


Easy Virtualization of Power Electronics

Creating real-time applications from
a circuit diagram



Are you developing controllers for power electronics and want to perform realistic HIL tests early on? You can now create tailored simulation models at the click of a button, even for complex unique circuits. Frank Puschmann, who played an important role in developing this new technology, explains how it works.

Mr. Puschmann, dSPACE provides simulation solutions for a wide range of application areas. Where does dSPACE stand in the simulation of electric motors and power electronics?

For over 20 years, dSPACE has been providing hardware-in-the-loop (HIL) solutions for the simulation of electric motors and power electronics. Our customers already use a high number of such systems, with great success. Due to the different requirements, there are solutions for processor-based simulation and FPGA-based simulation (FPGA = field-programmable gate array). We offer comprehensive libraries with ready-to-use simulation models for both platforms to cover even the most diverse applications. These applications range from auxiliary devices in vehicles, to traction transmissions for electromobility, up to industrial generators and multipoint inverters of regenerative power generators. A high number of analysis tools round off our portfolio. As an alternative to the existing solutions based on model libraries, dSPACE now also makes it possible to generate real-time applications directly from the circuit diagram, for both the processor and the FPGA.

Why does dSPACE provide this additional solution?

So far, we have given our customers ready-made solutions for the known and established topologies and structures. For example, dSPACE provides complete library elements for a B6 bridge circuit up to a three-phase induction motor. Special requests and customer demands, such as DC/DC converters, are covered by engineering solutions. However, we have come to notice that many applications are becoming more complex and more individual. Electric and hybrid vehicles have electrical systems with different voltage levels. The need for HIL simulation of power electronics systems is also increasing in the renewable energy and smart grid sectors. Especially for these systems with inherently different setups, we doubt that simulation based on ready-to-use library elements is useful. Individual engineering models often involve a high amount of work. With our new solution, customers can create the simulation model directly from within the circuit topology.

When will the solution become available?

From now on. In early 2016, we added an FPGA-based solution to >>

With the Electrical Power Systems Simulation Package, users can create simulation models directly from the circuit topology.



In addition to automotive applications, our products are also used for industrial applications such as wind energy generation, photovoltaics, and power grid simulation.

the already introduced processor-based solution. Both are now available in our Electrical Power Systems Simulation Package.

What development environments are compatible with the Electrical Power Systems Simulation Package?

The Electrical Power Systems Simulation Package can generate real-time circuit models for many development and circuitry tools, so we can always provide a customer-oriented workflow. Due to current demand, we are presently focusing on SimPowerSystems™, which the package is ideal for.

Can the offered packages and solutions be combined?

Yes, customers can always use the Electrical Power Systems Simulation Package with the existing model libraries, XSG Electric Components and ASM Electric Components. For example, if customers want to integrate parts of the circuitry in the simulation environment, but the parts are not included in our model libraries, they can create these parts from basic components. Customers can then generate complete applications for simulation on processor- or FPGA-based platforms. The dSPACE

multiprocessor technology provides a decisive advantage, because customers can use large, distributed systems for processor-based applications. For applications with high dynamic requirements, customers can outsource model parts that have to be simulated with a very small step size to the FPGA.

What's in it for the customers and who is this package for?

Customers benefit from the fast availability of unique models and the very low amount of effort involved in creating them. The various model libraries and tools can be combined and extended successively, so we always provide the best solution. Our new products still target our main application area, automotive engineering. Of course, we always have to keep an eye out for the latest trends. The shift towards electric drives is hard to miss. The technologies used in this field are very similar to those used in other industries, so only small adjustments are needed to also serve customers from areas such as wind power, photovoltaics, and power grid simulation.

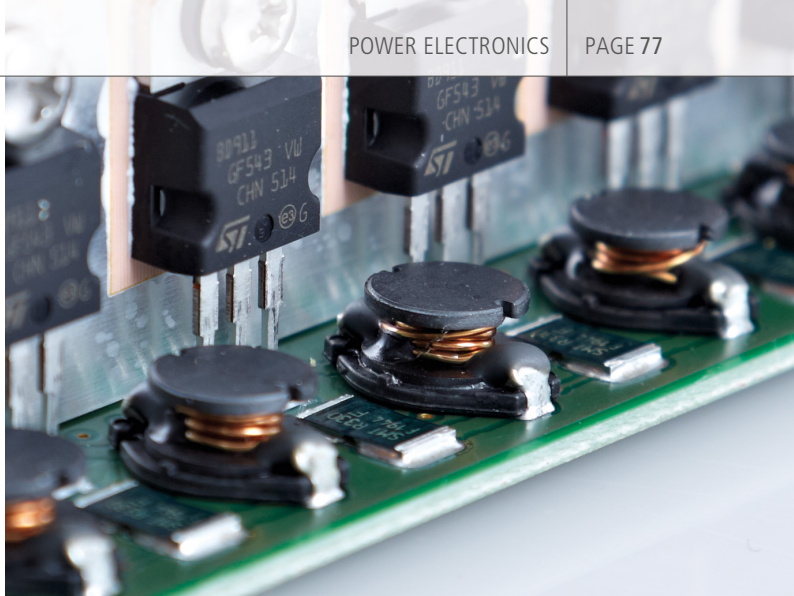
What will the next extensions to the platforms and libraries be?

We are in an excellent position with

our DS2655 FPGA Base Board. In mid-2016, we will introduce the SCALEXIO EMH Solution (EMH = Electric Motor Simulation). Together with the new SCALEXIO Real-Time PC, this solution improves the handling of our processor-based applications even further. In motor modeling, there is an increased need for multiphase drives. Nonlinear effects are also being focused on more often. This is why we are currently working on a generic e-motor model that can be parameterized with the usual characteristics, and also with data determined by the finite element method (FEM). Another functional extension we are planning is the realistic simulation of electrical faults.

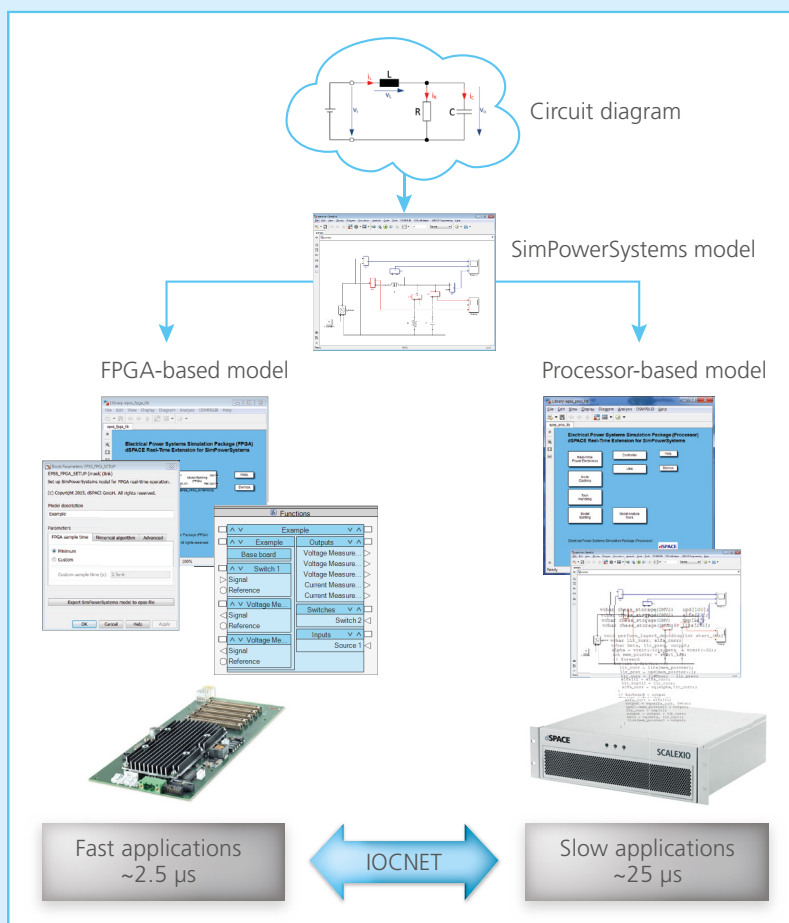
Mr. Puschmann, thank you for talking with us!

Frank Puschmann is a Senior Application Engineer in the E-Drive HIL group of the Application Engineering department.



The Electrical Power Systems Simulation Package

The new Electrical Power Systems Simulation Package generates real-time simulation models from information on the circuitry. Combined with SimPowerSystems™, the package offers an ideal development environment for testing electrical systems. In addition to model splitting and the mean value models for power electronics bridge circuits you already know from the dSPACE Power Real-Time Library, you can now also perform FPGA-based model computation. The package provides ready-to-use FPGA applications so you can integrate your own SimPowerSystems models without having to program the FPGA for each application. The Electrical Power Systems Simulation Package therefore combines the functions of the Power RealTime Library with a new, FPGA-based method. In a networked system, this combination lets you compute each model part on the ideal real-time platform for the respective latency requirements. The automatic translation of circuitry information into real-time code saves time during engineering and provides very precise, realistic simulation results, particularly when the FPGA-based solution is used. This generic solution is recommendable



especially if the required topologies cannot be simulated with the dSPACE standard libraries (XSG Electric Components and ASM Electric Components). You can use the Electrical Power Sys-

tems Simulation Package for applications such as auxiliary devices in vehicles, traction drives for electromobility, and electrical energy conversion of regenerative power generators.