

Abaqus Extension for Welding Simulations

Customized extension for Abaqus/CAE accelerates modeling and analysis of welding



Courtesy of Rolls-Royce

Welding simulations are complicated, often requiring accurate representation of geometric features, multiple weld passes, non-linear temperature dependent material properties, thermal and structural boundary conditions, and more. To capture all of these details, a significant user effort is required. While analysis capabilities for modeling welding processes have always been there in Abaqus (complemented by the extensive user subroutines feature), the setup of weld models – especially the preprocessing aspect – remained a time-consuming part of the weld modeling workflow.

Features and Benefits

The Abaqus Welding Interface (AWI) described in this Capability Brief provides a capability to significantly improve two and three-dimensional welding simulations by automating most of the time consuming tasks associated with building a weld model. In the Plug-In environment the analyst completes a few dialogue boxes with some basic information applicable to the entire welding process being analyzed, selects the beads for each weld in the model from the viewport, and optionally sets up a custom weld pass sequence (or lets the Plug-In automatically define the passes). The Plug-In then creates all the required analysis steps with appropriate data, creates energy transport boundary conditions for each step, creates sets for sensor output requests, and builds the entire thermal model followed by the automatic generation of the corresponding mechanical model for thermal stress analysis.

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Weld Specification

- Multiple welds can be active in one model
- Once created, a weld can be deleted, edited, or renamed

Bead/Chunk Specification

- Selected by picking faces. In 3D, can be automatically generated in swept geometry
- Once created, can be deleted, edited, and renamed

Pass Controls

- Allows default values for film loads, radiation loads, and step incrementation for all passes

Pass Specification

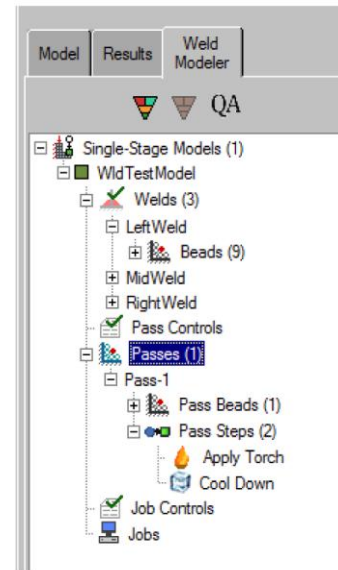
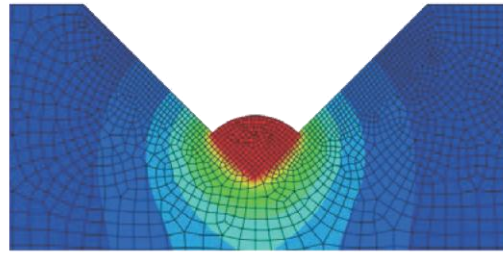
- Passes can contain any number of beads or chunks from any weld
- Can be chosen in 3 ways:
 - Automatically by assuming each bead/chunk is assigned to one pass
 - Manually by picking regions
 - Manually by choosing weld name, bead name and chunk name through Pass Manager
- Once created, the beads/chunks associated with a pass can be deleted or modified

Pass Steps

- During each pass an Apply Torch and a Cool Down step are automatically created.
- All incrementation controls can be modified
- Additional available step types:
 - Reset Temperatures - Steady-state step to heat-transfer model
 - Creep - Visco step to stress model
 - User-Defined - empty step added to stress, heat-transfer, or both models

Film and Radiation Loads

- Can be added to any surface of model, including beads surface as they are inserted
- Can be modified or turned off at any step during the analysis
- Are automatically removed on faces as they are covered by beads



Obtaining Abaqus Welding Interface

The Abaqus Welding Interface is freely available from a DS FTP download web site. Contact the office below to be added to the FTP site.

Installation instructions are provided in the documentation.

For More Information

A list of features is provided on the reverse side of this summary. More specific information may be obtained by downloading the documentation.

Support for the AWI is provided by the SIMULIA South office in Irving, Texas at 469.709.4877 and the SIMULIA Erie office in Cleveland, Ohio at 216.378.1070.