Accelerating Innovation in Electronic Product Development

David Cadge, Electronics Industry Lead, SIMULIA Technical Marketing

Smaller devices with more memory and features, environmental constraints, global sourcing, increased speed and decreased cost—these demands pose significant challenges for the electronics manufacturers who, arguably, have the shortest product lifecycle of any industry. Delivering the latest, greatest, smallest and next "must have" tech toy requires design and engineering solutions that will help the industry evaluate and improve product performance on the fly.

When I last wrote an Electronics Strategy Update for *INSIGHTS* magazine in October 2007, I discussed the industry need for unified Finite Element Analysis including: tools to capture and share simulation workflows, multiphysics—including multi-field simulation, advanced capabilities for material modeling, as well as technology for fracture and failure. Today, the industry challenges have only intensified. The good news is that SIMULIA's strategic R&D plans are on target and are helping our customers meet their product development demands. Consider some of the new and enhanced features added into the Abaqus products over the last two years such as: XFEM, low cycle fatigue, implicit dynamics, subcycling, and co-simulation. (See page 14 of this issue to learn more about the latest release of Abaqus 6.10)

In addition to expanding the capabilities in Abaqus, our R&D organization is now responsible for the development of an expanded portfolio of simulation solutions including Isight, Simulation Lifecycle Management, DesignSight, CATIA Analysis, and SolidWorks Simulation. Our electronics strategy now encompasses all of these solutions, and is bringing significant business value to the industry.

Our customers' motivation for using realistic simulation often focuses on reducing or replacing time-consuming and expensive physical tests with virtual tests. For example, an industry-standard moisture sensitivity test for a semiconductor might take several hours to complete—that is after waiting up to one month for a prototype part to be made and another week to pre-condition the specimens. A virtual test with Abaqus can replicate this physical test and can be completed within a matter of hours. This approach provides huge time and cost savings, while allowing the consideration of many more design alternatives.

Plus, realistic simulation can often reveal more than a physical test. Consider a cell phone drop test—simulation can provide views inside the device during the drop event that would be impossible to achieve from physical tests. Simulation also allows results from any location in the model and at any point in time during the analysis.

Unified FEA & multiphysics

Engineering work groups in the electronics industry need to perform a wide array of simulations. Abaqus FEA enables engineers to use a common simulation model and underlying technology to evaluate many different workflows.

In the case of cell phone manufacturing companies, engineers are doing more than just drop test simulation with Abaqus. They

are also using its range of capabilities for coupled structural-acoustics, thermal loading, bending/twisting, and flexible multi-body dynamics for mechanisms—all leveraging the same, underlying FE model.

Semiconductor companies are using Abaqus to perform virtual tests for thermal and power cycles (see page 20), vibration, moisture, and stress. They are looking at simulations covering the complete lifecycle of the component, from manufacture, to assembly, right through to consumer usage and final failure.

As components become smaller and more complex, designing to avoid fracture, delamination, and failure grows ever more important. SIMULIA is the technology and industry leader for modeling and analyzing fracture and failure. We extended our leadership by delivering the first commercial release of the Extended Finite Element Method (XFEM) in Abaqus 6.9. This method enables users to study crack initiation and propagation along an arbitrary solution-dependent path without needing to remesh. It can also perform evaluations for an arbitrary stationary crack. This capability has been further enhanced to support contour integral output, to run in parallel on multiple cores, and to support the implicit dynamic option for transient analyses like thermal shock.

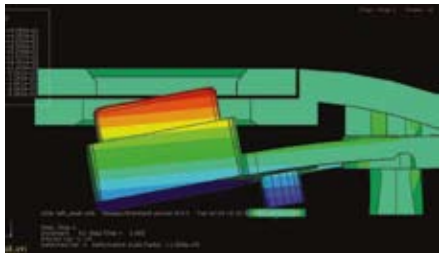
Abaqus 6.9-EF added the option to read multiple nodal output variables—temperature, normalized concentration, and electric potential—from previous Abaqus analyses. This technique enables customers to get the total stress state caused by coupled-fields with a single stress analysis; for example, the coupled response to temperature and moisture for a moisture sensitivity test or to temperature and cure shrinkage for a warpage simulation.

In Abaqus 6.10 we are releasing Abaqus/CFD which enables users to perform conjugate heat transfer simulations. The Abaqus/CFD solver can be easily coupled to an Abaqus/Standard model that has been created for thermal cycling and solder joint creep simulation, and used to perform cooling simulations.

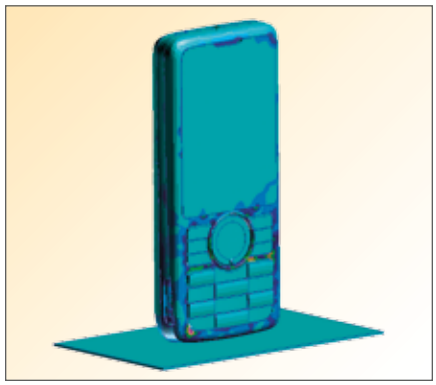
Simulation automation and optimization

Isight, which became part of our product portfolio in 2007, provides engineers with a suite of interactive tools for creating simulation process flows—consisting of a variety of applications, including commercial CAD/CAE software, internally developed programs, and Excel spreadsheets—in order to automate the exploration of design alternatives and identification of optimal performance parameters.

Isight enables users to automate simulation process flows and leverage advanced techniques such as Design of Experiments, Optimization, Approximations, and Design for Six Sigma to thoroughly explore the design space. Advanced, interactive postprocessing tools allow engineers to explore the design space from multiple points of view.



A process simulation for a Notebook power button is performed using Abaqus to analyze the stress caused when pushed. Realistic simulation enables design engineers to evaluate whether the Notebook's power button meets performance requirements. Image courtesy of ASUSTeK Computer, Inc.



Virtual drop tests of a cell phone are performed using Abaqus to analyze the stress and strain of main parts as the phone strikes a surface from various directions. Realistic simulation enables design engineers to evaluate whether the stiffness of the phone's components meets performance requirements. Image courtesy of Lenovo.

Managing simulation IP

Electronic product development companies continue to expand their use of coupled models for multi-field, multiphysics, and multi-scale applications resulting in data being transferred from one model to the next. They are also performing more simulations due to faster computing resources and the need to reduce physical testing. This activity is driving the need for solutions that allow engineers to capture and share simulation workflows while managing applications, computing resources, and simulation results. SIMULIA has responded to this industry demand by developing a product suite for Simulation Lifecycle Management (SLM). SLM accelerates product development by providing timely access to the right information through secure storage, search, and results visualization.

Customer engagements

SIMULIA is proactively engaged in the electronics industry. Our global team and customers present regularly at industry conferences (visit our website to download several of these papers). Our customers also participate in SIMULIA customer review meetings to provide input on their simulation requirements. We are responding to their requests by enhancing our product portfolio with robust technology for multiphysics, design optimization, and simulation lifecycle management. As a result, our customers are solving more complex engineering problems with fewer simplifying assumptions. Our goal is to help our customers create the next "must-have" electronic device faster and more affordably than ever before.

David Cadge
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David is responsible for developing and promoting our strategy for simulation within the Electronics industry. He has worked at SIMULIA since 1995 (initially in the UK office and then at the Providence, RI headquarters). David has worked in various capacities within the customer service and marketing teams. He has visited Electronics customers around the world to understand their simulation workflows and requirements. Information gathered during these visits helps SIMULIA provide enhancements for advanced technology, usability, and productivity so that simulation can become an integral part of Electronics design practices.

Download Electronics-related customer papers at: www.simulia.com/cust_ref