

DEFORM™ News

Events:

- May 6 & 7, 2008: The Spring DEFORM User Group Meeting in North America will be held in Columbus, Ohio. Information is posted on the User Area of the website at this time. Please plan on attending.
- June 23 & 26, 2008: SFTC will exhibit DEFORM at AEROMAT in Austin, Texas (booth #306). DEFORM will also be well represented in the technical sessions.

Training:

- July 8 & 9, 2008: DEFORM-2D training (includes DEFORM-F2) will be conducted at SFTC in Columbus, Ohio.
- July 10 & 11, 2008: DEFORM-3D training (includes DEFORM-F3) will be conducted at the SFTC office.
- August 13 & 14, 2008: The annual Die Stress Analysis Workshop will be conducted at Marquette University in Milwaukee, Wisconsin.

Ring Rolling

Ring rolling is a metal forming process that reduces the wall thickness of the ring while enlarging the diameter. During the ring rolling process, deformation occurs between the drive (king) roll and the mandrel (pressure) roll. As the cross-section of the ring is gradually reduced, the diameter of the ring progressively grows. Deformation can also take place in the axial direction between the conical axial rolls, thereby reducing the height of the ring or limiting the axial growth.

Ring rolling produces seamless rings with forged properties and circumferential grain orientation, resulting in good tangential strength and ductility. Tooling cost is low, set-up time is fast and the rolled sections require little or no machining. Contours may be rolled on both the inner and outer diameter of the ring, allowing for excellent weight reductions, material savings, and reduced machining cost.

Ring rolling is used in the production of large annular components in aircraft engines (as shown below). It is also a common means of producing gear

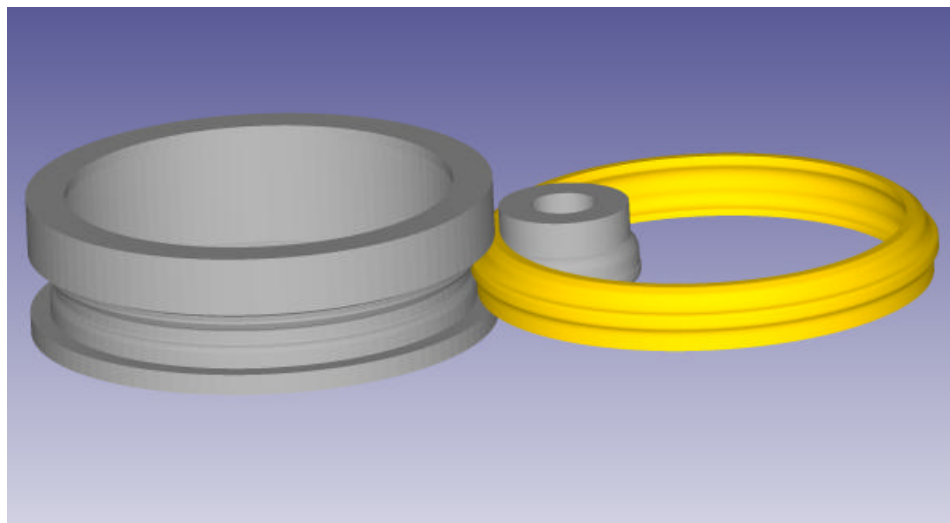
blanks for automotive and other mechanical applications. Additionally, a wide range of bearing components are produced by ring rolling.

Challenges in designing a ring rolling process include ideal preform design, folds and underfill in roll cavities. Without edge rolls, a fishtail section can develop on the end faces. Maintaining a proper balance between drive roll rotation and mandrel bite is required to avoid slipping and localized deformation.

Modeling the ring rolling process has been extremely challenging. Difficulties include excessive simulation time, volume control, accuracy and numerical stability difficulties.

DEFORM can now model non-isothermal ring rolling processes with axial rolls. The FEM engine is extremely efficient, as it was specifically designed for ring rolling. Simulations that have taken weeks in the past now run in hours to days. The DEFORM system uses an ALE solver with automated time stepping. The model uses 8 node brick elements including

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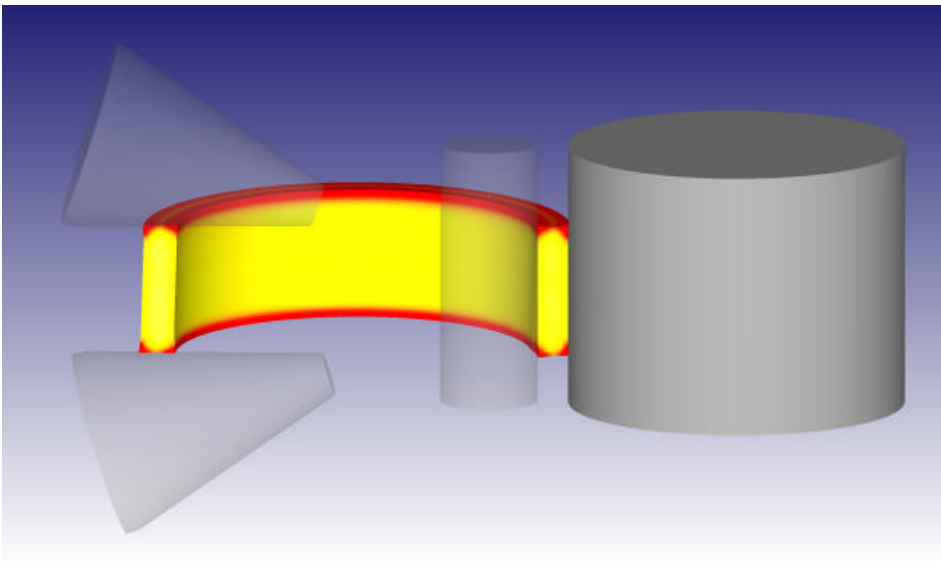
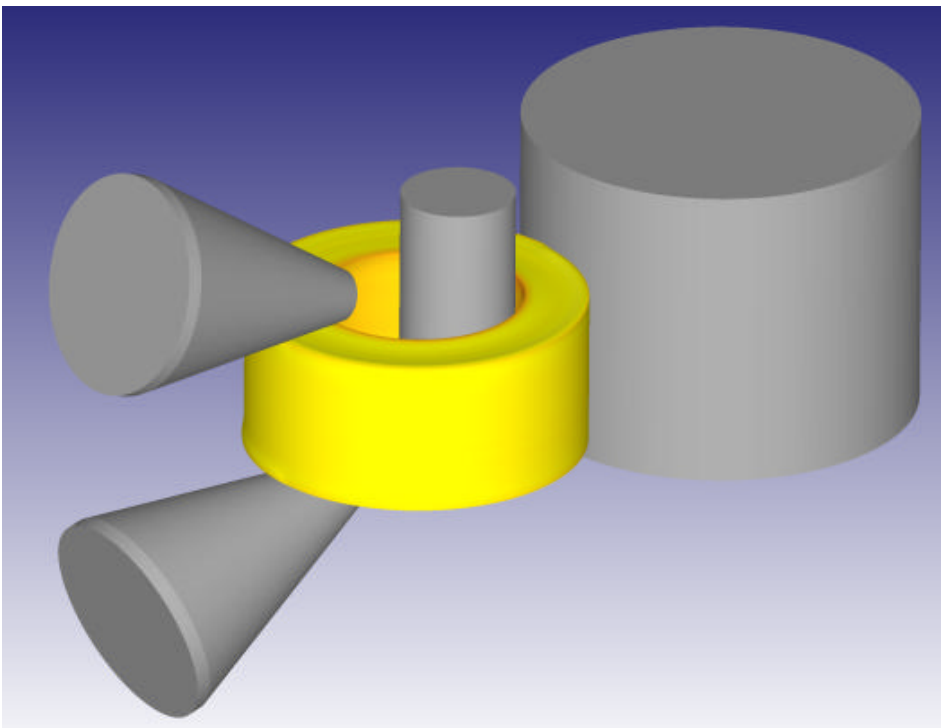


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fully automatic remeshing. The updating and contact algorithms are optimized for ring rolling. The result is an accurate solution, without artificial constraints on the rotation axis. DEFORM predicts material flow, roll cavity fill, rolling force (and torque), temperature and strain distribution. Processing variables and roll geometry can be varied to analyze its impact on the rolled rings. The images below depict the contours of temperature (top) and plastic strain (bottom) during

a typical ring rolling process. DEFORM can run ring rolling simulations on practical hardware with impressive speed. Test cases have been run with 20,000 brick elements running 25 to 75 revolutions in approximately an hour per revolution, on a single CPU PC.

This exciting new capability can be licensed as an add-on module to DEFORM-3D or as a stand alone program (DEFORM-RR). Contact SFTC for more information.



Releases:

DEFORM-3D V6.1 SP (service pack) 2 and DEFORM-F3 V6.1 SP 2 were released in February. DEFORM-2D V9.1 SP 1 was released in March. DEFORM-F2 V9.1 SP 1 is being released in early April. These service packs are primarily bug fixes and code refinements.

A major release is planned for 2008.

- In version 10.0, 2D and 3D will be integrated into a single database. All 2D and 3D systems (including DEFORM-F2 and DEFORM-F3) will be developed and released together.
- A new license manager is being developed that will improve simulation management, remote queuing and floating license operations.
- 2D - 3D GUI integration will be enhanced significantly for processes with both axisymmetric and general three-dimensional operations.
- The current M23 capability will be included in the new integrated GUI.
- Multiple material groups are being added to the shape rolling template and 2D preprocessor.
- A multi-stand ALE rolling capability is being developed.
- Improvements in ring rolling are being made to handle multiple drive and pressure rolls.
- Improvements to extrusion modeling and a dedicated template are being explored.
- New compilers are being studied to improve system performance.

More details on the 10.0 release will be presented at the upcoming DEFORM Users Group Meeting.

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