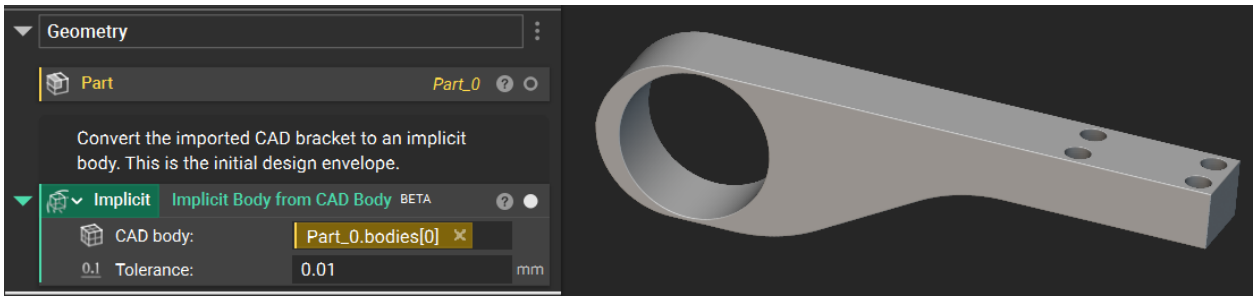
Follow Along: Stress Driven Wall Thickness

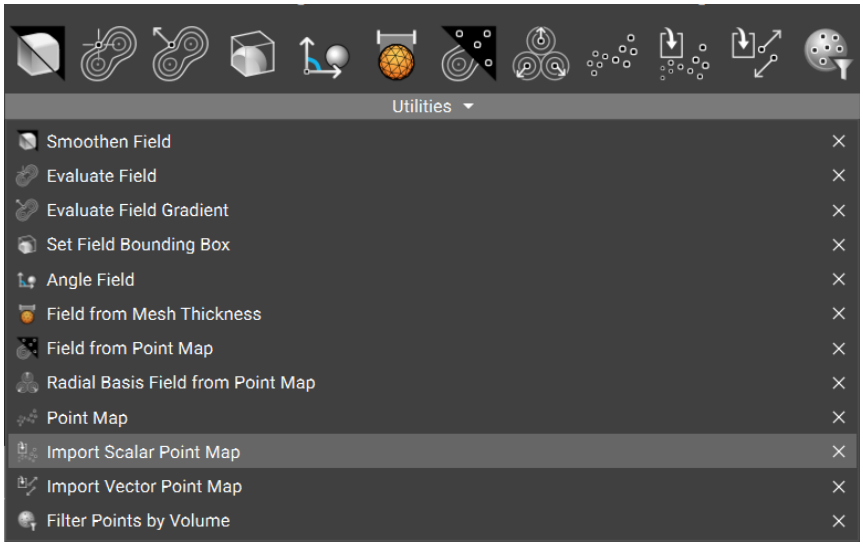
Let’s explore how we can manipulate geometry with a stress Point Map. In this lesson, we will create a variable shell and variable Infill Gyroid wall thickness on a bracket based on imported stress data.

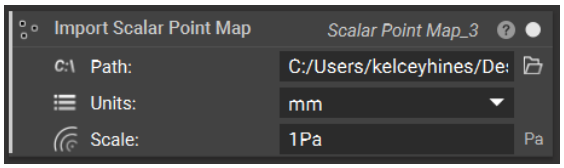
Step 1: Begin by creating a new Section and labeling it *Geometry*. Import the CAD file of the bracket, and pull the CAD body into your Notebook. Add an **Implicit Body from CAD Body** block to the Notebook, and convert the CAD body to an Implicit, making it a variable called *Implicit*.

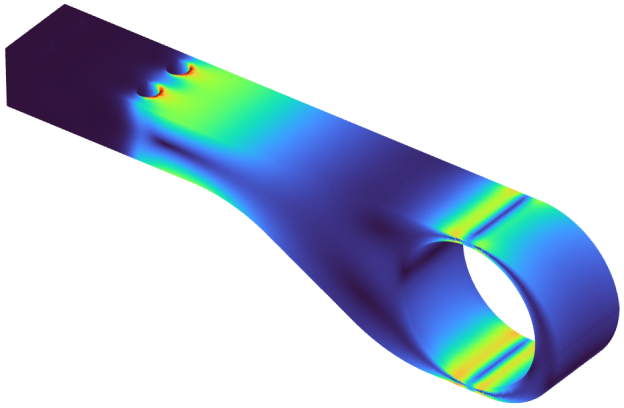


Step 2: Create a new Section named *Field From Stress Data*.

From the Fields tab in the Ribbon, add an **Import Scalar Point Map block** to the Notebook, set the file path to the .csv file of the stress data, set the Units to mm, and set the Scale to 1Pa. Your Point Map should look like the one below. Make this block a variable called *Stress Data*.

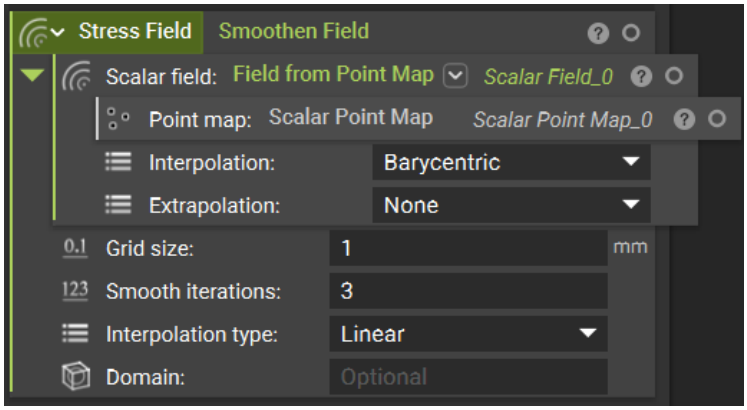






We need to convert this Point Map to a Field before using it to drive geometry. Add a **Field from Point Map** block, followed by a **Smoothen Field** block to your Notebook, and enter the inputs shown below.

Make the **Smoothen Field** into a variable called *Stress Field*.



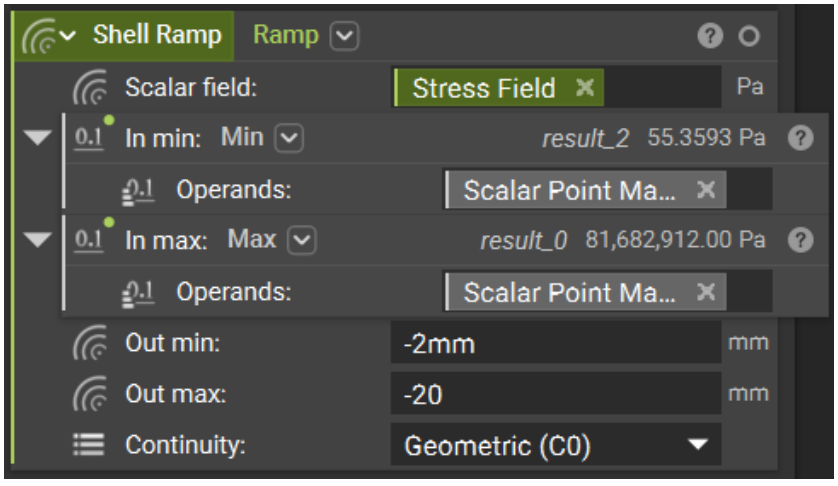
You can view this field using the hotkey F and the Turbo colormap in the Field Viewer.

Step 3: Create a new Section called *Varying Thickness*.

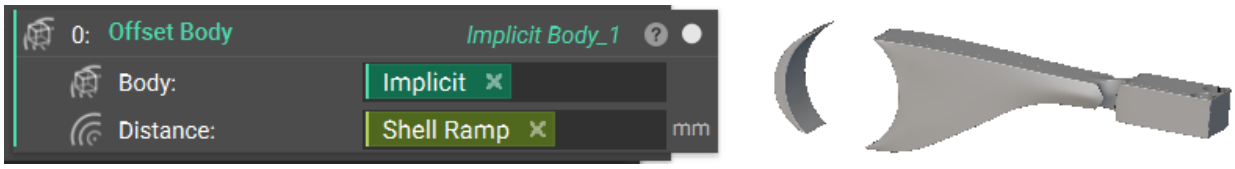
Now, let's create a shell for this part that is reinforced at the high stresses. Create a new Section called *Varying Shell*.

Add a **Ramp**, and add inputs as below. For the In min and In max values, use **Min** and **Max** blocks, changing the block overloads to scalar lists and using the Values property from the imported point map as your scalar list inputs.

Use negative values for the Out min and Out max to shell the bracket inward.



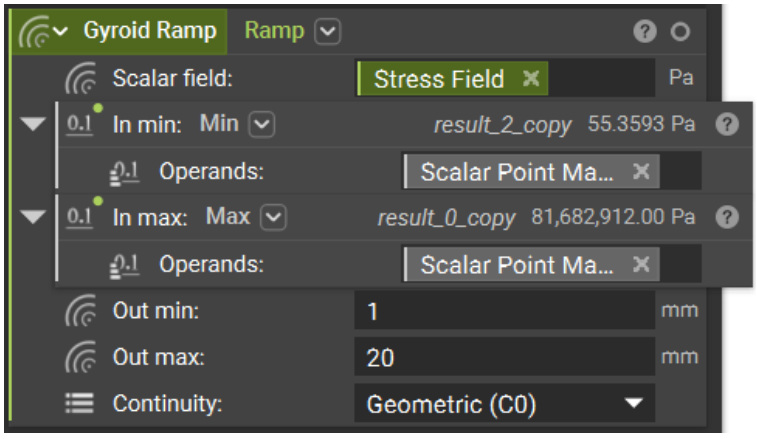
Add an **Offset Body** block, inputting the initial *Implicit* and the *Shell Ramp*.



Use a **Boolean Subtract** block to remove this internal body from the initial *Implicit*, and you should get the shell with variable thickness shown (with a Section Cut) below.

Step 4: Ramp gyroid wall thickness

Let's say we want to add a gyroid infill and reinforce the walls at places with higher stress concentrations.Copy and paste (or right-click and Duplicate) the *Shell Ramp* and re-name the new variable Make this a variable called *Thickness Ramp*. Add the Out min and Out max values below.



Use this *Gyroid Ramp* as the thickness, along with the *Implicit* and a cell size in an **Infill Gyroid** block. Make this a variable called *Gyroid*.

The areas of high stress will see much thicker TPMS walls than those with lower stress.

Step 5: Finally use a **Boolean Union** block to then merge the *Gyroid* with the *Varying Shell*. If you add a Blend radius to this union, additional material will be added to the outside of the part. To cut away this material, use a **Boolean Intersect** with the initial *Implicit*. Make this a variable called *Final Body*.

To view a high-resolution rendering of the result, use Ctrl+H on your keyboard.