DEFORM™ Application #109

Flashless Forging Development

Application of Simulation:

Metal-forming companies, such as UEF Automotive, which are involved in hot, warm and cold forging, rolling, extrusion and drawing processes, have traditionally relied upon empirical methods to optimize their metal-forming processes. The skill of the die designers has developed through inherited knowledge, which can be lost if the employee retires or leaves the company. Without this experience and some luck, the potential exists for many potentially expensive plant trials and design iterations.

UEF Automotive are now using DEFORM™-2D and DEFORM™-3D to reduce cost and shorten lead times. Typical applications have included:

- Progression design and improvement of material yield.
- Prediction of forming problems such as flow laps, fracture and under-filling of die cavities.
- Calculation of state variables such as temperature, effective strain, damage and material flow that may affect the metallurgical structure and performance of the product.
- Prediction of forming loads and die stresses for a range of mechanical and hydraulic presses.

Reduced Material Usage:

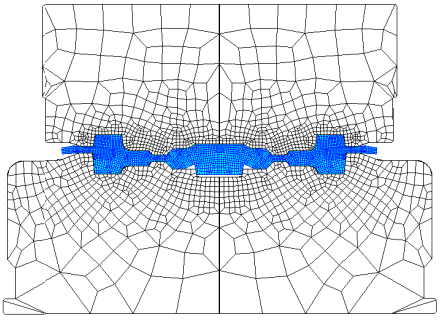
The following example demonstrates how forging simulation can be used to modify tooling geometry and analyse material flow – enabling material yield to be maximized.

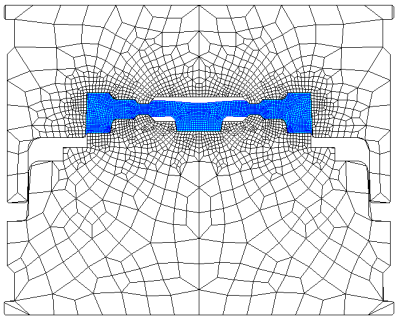
The simulation is a DEFORM™-2D axisymmetric problem with the tooling considered as rigid and only heat transfer to the tooling being simulated. The component was previously manufactured as a hot forging in the traditional manner with flash on a 1300 ton mechanical press, as shown.

By using DEFORM™-2D to assist in the design, a flashless version of the component has been developed, which also benefits from a reduced material volume in the central web – a resulting increase in material yield from 70% to 84%.

Reduction in Forming Load:

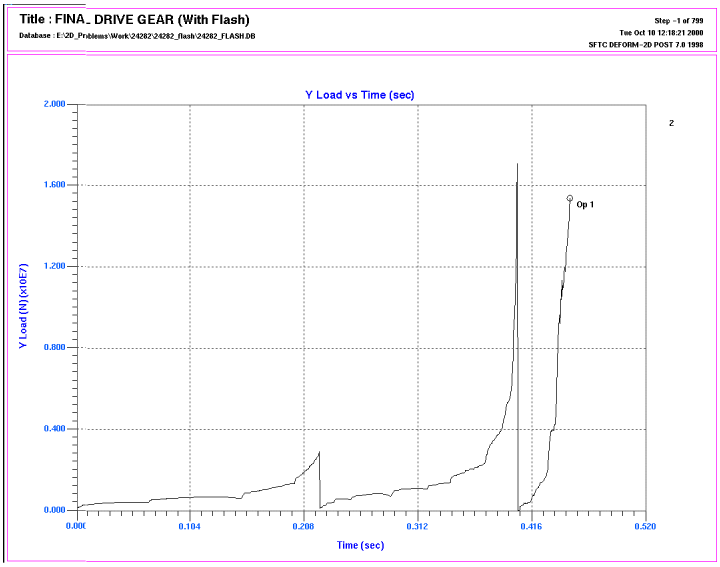
In addition to improving material utilization, the forging load in the block and finish operations has been reduced by making subtle changes to the die geometry. This has helped to prolong tool life and reduce down time at the press. The load-stroke plots show the forging loads before and after the design modification.

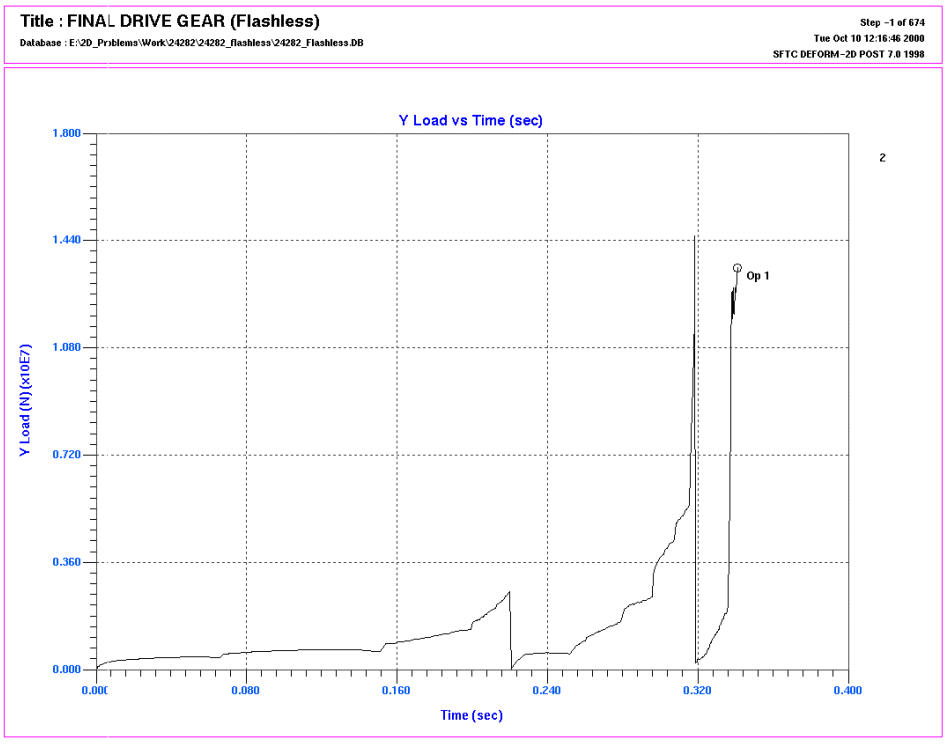




The original design with flash is shown to the left. The redesigned flashless forging is shown on the right.

DEFORM™
Design Environment for FORMing





The Load-Stroke curves are shown for the original design (above) and for the redesigned (flashless) forging (below).

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