UNIT 41: FCC Custom Criterion

The FCC Criterion is a calculation that was developed by Franco Chiesa of the Collège de Trois-Rivières (Québec) for prediction of total evolved microporosity in aluminum castings. This criterion is based on a calculation involving Local Solidification Time (time from Liquidus to Solidus) and Solidification Wavefront Velocity at each point in the casting. In moderately degassed aluminum castings, this criterion gives an estimate of the total percent structural microporosity at each point in the casting. SOLIDCast includes a menu item that allows this calculation to be performed as stored as a Custom Criterion function that can then be plotted.

It has been found that this calculation can also give useful results in other alloys (such as iron and steel) for prediction of areas of potential microporosity or spongy shrinkage. This criterion also has proven useful in identifying thermal centers within castings, so that, for example, the location of possible secondary shrinkage in iron castings might be displayed.

The range of numbers that will be developed for any given casting depends on the alloy and the geometry of the casting, so it is not possible to say ahead of time what a critical range should be for a particular casting. In general, the higher the number, the more potential for microporosity formation. It has been suggested that, to establish a starting point for plotting, look at a number that is at about 40% of the total range. For example, if the total range in a casting is from 0 to 1.9, then a number at about 40% of this range would be 0.76. This might be a good value to start plotting. Numbers higher than this will generally show less indications in the casting (the "more severe" areas) while lower numbers will generally show more indications ("less severe" areas).

Using the FCC Criterion in SOLIDCast is a two-step process:

1. After a simulation is complete, double-click the Simulation icon on the Project Tree to display the Simulation Status window, then close the Simulation Status window. Select Simulation…Calculate FCC Custom Criterion from the Simulation menu. A button will appear on the taskbar while the calculations are taking place.

2. After the calculation is complete, again double-click the Simulation icon on the Project Tree to display the Simulation Status window again. This action loads the minimum and maximum values from the FCC calculation into the system. Now close the Simulation Status window and select a plot. For example, select Simulation… Plot Iso-Surface. Under Select Data Type, click on the selection arrow, and find and select **Custom – High**. The range of the FCC Criterion will be displayed, and you can then begin plotting values.

An example of an Iso-Surface plot using the FCC Criterion is shown as follows:
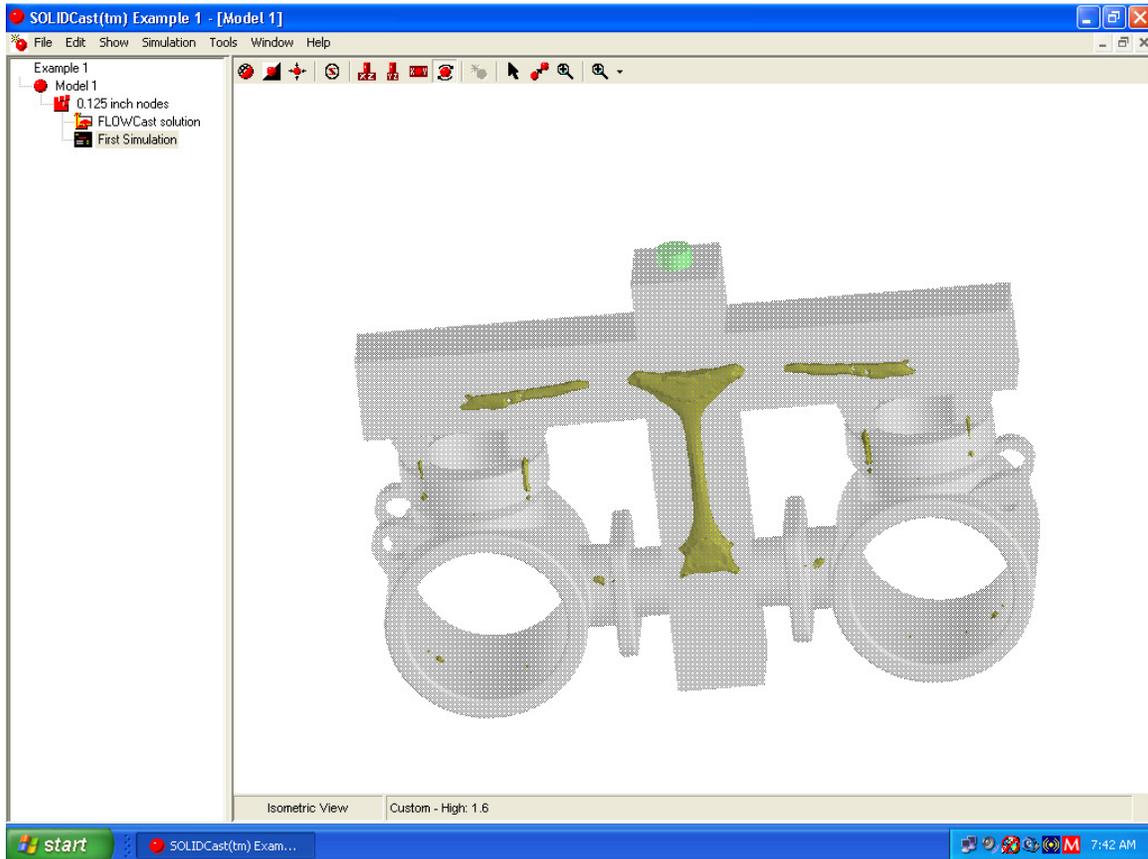
In this image, you can see several areas in the casting that may be prone to microshrinkage.