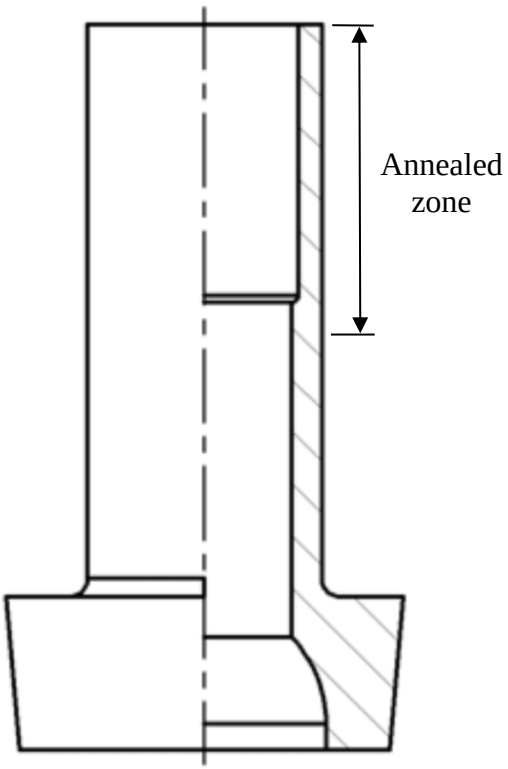
T026_Automated Interpolation of State Variables

Introduction

There are times when it would be very useful to automatically interpolate a state variable field onto a workpiece. An example of where this would be beneficial is in a DOE project where the workpiece has an initial temperature or strain gradient. If the geometry of the workpiece is a DOE variable, the state variable would need to be interpolated onto each workpiece in the DOE.

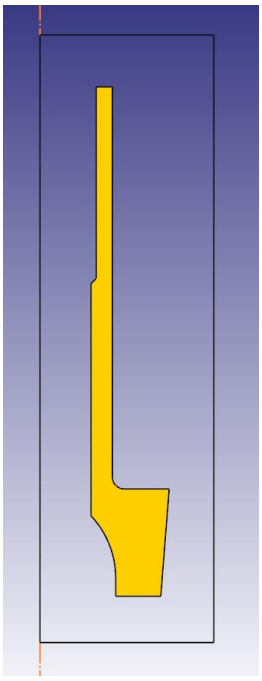
This document describes the steps needed to accomplish this automated state variable mapping when working with an Integrated Manufacturing (MO) project.

The part shown in this technical note was taken from a paper dealing with induction heating, where the end of the part is locally annealed. This is a perfect application for using this procedure in DEFORM, where the annealed zone is modeled by setting the strain to zero.



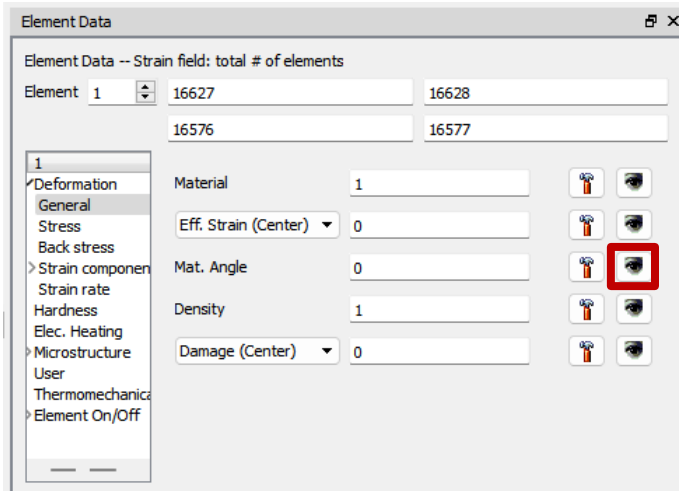
Create Mapping Object

Create an object in the Pre-processor. The geometry of this object should be larger than the workpiece and should completely overlap it. If a DOE project is to be run, where workpiece geometry is a variable, the geometry of this large object should be larger than any of the DOE geometries that will be created.



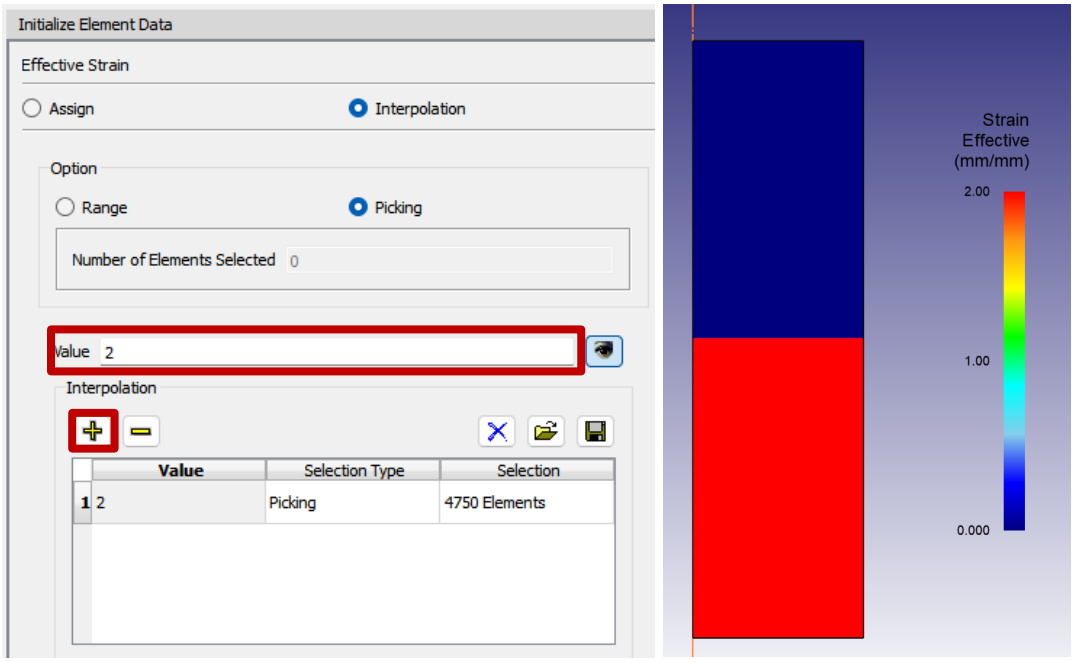
Mesh the object. Highlight the object in the tree and then go to **Object elements**  if interested in an elemental state variable (like strain) or **Object nodes**  if interested in a nodal state variable (like temperature).

For the variable of interest, click the **Initialize**  option.

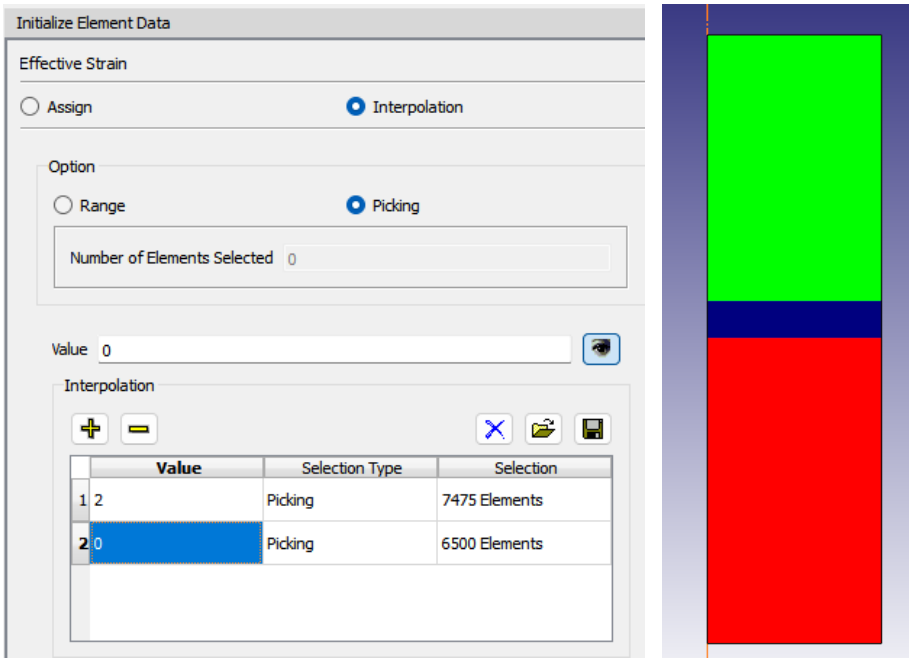


The **Interpolation** setting, along with the **Picking** option, can be used to select different regions of the workpiece to assign the state variable.

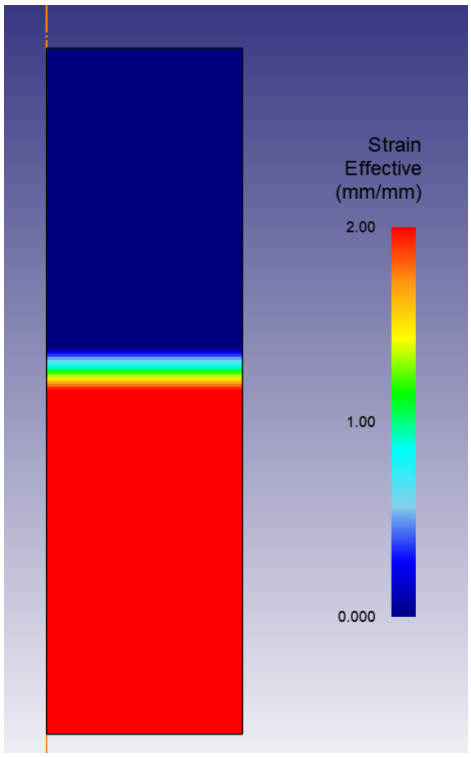
Select a region of the object using the selection tools on the left of the display window (such as ), define a **Value** for that region, and then click the  button to assign the state variable to that region.



Repeat to define all the regions you want. In this example, a high strain region is defined on the bottom of the object, and a zero strain region is defined on the top to represent the annealed material.



To create a smooth transition between these regions, hit Apply. The strain field is mapped onto the object.



Define a material for the object and then save the object as a .KEY file by selecting the object and then . Use a descriptive name like **LargeObject_wStrainGradient.KEY**.

Action Keyword DEFINT.KEY

Set up your simulation as usual using the Integrated Manufacturing (MO) environment. Do not spend time defining the state variable field on the workpiece. This will get assigned automatically soon.

Create a text file called **DEFINT.KEY** and edit it to contain the following:

DEFINT 1 1 0 1
Objects/LargeObject_wStrainGradient.KEY

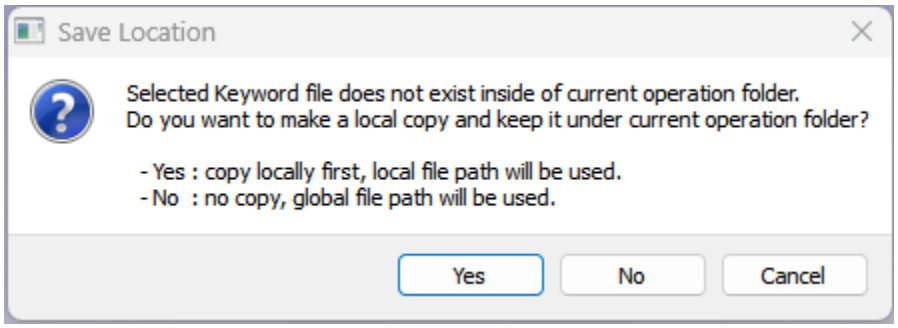
The formatting is as follows:

Line 1: DEFINT <ObjNo> <SrcObjNo> <SVTpe, 0: all SV> <SrcType, 1: KEY>
Line 2: Path to .KEY file
Line 3: empty

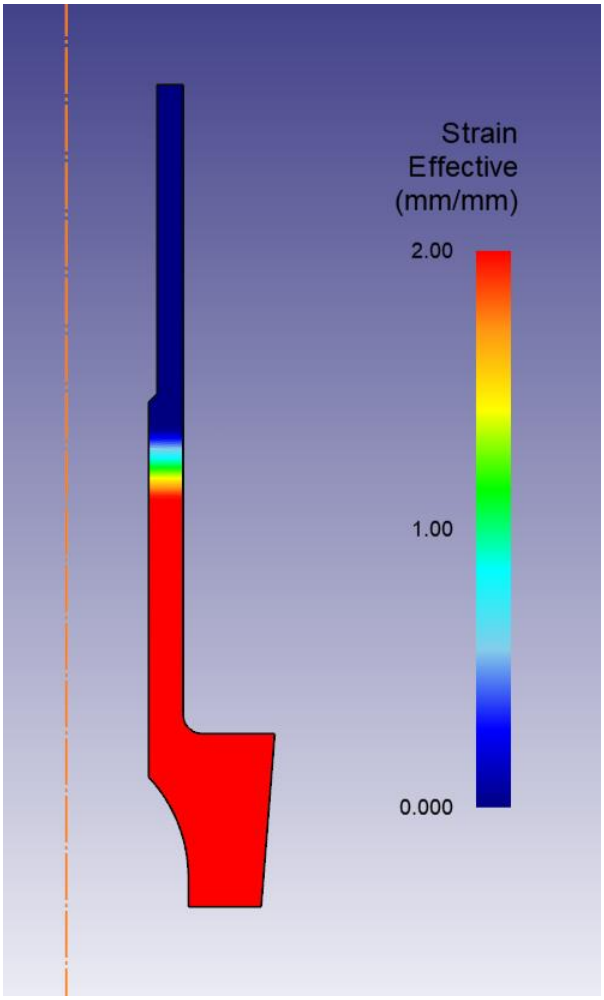
Make sure that the path in Line 2 is correct. This should be the local path from this particular project folder.

When you are finished setting up the simulation, go to **Generate DB** and check the **Append user-defined keyword file**.

Browse for the DEFINT.KEY file. You will get the following popup. It is usually best if you say **Yes** to copy the file locally.



When the .DB gets generated, the workpiece will have the new state variable field interpolated onto it. If this is a DOE project, this state variable mapping will occur in all of the DOE simulations.



Related Information

Please see the following reference for more information on this particular localized induction heating study.

- Zhi-guo Feng, Yang Li and Xiong-feng Liu. *Numerical Analysis of Annealing Process with Local Inductive Heating on A286 Alloy Tube.* Advances in Engineering, volume 100.