Spring, 2004

Volume 2, No. 2

DEFORM™ News

Events:

- The Spring DEFORM Users Group Meeting in North America is being held on May 4 & 5, 2004 in Columbus, Ohio. Contact us for more information.
- The European DEFORM Users Meeting will be held on May 18, 2004 in Manchester, England. The meeting will be hosted by Wilde FEA. All DEFORM Users and distributors are invited.
- Third Annual Chinese DEFORM UGM will be held on May 22-23 in Shanghai in conjunction with ICFG meeting.
- SFTC will present multiple papers and host an exhibit at Numiform in June in Columbus, Ohio.
- SFTC will present a course on metalforming fundamentals in conjunction with the Forging Industry Technical Conference in Detroit on April 19, 2004. The course is co-sponsored by DLA, FIA and SFTC.

Training:

- April 27 & 28, 2004: 2D training will be conducted at SFTC in Columbus, Ohio.
- April 29 & 30, 2004: 3D training will be conducted at the SFTC office.
- Advanced training will be conducted in conjunction with the May Users Group Meeting on May 6 & 7, 2004 at SFTC.
- The 9th annual Die Stress Analysis Workshop will be held on August 18 & 19 at Marquette University in Milwaukee, Wisconsin. Brochures will be circulated this month.

DEFORM™

Design Environment for FORMing

The Newsletter

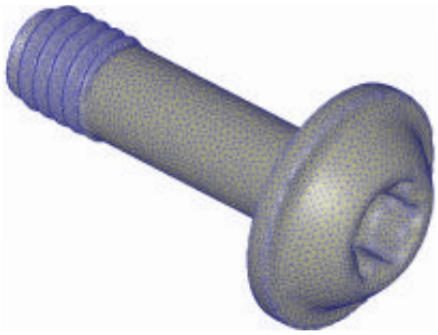
During the winter of 2003/4, service packs were released for all DEFORM Systems. USB security keys are now available to replace parallel port devices, which are not available on many new computers.

In this edition of the DEFORM News, we will highlight two areas of interest to many users.

Thread Rolling

Threaded fasteners are used on most mechanical assemblies. Threads are generally formed by machining or rolling.

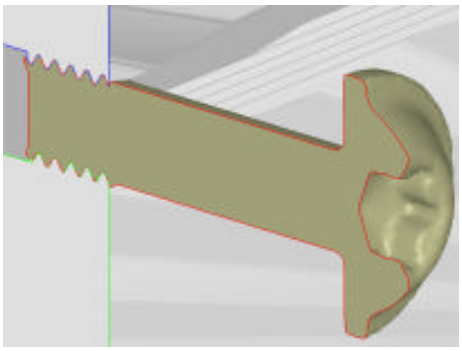
Turning or grinding processes can be used to produce machined threads. Machined threads are cut into the screw or bolt by removing the material. On the other hand, threads can be cold formed on the blank using hardened steel dies.



The FEM mesh is shown at the end of the thread rolling simulation.

Thread rolling has several major advantages over thread machining:

- The deformation involved in the rolling process work hardens the threads, resulting in increased strength.
- Rolled threads have improved fatigue resistance. The rolling process puts the surface in a state of compression, making it more difficult for crack formation and propagation to occur. The grain structure in a rolled thread is continuous, as opposed to the cut grains found in a machined product.
- Rolled threads typically have superior surface finish and a lower cost relative to machined threads.

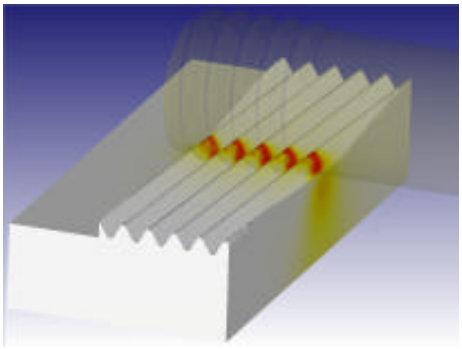


Slicing can be a useful tool when investigating thread unfill.

As a result of continuous development, the thread rolling process can be modeled in DEFORM-3D, and can be used to investigate thread formation, unfill and stress in the threading dies.

The images shown are from a thread rolling simulation that was run on a desktop PC in about a day. The simulation was set up based on a translational threading rolling machine. The blank

(over)



The effective stress (red is higher) is shown on this thread rolling die near the end of the forming process.

(continued)
is placed between the two threading dies, and then one of the dies moves in translation while the other die remains stationary. The friction between the blank and the dies causes the blank to spin and roll down the length of the stationary die. The dies are tapered so that as the blank is getting rolled, the threads are being formed in the blank.

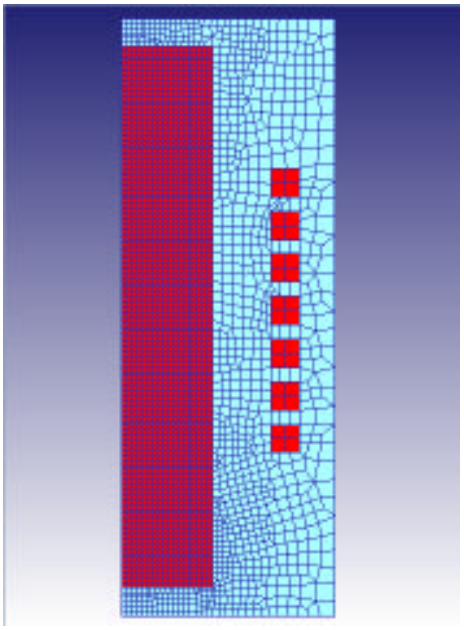
Induction Heating

Induction heating is a process where electric current flows in a coil, produces eddy currents and induces heat in a workpiece. The process is used to heat a part before forming or to austenitize surface layers during induction hardening. Two methods are available: a coupled Finite Element Method (FEM)/Boundary Element Method (BEM) and an FEM method where the air is meshed. The electromagnetic module is loosely coupled with the temperature module. Heat generation due to eddy currents will be condensed in the heat transfer analysis.

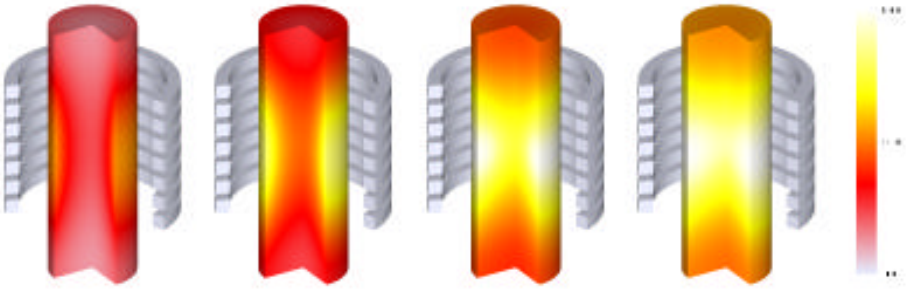
A fastener manufacturer heated a waspaloy rod prior to a hot heading operation. A specially designed seven turn helical coil was used to induce the required heat. 20kW were applied and an optical pyrometer registered a surface temperature reading in excess of 2000F after two seconds. According to the manufacturer, this was sufficient to provide the specified temperature of 1500F at the center of the rod. The properties for waspaloy were a function of temperature.

In practice, 20kW were applied to the process, yielding a 100A/mm^2 current density per turn of the coil in the simulation. The applied induction heating frequency was 10kHz. Inter object relationships were specified, with the air master to all other slave objects.

This induction heating simulation ran on a 600MHz laptop computer in less than two hours. This module is available for DEFORM-HT.



The DEFORM-2D axisymmetric problem set up, showing the common air object surrounding the 0.5″ diameter waspaloyrod and the seven copper coil turns. All objects have an FEM mesh.



After heating, the center rod temperature was predicted as 866C (1500F).

Upcoming Releases

DEFORM Users will continue to see a significant number of developments throughout 2004.

We are pleased to announce a new DEFORM System capable of performing three-dimensional simulation on popular forming processes including forging, cold heading, upsetting and extrusion. DEFORM-F3 is now available. This system provides an efficient and easy to use GUI optimized for forming processes. The FEM engine and AMG are common with DEFORM-3D.

DEFORM-2D version 8.1 is planned for release this summer. At the same time, we will release DEFORM-F2 to replace DEFORM-PC. As part of the planned transition, DEFORM-PC PRO users will migrate to DEFORM-2D. DEFORM-F2 will share the GUI strategy developed for DEFORM-F3.

During the past year, SFTC has been developing a ring rolling capability. We plan to demonstrate the new preprocessor and simulation results at our Spring Users Group Meetings.

A distributed computing environment is under development to allow three-dimensional simulations to be set up on a desktop and simulated on a fast computer on the network. The initial prototype has been completed and will be available in the next release. A simulation queue and a floating license are required to activate this new capability.

A new structure and GUI has been developed for multiple operations. SFTC staff will also demonstrate this at the Users Group Meetings. We strongly encourage our users to attend the upcoming Users Group Meetings to learn more about these and other developments.

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