Working to Democratize Multiphysics Simulation

CIMdata Commentary

Key takeaways:

- *Many leading PLM and simulation and analysis (S&A) solution providers are building integrated multiphysics portfolios, in many cases through strategic acquisitions*
- *COMSOL AB began with a multiphysics product vision and continues to expand and enhance their offerings via internal R&D*
- *The COMSOL Application Builder helps experienced S&A analysts build complex and validated multiphysics simulation applications*
- *COMSOL apps can be delivered globally by COMSOL Server in a Web browser to a wide range of simulation experts as well as design engineering users on desktops, laptops, or mobile devices*

COMSOL recently held their COMSOL Conference 2016 at the Newton Marriott, just outside Boston, Massachusetts. Over 300 attendees took part in the many training sessions, and convened for the excellent keynotes spread across the two-day agenda.

The privately owned COMSOL Group focuses on software solutions for complex multiphysics modeling and simulation. Founded in Sweden in 1986, the company's offerings had their start in a graduate course at the Royal Institute of Technology in Stockholm. Today the company has over 500 employees located in 21 offices around the world, including about 80 in their local Burlington, MA office.

In 1998, COMSOL released their flagship product, COMSOL Multiphysics. COMSOL Multiphysics is a finite element-based formulation for physical systems including solid mechanics, electromagnetic field theory, and transport phenomena. Since then the company has worked to expand their portfolio with a set of discipline-specific capabilities, including electrical, mechanical, fluid, chemical, and multipurpose modules. The wide range of available coupled physics formulations makes it applicable to designing high-technology products like batteries and electromechanical devices. It can be used in conjunction with MATLAB as part of a systems model, and it features optimization and two-way associativity of geometry with most major mechanical computer-aided design (MCAD) packages, including Dassault Systèmes CATIA V5 and SOLIDWORKS; Siemens PLM Software's Solid Edge; Autodesk AutoCAD, Inventor, and Revit; and PTC Pro/ENGINEER and Creo Parametric. According to COMSOL, they have a large and highly educated user community; of their 100,000+ users, about 80% have a Masters and/or a Ph.D. degree.

In late 2014, COMSOL expanded their portfolio, adding COMSOL Application Builder, an extension of their multiphysics platform, and COMSOL Server to help deliver simulation applications to a much broader user community[1] beyond these well-educated specialists. For some time, CIMdata has talked about the importance of making simulation accessible to a broader range of design and engineering users beyond the typical specialist users. This "democratization of simulation" can be achieved by helping experts build focused applications for this less-skilled-in-simulation-techniques audience. This audience is precisely the target for these new COMSOL offerings. Democratization is a concept that CIMdata has supported in publications, events, and the activities of our Simulation-Driven Systems Development

[1] https://www.comsol.com/press/news/article/1229/

Knowledge Council, and we are pleased to see that COMSOL is addressing this important issue.

Using these new solutions, experts can design and build complex simulation applications for use by non-experts in design, manufacturing, and other functions. COMSOL Multiphysics ships with a large application library that provides examples that customers can adopt, adapt, or review. Tools in the Application Builder desktop environment (currently only running on Microsoft Windows) can turn any COMSOL Multiphysics model into an application with its own interface for delivery in a Web browser. The Form Editor makes it easy to select, drag, drop, and edit the user interface layout. Users can also "white label" their internally developed applications to make these apps a seamless part of their computing environment. Figure 1 shows an example of how complex simulation applications can be delivered in a Web browser. At this most recent event, customers showed how they are reaping the benefits of this democratized environment.

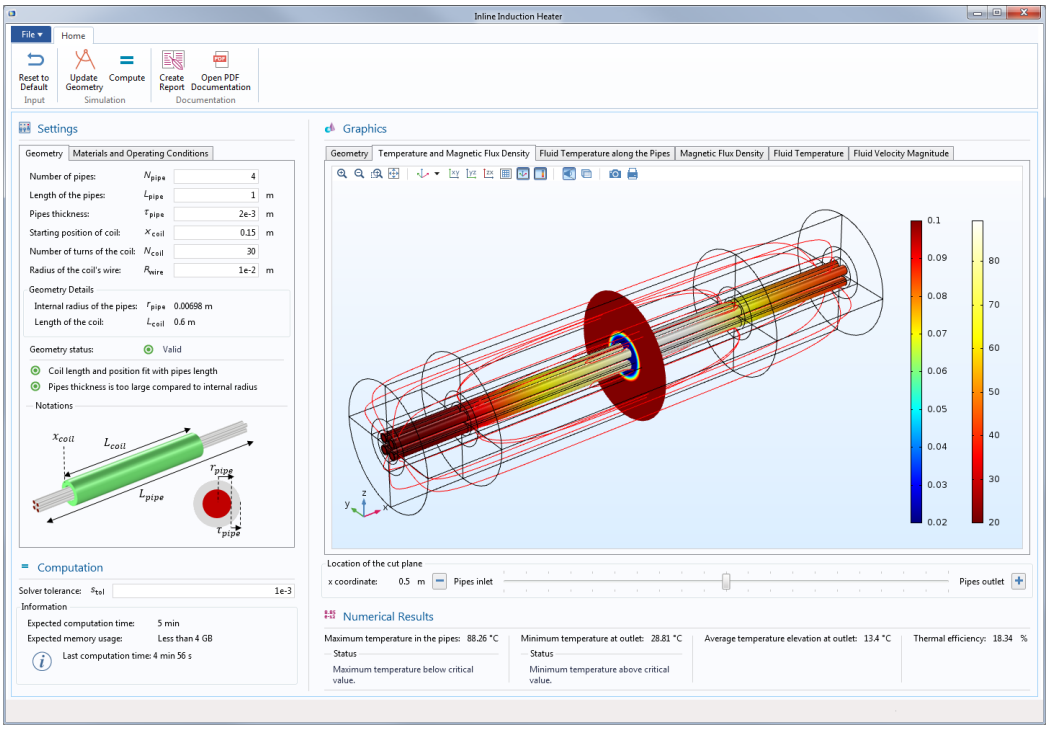

Figure 1—COMSOL Server Applications Delivered in a Web Browser
(Courtesy of COMSOL)

COMSOL's CEO and co-founder, Mr. Svante Littmarck, started the democratization theme, claiming that "multiphysics for everyone" is COMSOL's mantra, one downplayed to "multiphysics for many" by Mr. Bjorn Sjodin Vice President of Product Management during his session. But as their slides and demos clearly showed, applications are straightforward to build, by those who truly understand the physics and testing regimes being democratized, of course. Companies can use HTML, Cascading Style Sheets (CSS), or JavaScript to customize these applications to support their own needs.

COMSOL's business model is as interesting as the technology. Analysts creating applications need to have a full COMSOL Multiphysics license for all the physics they embed into each application. However, users of these applications only need a COMSOL Server license at a cost ratio 1/10 of the full COMSOL Multiphysics license cost for the applications they use.

Customers seem to be resonating with this approach, but it is still early in the adoption phase for many.

COMSOL is emerging as a major player in the integrated multiphysics realm and has grown almost 100% organically, a rarity in the S&A industry. It is interesting to contrast COMSOL's approach with other leading S&A solution providers who are building out comprehensive multiphysics suites through a series of acquisitions. Leaders like ANSYS, Altair, Dassault Systèmes, ESI, and Siemens PLM Software have to integrate their acquired products, in terms of user experience as well as analysis flow. Creating this integrated environment has been COMSOL's vision from the beginning. One can argue about suites vs. best of breed solutions, and many do, but the reality is that a S&A environment needs to be open to solutions from a range of providers. COMSOL recognizes that they cannot be all things to all analysts, and that their customers will use other applications. To connect with other solutions common in PLM environments, COMSOL develops most of their own integrations ("LiveLink for X"). However, this deeper integration approach does not extend to other S&A solutions. As such, COMSOL is still a relatively closed environment when compared to the other leading S&A platforms, which often readily support using solvers from multiple solution providers.

As companies increasingly move toward multiphysics and multi-disciplinary design optimization to address the performance requirements for tomorrow's complex cyber-physical systems, an open and collaborative approach will be essential. COMSOL has made great strides to help democratize multiphysics, and CIMdata hopes they will bring that same demonstrated focus and great skill to address these increasingly complex analysis problems in the future.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. To learn more about CIMdata's services, visit our website at http://www.CIMdata.com or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI 48108, USA. Tel: +1 734.668.9922. Fax: +1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.