

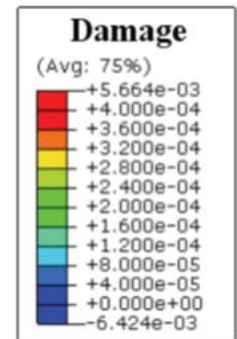
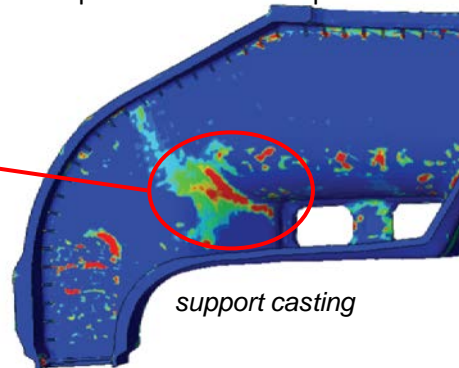
# METALCASTING E-SMARRT

Energy-Saving Melting and Revert Reduction Technology



## Simulation of Hot Tears in Steel Castings Reduces Costly Rework

During steel casting solidification, contractions and distortions can cause final product dimensions to vary significantly from the original pattern. Casting cracks that form late in solidification, called hot tears, occur when tensile strains can no longer be accommodated by liquid metal flow. Dimensional changes and hot tears are major problems in the steel casting industry, resulting in costly scrap or repair work. Correcting these problems required a tedious trial-and-error process. The University of Iowa, partnering with the Cast Metals Coalition on the E-SMARRT program, developed a casting simulation model that predicts dimensional changes and hot tears, replacing expensive and time-consuming trial-and-error processes with computer simulation.



## SUCCESS STORY

**Problem:** Initial casting trials for a prototype casting used in a Caterpillar off-highway truck frame resulted in hot tears at internal corners.

**Solution:** The new hot tear/dimensional change simulation model was able to successfully predict the hot tear location. Hot tears were eliminated by systematically modifying casting parameters and geometry, and then re-simulating until the predicted hot tears were alleviated.

**Benefits:** This new model is estimated to save 24,430 million BTU per year per unit affected by this new technology. A unit is defined as 1% of the total U.S. steel foundry production tonnage per year. The model has been implemented in MAGMASoft, the worldwide leading casting simulation software.

"Caterpillar has implemented the hot tear model developed at the University of Iowa into its suite of casting modeling and simulations tools. This pioneering research is routinely utilized to solve complex hot tear problems observed in first article castings. Having a model that can be used earlier in the casting development process is helping to avoid costly hot tear problems through improved design." - Rick Huff, *Manufacturing Technology, PD&GT, Caterpillar, Inc.*



METALCASTING  
**E-SMARRT**  
843.760.3219  
[www.e-smarrt.org](http://www.e-smarrt.org)