Fall, 2011

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DEFORM™ News

Training:

- December 6-9, 2011: DEFORM training will be conducted at the SFTC office in Columbus, OH.
- February 7-10, 2012: DEFORM training will be conducted at the SFTC office in Columbus, OH.

Extrusion Modeling in DEFORM

Recently, SFTC participated in the International Conference on Extrusion and Benchmark in Bologna, Italy. A paper was presented that detailed how DEFORM was being used to solve real world industrial extrusion problems. DEFORM results for the conference's two benchmark extrusion cases were also presented. In addition, a technical seminar on "Extrusion Simulation in DEFORM" was given. This material is summarized in this DEFORM News.

All the presentations given in Italy are available in the User Area of the DEFORM website.

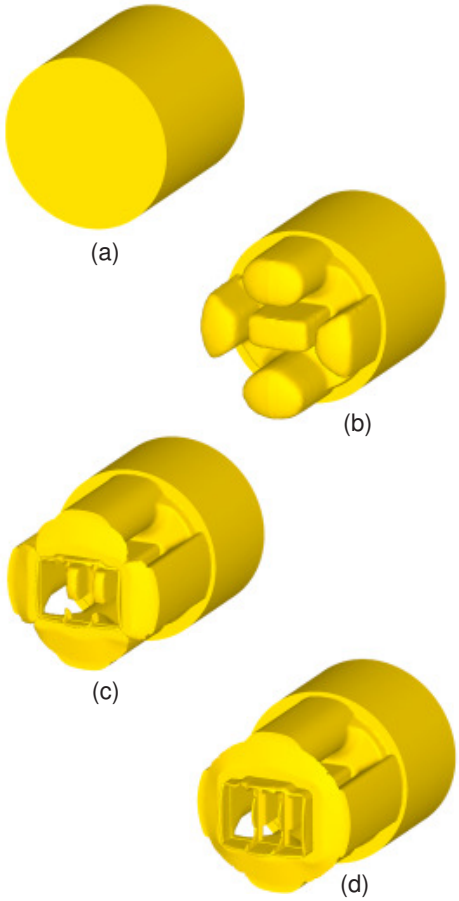
DEFORM currently has three options for modeling extrusion:

Updated Lagrangian (UL) – This is a transient analysis where the entire extrusion process is modeled. The complete load vs. stroke profile can be obtained. Die cavity filling, end effects and weld seam formation are observed. Once the cavity is filled and the extrudate starts to form, frequent remeshing increases simulation runtime.

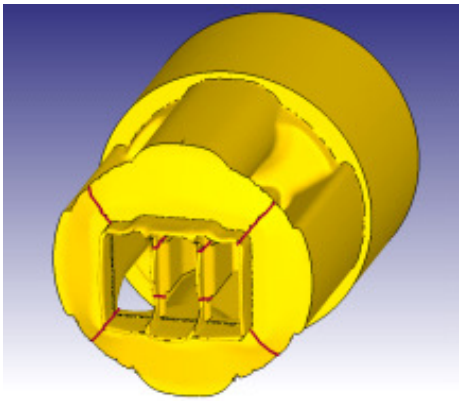
Arbitrary Lagrangian Eulerian (ALE) – This solution is based on the transient UL method, but no remeshing is required. A partially extruded billet is the starting point of the analysis. Load, extrudate shape/deflection and state variables at steady-state are the main results from an ALE analysis.

Steady-State (SS) – This is a one-step analysis (no time effect) which assumes steady-state behavior. Load and extrudate shape/deflection at steady-state are the main solutions.

The progression on the right shows a typical Updated Lagrangian extrusion simulation. The filling of the die cavity is shown. The effect of die changes on material flow can be observed.



Stages of a UL extrusion simulation: (a) initial billet, (b) extrusion of legs, (c) material in welding chamber, (d) final estrudate formation.



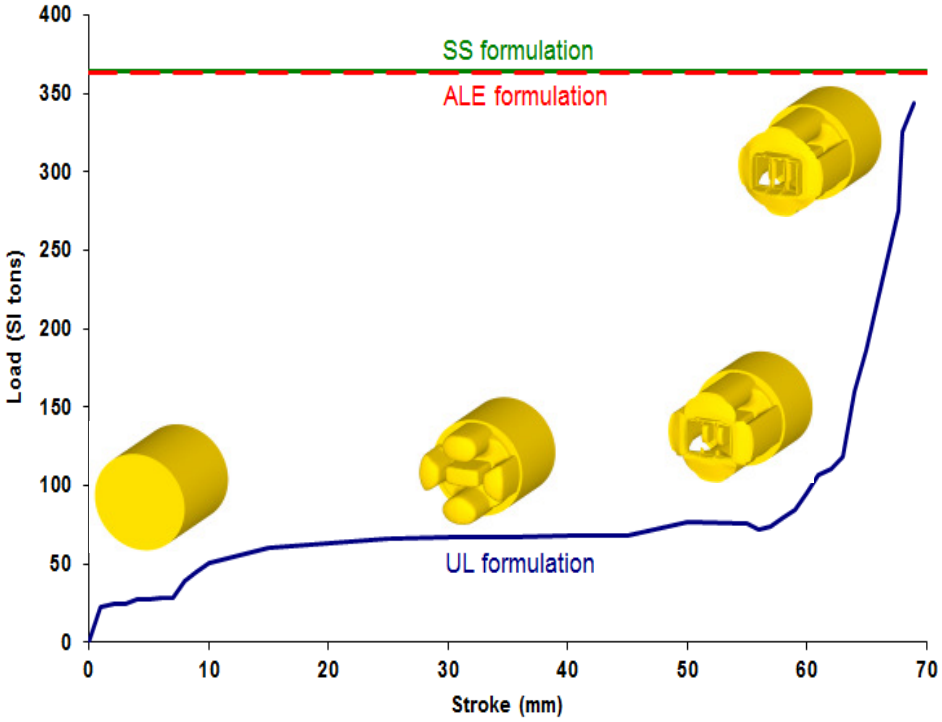
The formation of weld seams can be studied in a UL extrusion analysis. The seams are highlighted in red.

DEFORM™

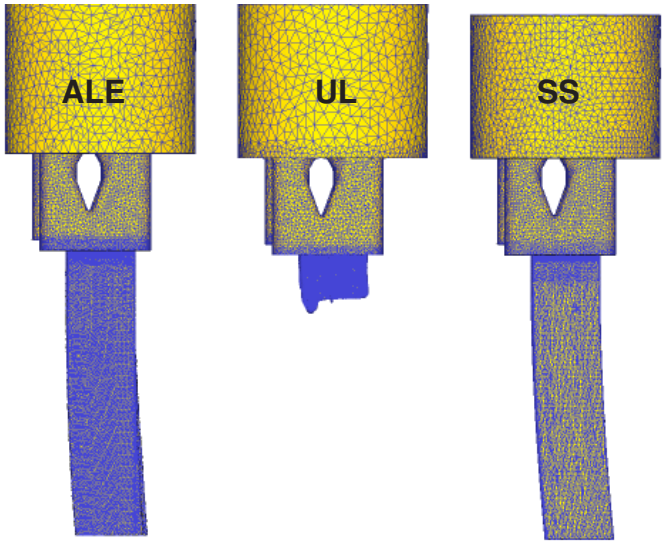
Design Environment for FORMing

The formation of the weld seams can be studied in a UL analysis since the filling of the die cavity is simulated. SS or ALE analyses cannot model this seam formation because the starting billet already fully fills the dies and is partially extruded. The UL analysis is also the only method that can predict the shape of the end of the extrudate.

The load vs. stroke curves for the three methods are shown below. The UL curve spans the entire cavity filling process. The load that is calculated for the SS and ALE simulations is the steady-state load. If the UL simulation is run long enough, the load should converge with the SS and ALE solutions.



Both the ALE and SS simulations start with a billet that has a straight extrudate that is already formed. One of the main results of these simulations is the shape of the deflected extrudate. The below image shows that the ALE and SS deflected shapes are very similar. If the UL simulation were run long enough, the extrudate deflection should look very similar to those in the ALE and SS simulations.



Releases:

The official DEFORM v10.2 was released at the end of August.
An updated DEFORM v11.0 (beta) was posted to the User Area in October.

DEFORM v10.2 includes the following major enhancements:

- More user-friendly triggering of 64-bit simulations
- 64-bit user subroutine support (Windows and Linux)
- Improved batch queue stability
- Centos 5 & Suse 11 support
- Dual frequency induction heating in DEFORM-2D
- DEFORM-3D resistance heating
- Mesoscale microstructure model

Additionally, DEFORM v11.0 (beta) contains:

- Enhanced 3D extrusion analysis
- 2D torsion model that supports elastic-plastic materials

SFTC is currently working on DEFORM v10.2.1 which will include:

- A switch to MPICH2 on CentOS 4, CentOS 5 and Suse 11 to improve MPI stability
- Improved handling of 3D hydraulic press modeling
- Memory handling fixes for coupled die stress models with multiple time steps using CG solver in MPI mode.
- Improved handling of models involving multiple sliding dies.

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