Spring, 2012

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DEFORM™ News

Training:

- June 5-8, 2012: DEFORM training will be conducted at the SFTC office in Columbus, OH.
- August 7-10, 2012: DEFORM training will be conducted at the SFTC office in Columbus, OH.

Events:

- August 22-23, 2012: The "Process Modeling for Metal Forming Die Stress Analysis" workshop will be held at Marquette University in Milwaukee, WI.

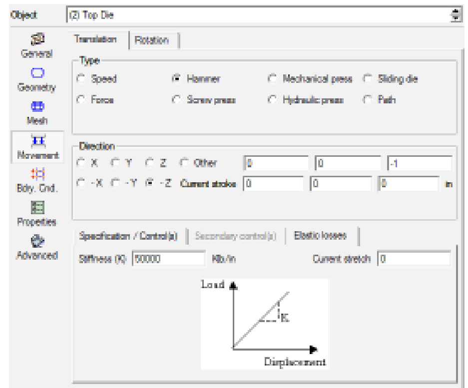
Hammer Stiffness

Hammers are a popular choice in forging equipment because they are versatile and economical. Hammer processes are designed to produce forgings using multiple blows across any number of die cavities. Users must consider how hammers work in order to properly define simulation movement controls.

Die movement is energy controlled. Each blow starts with an initial kinetic energy and ends when that energy is consumed. Not all of the energy goes into deforming the workpiece. Some is lost to inefficiencies, including friction and deflection of the dies, ram and anvil.

Movement controls directly affect how much deformation takes place in hammer forging simulations. Energy and mass inputs are obtained from equipment specifications or simple calculations. These do well to define the initial energy. Yet, energy losses must still be accounted for in some way.

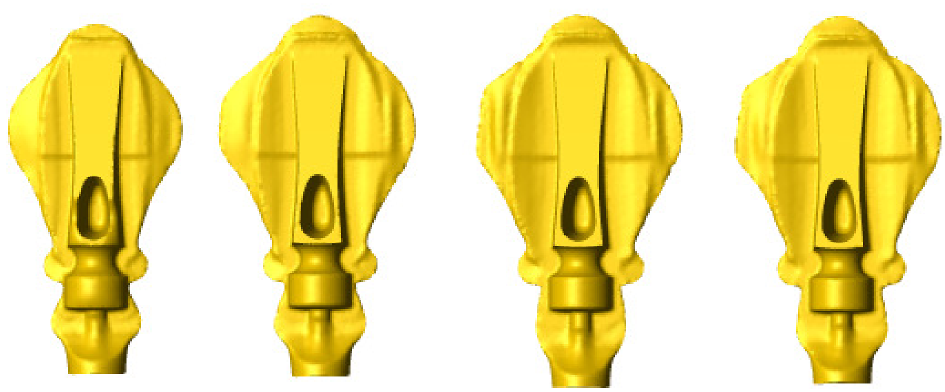
A common approach uses the efficiency input to account for all energy losses. In each operation, efficiency must be adjusted based on hammer size, part size and estimated forming load. For example, a large (stiff) hammer can forge a given part more efficiently than a smaller one. The use of a constant efficiency is unlikely to produce consistent results, as different forging processes require different efficiency settings, even though they are run on the same hammer.



Stiffness is specified on the "Elastic losses" tab within Movement controls.

A better approach incorporates a constant stiffness input that accounts for the variable inefficiencies, such as deflection. Stiffness calculations assume that the hammer system acts as a simple spring, where displacement and energy (loss) increases as load increases. A constant efficiency input is then only used to account for the constant inefficiencies, such as friction. The benefit of this approach is that each hammer in your forge shop can be characterized by its own stiffness and efficiency constants.

The appropriate hammer stiffness constant can be determined by using a practical correlation method. Before proceeding, it is of utmost importance that the user



The influence of hammer stiffness is shown in the predicted finish forging results (above). Fill and flash increase as stiffness increases (from left to right). At the highest stiffness, the shape looks good but the blows are under-predicted.

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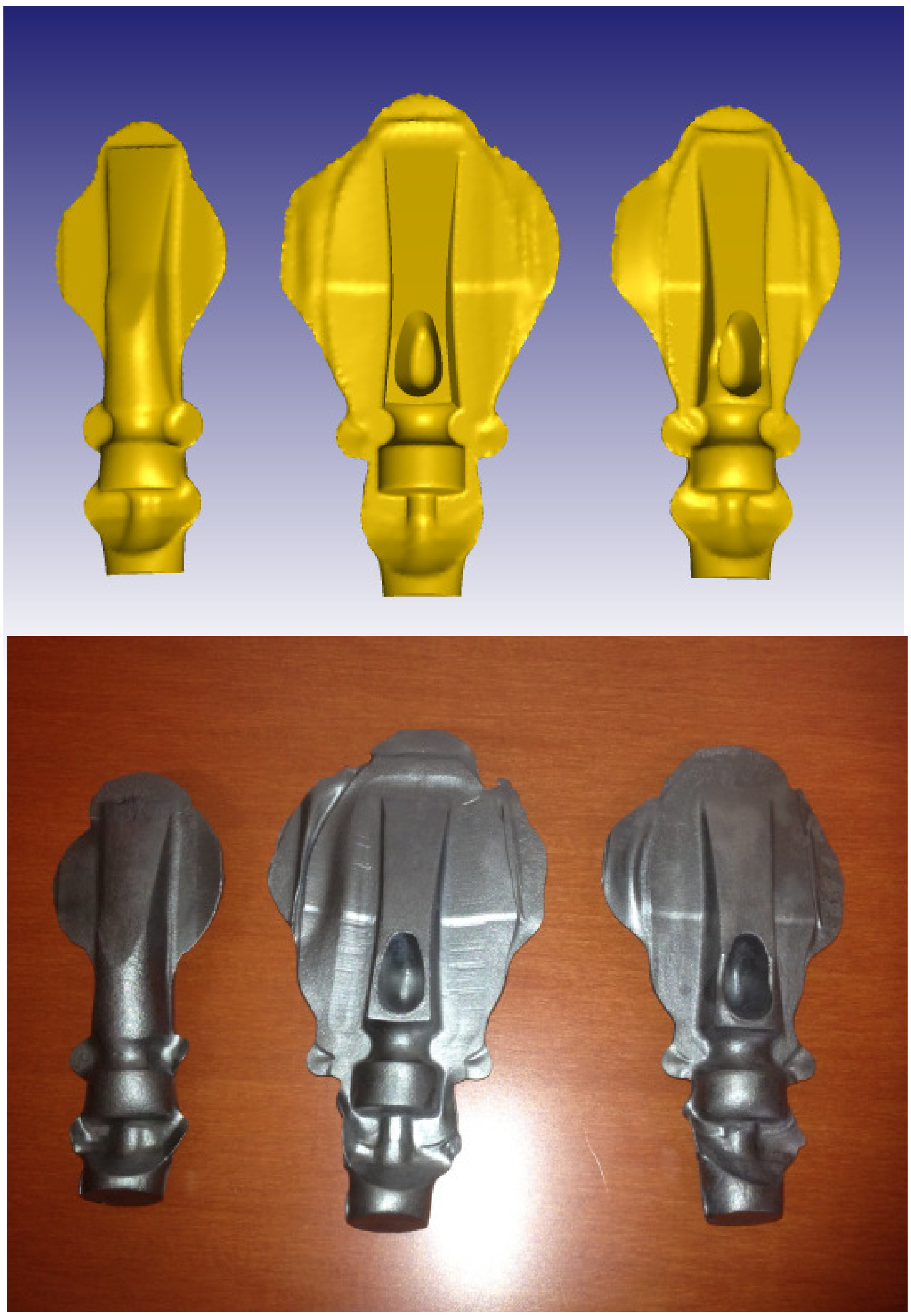
first confirms all other major process variables (temperature, material, friction, etc.) through correlation. Special attention should be paid to temperature, due to its' influence on flow stress. Failure to confirm the proper process variables may result in an inaccurate stiffness determination.

Stiffness characterization involves running a series of identical simulations using different stiffness values. Each simulation should model the entire hammer forging process, for example from bust to finish. The predicted shape and the number of "working" blows can then be compared to actual results. The ideal stiffness value is the one that produces the best match to reality, in both part shape and number of blows.

Characterizing a range of parts and processes should result in a good understanding of a hammer's stiffness and efficiency. Contact your local distributor or SFTC for assistance in determining stiffness values.



Simulation results showing the predicted bust, finish and block forgings when hammer stiffness was set to 50,000 klb-in (top). Through correlation it was determined that this stiffness provided the best match to the actual forgings (bottom).

Releases:

DEFORM V10.2 Service Pack 1 (V10.2.1) was released in April. The Service Pack is available for download in the DEFORM User Area.

DEFORM V10.2.1 includes the following major enhancements:

- Better stability and performance via MPICH2 for CentOS 4, CentOS 5 and Suse 11 Linux operating systems
- Improved 3D hydraulic press models
- Memory management fixes enable coupled die stress simulations using the C-G solver in MPI mode
- Upgraded control of models that include multiple sliding dies
- Better handling of arbitrary path movement when torque is specified
- Non-isothermal modeling of rolls is supported by the ring rolling template
- Axial roll position as a function of workpiece diameter for ring rolling
- Improvements in 3D view factor computations and controls
- Release examples are now available in both unit systems and contained under a new folder
- Process Monitor now displays full path information for jobs
- Enhanced grain size prediction by the Avrami Recrystallization model
- Volume compensation was improved for simulations where the anisotropic yield function is selected
- License behavior with 64bit MPI on Windows has been revised
- Bug fixes

Example courtesy of Vaughan & Bushnell Manufacturing Company

Scientific Forming Technologies Corporation

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