Winter, 2006

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DEFORM™ News

Events:

- May 9 & 10, 2006: The Spring DEFORM Users Group Meeting in North America will be held at a location to be determined. Call for more information.
- August 16 & 17, 2006: The 11th Annual Die Stress Analysis Workshop will be held at Marquette University in Milwaukee, WI.

Training:

- February 14 & 15, 2006: DEFORM-2D (includes DEFORM-F2) training will be conducted at SFTC in Columbus, OH.
- February 16 & 17, 2006: 3D training (includes DEFORM-F3) will be conducted at the SFTC office.
- May 11 & 12, 2006: Advanced training will be held at the SFTC office, in conjunction with the Spring DEFORM Users Group Meeting.

DEFORM™

Design Environment for FORMing

The Longest Flight:

Recently, a Boeing 777-200LR plane created a world record for the longest non-stop flight ever. The flight started from Hong Kong on November 9th, 2005. It flew due east over the Pacific Ocean, crossed continental U.S and the Atlantic Ocean and landed in London on November 10th, 2005. This record setting flight covered 13,422 miles in 22 hours and 42 minutes. DEFORM played a significant role in the development of this aircraft.

Boeing 777 was the first commercial aircraft to be designed entirely by computer. No paper drawings were ever produced. This allowed a virtual 777 to be assembled in simulation, allowing engineers to examine for interference, and to test if the many thousands of parts would fit together properly before costly physical prototypes were manufactured. The first 777 was within 0.023 inches of perfect alignment, while typical airframe airplane parts experience a half inch of misalignment.

Boeing 777

Boeing 777-200LR plane uses two GE90-115B engines, the world's most powerful jet engine with a rated thrust of 115,000 lbs. The diameter of the engine (135 inches) and nacelle are larger than the fuselage of a Boeing 737 (133 inches). Computer design and modeling simulation tools, including DEFORM, were extensively used for the development of GE90.

GE90-115B Engine

Most of the critical structural and landing gear components for the Boeing 777 plane and rotating parts for the GE90 engine were modeled using DEFORM. Longer range planes and higher thrust engines meant pushing the limits of suppliers' comfort zone in terms of size of the parts and increased performance requirements. This program included an aggressive product development schedule, in addition to stringent quality requirements. Better property response and tighter tolerances translated to smaller processing windows and control limits. DEFORM Users enjoyed the ability to optimize their manufacturing processes and reduced their development time. DEFORM is being extensively used by material suppliers, forgers and OEM's around the world.

Customer Comments:

"Aircraft engine components have stringent microstructural and mechanical property requirements, and use materials with tight processing windows. Process modeling using DEFORM has been a key tool in all

stages of the manufacturing process in 'making it right the first time' for all the new components, especially those of a size/shape/material for which there is no prior experience. Modeling reduces tooling and material cost and lead time; it improves quality, properties and reproducibility. GE Aviation has been leading the development and application of modeling to accurately predict mechanical properties and microstructural characteristics and optimize product and process design." -- Dr. Shesh Srivatsa, GE Aircraft Engines.

"Ladish has produced critical engine components for the GE90-115B engine, which powers the Boeing 777. These critical components are made from nickel-based powdered super alloys. The application of these parts required extensive modeling to assure their conformance to specifications. Ladish used DEFORM to simulate all heating, forging, heat treatment and cooling operations. Machining simulations were also performed to predict machining distortion and stresses." -- Mr. Craig White, Ladish Co., Inc.

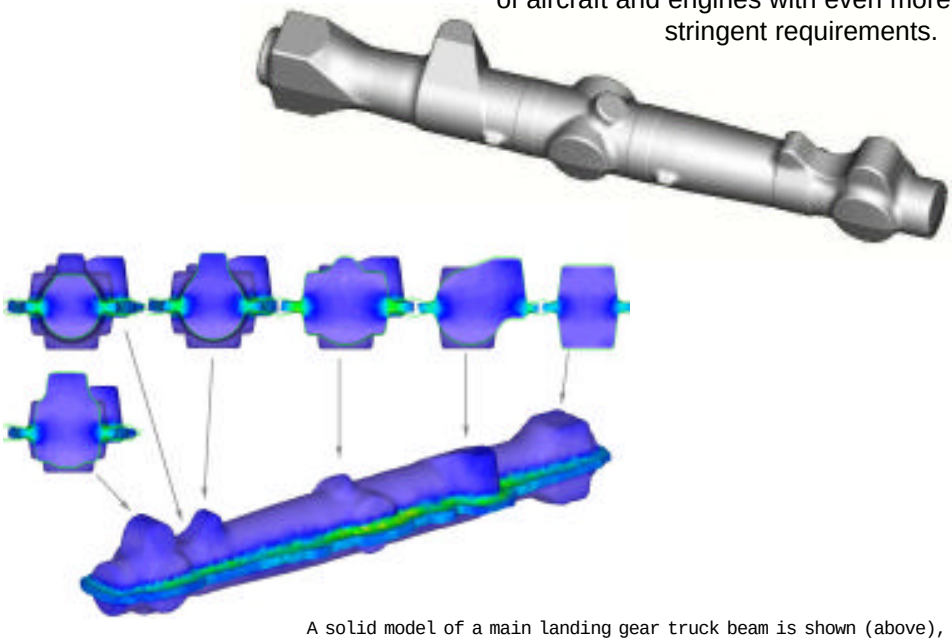
"VSMPO has produced landing gear and structural components for the Boeing 777 program. DEFORM-3D modeling was used in the design, development and optimization of the forging process for the Boeing 777 landing gear components." -- Mr. Vadim Timokhov, VSMPO Corporation.

Rotating Disk for GE90-115B Engine
Courtesy: Ladish Co., Inc.

"Shultz Steel Company is one of the major forging parts supplier for Boeing 777 program. DEFORM-3D helped Shultz engineers to improve their design of forging parts." -- Dr. Henli Chen, Shultz Steel.

Ongoing Developments:

DEFORM has actively participated in the development of advanced aerospace systems since it's inception. Current developments will support the requirements for the next generation of aircraft and engines with even more stringent requirements.



A solid model of a main landing gear truck beam is shown (above), with a DEFORM-3D simulation of the final forging operation (left).
Courtesy: VSMPO Corporation, Russia

Releases:

DEFORM-2D and DEFORM-F2 have been web released for bug fixes. Versions 8.3 and 9.0 (beta 1) are available for download. These versions will require a new password.

DEFORM-2D and DEFORM-F2 enhancements for version 9.0 include:

- improved movement (press) control, including press stretch;
- tool wear (2D);
- machining distortion module (2D);
- new material models and additions to the material library;
- postprocessing (and animations) spanning multiple databases, and
- GUI refinements (F2) to geometry, BCCs, die stress and operation management.

DEFORM-3D and DEFORM-F3 enhancements for version 6.0 include:

- improved movement control;
- geometry editing/repairing module;
- heat transfer stages and transient analysis options in rolling;
- GUI improvements (F3);
- improved convergence in rate sensitive elasto-plastic material models;
- postprocessing large databases without purging and merging, and
- significant improvement to multiple CPU scalability.

Tentative release schedules are planned for early 2006 as follows:

- DEFORM-3D and DEFORM-F3 V6.0 (beta1) - March, 2006
- DEFORM-2D and DEFORM-F2 V9.0 - official release - May, 2006
- DEFORM-3D and DEFORM-F3 V6.0 - official release - July, 2006

For a complete list of all the improvements, please refer to the release notes on the DEFORM User's area.

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