Fall, 2008

Volume 6, No. 4

DEFORM™ News

Events:

- November 12 & 13, 2008: The Fall DEFORM User Group Meeting will be held at the Nationwide Arena in Columbus, Ohio. Details are available on the web site. Register now for this exciting event.

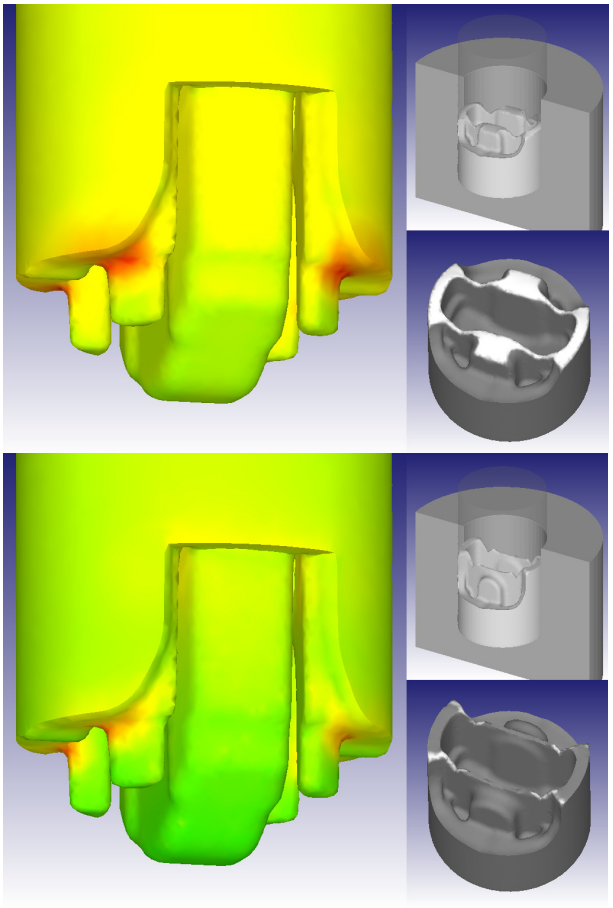
Training:

- Advanced training will be held at the SFTC office in Columbus, Ohio on November 13 & 14, after the Fall DEFORM User Group Meeting.
- December 9 & 10, 2008: DEFORM-2D training (includes DEFORM-F2) will be conducted at SFTC in Columbus, Ohio.
- December 11 & 12, 2008: DEFORM-3D training (includes DEFORM-F3) will be conducted at the SFTC office.

3D Die Stress

Die stress analysis is a common tool for predicting die failures during forming operations. Decoupled analysis is used in the vast majority of cases to model the end of the die stroke, where the highest forming load usually occurs. This method is proven to be efficient and accurate.

In some cases, die failure may result from high stress produced during the stroke. It is hard to identify the exact moment when the stress peaks without a die stress history. Loosely-coupled analysis provides this history via a series of one-step die stress solutions. Step results are reviewed in-sequence to identify the peak die stress during the stroke.



The images above show the piston forging operation and maximum principal die stresses at the middle (top) and end (bottom) of the stroke.

Besides die failure, excessive die deflection can cause out-of-spec parts. One example is in reverse extrusion with an off-center punch. Material fills one side of the die cavity easier than the other, which increases punch deflection. Yet, this only increases the uneven die fill. Thus, the cycle repeats and the punch proceeds to “walk” off center. Only tightly-coupled analysis solves for both plastic workpiece deformation and elastic die deflection at the same time.

Coupled die stress analyses are more CPU intensive than traditional decoupled die stress simulations, thus they take longer to run. A deformation simulation using rigid dies that runs in a few hours, might run overnight when incorporating a coupled die stress analysis with one elastic die. A coupled analysis of the entire die stack can take a day or more to run.

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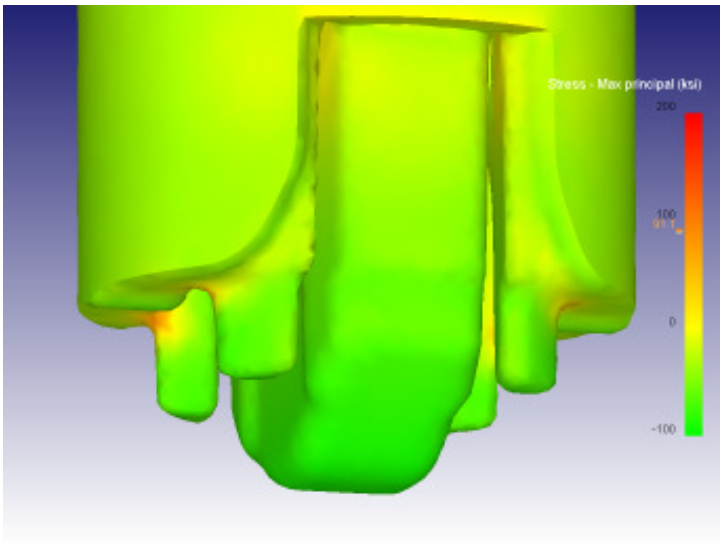
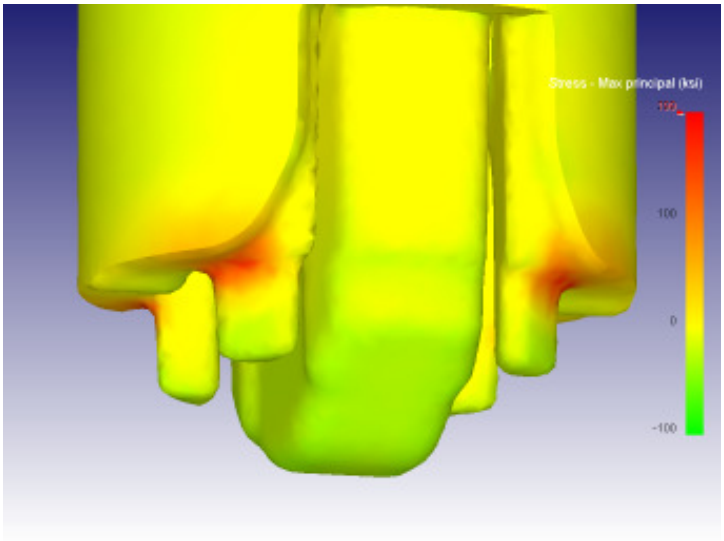
Coupled Die Stress Example:

Wiseco Piston encountered punch failures while producing an aluminum piston. Fractures formed at the base of plug features on the punch die. A tightly-coupled, incremental die stress analysis was performed on the forming operation to investigate the tool failure. The analysis involved a moving elastic punch, a plastic workpiece and a rigid die.

High tensile stresses were found to occur during the middle of the stroke. The location of the stresses matched the actual die failure location. The stresses were highest when there was a side force imbalance on the plugs. This caused significant deflection of the plugs, increasing tensile stresses at their bases.

By the end of the forming operation, the part had filled out and compressive stresses had offset tensile stresses. Thus, tensile stresses were understated in die stress analyses that only focused on the end of the stroke.





Decoupled die stress analysis at the end of stroke (top) predicted a maximum tensile stress of 91 ksi. Coupled die stress analysis (bottom) predicted tensile stress of 199 ksi during the die stroke. The highest forging load did not occur at this step.

Releases:

DEFORM-3D V6.1.3 and DEFORM-F3 V6.1.3 were released in May. DEFORM-2D V9.1.1 was released in March. These service packs are primarily bug fixes and code refinements.

A major release is in development for the very near term. Version 10.0 will include 2D - 3D integration, license manager improvements, multiple material groups and developments in shape rolling and ring rolling. Additionally, compiler and operating system studies are being performed to improve system performance.

More details on the 10.0 release will be presented at the upcoming DEFORM User Group Meeting. For specific details, please contact SFTC.

Scientific Forming Technologies Corporation
2545 Farmers Drive
Suite 200
Columbus, OH 43235
Tel: (614) 451-8330
Fax: (614) 451-8325
www.deform.com