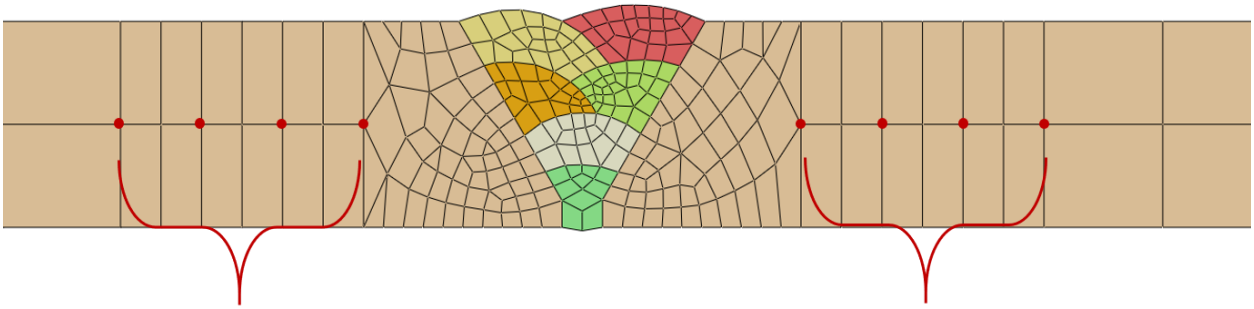
Plate Weld - Validation Brief

This brief describes the validation of QustomWeld by reproducing a model described in papers presented at the ASME PVP 2012 and from the International Journal of Pressure Vessels and Piping.

> S. Murugan, P.V. Kumar, B. Raj, M.S.C. Bose, "Temperature distribution during multi-pass welding of plates". International Journal of Pressure Vessels and Piping 75, 891-905 (1998).
>
> David J. Dewees, P.E., "Comparison of 2D and 3D Welding Simulations of a Simple Plate", ASME PVP2012-78573.

Model Creation

The plate consists of 6 weld beads with a reasonable mesh on the weld itself, but a mesh biased to quickly coarsen the further away from the weld. The model was reproduced in 2D and 3D models, with the 3D model analyzed with continuous bead placement, 5 chunk placement, and single chunk placement of all 6 beads. The double-ellipsoid, Goldak model is used to model the flux from the torch.

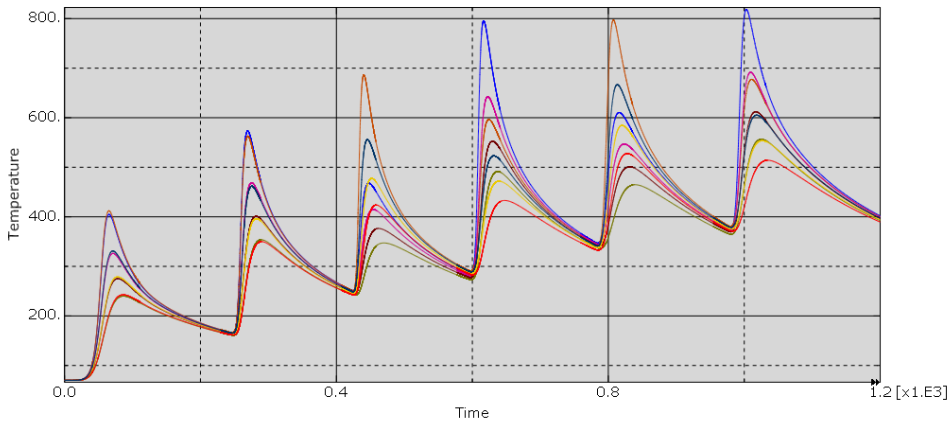


Left Thermocouple Nodes

Right Thermocouple Nodes

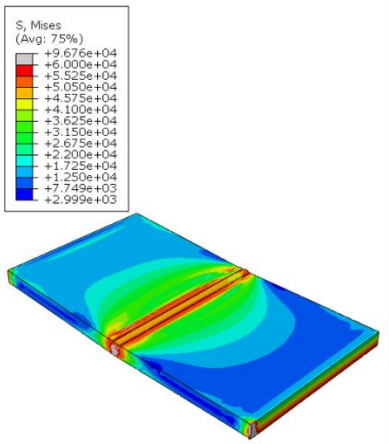
Temperature History Plots

Below is shown a temperature history of the inside thermocouple nodes for the continuous bead placement case. Very good agreement is achieved between QustomWeld and the temperature thermo couples.

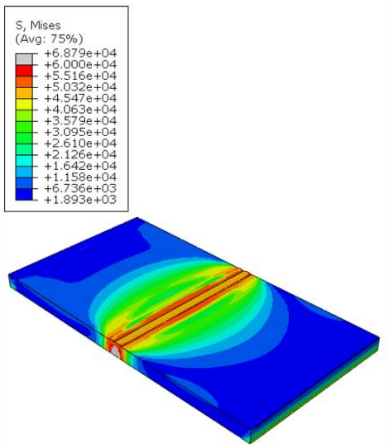


Stress Contour Plots

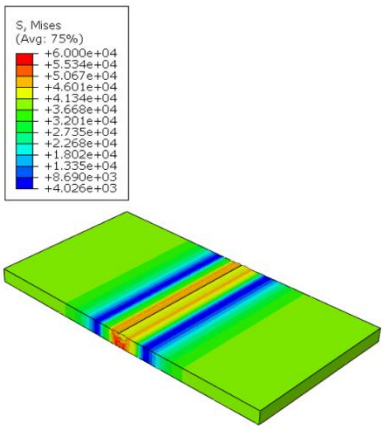
Contour plots of the Mises stress is shown below. Very good agreement with the Dewes' paper is realized. The plots show that both 3D chunking and 2D may be used to approximate the residual stresses and plastic strains, however, the 2D and the 3D chunking approximation do not approximate the plate distortions well. For distortions, a continuous placement or placement with a significant number of chunks must be used.



3D, Continuous

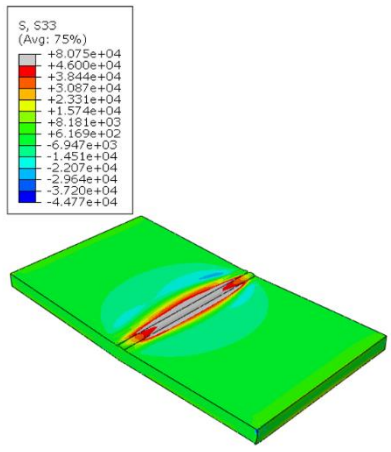


3D, 1 Chunk

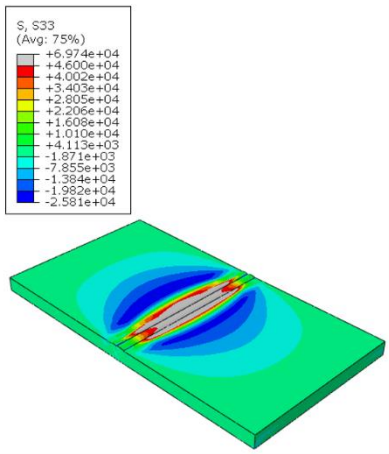


2D, Plane Stress

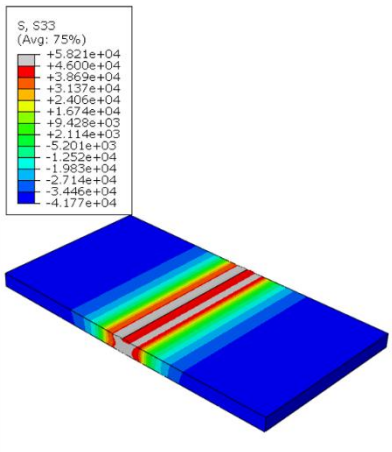
The plots show a reasonable approximation of the stresses in welding direction for the 3D and single chunking method. The stresses of the 2D approximation do not match at the ends of the plate as expected, but match fairly well at the center of the plate.



3D, Continuous



3D, 1 Chunk



2D, Plane Stress

For More Information:

Please visit the QustomApps.com website for more details. For questions, contact Mike Shubert, sales@QustomApps.com, +1 469 968-7494.