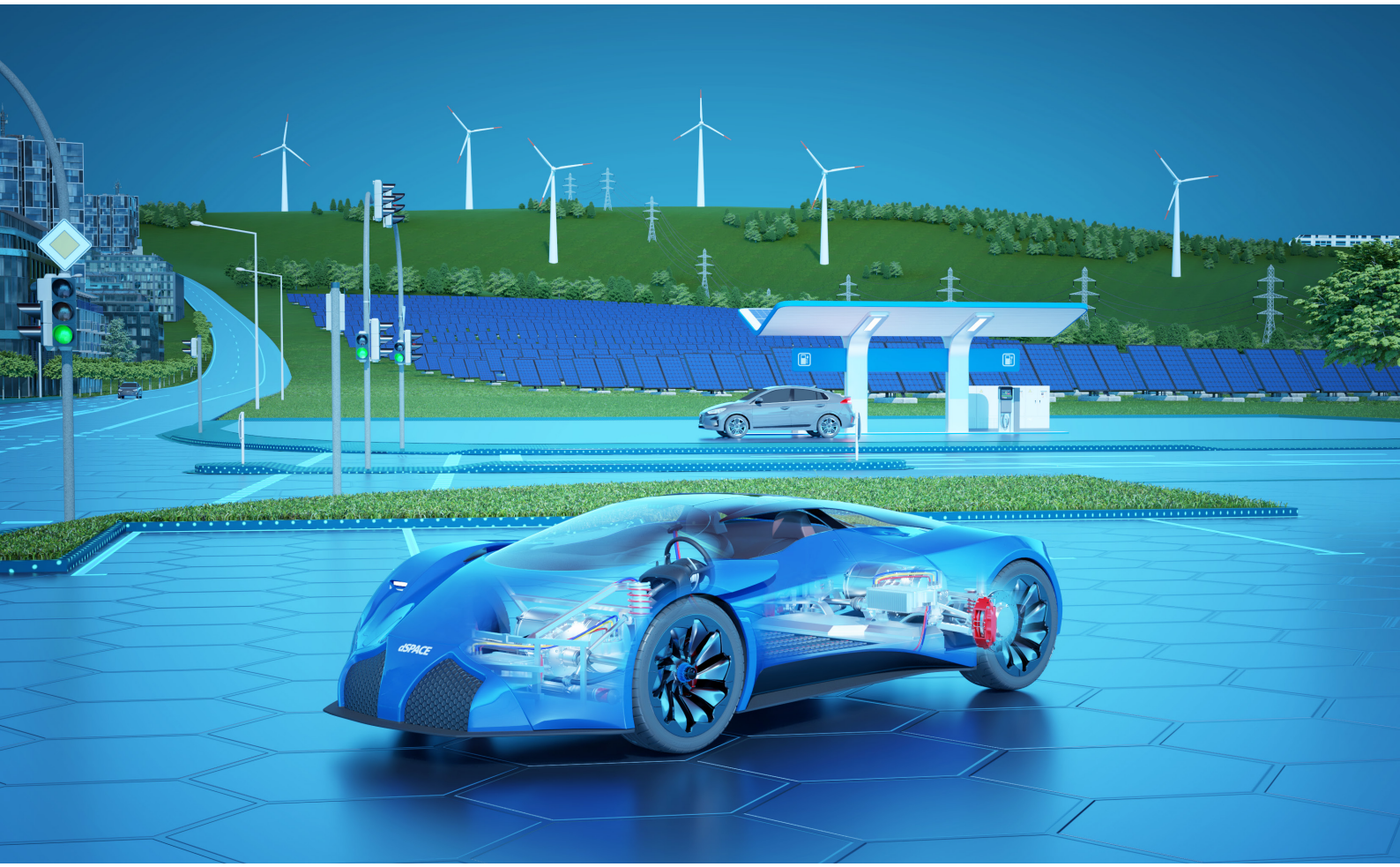
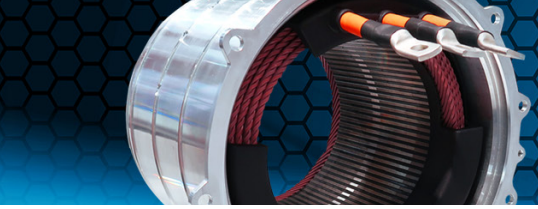
www.dspace.com



Electromobility

Electrification made easy – with the most comprehensive solution portfolio for development and validation

dSPACE

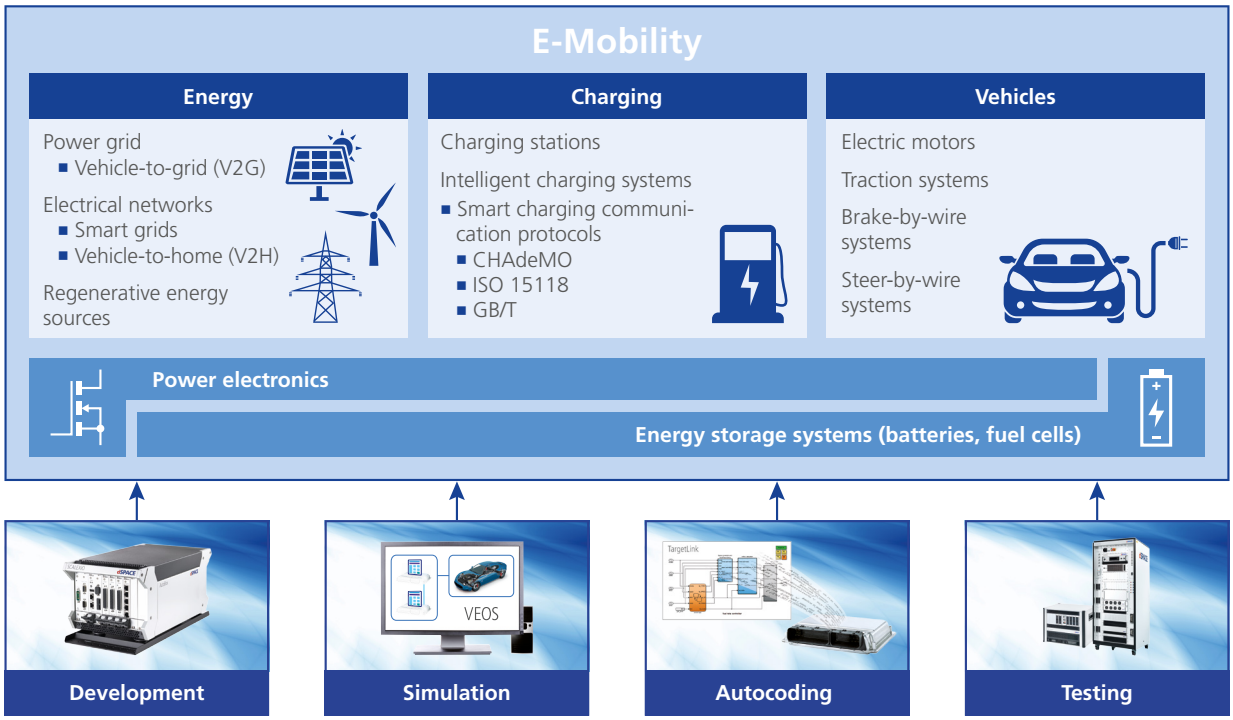


Electromobility

Switching mobility to electric even faster

Whether you are working on electric motors, power electronics, batteries, fuel cells, electrical networks, or intelligent charging systems: dSPACE offers a complete portfolio based on decades of experience for all your electromobility projects.

Rely on an innovative, scalable tool chain and get everything from a single source with dSPACE – your partner for developing and testing electromobility applications.



Highlights

- State-of-the-art computing technology as well as a wide range of ready-to-use toolboxes and open model libraries for developing and testing
- Ready-to-use nonlinear multiphase motor models for testing on the signal and power levels
- Highly dynamic mechanical test benches to include mechanical components in the hardware-in-the-loop simulation
- High-voltage electronic load modules for power hardware-in-the-loop testing of control systems
- High-fidelity battery models combined with high-precision battery cell simulation for testing battery management systems
- Highly sophisticated power electronics simulation and support of the latest communication protocols to test charging infrastructures and onboard power electronics

Why dSPACE?

- One-stop supplier with decades of experience in electromobility
- Cutting-edge developments and outstanding performance
- Seamless integration from charging station to traction motor applications
- Versatile and reliable platforms for in-vehicle prototyping and laboratory setups
- Flexible switching between a processor- and FPGA-based approach using the same hardware platform
- Customized test setups and system designs

NEW: Smart Charging Solution

Developing and testing intelligent charging technologies

Highlights

- Support of all common charging standards, such as ISO 15118, DIN SPEC 70121, IEC 61851-1, CHAdeMO, and GB/T
- High degree of customization as well as fault injection and logging capabilities
- Seamless workflow with Simulink®

Application Areas

The Smart Charging Solution is a key solution for developing and testing technologies involved in the electric vehicle charging process. The combination of hardware and software components offers comprehensive test possibilities. Thanks to its high flexibility, the Smart Charging Solution offers versatile application options, including the simulation of electric vehicle supply equipment (EVSE) as well as the simulation, test, and development of onboard chargers. In this way, it supports both manufacturers of electric vehicles and manufacturers of charging stations in developing and testing smart charging technologies.

Simulating Electric Vehicle Supply Equipment

- Test real electric vehicles and onboard chargers by connecting them to simulated charging stations supporting different standards
- Test various ECUs and power electronics components involved in the charging process

Simulating and Developing Onboard Chargers[1)]

- Test charging stations with simulated vehicles
- Replace the vehicle ECU or the communication controller for testing vehicle prototypes

Key Benefits

- ISO 15118 and DIN 70121 powerline communication
- CHAdeMO and GB/T support
- Isolated interface between the HIL simulator and the ECU
- Interfaces for all common charging plugs (e.g., Type 1, Type 2, CCS1, CCS2, GB/T, CHAdeMO)
- Support of AC and DC charging
- CAN FD interface for easy integration
- Rapid control prototyping (RCP) as well as hardware-in-the-loop (HIL) simulation
- Monitoring and manipulation of power-line communication used, e.g., for pairing mechanism (Signal Level Attenuation Characterization, SLAC)
- Simulation of errors during communication

Hardware and Software

The Smart Charging Solution includes hardware and software and can be easily integrated into your test setup. For more information on the individual components, please see the next page.

1) *Available for CHAdeMO and GB/T communication. ISO 15118 and DIN SPEC 70121 communication will be available with a later Release.*

dSPACE

Hardware

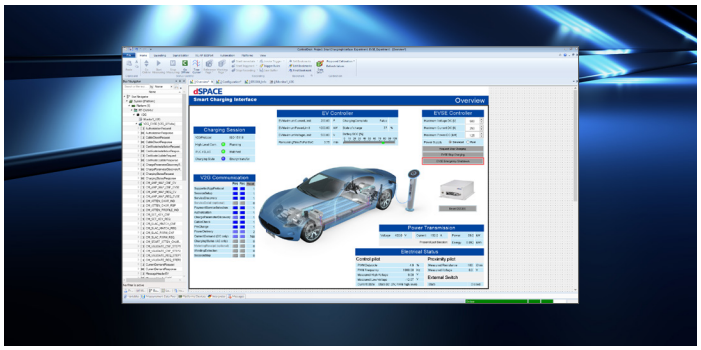
DS5366 Smart Charging Interface

The hardware component of the Smart Charging Solution, the DS5366 Smart Charging Interface, comes as an isolated interface between the hardware-in-the-loop (HIL) simulator and the electronic control unit (ECU). It provides a CAN FD interface for connecting to the HIL simulator as well as USB and Ethernet interfaces for protocol tracing and data logging.

Technical Details

- Internal 4 GB SD card for customer settings
- Host interface
  - 1 Mbit/s CAN FD
  - USB logging on connected PC
  - Ethernet raw data
  - Input for custom PWM voltage
  - Input for custom PWM impedance resistor
- Target interface
  - Control pilot (CP), proximity pilot (PP), protective earth (PE)
  - 2 x relay output for power switching and user applications
- CAN FD interface
  - Monitoring of SLAC and vehicle-to-grid (V2G) messages via CAN
  - Dynamic access to control messages of the DS5366 Smart Charging Interface
- Power supply
  - 8 ... 30 V DC input voltage
  - ~ 6 W power consumption

Software



Smart Charging Interface Software

The Smart Charging Interface Software includes a Simulink® model, ControlDesk layouts, and a DBC file that describes the CAN FD communication. The Simulink model supports all common charging communication standards. It includes a user interface for parametrization and allows for the connection and simulation of power electronics components. By using the ControlDesk layouts, you get an overview of all the relevant electrical information, the messages involved in the charging communication, and the communication status. You can also use the layout for configuration purposes, e.g., for parametrization as well as electrical and timing manipulation.

Functionality Overview

- Simulink model
  - Behavior model of a charging station
  - User interface for connecting and simulating power electronics components
  - Open model for all communication standards that can be coded for different real-time systems
  - Suitable interface for ASM Electric Components
- ControlDesk layouts
  - Overview layout including electrical information as wells information on the communication status
  - Specific overview and configuration layout including timing manipulation for all standards
  - Status and device information
  - Plotting of charging curves with all relevant data
  - CAN monitoring for the message exchange with the real-time system
  - Warnings and error counter
- Automatic Mode and Manipulation Mode
  - Logging of all request and response messages on CAN FD
  - Override mechanism for parameter manipulations
  - Possibility to connect power electronics components
  - V2G data manipulation
  - Timing manipulation by restraining V2G response messages on CAN FD

NEW: Electric Test Bench

High-voltage power hardware-in-the-loop

Highlights

- Testing electric motor controllers including power electronics with emulated motors and accurate real currents
- Modular hardware for different applications and special application topologies
- Turn-key test bench concepts for a wide range of electromobility applications

Application Areas

Hardware-in-the-loop (HIL) systems from dSPACE provide highly dynamic emulation of electric motor and battery components with several hundred kilowatts of power and voltages up to 1,000 V. All drive components of hybrid and fully electric drives can be represented with a real energy flow. The smaller systems based on the DS5380 and DS5381 modules are also suited for emulating and testing ECUs with low voltages of up to 60 V.

These power hardware-in-the-loop (PHIL) capabilities make dSPACE a unique provider of single-source, ready-to-use simulation solutions for the complete range of electric vehicle drives.

Typical applications are dynamic tests at power level of

- Automotive motor controllers
- Industrial servo controllers
- DC/DC and AC/DC converters

These applications can be used in a variety of test scenarios:

- Functional tests
- Load test (burn-in, end-of-line, controlled fault conditions)
- Test of controller robustness (motor parameter variation)
- Test of critical operation conditions

An open (Simulink®/Xilinx®) library from dSPACE provides the required simulation models, from FPGA models for motors, XSG Electric Components Models, and position sensors to the dSPACE Automotive Simulation Models (ASM) for batteries and complete powertrains.

Key Benefits

The high-voltage load setup based on the new DS5385 modules features a compact and modular design. The compact units can be used flexibly with regard to currents per phase and number of phases as well as the type of voltage source to be emulated. The system's scalability allows for a combination of multiple high voltage cabinets to further increase the test system's power. Using the same hardware for the emulation of loads, such as electric motors, and sources, such as batteries, makes the systems cost-effective and easy to maintain. The energy flow in the system circulates without complex grid feedback, leading to high efficiency and minimum load on the mains supply.

Unique Features

- Specifically tailored for HIL simulation at power level
- Efficient operation thanks to a circular energy flow without energy recovery to the mains: power supply requires only 20% of emulation power
- Water-cooled high-voltage power electronics for user-friendly environment conditions
- Current-based emulation for simulating variable motor inductances without the requirement for switching or exchanging any hardware components
- High power density per emulation rack, leading to a small overall system footprint
- Identical open simulation models for tests on signal level and power level
- Safe test conditions due to safety mechanisms for power electronics
- In-house development of hardware and software by dSPACE, resulting in a turn-key system from one provider