DEMOCRATIZING SIMULATION WITH APPLICATIONS

Simulation applications (and the ability to distribute them) benefit organizations by making modeling accessible to a wider range of engineers, colleagues, and customers.

by THOMAS FORRISTER

FIGURE 1. Users can access applications via COMSOL Server™ and run them on a web browser or client.

Simulation is a powerful tool that enables users to save time and money by studying physics phenomena within designs to predict operating conditions before prototyping. However, computational modeling is often left to the simulation specialist, which can limit resources and production within a company. While other team members may not be experts in simulation, their insights can be invaluable to research, design, and manufacturing processes.

Extending the reach of multiphysics simulation enables companies to get higher-quality products to market faster and cheaper than by developing iteration after iteration of a prototype. By creating and distributing simulation applications, specialists can include nonexperts in simulation in the process, demystifying it and breaking down barriers within an organization so that there is more room for collaboration, prediction of outcomes, innovation, and optimization.

At Veryst Engineering, AltaSim Technologies, and GLL Bio-Med Analytics, building and distributing applications helps make their customers' design workflows more efficient.

⇨ APPLICATION DEVELOPMENT AND DISTRIBUTION MADE EASY

Applications enable anyone to test parameters and run repeated analyses without a simulation specialist. This larger group of customers or colleagues without engineering backgrounds can make quick, informed decisions with confidence. This way, teams can work together more effectively.

To get an overview of the workflow from model to application, a simulation expert will start by creating a model in COMSOL Multiphysics®. Then, the expert can use the Application Builder in COMSOL Multiphysics to turn the model into an application. Applications can be created in minutes using drag-and-drop functionality. The result is a specialized interface with restricted inputs and outputs, so that the end user focuses only on the parameters pertinent to their work.

"The application development process itself is very easy and user friendly," says Nagi Elabbasi from Veryst Engineering, a consulting firm that offers simulation expertise to customers. He added that applications have a lot of functionality, and for Veryst, they are also a good marketing tool. As Elabbasi explained, "In the applications, you have access to extensive Java® functionality," which means that Veryst can link applications to their material library, PolyUMod, allowing for even more advanced application development to share with their customers.

To give collaborators access to

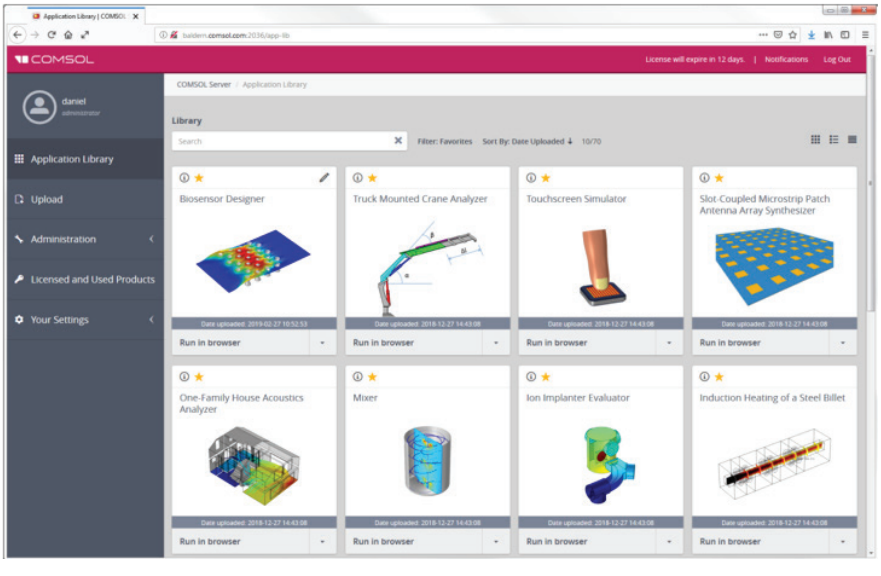

FIGURE 2. Applications and their usage can be managed using COMSOL Server™.

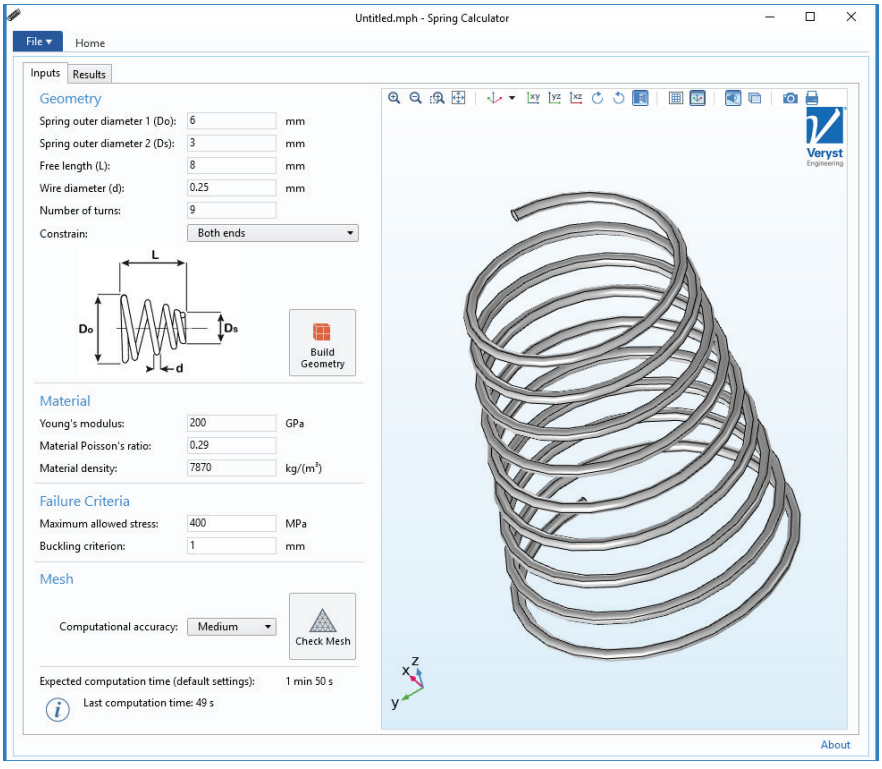

FIGURE 3. A spring calculator application. Image courtesy Veryst Engineering.

applications, there are two methods: compiling standalone executable files or distributing them via an application-management tool. As the name implies, COMSOL Compiler™ is used for creating compiled applications that can be run without a COMSOL® software license on Windows®, Linux®, or macOS. COMSOL Server™ is the choice for those who want to upload and manage applications for their organization and let their application users run simulations via web browser or client (Figures 1–2).

⇨ PRESENTING SIMULATION APPLICATIONS AS CUSTOMER SOLUTIONS

The ways in which consultants use simulation applications with their customers varies. For instance, GLL has received positive feedback from their customers about how applications allow even those without a physics background to run analyses. "You can see a light going on in their head," says Gary Long of GLL, "when they realize they can produce their own simulations and results."

Sometimes, a customer realizes the possibilities opened up by applications after working with a model developed for them. In Veryst's experience, customers will "realize how the model is useful to them, want to use it internally, and then they see how an application can help them do that," says Elabbasi, adding that the more the awareness of applications spreads, the earlier they will be able to introduce applications when working with customers.

At AltaSim, applications come into play after learning more about what their customers need. "We go through a lot of discovery with our clients to understand what it is, exactly, that they're looking for," says Kyle Koppenhoefer of AltaSim, "and if we find some key parameters, then we typically suggest an application."

⇨ BUILDING SPECIALIZED APPLICATIONS TO MEET A VARIETY OF CUSTOMER NEEDS

Even the most complex models can translate into easy-to-use interfaces (applications). Veryst's customers use applications to simulate design variations and perform parametric studies and sensitivity analyses, which "helps them focus on their core expertise of improving the product," says Elabbasi, "and not worry about the simulation settings." Some of Veryst's customers just use applications as interactive model viewers

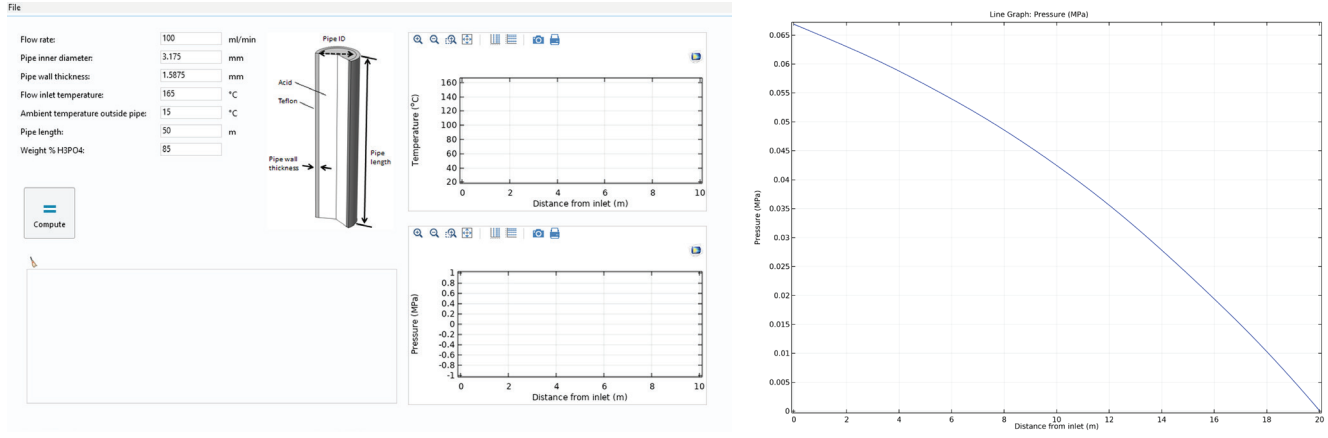

FIGURE 4. An application can be built with restricted inputs (left) and outputs (right) for ease of use. Image courtesy AltaSim Technologies.

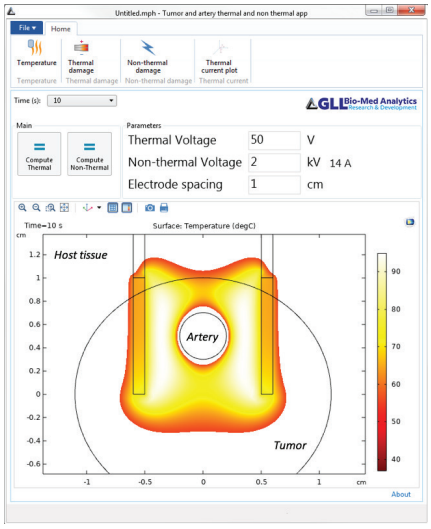

FIGURE 5. Two simulations in one application: a thermal and nonthermal tumor ablation application created by Gary Long of GLL. Image courtesy GLL.

that enable them to visualize model results in 3D, including rotating the model, looking at results at different cross-sections or at different times, and more (Figure 3). That helps them better understand the model predictions.

Applications enable organizations' internal simulation experts to focus on more advanced modeling projects by distributing applications to other teams. Koppenhoefer says that applications give field engineers a better understanding of how their designs operate, so they are better able to make design decisions.

AltaSim assists with their customers' challenge of reducing rework. For example, variations in factors like temperature and flow rate make it difficult to accurately predict a device's real-world behavior, leading to designs that have to be continuously reworked. This process can be greatly reduced with applications, because engineers from a range of specialties can run as many tests as they need, leading to increased productivity and revenue. (Figure 4)

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>
> — NAGI ELABBASI, VERYST ENGINEERING

Many of GLL's customers are medical device startups that often perform their own experiments. GLL simulates these experiments to demonstrate the accuracy of modeling to their customers. "It's very powerful to see the [simulation] results and compare them to experimental results," says Long. They then build applications from the validated models to get simulation engineers, application users, and other team members (often doctors) on the same page by visualizing simulation results in real time.

GLL built a medical device application (Figure 5) that simulates thermal and nonthermal tumor ablation. The application helps engineers design devices that ablate cancer cells, visualize ablation zones, and even import MRI and CT scans for specific anatomies. The user interface for the application includes a menu so that users can easily choose a study. For instance, because the temperature and thermal necrotic zones are time dependent, users can specify a time at which they can see the damage due to the heat or temperature profile in the results (Figure 6). The application includes three inputs for parameters: thermal voltage, nonthermal voltage, and electrode spacing. The current can be plotted via the experimental current so that users can easily validate the simulation.

⇨ COLLABORATION PROMOTES INNOVATION

As illustrated by these three simulation experts, the democratization of applications is well underway. The Application Builder makes it simple to build a simulation application in as little as a few minutes, and COMSOL Server and COMSOL Compiler help bring the applications to the people. Through the democratization of simulation, specialists, researchers, engineers, and customers can develop and innovate by working together. ❖

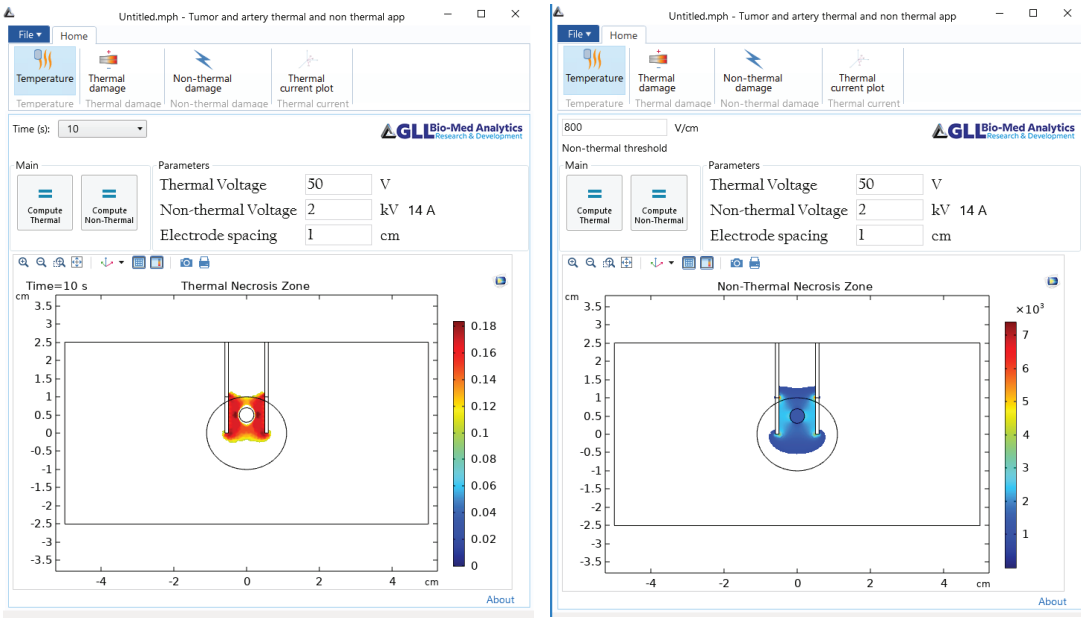

FIGURE 6. A medical device application enables users to study thermal or nonthermal necrosis zones. Image courtesy GLL.