Q&A Session
Web Seminar: Introduction to Thermal Simulation of Electronics
20th February 2013

Q. Can Kirchhoff law be included in CFD method, particularly with FloTHERM?
A. FloTHERM does not represent Kirchoff law in any simulation. However we are able to analyze the joule heating effects as a result of current flowing down a bar. It is also possible to import a power map for a printed circuit board that has been simulated in Hyperlynx PI.

Q. Is it possible to perform co-simulation with other Mentor products (electrical and electronics simulation products)? Where can I find more information about these?
A. A number of our products will communicate with each other. It is possible to transfer data from board layout tools, import component characteristics from our test device T3ster and to use a power map created in Hyperlynx PI.

Q. To create a thermal path in order to dissipate the heat, would it be possible to use a shield, joined with the heating components with thermal paste? Would it cause problems for electromagnetic protection?
A. This would be a perfect task to carry out using FloTHERM. Run a base case and then add the parts to see what will happen. With regard to the electromagnetic effects this is not part of the FloTHERM simulation as we only deal with flow and temperature effects.

Q. Is there a way of validating thermal simulations other than using a physical prototype?
A. At a basic level there are a number of simple equations which can check bulk behavior. Some of these techniques are introduced in a course called “Thermal management of electronics” presented by Jeff Punch. Details of this can be found on our web site.

Q. is it possible to use Flowmaster with FloTHERM? Could you give some information about co-simulation?
A. It would be possible to use results from one software as boundary conditions for the other, though at present this would be a manual process. We are working on integration of 1D and 3D simulation and some of our products are linked in this manner. More information can be found on our web site.

Q. How do you create Delphi models from a detailed model?
A. We would use a web based utility that we have developed for this purpose – called FloTHERM PACK. Using design sheets you can quickly create a detailed model of the component and from this we can create the Delphi model (and also 2R models). Behind the scenes, simulations are made with different boundary conditions including JEDEC standard tests. From these the networks are calculated and these models tested to compare the results and a measure of the accuracy defined.

Q. What is the maximum accuracy?
A. The accuracy will depend very much on the detail of the information available on the system. The more accurate the input and boundary conditions the more accurate the results. So if you were to model a test environment in exact detail you would be
able to match your physical measurements very closely – remember to add detail such as thermocouples as these do have an effect. Having said that, very useful design information can be obtained early in the process with very little information. At this point we are interested in trends and differences in designs rather than absolute accuracy.

Q. **Does the tool import files directly from Expedition PCB and ProE?**
A. Yes we can. For Expedition we have a small utility that installs an export facility into Expedition. This allows you to create a file including the board dimensions, component placement and tracking details. This utility is also available for Cadence Allegro and APD, Zuken CR5000 and Mentor Graphics Boardstation. In addition we are able to import the neutral file format IDF. For mechanical CAD data we are able to import from a number of CAD packages via native files but also using neutral file formats – IGES, STEP and SAT are the most common.

Q. **How do you determine grid independence?**
A. Using the grid set up tools it is a very quick job to change the grid. Generally we would recommend that you run a number of simulations increasing the number of grid cells until the results no longer change. This can be set up with a degree of automation using the command center. In my experience this does not need to be run on every model you create – if the simulation is similar to earlier ones then the same lessons learned with regard to grid can be transferred.

Q. **Are there thermal models for electronic components (example: LED's) similar to PSPICE?**
A. For electronic component we have 2 resistor (Junction to board and junction to case), Delphi network models and also the ability to use resistance / capacitance networks as measured by our T3ster hardware solution.

Q. **Can you recommend any texts/material that talk about the underlying mathematics/concepts of thermal simulations specifically for electronics?**
A. There are a number of texts available varying in detail and mathematical complexity. One good book that we recommend for the a good introduction to the subject is "An Introduction to Computational Fluid Dynamics, The Finite Volume Method" by H K Versteeg and W Malalasekera.

Q. **How do you check conservation of energy with the results?**
A. One of the post processing facilities we have is a tables feature. This can create tables to show heat flow from say all surfaces of an enclosure. It is possible to export this to a spread sheet for further analysis.

Q. **How do you setup heat transfer between solid surface and fluid?**
A. This is automatically dealt with as a part of the simulation. The software will calculate the heat transfer based on the flow criteria and thermal conditions local to the surface.

Q. **Is it important to consider radiation in simulations?**
A. It will depend on the simulation that is being performed. Radiation as a heat transfer method will be more significant in a natural convection case than in a case with forced airflow. The decision to consider it will be made by the user.

Q. **Is there a way in FloTHERM to set up trace heating inside PCB?**
A. It is possible to define a current through a block and derive their heating effects (Joule heating). This is OK for simple configurations but for more complex trace patterns we would recommend importing a power map from a tool such as Hyperlynx PI.

Q. Are FloTHERM models interchangeable with ICEPAK models?
A. It is possible for some ICEPAK models to be imported into FloTHERM.

Q. How flexible/featured is mesh generation?
A. We use a Cartesian mesh that is able to give fast, stable robust answers. It is set up on a system level (over the whole volume being modeled) and also more locally to be able to define detail over small features such as components.

Q. Is it possible to simulate variable speed fan?
A. It would be possible. Depending on the case there may be differing levels of manual intervention.

Q. Does Mentor Graphics perform thermal modeling as a contracted service?
A. Yes we can do. Simply contact your local sales office to discuss any requirements.

Q. Does Mentor Graphics offer on-site CFD training?
A. Find out more at http://www.mentor.com/training/course_categories/flotherm

Q. Can FloTHERM simulate with different fluids (i.e. water and air) like in a heat exchanger?
A. FloTHERM is capable of simulating the effects of different fluids and can easily be set up to model say a water cooled heat sink.

Q. Which all turbulence models does it include?
A. General we make use of a single equation turbulence model where a varying level of turbulence is calculated based on the proximity of surfaces. It is ideal for cluttered geometries that are found in typical electronics applications. We also have the k-epsilon model for the few cases where the default model is not suitable.

Q. Can you provide a demonstration on a real product?
A. If you have a specific requirement then we can arrange for a local account manager to contact you and discuss these. Also we have some real world demonstrations on our web site: http://www.mentor.com/products/mechanical/multimedia/

Q. Is there a location where one can download and share engineering database items like material properties, surface properties, 2 resistor components, etc.?
A. We don’t maintain such an area. However a number of manufactures (particularly component manufactures) make models available on their web sites or by request.

Q. I’m doing transient analysis for a cell phone and would be interested to hear if FloTHERM is capable of doing transient simulation with varying power dissipations. Actually the problem is that power dissipation should be temperature dependent, not time dependent. I mean when a certain temperature is reached, power dissipation should be changed. I have
understood it’s not possible in current FloTHERM version, but do you have any script or workaround available for that?

A. Unfortunately you are correct and a power vs. temperature profile is not available in the current version. The only workaround that I can think of is to manually observe a monitor point in the profiles window, stop the simulation when you see this reach the temperature required and change the power before restarting the run. This is very manual process but the good news is that such a feature is in the requirement list for the next version of FloTHERM. However, I can’t confirm that it will be successfully implemented or the timescales for release as any such features are subject to a rigorous testing process.