

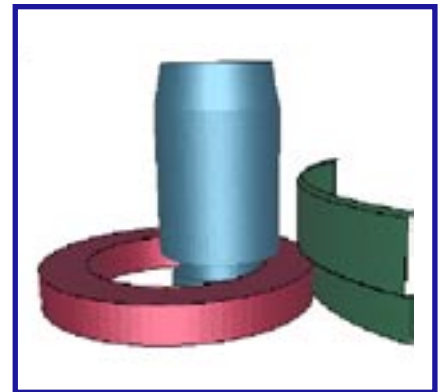
## > Forge3® v6.2 now simulates the ring rolling process...

The features of Forge3® have been extended to simulate ring rolling. Forge3® will predict the shape of the final rolled part together with any potential laps or underfills.

In addition, Forge3® predicts the local deformation, temperature, stresses, strain rate and other typical Forge3® results. With this information, it is possible to predict

the final part characteristics after heat treatment (grain size, hardness, ....).

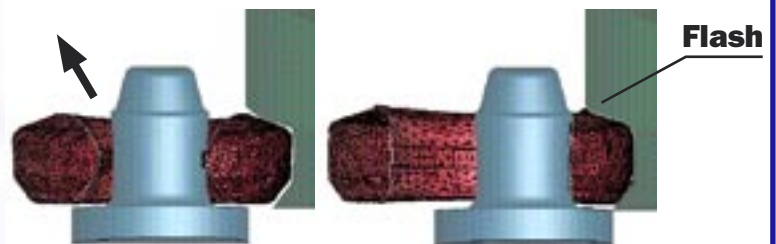
The inputs required for the ring rolling simulation are ring material, process description, tool design and rolling machine parameters. These are easily entered through the ring rolling template in the Forge3® pre-processor.



### > Forge3® ring rolling simulation of an automotive gear preform

The ring rolling process for an automotive gear preform is relatively unstable during the forging operation. A Forge3® simulation shows this instability.

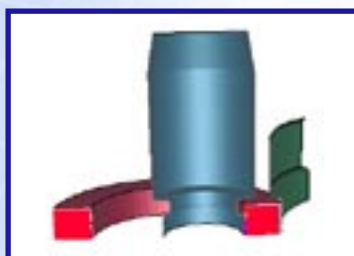
In the following figure, the black arrow shows the direction of the ring movement caused by the instability.



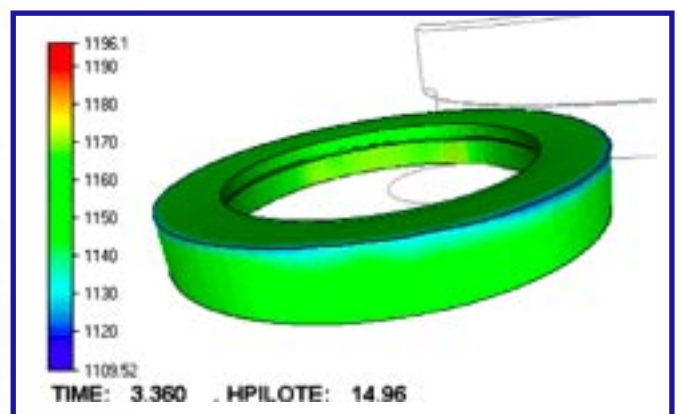
Forge3® was used in this example to determine the appropriate stroke to achieve a better shape and correct filling without creating flash or other defects.

### > Forge3® ring rolling simulation of a roll bearing ring

This example shows the forming of a typical contoured ring. It illustrates the ability of Forge3® to predict the filling of complex shaped rings.



As part of the simulation, Forge3® will predict temperature, equivalent stress, strain, and many other parameters in the part. In the aerospace industry, these results (temperature, equivalent stress and strain) can be used to predict the final part characteristics (grain size, mechanical properties...).



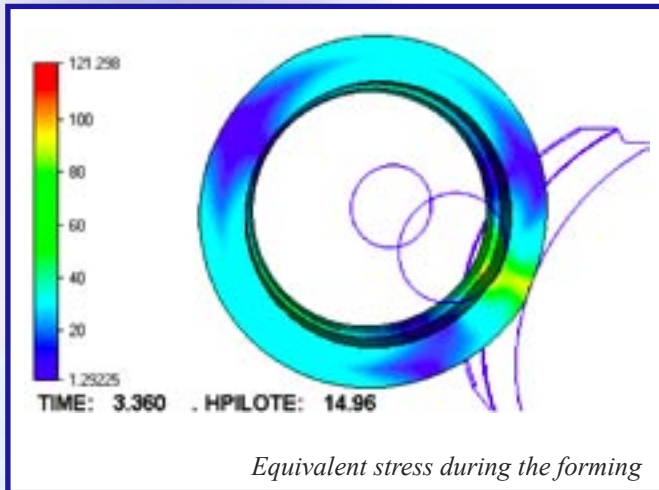
Temperature at the end of the mandrel movement



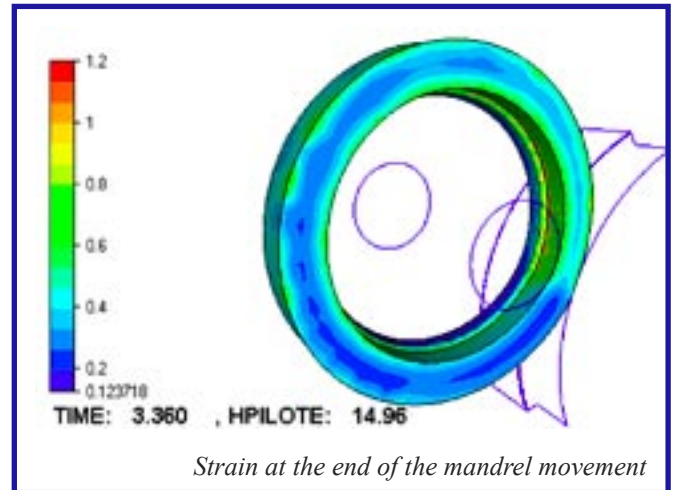
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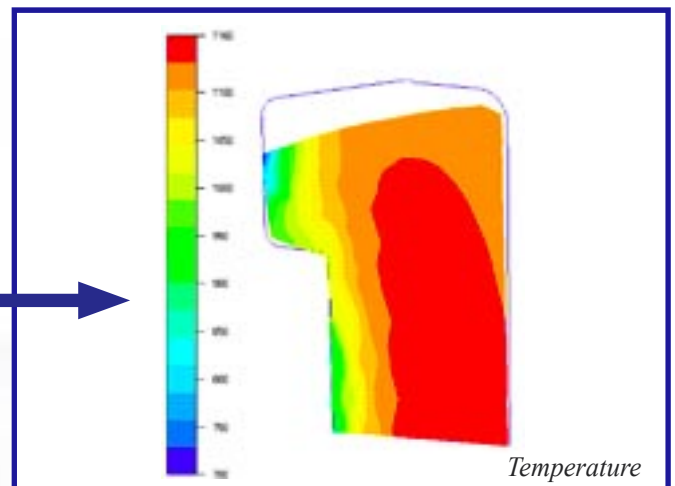
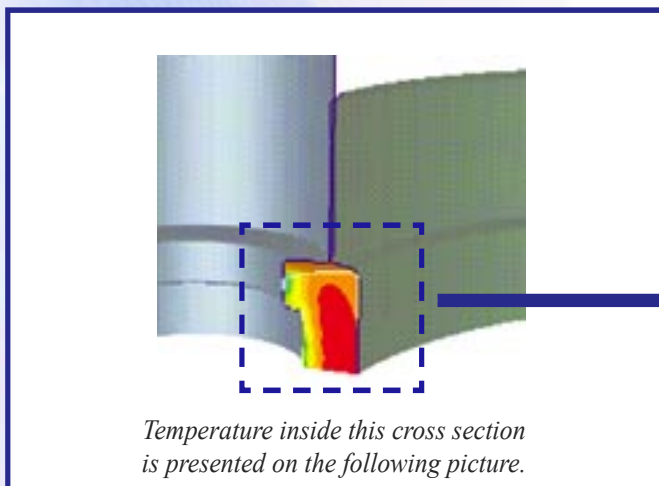


*Equivalent stress during the forming*



*Strain at the end of the mandrel movement*

Forge3® helps the user to predict if the process will be stable or unstable. Cross sections of the ring can be viewed in the post-processor of Forge3®. This enables the user to analyse the results inside the part



## > Forge3® V6.2 technical features for ring rolling

Forge3® V6.2 includes new technical features for the simulation of the ring rolling process.

The **Runge Kutta** second order time stepping scheme minimizes the ring volume variation due to the integration of large displacements.

The **automatic re-meshing** precisely controls and adapts the mesh when necessary without any intervention.

The instability of the ring rolling process is caused by multiple potential rigid body movements. These are due to the very small contact surface between the ring, mandrel and king roll. The **robustness of the solver** and its **strong stability** enable Forge3® to reach a good and rapid convergence even in such challenging conditions.

A specific new feature has been introduced in Forge3®

to take into account the effect of the side rolls during the simulation. The purpose of these rolls is to center the ring, and they are replaced in the simulation by a **ring centering** condition. The center of the ring is controlled by a “spring” mechanism and stays on the line defined by the mandrel and king roll axis of revolution.

The GLPre pre-processor in Forge3® uses a **specific ring rolling project template**. This means that the user can easily setup a ring rolling simulation in a matter of minutes. The template includes the ring, the king roll and its rotation speed, the mandrel and its radial speed or load. Axial rolls can also be included in the simulation.

Rectangular and contoured cross section rings can be simulated. The ring rolling simulation can be hot, warm or cold, and involve any type of metal.



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