ADDITIVE MANUFACTURING

This tutorial demonstrates the functionality of Design for Additive Manufacturing criterion: **Channel Ratio**

CHANNEL RATIO

In Additive Manufacturing, sometimes channels are required in a part to allow for system cooling or blow out of residual powders. If the channel is too narrow or too long comparative to the diameter, due to heat dissipation problems, the channel may deform or collapse during printing. Since the printing is layer by layer along the Z direction of a 3D printer, the required channel ratio will vary based on the angle between the axis of the channel with respect to the build plate. However, there are too many factors to determine what minimum diameters are required at what degree, and what ratios are best fit. For example: printing material, product design, cooling fluid, etc. Thus, the minimum diameter and minimum channel ratio are set to the user's experience and discretion while using the DFAM checker **Channel Ratio**

The **Channel Ratio** checker determines whether the diameter to length ratio of a channel at any cross-section is greater than or less than a specified **Minimum Ratio**

NOTE: The "diameter" in case of any polygonal shaped channel is the diameter of the largest inscribed circle of the polygon at a given cross-section of the channel

The test results in highlighted areas of passed and failed segments

1. Open the part "Channels.prt"
2. On the **Ribbon bar,** in the **Design for Additive Manufacturing** tab, click on **Channel Ratio**
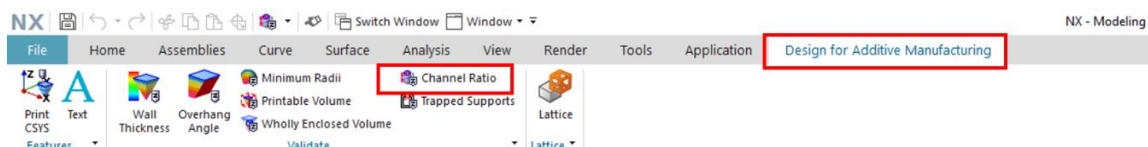
3. In the **Check Channel Ratio** dialog box, in the **Channels** group, click on **Get Channel Faces from Body**

4. In the **Get Channel Faces from Body** dialog box, select the body from the graphics window

5. In **Dimensional Limits** group, specify **Maximum Width = 5.0000**

   NOTE: The maximum width of the channel is to be entered based on user's discretion. It depends on various factors like- printing material, product design, printer's capability, etc. However, this value can be entered as a threshold value to categorize the part features into "channels" and "not channels". If the maximum width of a feature is less than the entered value, it is a channel; else it is not a channel and not considered into the channel ratio calculation

6. Click **OK**

   Notice in the **Check Channel Ratio** dialog box, in the **Channels** group, 37 faces have been selected. **Select Faces (37)**

   Notice the selected channels on the part in the graphics window. Also notice that some channels have been excluded from the selection as the maximum width of these channels is greater than the specified maximum width

   Notice that open channels have not been selected as they are not considered "channels" in AM
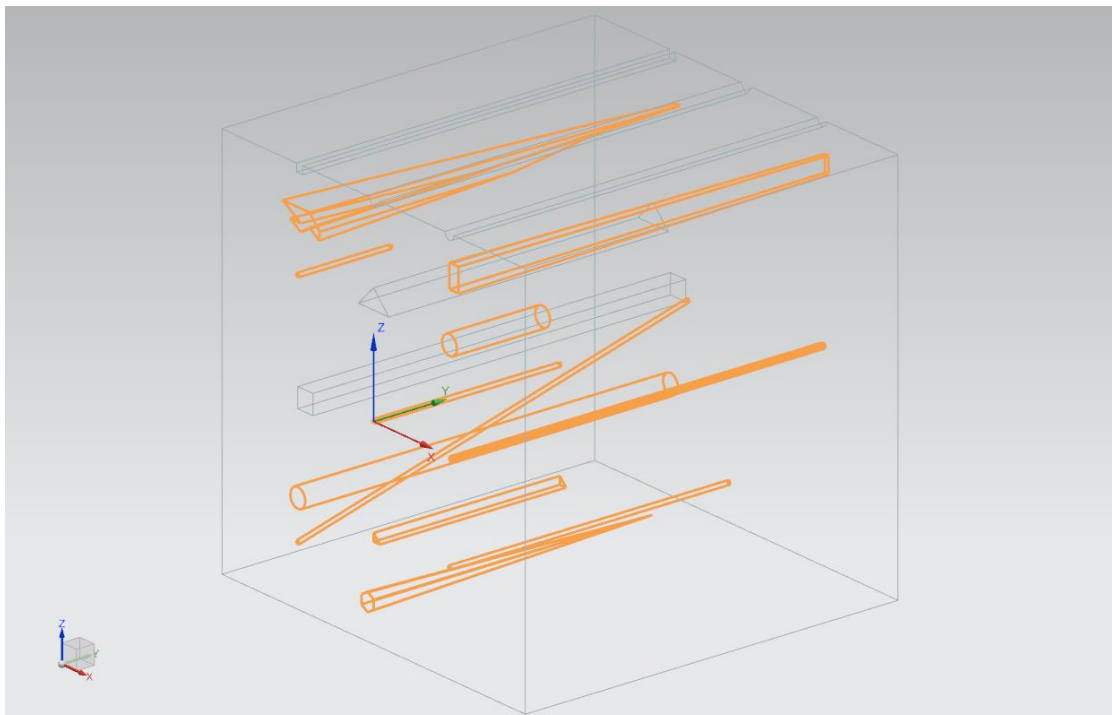
NOTE: The channel faces can also be manually selected by clicking on individual channel faces in the graphics window. If the user chooses to manually select channel faces, there is no question of specifying the **Maximum Width**

7. In the **Build Plane** group, in **Specify Build Plane CSYS**, click on ⬚ icon
In the **CSYS** dialog box, set the following (use default settings) -
Dynamic
Reference = Absolute Displayed Part
Specify Orientation (X, Y, Z) = (0, 0, 0)
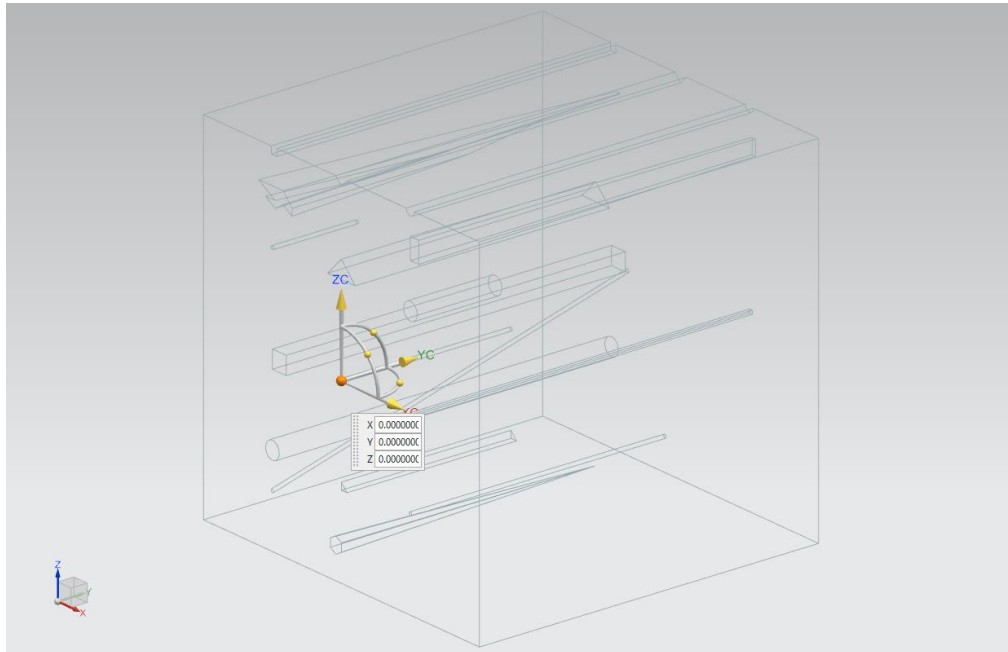
8. Click **OK** to close the **CSYS** dialog box
9. In the **Check Channel Ratio** dialog box, in the **Ratio** group, use default values
   Angle | Minimum Diameter
0	0.4
45	0.5
90	0.7

   Segment Length = 50
   Minimum Ratio = 0.02

NOTE: The "Angle" field indicates the angle between the channel axis and the build plate. The Angle – Minimum Diameter pair values can be set to the user's discretion. For any angle that lies in between the three specified angle intervals, the corresponding minimum diameter is automatically interpolated

10. Keep the box **Show Only Failed Segments** <u>unchecked</u>

11. In the **Process Results** group, click on **Calculate Ratio**

12. In the **Setting** group, set **Display Resolution = Standard**

Notice the passed and failed channel sections highlighted in the graphics window