Fall, 2006

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DEFORM™ News

Events:

- October 24 & 25, 2006: The Fall DEFORM Users Group Meeting in North America will be held in Covington, Kentucky, south of Cincinnati.
- DEFORM Users Group Meetings will be held in Japan, England, Germany, Austria, India and other locations this fall. Contact your local distributor for more information.

Training:

- October 26 & 27, 2006: Advanced training will be held at the SFTC office, in conjunction with the Fall DEFORM Users Group Meeting.
- December 5 & 6, 2006: DEFORM-2D training (includes DEFORM-F2) will be conducted at SFTC in Columbus, Ohio.
- December 7 & 8, 2006: DEFORM-3D training (includes DEFORM-F3) will be conducted at the SFTC office.

DEFORM™

Design Environment for FORMing

New SFTC Staff

We are pleased to announce that Jim Miller has joined SFTC as a Principal Research Scientist. Jim will focus on sales, applications, technical support and training. He gained over 7 years of experience with forging, CAD, finite element analysis, process and product design for Alcoa Wheel & Forged Products. Jim has a Master's in Mechanical Engineering from Case Western Reserve University and is also a graduate of The Ohio State University. Jim enjoys skiing, golf, football, astronomy and computers. Please join us in welcoming Jim to SFTC.

Press & Hammer Movement

Over the past two years, significant enhancements to movement controls have been developed. In late 2004, each of the common equipment types was analyzed to provide practical and applicable functionality. Some highlights are discussed.

Mechanical press ram velocity is determined by geometry of the drive train and flywheel speed. In general, this is adequate to simulate forging processes. The flash thickness is determined by the die position at bottom dead center. As the forging load increases relative to the press size and stiffness, a thicker flash thickness is observed in production. This is the result of elastic deflection of the press frame, drive train and die stack. This deflection can now be predicted in DEFORM, by inputting the system stiffness.

Energy controls the ram speed in hammer forging. In a hammer, kinetic energy is converted to deformation energy. Energy losses (inefficiency) can be quantified as the difference between the maximum kinetic energy at initial die contact and deformation energy. Deformation energy can be calculated as the area under the load-stroke curve. DEFORM Users observed lower efficiency on finish forging operations, where loads are typically the highest. Unfortunately, the efficiency is an unknown before a simulation or production trial is run. The system stiffness can be used to capture the non-recoverable elastic losses (inefficiency).

The elastic deflection of the tooling and press has been implemented in the screw presses as well.

Hydraulic press speed is limited by power. The speed limit model has been improved significantly in DEFORM-3D/F3 version 6.0 and DEFORM-2D/F2 version 9.0. Some development is ongoing to handle a few challenging cases such as peak loads early in the forging stroke (extrusion) or very rapid change in load.

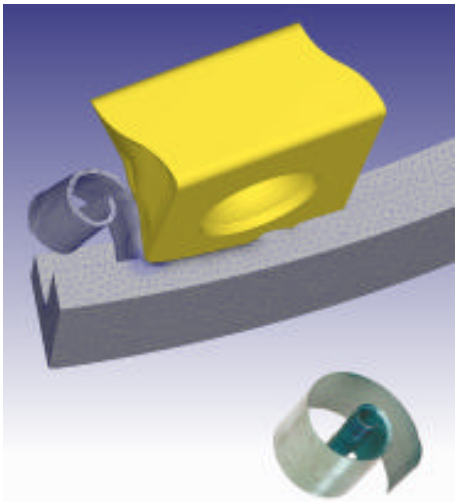
User defined velocity profiles have been implemented to provide accurate die movement for specialized mechanical presses such as the knuckle press, wedge press or scotch yoke press.

Coupled die movement has been implemented to allow one die to track the movement of another - even in a different direction. This will be useful in side ram forging on mechanical presses.

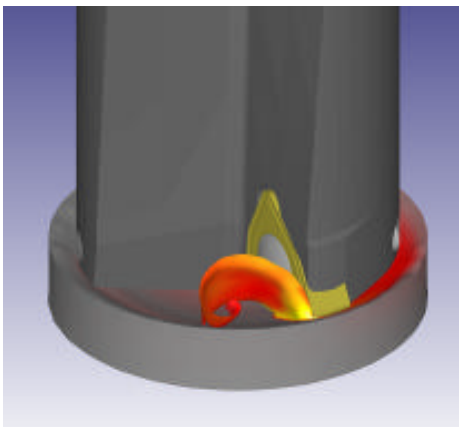
Sliding die movement has been improved and tested on a wide range of cases. Ongoing developments are planned.

Cutting Simulation

Simulation of cutting processes has improved significantly over the last few years. Practical 3D simulation of turning, drilling and milling are being performed by DEFORM Users around the world.



A DEFORM-3D simulation of an Ingersoll S-MAX insert is shown (above), with an actual chip. Insert manufacturers use simulation to predict chip shape, cutting behavior and tool wear. An excellent paper was published by Dr. Kammermeier and Mr. Mylavaram of Kennametal on this topic in 2005 (SFTC reference paper #151).



The drill simulation (above) provided by Manchester/OTM, was shown at IMTS this fall.

Cutting simulation has posed a range of exciting new challenges. These include solution speed, large model size, critical (small) features on large models, localized deformation, self contact, frequent remeshing and extremely steep mesh gradients. As these issues are enhanced, code stability and capabilities are improved for more traditional applications, such as hot forgings with thin flash or net shaped gears.

Ring Rolling

A prototype of our new ring rolling code will be released with DEFORM-3D version 6.1 beta. The FEM engine is a totally new program, optimized for ring rolling. The current code is isothermal. It supports a drive roll and mandrel. Current speed tests are very encouraging. Models with 15,000 brick elements are running 20 - 25 revolutions in a day on a single processor PC.

System Support

As of the current releases, DEFORM will run on the Suse 92 Linux operating system. As previously announced, support for Sun and SGI (UNIX) will be phased out after December 31, 2006.

Additionally, DEFORM-PC and DEFORM-PC PRO have been phased out over the last three years. DEFORM-PC users should be transitioned to DEFORM-F2 and DEFORM-PC PRO users should be running DEFORM-2D. Please contact SFTC technical support or your local distributor with any questions.

Examples are Welcome

Please forward copies of technical papers, presentations or DEFORM examples to SFTC staff. We are interested in any new applications or production case studies.

Releases:

DEFORM-2D and DEFORM-F2 version 9.0 have been released. Highlights of the release include:

- improved movement control, including press stretch (elastic loss);
- tool wear (2D);
- machining distortion module (2D);
- new material models and additions to the material library;
- current flux for resistance heating;
- meshing objects with multiple boundaries;
- strain components due to plastic, thermal, elastic, transformation and creep;
- improvements in the rate dependent elastoplastic material model, and
- GUI refinements (F2) to geometry, BCCs, die stress and operation management.

DEFORM-2D version 9.0 service pack 1 is planned for release in November.

DEFORM-3D and DEFORM-F3 version 6.0 have been released. Enhancements and bug fixes include:

- improved movement control;
- geometry editing/repairing module;
- heat transfer stages and transient analysis options in rolling;
- GUI improvements (F3);
- improved convergence in rate sensitive elastoplastic materials;
- postprocessing large databases without purging and merging, and
- significant improvement to multiple CPU scalability in both multiple processor and cluster computers.

For a complete list of all the improvements, please refer to the release notes on the DEFORM User's area.

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