Accelerating Innovation in Electronic Product Development

by David Cadge, Electronics Industry Lead, SIMULIA by Dassault Systèmes

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 multifield 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.

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 precondition 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.

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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, 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 warp-