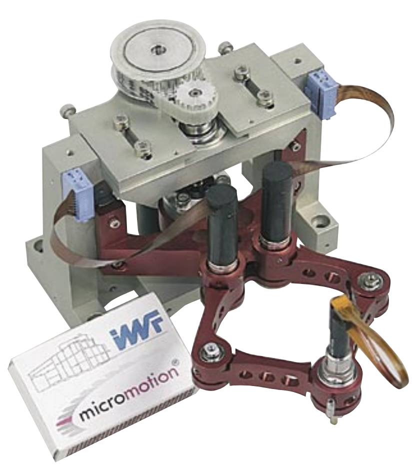
In designing PARVUS (Latin for "small"), we used a range of components from microsystem technology, among them micromotors and microgears. The result is a robot the size of a postcard that positions and assembles as accurately as its bigger brothers. Potential fields of use for the robot are the semiconductor industry (circuit board component placement) and optics (processing and adjusting lenses and mirrors). With PARVUS, automated assembly lines can literally be set up on a desk – instead of reaching the size of a gym as they do now.

Two Arms Instead of One

The special feature of PARVUS is the parallel structure of its arms. Parallel structure means that it has two arms coupled with one another at the hand axis. This construction ensures good stability and allows very precise, reproducible positioning. Controlling two coupled arms is more complex than controlling a single, independent arm, however. This is the reason why robots with a parallel structure have so far been used only rarely in industry despite their basic advantages. In PARVUS, the complex motion sequences are controlled with the aid of a dSPACE prototyping system based on a DS1103 PPC Controller Board. Using this equipment, our first prototype positions at a repeat accuracy of under 10 micrometers (µm). Theoretically, even a precision of under 1 µm is possible.



▲ *The special feature of PARVUS is that its two arms are coupled at the hand axis. The complex motion sequences are controlled by a dSPACE prototyping system.*



▶ *PARVUS the miniature robot – shown here with a matchbox to give an impression of size – positions workpieces at a repeat accuracy of under 10 µm.*

Controlling with dSPACE Equipment

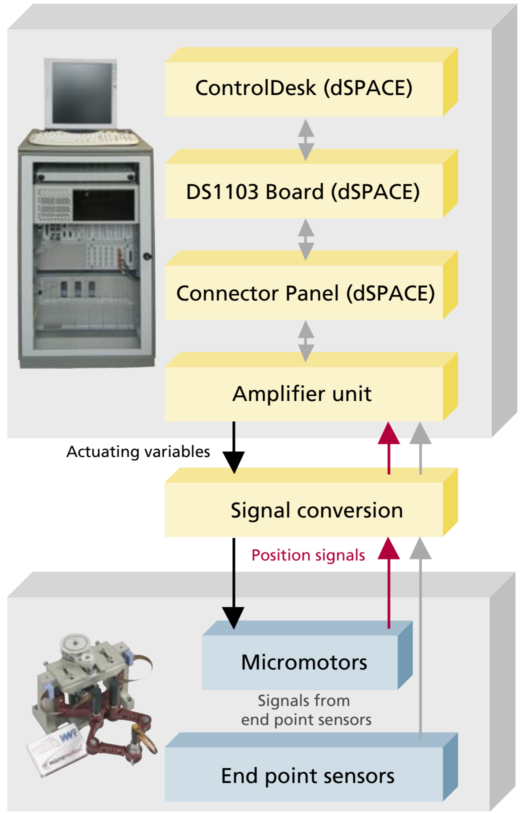
The advantages of the dSPACE system are the hardware's high performance and the ease with which it can be operated via ControlDesk, the experiment software. A further advantage is the ability to use MATLAB®/Simulink® to develop the robot control. This all adds up to a convenient working environment that enabled us to concentrate entirely on developing a fully-fledged robot control. Linear or circular interpolation is used to control the motion sequence of the robot arms. PARVUS has a total of 4 micromotors, which send position signals via encoder to the dSPACE prototyping system.

This in turn calculates the actuating values and returns them to the motors to keep the motion on course. The kinematic equations between the robot's arms and its working space are calculated in real time. To ensure the arm movement is sufficiently fast, the sample time is 0.1 milliseconds.

Assembly Line in Desktop Format

PARVUS the miniature robot is tiny compared with conventional assembly robots, but works just as precisely. So the assembly line of the future will fit on top of a desk. Miniature robots have obvious advantages over conventional assembly robots: They have a considerably lower energy requirement, because there is less mass to move.

They are also cheaper to produce, because not much material is needed to construct them. And if the robots ever have to work in clean rooms, the rooms themselves can be smaller and less expensive.



◀ *Schematic of the control. The convenience of dSPACE hardware and software saves a lot of time otherwise spent on technical details.*

Arne Burisch
Institute of Machine Tools and Production Technology
Technical University of Braunschweig
Germany

Ellen Slatter
Harmonic Drive AG, Parent Company of Micromotion GmbH
Germany

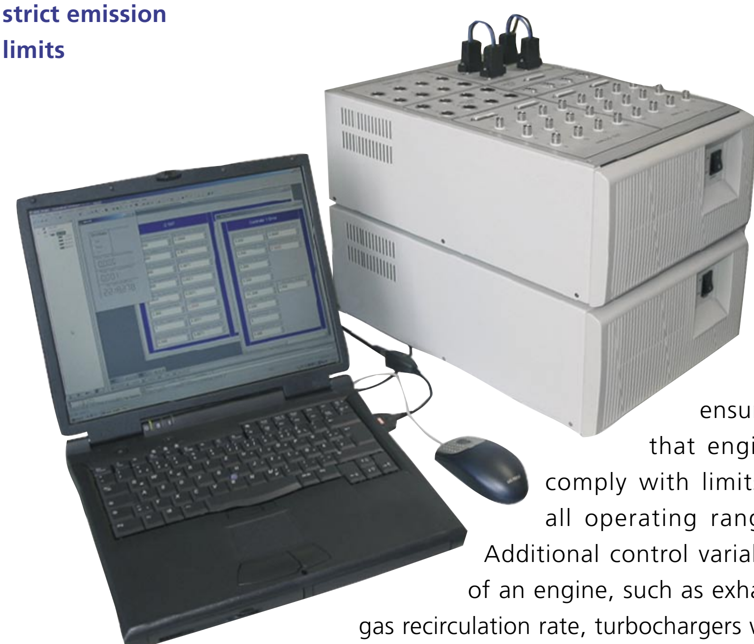
◀ *The robot's heart: the micro-harmonic drive (big picture) with tiny microgear (small picture).*

Clean Air with RCP

- Cooperation between DaimlerChrysler AG and TU Darmstadt
- New measurement strategy with rapid control prototyping
- Compliance with strict emission limits

DaimlerChrysler AG in Stuttgart greatly speeded up function design for its new engine series for commercial vehicles by the systematic use of dSPACE-based rapid control prototyping (RCP) systems. Developed at the Institut für Automatisierungstechnik (IAT), the institute for automation technology in Darmstadt, the model-based measurement strategy is implemented on modular dSPACE hardware, which allows the engine's actuators and sensors to be connected directly. Added to this system are MicroAutoBoxes connected to existing ECUs via XCP.

With the increasing strictness of statutory emission regulations, engine designers face the task of ensuring that engines comply with limits in all operating ranges. Additional control variables of an engine, such as exhaust gas recirculation rate, turbochargers with adjustable vanes, injection parameters, and so on, also play a major role. As the number of variables to be controlled increases, so does the workload involved in developing the necessary functions in the ECU. Because around 60% of emissions arise during the acceleration and deceleration phases, performing optimization in dynamic engine operation is growing in importance. The development process is now far more efficient with the RCP system from dSPACE.



▲ *Modular RCP system with the IAT's sensor/actuator interface for commercial vehicles.*

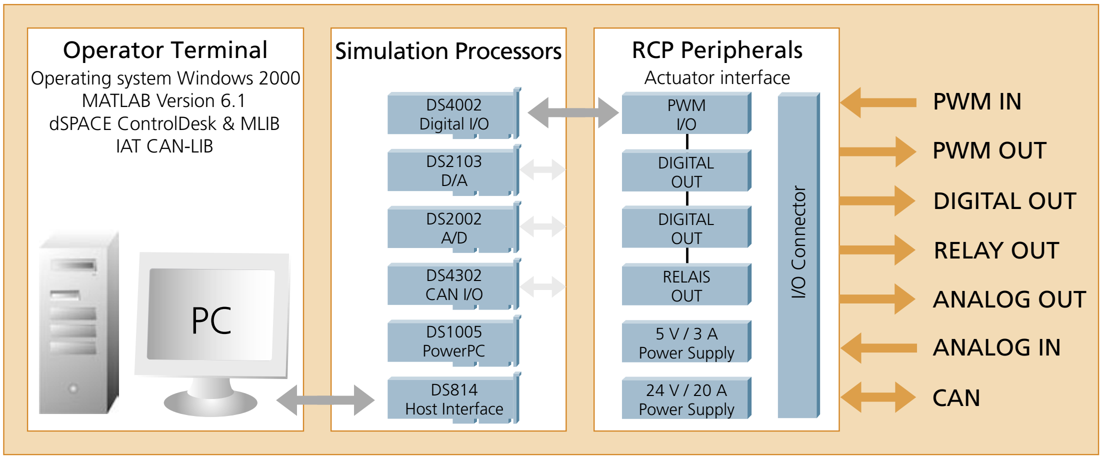
> *"We are currently running more than 10 dSPACE systems in engine development for commercial vehicles."*
> ***Dipl.-Ing. Peter Renninger***

We first designed a new function under MATLAB®/Simulink®, and then tested it on an engine test bench in bypass mode. Bypassing means that only the new function is performed by the RCP system, while all the other functions remain on the ECU.

Data Acquisition with RCP

To obtain the data needed for the function, we tested an engine dynamically on the test bench. The measurement strategy designed here at the IAT partly ignores the engine's transient behavior, which considerably reduces measurement times. This type of measurement is only possible if a real-time-capable RCP system is used. The RCP system overwrites the output signals from the engine control with special excitation signals and records the corresponding measurement variables at a high sampling rate. In contrast to conventional measurement, this procedure allows continuous recording of the sensor data, which we took as a basis for designing a model of the parameters and the control maps. We used both block-oriented modeling approaches (polynomial equations with external dynamics) and neural networks of the LOLIMOT type (local linear model tree), which provide a very simple approximation of nonlinear processes. The control maps are optimized offline by means of these models.

> *"Without these systems, the time needed for engine development would be far greater, and in some respects we could not achieve the same quality of results at all."*
> ***Dipl.-Ing. Peter Renninger***



Structure of the modular RCP system with the sensor/ actuator interface developed at the IAT.

This allows systematic testing of the requirements regarding consumption, response behavior, and emission, and also takes different dynamic test cycles into account.
This development chain was successfully applied at DaimlerChrysler in the development of a combined EGR/WG (exhaust gas recirculation/wastegate) control for a 6-cylinder diesel engine for the 900 series.
We developed and automatically calibrated a control that meets all the requirements regarding emission and dynamics in a very short time.

The RCP System from dSPACE

The RCP system used by IAT is based on modular dSPACE hardware consisting of different plug-on boards. These are given a hardware interface, which we used to connect the sensor and actuator systems,

> *"The RCP systems not only speed up function development but also reduce measurement times on the test bench, by enabling us to use new, dynamic measurement strategies on the engine test bench."*
> ***Dipl.-Ing. Matthias Weber***

and a CAN interface with a truck voltage (24 volt). For greater flexibility, additional 12-volt and 42-volt voltage levels were also provided.
Where a prototype ECU is already available for an application, we use a MicroAutoBox, which communicates with the engine control via CAN and the XCP protocol. It performs sensor measurement and also controls the connected actuators.

The programs required for function development and measurement were written under MATLAB/Simulink. We were able to monitor the experiment conveniently on a graphical user interface, via ControlDesk from dSPACE.
With this combined system of modular hardware and MicroAutoBox, the test bench engineer can record all the relevant engine control variables in real time via the dSPACE system and replace signals from the engine control by signals from the RCP system at suitable entry points.

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Glossary

XCP – CP stands for Calibration Protocol, X for various types of communication such as CAN and USB.

Neural networks – A computation model for information processing inspired by biological systems (such as the nervous system and the brain).

Transient behavior – The behavior of a forced vibration from the start of excitation to the start of a stationary vibration state.

Electromotor Valve Drive

- Developing continuously variable, electromotor valve actuators
- Institut für Automatisierung und Informatik Wernigerode in cooperation with Harz University
- dSPACE prototyping system

The Institut für Automatisierung und Informatik Wernigerode (Institute of Automation and Informatics, IAI) in Germany has been working with Harz University for some years now on a linear engine concept for operating gas exchange valves in combustion engines. Their research has produced an electromotor valve gear that combines the advantages of variable mechanical valve gears with those of electromechanical valve gears. A dSPACE prototyping system was used for laboratory tests.

For many years, automobile manufacturers have been working on designing variable control times and variable lift in gas exchange valves. The introduction of fully variable mechanical valve drives demonstrated that the efficiency of a combustion engine can be considerably improved by variable valve control times. In addition to reducing fuel consumption and pollutant emissions, variable charge changing also has the potential to boost engine torque in the lower speed range. In multicylinder engines, fully variable valve control allows individual cylinders to be switched off, so that the active cylinders work at high operating points, which improves combustion. By combining cylinder switch-off under part load conditions with variations in valve control times and valve lift, consumption can be reduced by up to 16%.

▲ *The basis of the valve test bench is a part of a production cylinder head. The gas forces effective on the valve are simulated by air pressure.*

Our Project

At the IAI, we worked together with Harz University to investigate the use of various linear motor concepts. The investigations were funded by the InnoRegio program of grants run by the Federal Ministry of Education and Research. The result was a linear actuator based on the moving magnet principle and characterized by high dynamics, low moving mass, low power requirement, and small installation dimensions. The concept allows both partial valve lift and electronic valve clearance compensation to be implemented. This actuator combines the advantages of fully variable mechanical valve gears with those of electromechanical valve gears.

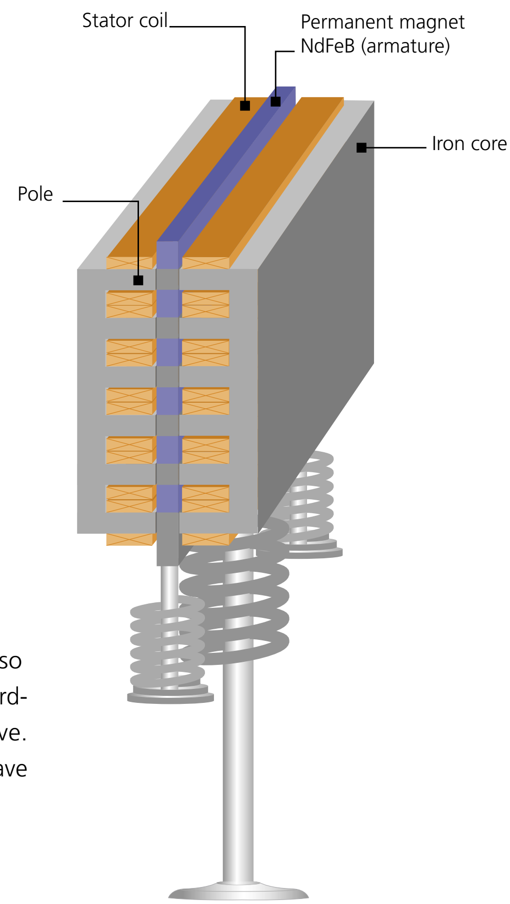
- With partial valve lift, the valve gap has a positive effect on the gas mix state in the cylinder (mechanical, continuously variable valve gears)
- The variable valve overlap allows favorable thermal preparation of the gas mixture by means of hot residual exhaust gas (electromechanical valve gears)

The precision that the valve gear components need for continuously variable, mechanical valve gears, and the hydraulic valve clearance compensation elements that are commonplace today, are both replaced by the electronic control. Variability at the inlet valve allows defined control of the quantity of fresh gas, or in other words, it performs the function of a throttle valve. The ability to switch individual valves in and out reduces the energy consumption involved in charge changing under partial load conditions and prevents the cylinders from cooling down.

The Actuator

The valve actuator is characterized by stationary coils between which permanent magnets are moved. As soon as current starts flowing through the stator coil, a magnetic flow forms in the iron core. This is the same as the magnetization direction along one iron pole of the permanent magnets, and opposite to it along the other. The resultant variable flux exerts a vertical force on the permanent magnets. When the direction of current is reversed, the force also changes direction. Valve lift is supported by a classical valve spring in conjunction with two additional springs mounted on the armature. The force curves resulting from finite element calculation manifest intense nonlinearities, which contribute to the high dynamics of the valve gear. In a first approximation, the force behaviors for the range that is relevant to the control can be described by adding a sinusoidal and a linear component. This is adjusted to process conditions by stacking basic elements. The actuator's dimensions fit into the available installation space. The resultant installation height is lower than that of camshaft-based systems.

▶ The moving magnet principle provides high forces at a small installation volume. The 6-pole actuator generates forces over 600 N at a current density of 20 A/mm².



The Control

For the control of the valve gear, we chose a cascade structure consisting of an analog current controller and a digital position controller. The position controller was first implemented on the basis of MATLAB®/Simulink® and then ported to the dSPACE hardware. In addition to the actual controller, we also used the DS1103 PPC Controller Board to measure various process variables, which we visualized with ControlDesk. The DS1103 also generates reference valve lift curves, compensates nonlinear force components, and performs further monitoring functions. A sampling rate of 20 kS/s (samples per second), which provides a resolution of approx. 2° crankshaft angle at an engine speed of 6000 min-, leaves 50 µs for

> *"The seemingly unlimited computing power of the DS1103 allows us to process even complex control algorithms at a high sampling rate in real time."*
> ***Steffen Braune***

computing all functions. The efficiency of the ported algorithms is therefore vital. We are currently testing alternative control concepts. By simply porting previously simulated control algorithms to put the first laboratory sample into operation, we gained great flexibility, and it proved to be an extremely time-saving approach. Process data capture with the DS1103 and visualization with CalDesk allowed fast data evaluation and enabled us to make direct comparisons with previously simulated structures. The seemingly unlimited computing power of the DS1103 allows us to process even complex control algorithms at a high sampling rate in real time.

In addition to research on operating the actuator on the 12-V vehicle electrical system, we are currently also investigating halving the hardware requirements per valve. Tests on the fired engine have yet to be carried out.

Steffen Braune
Institut für Automatisierung und Informatik
Wernigerode
Germany

Glossary

Finite element computation –
Numeric procedure for an approximative solution to differential equations.

Valve gear –
Controls the gas cycle in combustion engines.

Valve clearance –
Small distance between the camshaft and the valve to ensure the valve will close securely even if it expands when warm.

Moving magnet principle –
Permanent magnets are moved by a stationary coil.

Testing Fuel Cell Technology

- Alternative propulsion concept developed with dSPACE technology
- Closed simulation environment
- Seamless, model-based development chain

General Motors (GM) and Opel are working on bringing hydrogen vehicles with fuel cell propulsion up to production level. To ensure the success of the development process, they have set up a closed simulation environment and are using simulation models in various process phases. Several dSPACE products – MicroAutoBox, dSPACE Simulator, ControlDesk, AutomationDesk, etc. – have been fitted seamlessly into the overall development chain, where they are making a major contribution.

The Road to HydroGen3

As vehicle numbers increase throughout the world, with a concomitant rise in fossil energy consumption and the effect this has on the environment, the automotive industry faces the challenge of developing alternative systems of propulsion. Hydrogen-powered vehicles have the most potential in the search for a viable alternative to combustion engines. Against this background, GM and Opel set up the GM Fuel Cell Activities (GM FCA) development center in November 1997. The aim: to bring fuel cell technology up to production level. GM and Opel have so far invested over a billion dollars in the venture. Today, around 600 employees are working on different aspects of the joint fuel cell program at five different locations – in the USA (Rochester, Warren, Torrance), in Germany (Mainz-Kastel), and in Japan (Tokyo). The latest result of their work is the "HydroGen3", an experimental vehicle based on an Opel Zafira.

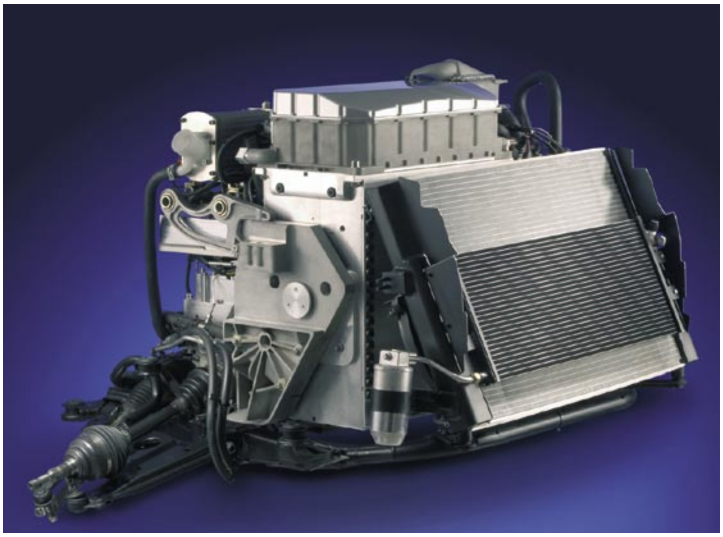
▲ *One of the HydroGen3 experimental vehicles.*

Compact Power Plant Under the Hood

The heart of the HydroGen3 is its fuel cell stack, a compact, highly efficient power plant that fits under the Opel Zafira's front hood together with the electric motor and ancillary units. GM FCA developed the fuel cell stack with 200 single cells connected in series, in which hydrogen and oxygen react in an electrochemical process to generate electrical energy. This is used to drive the HydroGen3's electric motor, which has an output of 60 kW/82 HP. The unit, with a maximum torque of 215 Nm, takes the fuel cell Zafira from zero to 100 km/h in around 16 seconds and reaches a top speed of 160 km/h. As regards the tank system, GM FCA is using a dual approach. Some of the experimental vehicles, called "HydroGen3 liquid", have superinsulated tanks that hold extremely cold, liquid hydrogen. Others, called "HydroGen3 compressed 700", have high-pressure tanks that store gaseous hydrogen at pressures of up to 700 bar.

Extensive Simulation

The control system for the fuel cell propulsion unit is being developed in a seamless process closely based on the classical V-cycle. The ability to slot simulation



▲ *The fuel cell stack – the power station under the hood.*

technology into all phases of the development process is particularly important. Over the years, GM FCA has accumulated a wealth of sound specialist know-how on fuel cell propulsion. Specific modeling tools such as MATLAB®/Simulink® were used to create a closed simulation model of the overall system. This consists of components for the fuel cell propulsion system (FCPS), the FCPS controller, the vehicle plant model, and the restbus simulation of other electronic control units (ECUs). The fuel cell propulsion system itself is split into subsystems (electric storage system, fuel cell power module, electric traction system, cooling system, H2 storage system, and driver interface). The model of the vehicle platform closely follows the design of the actual production vehicle.

Using dSPACE products means that the simulation models that are developed can be used in several different process phases – that is, not only during model-in-the-loop simulation but also in rapid control prototyping (RCP), hardware-in-the-loop (HIL) simulation, and others. Moreover, the model of the overall system is the basis for further applications. It is not only used to develop the FCPS controller, but also to operate the test benches, perform system integration, and develop operating strategies.

Developing the FCPS Controller

Following extensive offline simulations at the workstation, the developed FCPS controller was initially tested without production-close ECUs, simply by using dSPACE's MicroAutoBox as a prototyping system. Autocoding was used for easy transfer of the controller model to the MicroAutoBox. Then after successful fullpass prototyping, from 2004 onwards the E67 production ECU (from GM Powertrain) was used for the FCPS controller. Functions that are still under development are implemented in bypass mode via the MicroAutoBox. Today, FCPS controllers for preproduction development are being tested both in HIL test benches (based on dSPACE Simulator Mid-Size) and in a fleet of test vehicles.

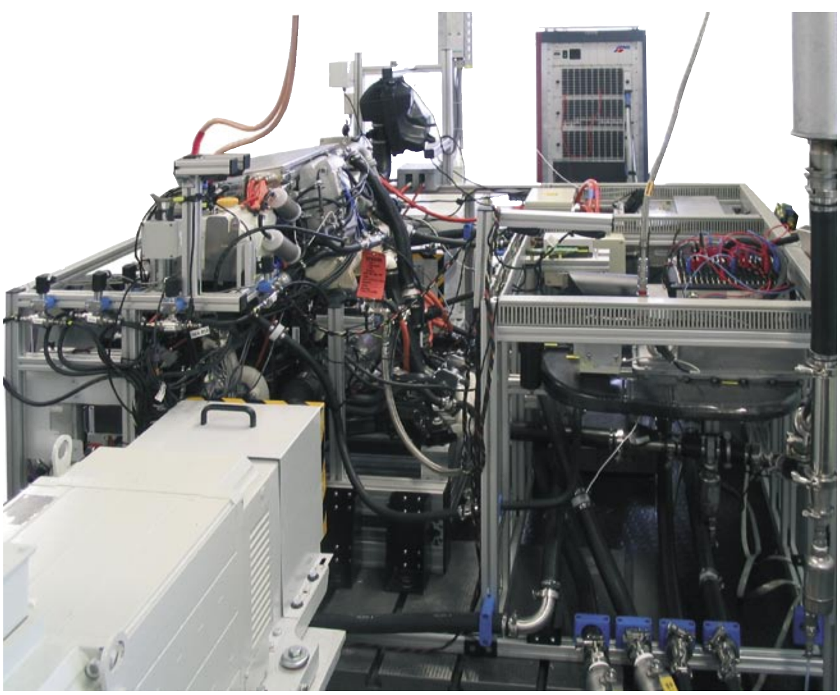
Using HIL Simulation on the Test Benches

Responsibility for developing the individual parts of the fuel cell propulsion system is distributed across

several GM locations. Yet despite parallel development at different locations, HIL simulation enables GM FCA to perform early validation of both the FCPS controller and the subsystems any time they need to do so. A dSPACE Simulator Mid-Size is currently being employed to operate fuel cell propulsion test benches with dynamometers and pure fuel cell test benches. In each case, the HIL simulator works together with the object under test, standing in for specific subsystems or ECUs that are not present in reality. The relevant simulation models from MIL simulation can be reused for this with very little adjustment. The dSPACE software used includes ControlDesk for setting up simulator user interfaces and AutomationDesk for automatic operation of the fuel cell test bench.

Advantages of HIL Simulation

The simulated components can be successively replaced on the HIL test bench by their real counterparts. It is no problem to switch back and forth between model and real object, so complete tests can be run on the closed system at any time.
Early tests on the HIL test bench investigate the connections to adjacent subsystems and ECUs. This provides greater maturity and higher quality at subsystem level very early on, thereby considerably reducing the effort involved in later system integration.



▲ *Fuel cell propulsion test bench with dSPACE Simulator.*

Summary and Outlook

To develop the hydrogen propulsion system, GM FCA implemented a seamless, simulation-aided development environment. MIL and HIL simulations proved valuable components in the control development environment and the fuel cell test benches. The overall simulation environment can be flexibly configured for different operational modes (offline/HIL/restbus simulation), with very little software modification. Model-based development allows offline workstation simulation, real-time simulation at HIL and system test benches, and control prototyping on test benches and in vehicles. Using the dSPACE products makes simulation technology an integrated component in all phases of the development process. This means that the same versions of the control software can be used for test benches and vehicles, and there is no special test bench software that would require extra maintenance.

Dr.-Ing. Stefan Sinsel
Adam Opel GmbH
GM Fuel Cell Activities,
Germany

Best Practices for TargetLink Models

New modeling guidelines for TargetLink, produced jointly with a German OEM, aim to optimize the generation of efficient C code from control algorithms. Version 1.0 has just been released and is available to all TargetLink users. Currently, models often require reworking at the interface between control design and software development. The new guidelines cut out a lot of this extra work and boost development productivity.

- More productivity in the development process
- Seamless transition from control design to software development
- Tips on efficient code, MISRA conformity, transparent models, and many others

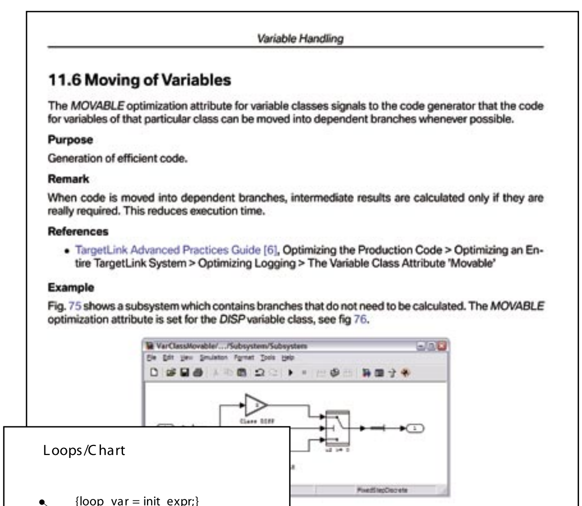
Why Use Modeling Guidelines?

A problem often encountered in target implementation is that the control design includes modeling styles and modeling elements that cannot be transformed into efficient C code. When this happens, models have to be reworked during the software development phase - a time-comsuming and error-prone process. The TargetLink Modeling Guidelines now help control designers to select a suitable language subset in Simulink®/Stateflow®, and software developers to achieve optimum model conversion to highly efficient C code.

Contents of the Modeling Guidelines

The TargetLink Modeling Guidelines comprise around 150 rules, covering the following aspects:

- Transparent controller layout
  Like coding guidelines at software level, modeling rules enhance transparency and readability at model level.
- Suitable language subset
  The defined subset of language elements from MATLAB/Simulink/Stateflow allows optimum implementation by TargetLink.
- Optimum fixed-point code
  The rules provide a guide to converting models into highly efficient fixed-point code, complementing the features (autoscaling, etc.) that TargetLink already contains.
- Code generation options
  The guidelines describe optimization settings for handling variables and functions to generate efficient code.
- MISRA compliance
  The rules help to ensure that the generated code will have maximum compliance with MISRA C.



Variable Handling

11.6 Moving of Variables

The *MOVABLE* optimization attribute for variable classes signals to the code generator that the code for variables of that particular class can be moved into dependent branches whenever possible.

Purpose

Generation of efficient code.

Remark

When code is moved into dependent branches, intermediate results are calculated only if they are really required. This reduces execution time.

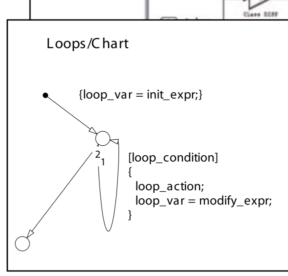
References

- TargetLink Advanced Practices Guide [6], Optimizing the Production Code > Optimizing an Entire TargetLink System > Optimizing Logging > The Variable Class Attribute 'Movable'

Example

Fig. 75 shows a subsystem which contains branches that do not need to be calculated. The *MOVABLE* optimization attribute is set for the *DISP* variable class, see fig 76.

◄ *Every rule has a name, definition, purpose, background information, and optional references and examples.*



▲ *Using design patterns in Stateflow (modeling a loop in this example) allows direct conversion into efficient C constructs.*

TargetLink users can obtain the Modeling Guidelines (PDF document) free of charge from Technical Sales at *info@dspace.com*

AutomationDesk Connects to DOORS

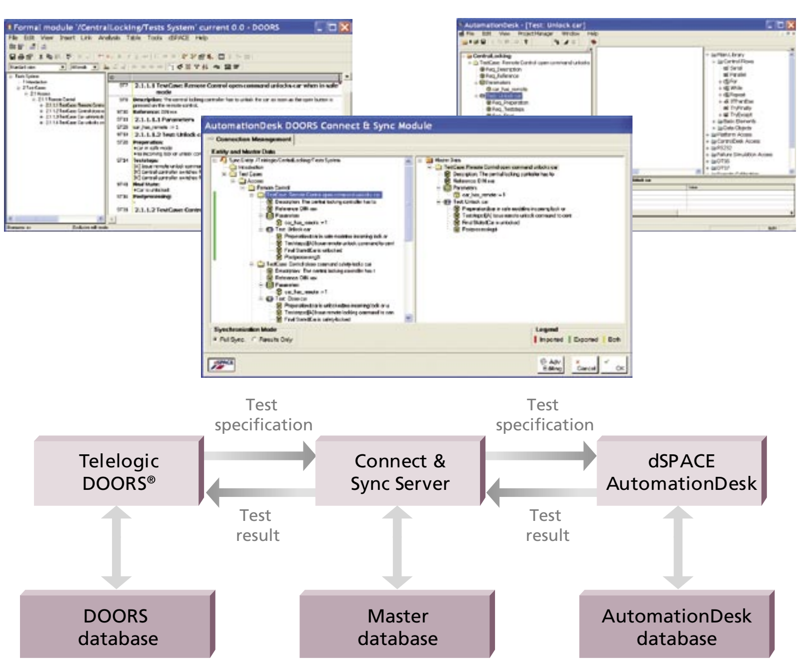
- **Requirements traceability for seamless developement**
- **Test requirement, description, and result all linked**
- **Electronic control unit tests can be run from DOORS**

A special integration solution now connects dSPACE's test software, AutomationDesk, to Telelogic DOORS®, a requirements management tool – so requirements and test specifications can be tracked across tools. Test specifications from DOORS can be transferred to AutomationDesk test projects. All test results are available in DOORS, where they make it easier to track and analyze the development process.

Bridge Between Two Tool Worlds

The traceability of requirements is a key issue in developing software for electronic control units (ECUs). The objectives are to log and record the progress of each project, and to determine whether all the requirements are being met throughout the course of software development. Tools like Telelogic DOORS support the management of any kind of requirement. The specifications for software tests are also frequently handled with DOORS. For efficient traceability and coverage analysis of test requirements, dSPACE has hooked up AutomationDesk to DOORS, the requirements management software from Telelogic.

▼ How the link between AutomationDesk and DOORS works.



Bridged by Connection Server

The link between AutomationDesk and DOORS, enabling the data in the two tool worlds to be synchronized, is the AutomationDesk DOORS Connect & Sync Module. Individual DOORS objects correspond to specific, identically structured elements in AutomationDesk. For example, a document in DOORS can be assigned to a corresponding project in AutomationDesk, and a folder or test sequence in AutomationDesk can be assigned to a test specification in DOORS. If test specifications have the same structure, based on predefined templates, the Connect & Sync Module can convert them into AutomationDesk elements automatically. Users define the rules for mapping the DOORS data to AutomationDesk themselves. Test implementation in AutomationDesk no longer needs to be performed from scratch, as structures and parameters from the DOORS test specification can be used.

Two-Way Exchange

The data and structures of the two tool worlds are synchronized via the Connect & Sync Module, which is also used to exchange parameters. AutomationDesk tests can also be run directly from within DOORS. In the other direction, when test execution is completed AutomationDesk passes the test results (such as passed, failed, or undefined) back to DOORS. Test results from AutomationDesk can be displayed in DOORS and tracked across tools. The link between the two tools means that DOORS always has the current state of the requirements and the associated test results.

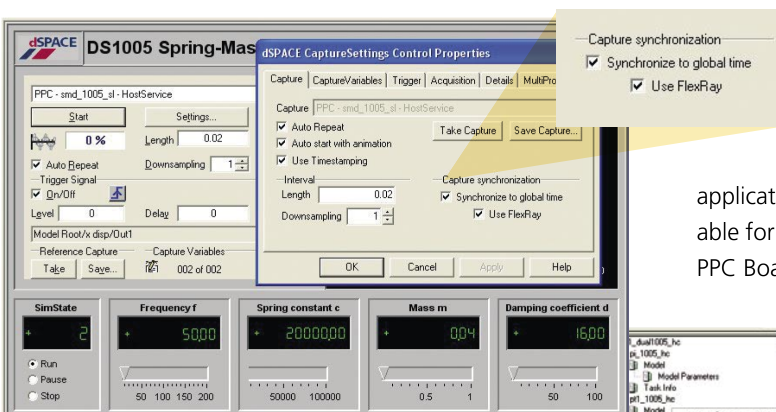
New Features for ControlDesk

Version 2.8 of ControlDesk, the test and experiment software, allows different capture services to be synchronized to a global time base – useful for easy data comparison. Parameter sets can also be written to PPCs file without the need for recompilation.

- Synchronous data acquisition with global time base
- FlexRay support
- Direct update of parameter sets

Synchronous Data Acquisition

With ControlDesk 2.8, multiple data acquisitions can be synchronized to a global time, defined relative to the start of ControlDesk's Animation mode. The global time base makes it easy to compare data that is acquired by different capture services. Global synchronization can be activated for each host service individually on the capture settings controls. When global synchronization is activated, the global time is displayed on the time axis of Plotter instruments and used as time stamps in streamed IDF files.



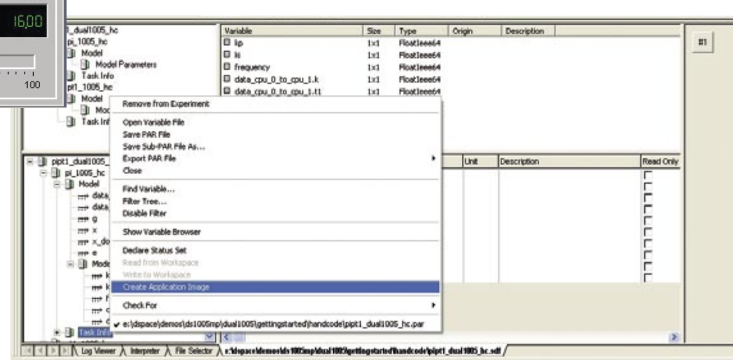
▲ *ControlDesk 2.8. allows the synchronization of data acquisition to a global time base.*

The synchronization feature uses the same algorithm as CalDesk, the measurement and calibration software, and achieves a precision of about 60 µs.

The precision of the global synchronization feature can be enhanced by factor 2 (to 30 µs) when the synchronized real-time systems are connected via FlexRay bus. In addition, signals from different capture services can be mixed in one single ControlDesk Plotter.

Direct Update of Parameter Sets ("Create Application Image")

With ControlDesk 2.8, the context menu of the parameter editor has a new item, "Create Application Image". This allows a parameter set to be written to a PPC file without the need for recompilation. The precondition is that the real-time program was built with the Real Time Interface option "Enable data set storage in application". This option is initially available for MicroAutoBox and the DS1005 PPC Board.



▲ *You can write a parameter set to a PPC file without recompilation – using the new option "Create Application Image".*

Glossary

PPC file –
The executable file that contains the simulation application.

IDF file –
Intermediate data file generated by stream-to-disk data acquisition.

For details of the release date of ControlDesk 2.8 as part of dSPACE Release 5.1, see *www.dspace.com/goto?releases*

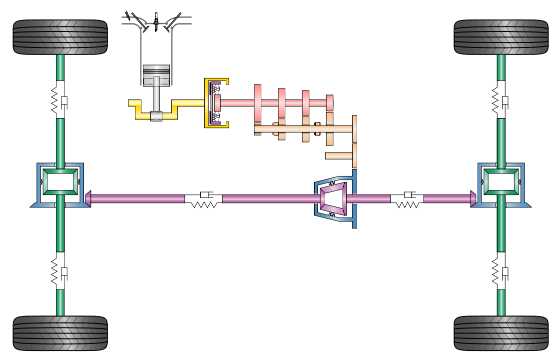
Virtual Vehicle Dynamics with ModelDesk

- **Vehicle dynamics simulations with the ASM Vehicle Dynamics Simulation Package**
- **Parameterization in ModelDesk**
- **Working with the Road Generator and Maneuver Editor**

A year ago this June, dSPACE announced a new product line: the Automotive Simulation Models (ASM). Since then, the models available for engine and vehicle dynamics applications have successfully gone into action in industry. What users particularly appreciate is the openness of the models, which goes right down to the Simulink standard block level. But that's not all they have to offer. The vehicle dynamics model, for example, has parameterization software that sets new standards in ergonomics and performance.

An Integrated Solution

While the vehicle dynamics model is used in real-time in an HIL simulator or executed directly in a Simulink environment, the parameterization software, ModelDesk, provides the graphical front end for the user. The model is parameterized in experiments, which are self-contained simulation projects with complete project management. ModelDesk and the vehicle dynamics model are both in the ASM Vehicle Dynamics Simulation Package.

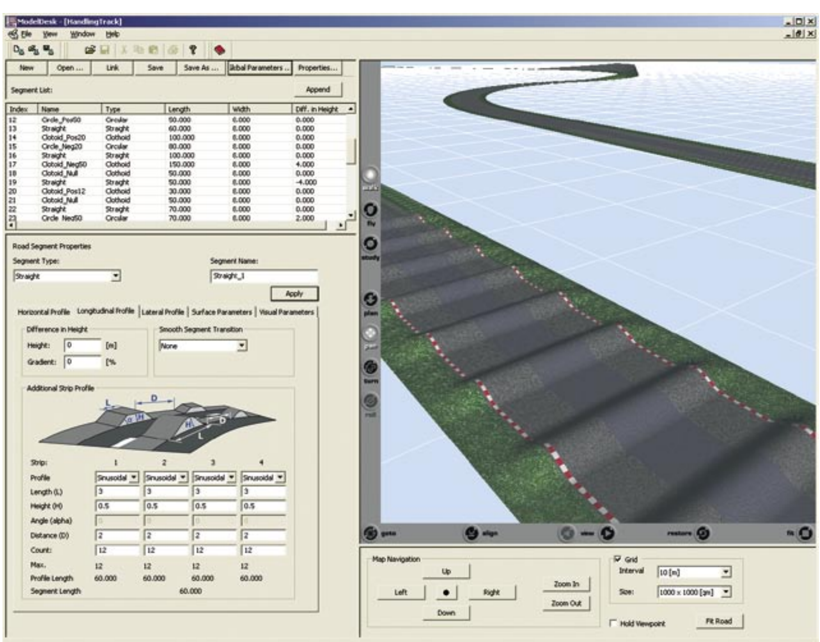


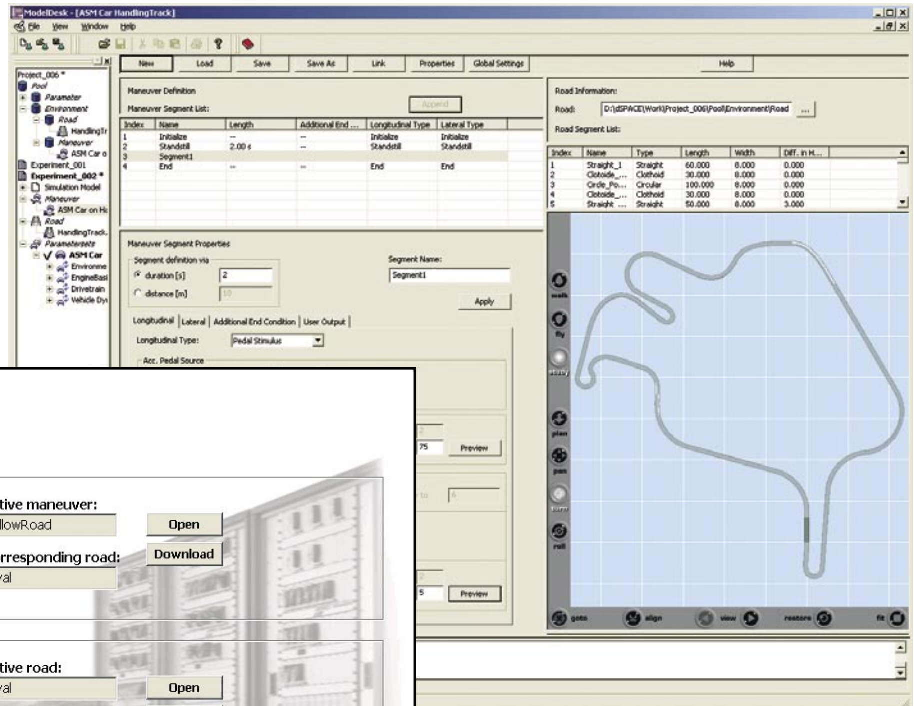
▲ *Configuring the drive train.*

Vehicles, Roads, and Maneuvers

When using ModelDesk, you begin by configuring the vehicle you want to use in vehicle dynamics simulation. Configuration includes choosing the drive axles, the transmission type, and the tire model to be used. Next you have to select a road – you can either use one of the ready-made roads or create one of your own. The final stage in the process is the driving maneuver, which defines how the vehicle should actually move along the road. There is a selection of standard maneuvers that are frequently used for vehicle dynamics tests (steady-state cornering, lane changes, braking on roads with different frictions, etc.). And of course you can add any maneuvers in the Maneuver Editor, and even make optional user inputs during simulation (man-in-the-loop). A mouse click in ModelDesk transfers the parameter set to the model, and the simulation can start. If you want to compare two vehicles, you can create a parameter set for another vehicle configuration – for example, by selecting a different drive type, such as all-wheel instead of rear-wheel drive. This new vehicle now goes through exactly the same maneuver on the same road, allowing the effects of a different drive type to be observed directly.

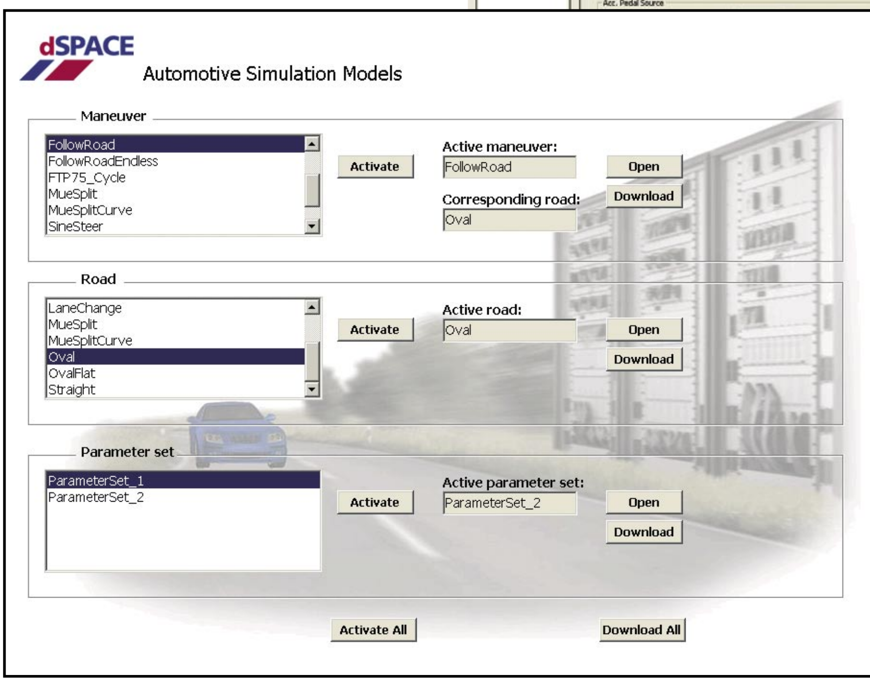
▼ *Straight, circular, clotoid, and cubic spline segment types are joined to form roads in the Road Generator and immediately visualized.*

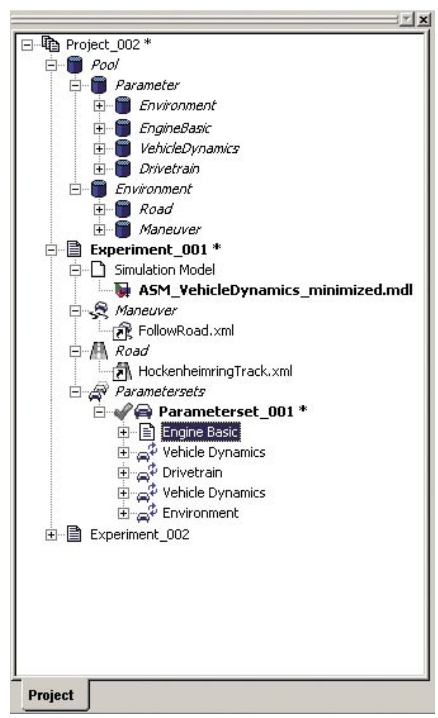




▲ The driving behavior on the road is defined in the Maneuver Editor.

▼ This page provides access to all the defined parameter sets, to make parameterization quick and easy.





▲ The Navigator is used to manage experiments and their parameter sets.

Road Construction

To provide sections of road appropriate to each experiment, ModelDesk has an integrated Road Generator. This is used to create roads segment by segment. A 3-D preview means you can see the entire road, or sections of it, while you are building. The length, curve radius, gradient, etc., of each segment are defined and handled in a segment list. The segment selected from the list is shown in the road preview. Special road features such as lateral slope, bumps, and surface properties can be defined either per segment or globally. To present real challenges to the vehicle chassis, there are numerous options for including road surface irregularities (road damage).

Driving Maneuvers

Once the vehicle and the road have been defined, ModelDesk's Maneuver Editor is used to specify the vehicle's actual movements. Maneuvers are also created in segments, which are defined on either a time or distance basis. The road and its segments can be imported into the Maneuver Editor as a reference. Each maneuver segment can then be defined individually. For example, if you use "Follow Road", the driver integrated into the model simply follows the road. In other segments, you could perform steering maneuvers, for example, to avoid obstacles. The vehicle's longitudinal behavior is defined by stimuli for the pedals and the gears. You can also leave the speed to the internal driver, who will then use a target speed appropriate to the road features.

Remote Control for AutomationDesk

- Remote-controlled test runs
- Access via COM/ DCOM interface
- AutomationDesk – Automation Server

Version 1.3 of AutomationDesk, the test automation and test management tool, comes with a COM interface for remote control. The new interface can be used for tasks such as programming batch processes, and for users to design their own GUIs and dialogs. Another innovation is the AutomationDesk – Automation Server, a cost-saving server variant for test execution, as an alternative to the full version of AutomationDesk.

New COM Interface

AutomationDesk 1.3 has a COM-based application programming interface (API) for remote-controlling and automating selected AutomationDesk functions. These are some of its typical use cases:

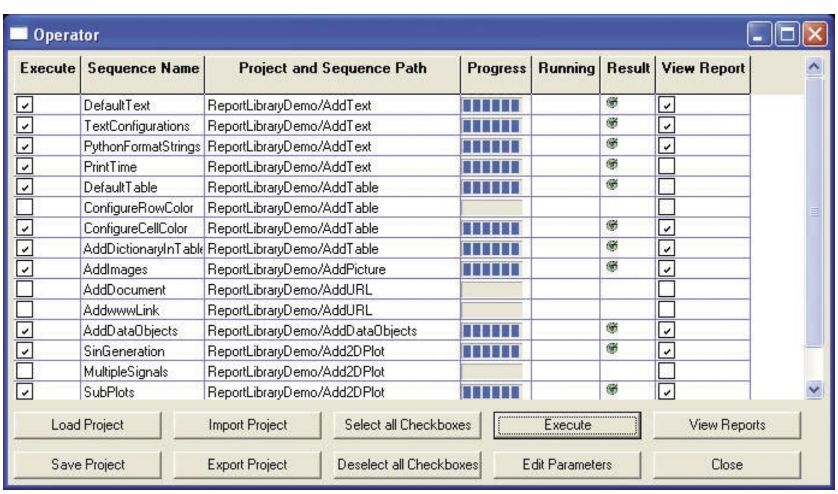
- Programming batch processes (with Python, Visual Basic, C++, etc.)
- Designing interactive GUIs (for example, for test execution purposes)
- Connecting other tools to AutomationDesk

The COM interface is language-independent and can be used to call almost all the functions available in AutomationDesk's Project Manager. These include:

- Loading and saving AutomationDesk projects
- Exporting and importing AutomationDesk projects
- Creating project trees
- Parameterizing data objects of Int, Float, and String type
- Executing projects, folders, and test sequences
- Displaying the current execution status
- Displaying test results (passed, failed, undefined)
- Generating test reports

Test sequences from the Custom Library can also be instantiated via the COM API. However, test sequences cannot be edited via the COM API.

▼ *Example of a client application for test execution via COM interface.*



New Automation Server Variant of AutomationDesk

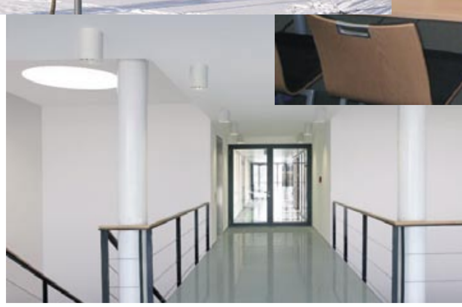
The AutomationDesk – Automation Server is a new, cost-saving server variant without its own user interface, available from Version 1.3 of AutomationDesk. The Automation Server is accessed via the new COM interface, so the same functions are available as for the remote-controlled full version of AutomationDesk. The Automation Server can also be controlled via DCOM. This new run-time version has the advantage of reduced license costs, making it useful wherever the comprehensive functions of the full version are not required, for example, in automated test execution on hardware-in-the-loop simulators.

New Facility in Paderborn

As reported in previous issues, work on our new facility in Paderborn has been going ahead at a steady pace. A year after the start of construction in January 2005, just under 140 dSPACE GmbH employees have relocated to the new building.

Some Paderborn departments relocate

dSPACE now has more than 600 employees in Paderborn, spread across six buildings. Constant expansion means we will have to relocate completely, and the first stage has now been completed. So dSPACE currently has two separate locations in Paderborn. The new facility, at the Giefersstrasse location, has modern production and logistics areas, and offices for our custom engineering, electronics production, logistics, purchase, and technical sales staff. Since March, dSPACE training courses are now also held in the new seminar room there.



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Giefersstrasse Facility
Giefersstrasse 26
33102 Paderborn
Germany

Relocation of dSPACE Sarl

As already mentioned in dSPACE NEWS 1/2006, our subsidiary in France, dSPACE Sarl, has moved to a new building in Bièvres.

New office for dSPACE Sarl

Relocation to larger premises was necessary because the sales and engineering teams had grown – and also because we needed extra facilities for development, testing, and applications. We can now provide even better service for our French customers. The new building also has the added advantage of more spacious offices and a dedicated training room. We are certain that it will be a pleasure for our French customers to visit us here!

New address:
dSPACE Sarl
Parc Burospace
Bâtiment 20
Route de la Plaine de Gisy
91573 Bièvres Cedex
France

New President in Yokohama

- New President for dSPACE Japan K.K.
- Introducing Hitoshi Arima
- Dr. Herbert Hanselmann talks about strategic objectives

As promised in our last issue, here are more details of our new subsidiary, dSPACE Japan K.K. in Yokohama, to give you an idea of what type of company we are. We spoke with Dr. Herbert Hanselmann, President of the dSPACE parent company, about his strategic objectives and asked Hitoshi Arima, President of dSPACE Japan K.K., to introduce himself.

Hitoshi Arima

You are now President of dSPACE Japan K.K. What was your previous position, and what were your responsibilities?

My previous position was President of MontaVista Software Japan and Vice President of Japan Sales of MontaVista Software, Inc., which is an embedded Linux solution provider, located in California, USA. I started up the Japanese office of the company as a country manager in 2000, and managed all Japanese business and organization for 5.5 years.

▲ *Hitoshi Arima, President of the new subsidiary dSPACE Japan K.K..*

The company grew successfully, especially in the mobile, telecom, and consumer electronics markets.

I was in the operating system industry for 16 years in total, and had experience of various management positions in development, technical support and business development at WindRiver and Integrated Systems. At Integrated Systems, I was also doing presales technical support for MATRIXx.

My first job after graduation from the university was as a development engineer working on an industrial robot, and I developed a robot for the automotive industry.

Why did you choose to pursue a new career at dSPACE?

I have been always very interested in the automotive market, especially automotive ECUs, through my job experience in the fields of industrial robots, real-time OS, and software like MATRIXx.

dSPACE is a leading company in this market, and it seemed so exciting to expand dSPACE's business in Japan, leveraging my business and management experience. At the same time, I was very impressed by Dr. Herbert Hanselmann's philosophy of business, and would really like to work with him.

In your opinion, what are the most crucial tasks during the start-up phase?

I believe that it is very important to form a professional and flexible team to respond to customers' needs and to provide superior service.

My crucial task is to establish an organization where all employees can exploit their ability to the full.

Could you describe the structure of your company for us?

The Japanese organization consists of sales, engineering and administration.

Today we have 12 local employees and 7 from German headquarters and we are planning to increase this number.

What would you like to achieve in your first full year with dSPACE?
First of all, I would like to establish steady and reliable operation for direct sales. To do so, I will hire the necessary personnel, train all employees including sales and technical support, and build up a team who can provide superior service to ensure customer satisfaction.

What are your long-term goals?
My long-term goal is to establish stable management as well as the best reputation with our customers in Japan. I believe if I can achieve this, our employees can have a high level of job satisfaction and achieve self-fulfillment for themselves as well. For myself, I would like to contribute to society through the work.

Dr. Herbert Hanselmann

How would you describe the function of the new company?
Over the last 15 years, Japan has become one of dSPACE's largest export markets. The new company will give us closer contact with our customers. We can react to their needs and requests faster, and provide on-site support with experienced engineers.

Do you plan to increase the number of employees?
The plan is for approx. 30 employees, to cover not only sales, consultation, and product support, but also local and on-site engineering projects. Such projects will include customized specification, commissioning and maintenance of hardware-in-the-loop simulators, as well as process integration work for all our products.

dSPACE worked with a Japanese distributor for 15 years. Why have you now set up your own company?
Our time with LinX as our distributor was very successful for us, but the situation changed and this long-standing cooperation was no longer possible. That is why we decided to set up our fourth subsidiary in Yokohama, Japan.

Did you make special arrangements to guarantee service for customers, especially in the initial phase?
We had to cope with this new situation at short notice. We did not hesitate to complement our Japanese staff with a group of experienced engineers from headquarters. A lot of traveling was and is going on. Seven engineers from Paderborn are joining as expatriates for a long-term stay. They received language and cultural training so they can get their technical expertise across.

▲ *Dr. Herbert Hanselmann, President of the dSPACE parent company.*

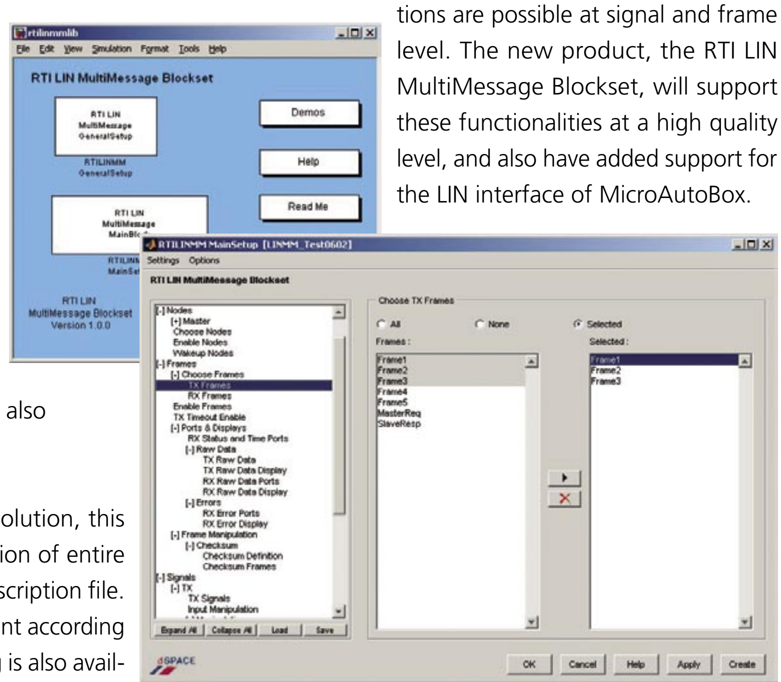
dSPACE has a wide product range. Will you be focusing on anything in particular?
dSPACE always has been strong in hardware-in-the-loop simulation. In Japan, certain types of hardware-in-the-loop simulation are new to our customers. Naturally we will build our presence in that sector. But we will also put emphasis on calibration and rapid control prototyping applications, where extensive on-site support is necessary and important.

Thank you for talking to us.

Support of LIN 2.0

dSPACE Release 5.2, due out soon, will include the new RTI LIN MultiMessage Blockset to support LIN 2.0 at product level. Modular dSPACE systems (with the DS4330 LIN Interface Board) are currently supported in two ways:

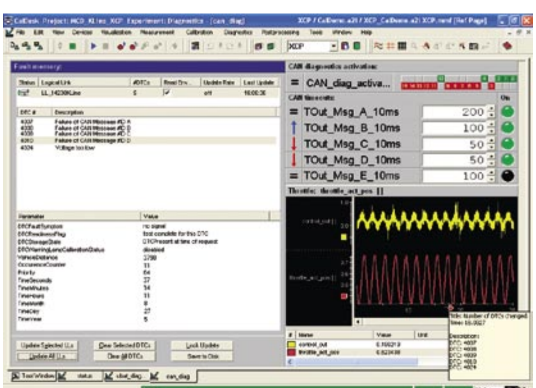
- RTLIB provides basic functions for setting up LIN 2.0-compliant communication in C code.
- A solution for graphical handling of the functions is also available.



Called the LIN MultiMessage Solution, this allows the graphical configuration of entire LIN networks based on a LIN description file. Unconditioned frames can be sent according to LIN 1.3 or LIN 2.0. Scheduling is also available as a master functionality. Wake-up functionally is additionally supported, and several online manipulations are possible at signal and frame level. The new product, the RTI LIN MultiMessage Blockset, will support these functionalities at a high quality level, and also have added support for the LIN interface of MicroAutoBox.

Now CalDesk Can Do Even More

Several new features have been added to CalDesk, our measurement and calibration software, in the new Version 1.3.



- ODX-based diagnostics and electronic control unit flash programming
- Extended interface support: now also XCP on USB
- New display instrument simplifies measurement data visualization

The handling of prototyping hardware has also been improved: New calibration results can now be flashed without the application having to be recompiled. New features make measurement and data recording easier. For example, at the touch of a button users can save the contents of the measurement buffer to a measurement file while measurement is running.

TargetLink 2.1.6

The new version is the first patch for TargetLink 2.1 and available for download now. It offers direct navigation from TargetLink block dialogs and the TargetLink Property Manager to the Data Dictionary and also adds support for Renesas SH Series C Compiler 9.0 for the Renesas SuperH SH2 Target Optimization Module.
The following additional targets can now also be simulated:

- NEC C Compiler 2.72 for NEC F_Line-Drive It!
- Metrowerks CodeWarrior 1.5 for Axiom MPC5554DEMO
- Microtec C Compiler 3.2 for dSPACE DS1603
- Wind River C Compiler (Diab) 5.2 for dSPACE DS1603
- Renesas SH Series C Compiler 9.0 for EVB7058
- Renesas SH Series C Compiler 9.0 for EVB7055F

www.dspace.com/goto?releases

Papers

"ODX in an ECU Calibration System"
Dirk Fleischer, dSPACE GmbH

"Close-to-Production Prototyping"
Martin Eckmann und Frank Mertens,
dSPACE GmbH

Paper download:
www.dspace.com/goto?paper_download

Events

EUROPE
SENSOR+TEST
May 30 – June 1, Nuremberg, Germany
Exhibition Centre Nuremberg, booth 356
http://www.sensor-test.de

MI – 10. Internationaler Fachkongress Fortschritte in der Automobil-Elektronik
September 20-21, Ludwigsburg, Germany
Forum am Schlosspark
http://www.m-i-c.de

VDI/VDE – Elektrisch-mechanische Antriebssysteme
September 27-28 , Böblingen, Germany
CongressCentrum
http://www.vdi-wissensforum.de

JAPAN
dSPACE Japan K.K. User Conference 2006
May 23, Shinagawa, Tokyo, Japan
Tokyo Conference Center Shinagawa
http://www.dspace.jp

JSAE 2006
May 24 – 26, Yokohama, Japan
Pacifico Yokohama Complex
http://www.jsae.or.jp

Embedded Systems Conference
June 28 – 30, Tokyo, Japan
Tokyo International Exhibition Center
http://www.esec.jp/en

For more event news, visit *www.dspace.com*

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- By mail
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- Request information via our Website *www.dspace.com/goto?dspace-news-info*
- For more details, visit *www.dspace.com*
- 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!

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; Cambridgeshire, United Kingdom; Novi, MI, USA; or Yokohama, Japan! Due to our continuous growth, dSPACE is looking for engineers in

- Software development
- Hardware development
- Applications
- Technical sales
- Product management
- Technical user documentation

Training

Please check the corresponding field on your response card.

- dSPACE Real-Time Systems
- ControlDesk
- RapidPro
- Rapid Control Prototyping with CalDesk
- TargetLink
- Hardware-in-the-Loop-Simulation
- AutomationDesk
- MotionDesk
- RTI CAN MultiMessage Blockset
- Automotive Simulation Models
- CalDesk

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