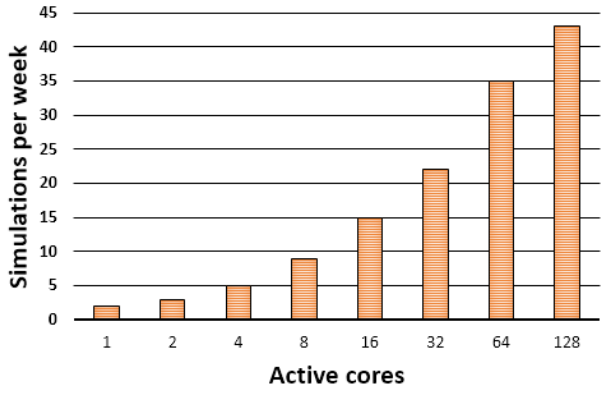

FIGURE 3: Moving from a single workstation with eight cores to a modestly sized cluster can lead to a significant performance increase.

Siatkowski built was for a DC choke (see Figure 2).

"With COMSOL Multiphysics, I can run a simulation that has parameters like width, height, thickness of the wires, etc. and explore the entire design space defined by our teams and customers. Our product developers and sales teams can now work more efficiently and easily find the best solution," explained Siatkowski.

» IT'S ALL IN THE ARCHITECTURE

"FOR SMALLER MODELS, I can build a model on my workstation and run the computation there," explained Siatkowski. "But for the larger models, my workstation is not fast enough and does not have enough memory."

This is when the flexible nature of COMSOL came into play and BLOCK fully benefited from the available HPC capabilities supported by the software architecture and generous licensing. Siatkowski instead runs his models on several computers with multiple cores.

"I'm currently using a cluster with 22 cores and 272 GB of RAM and I can easily run my simulations remotely on it," said Siatkowski. "COMSOL supports distributed memory computing where each node of a cluster can also benefit from local shared memory parallelism; this means that I'm getting the most out of the hardware available." The speedup obtained in terms of simulations per week for a large electrical study is shown in Figure 3.

After executing the simulation on the high-performance computer, Siatkowski reviews the result on his workstation, where he can then also perform postprocessing. "The benefit of this is that during the simulation itself, my workstation is free and I can continue with other work and even do pre- or postprocessing on other models. The architecture that the COMSOL software has allows us to be more productive and service our customers better."

From left to right: C. Kliesch (Bachelor Student), Dr. M. Siatkowski (Advanced R&D), M. Owzareck (Advanced R&D), A. Bimidi (Student Apprentice), Y. Kumar (Master Student), Dr. D. Kampen (Head of Advanced R&D)

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These tools allow our engineers to tailor our designs to meet customers' needs with minimal time and input. In the past, these recurring analyses took hours and required an employee specializing in simulation; with a COMSOL application, employees at all levels of our organization can run simulations nearly effortlessly.

All told, multiphysics simulation and application design through COMSOL allows our designers to make better, more competitive products. Efficiency is core to our company philosophy—doing more, using less. This is not limited to the efficiency of our products, but also in the way we conduct business, generate ideas, and create new designs. The Application Builder is now a vital element in helping APEI build the best wide band gap solutions possible.

BRICE MCPHERSON *is a senior engineer at APEI, with 11 years of experience in high performance, extreme environment wide band gap power semiconductor packages. He specializes in the parametric CAD design and analysis of APEI's power modules and conversion systems.*

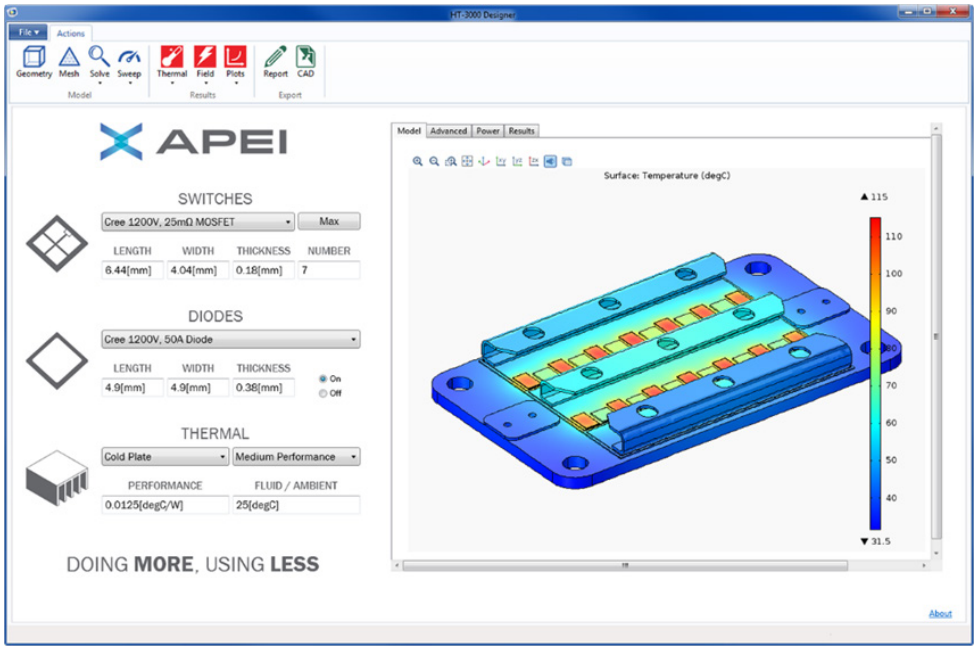
SIMULATION APPS STREAMLINE THE DESIGN OF POWER ELECTRONICS

By **BRICE MCPHERSON**

POWER ELECTRONICS ARE ESSENTIAL in nearly every application that uses electricity, from cell phone chargers to industrial scale power distribution. Different applications require converting power from one form to another. For example, driving the motor on an electric vehicle requires power switches, drivers, filters, sensors, and control circuitry. These conversion systems need to process power as efficiently, safely, and cost-effectively as possible.

At APEI we are pushing the limits of power electronic systems, developing advanced solutions utilizing wide band gap semiconductors that can block higher voltages, carry larger amounts of current, switch on and off more quickly, and more effectively dissipate waste heat than traditional semiconductors. These benefits are key to processing large amounts of power in increasingly smaller volumes and at higher efficiencies.

The COMSOL Multiphysics® software and the Application Builder are fundamentally changing the way that we design, support, and market our products. In the real world, most problems are not constrained to singular, isolated physical phenomena. For electronic systems, thermal, electrical, and mechanical behavior are closely intertwined; their effects and interactions must be studied simultaneously in order to see the full picture of factors driving performance. COMSOL Multiphysics simulations have been essential tools for our engineers to extract a more detailed understanding of our products, virtually assess real-world performance, and reduce the amount of prototyping needed.



A COMSOL® software simulation application created at APEI for predicting the performance of different power module designs.

When the Application Builder was released, we were eager to try it out. It was surprising to see how easy it was to build our first application—a tool to analyze the fusing current and impedance of the tiny bond wires used to interconnect semiconductor devices. It took little time to transition an existing COMSOL® software simulation to an application designed for ease of use, while still based on a powerful multiphysics model. A drag-and-drop graphical interface, straightforward controls and entry fields, and full integration within the COMSOL environment narrowed the learning curve considerably. In short, if you can build a model, you can easily build an app from it.

We now have multiple apps ranging from simple design tools to comprehensive analyzers that extract all relevant performance and design metrics for custom configurations of our power modules.

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