3D Printing & Parametric Design

LWHS - 2022-2023

******Submit Documentation of each tutorial on your google site, include: Screenshots and one sentence about your thoughts/challenges on each tutorial ******

Surface Transformation

- Grasshopper contains many kinds of transformations under the **Transform** tab. The most mysterious (and useful) of these are the ones that transform the geometry onto a surface, similar to Rhino's flow along surface command.

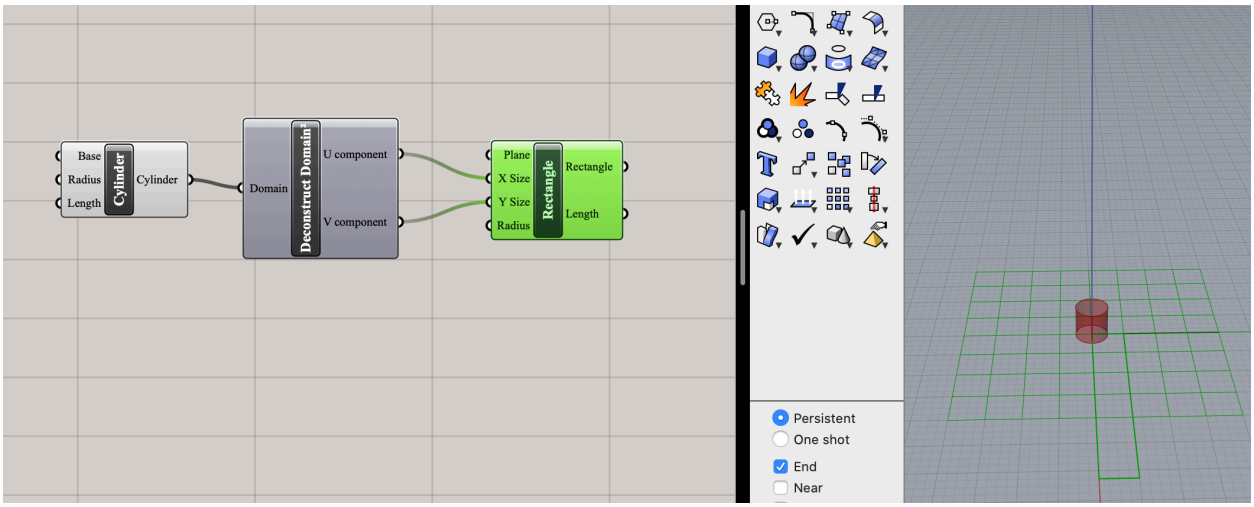
Mapping Curves to Surfaces

- The simplest way to make a given geometry conform to that of a surface is to use the **Map Surface Component.** This component will take a curve in the domain space of a surface, and turn a transformed curve on the surface itself.

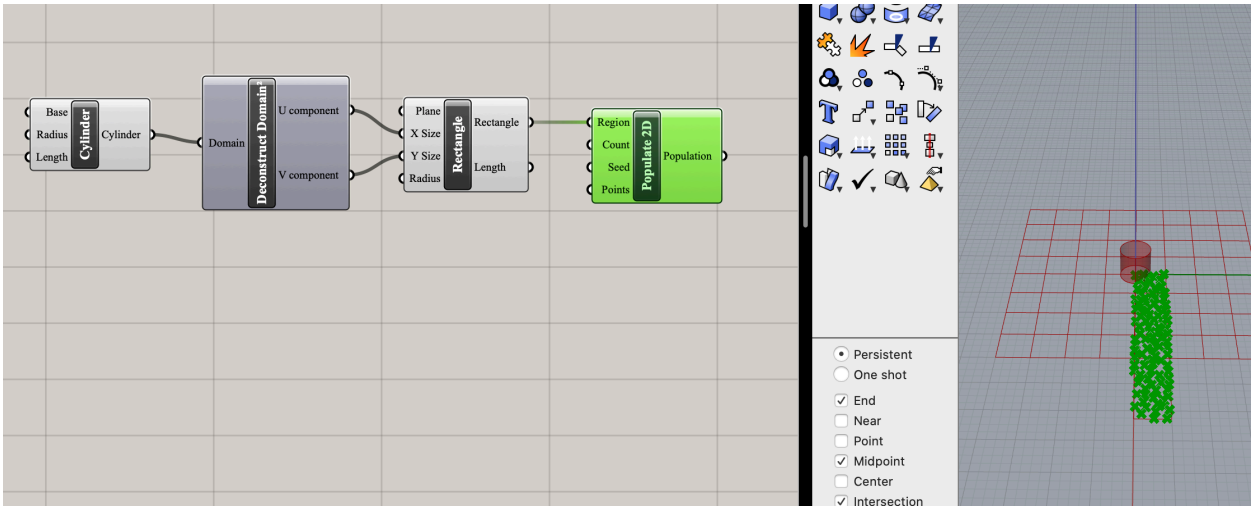
Visual Example

1) Drop in a **Cylinder Component** (Surface tab, Primitive panel)
2) Drop in a **Deconstruct** $Domain^2$ **Component** (Maths Tab, Domain panel)

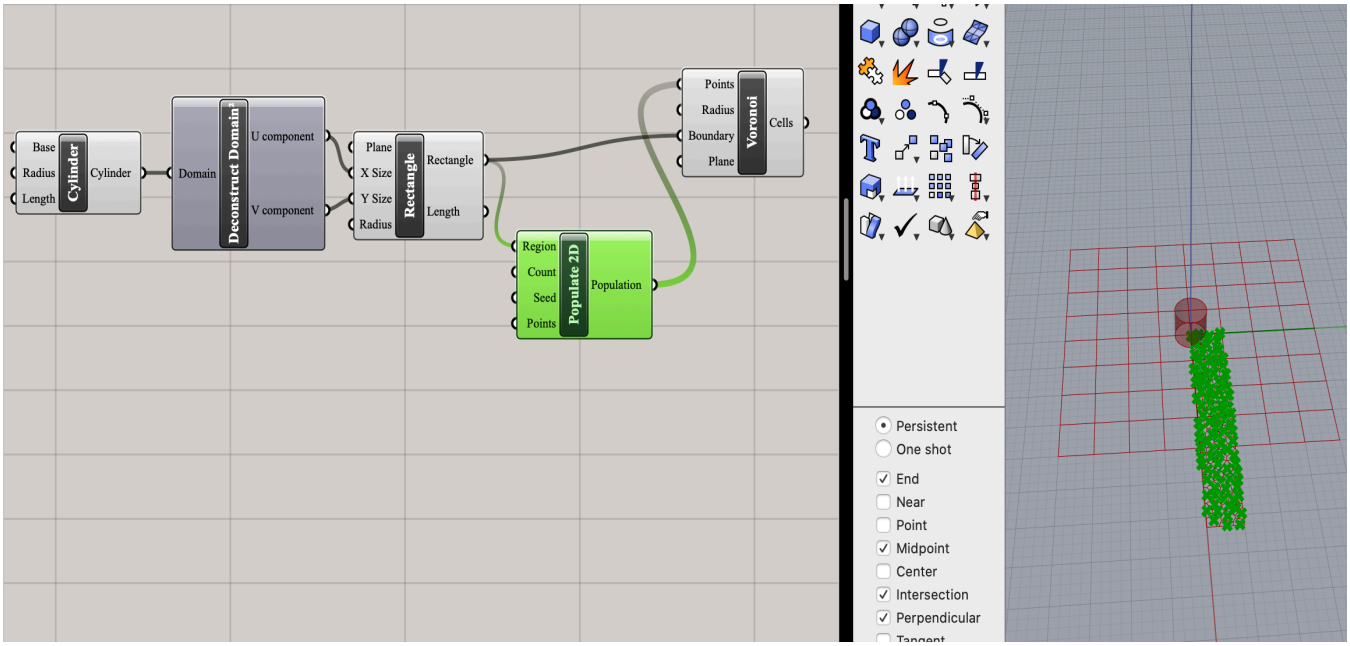
3) Connect the **output** of the **Cylinder Component** to the **Domain input** of the **Deconstruct** $Domain^2$ **Component**
4) Drop in a **Rectangle Component** (Curve tab, Primitive panel)
5) This rectangle component will create a rectangle in the XY-plane that represents the boundary of the domain parameter space of the cylinder
6) Connect the **"U Component" output** of the **Deconstruct** $Domain^2$ **Component** to the **"X" input** of the **Rectangle Component**
7) Connect the **"V Component" output** of the **Deconstruct** $Domain^2$ **Component** to the **"Y" input** of the **Rectangle Component**



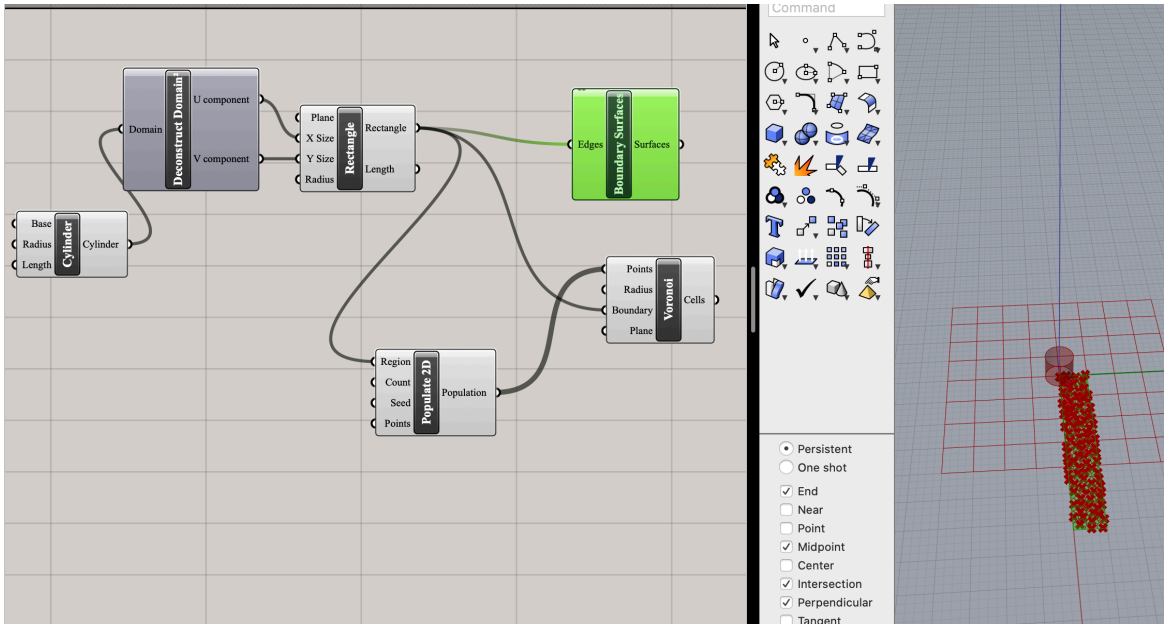
8) To create an interesting set of curves to map to the cylinder, give this rectangle to a **Populate 2D Component.** This creates a random set of points in the region of the XY-plane bounded by it.
9) Drop in a **Populate 2D Component** (Vector tab, Grid panel)
10) Connect the **"Rectangle" output** of the **Rectangle Component** to the **"Region" input** of the **Populate 2D Component.**



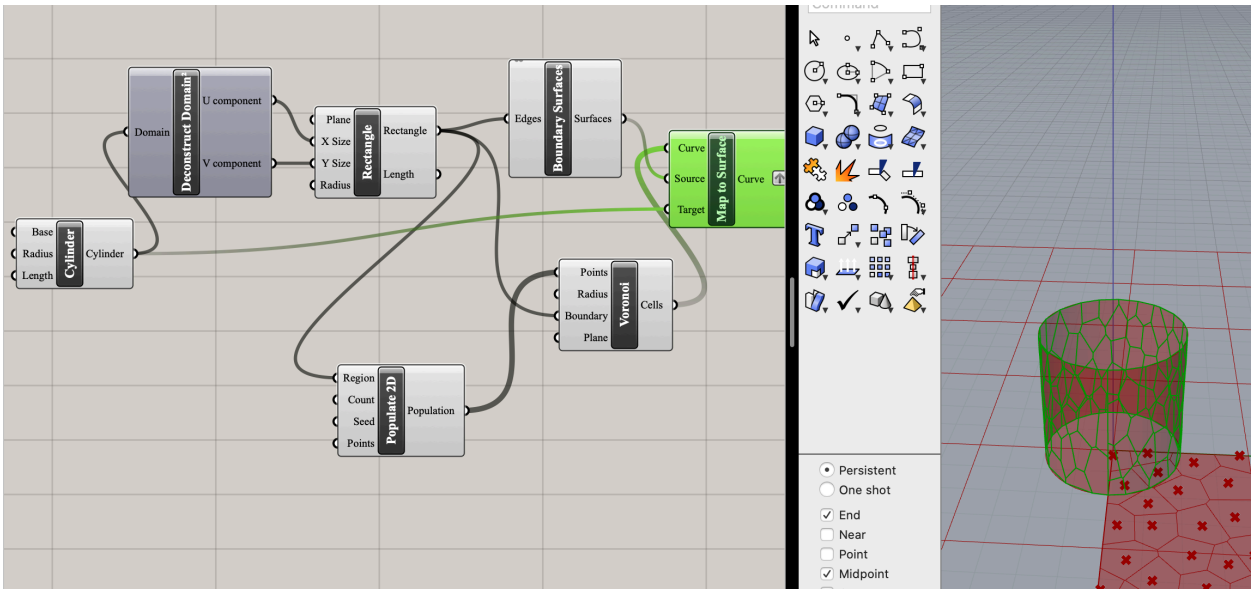
11) Let's feed these points to a **Voronoi Component**. This component finds the largest non-overlapping curves that surround each point and are still within the original rectangle.
12) Drop in a **Voronoi Component (Mesh tab, Triangulation panel)**
13) Connect the **"Rectangle" output** of the **Rectangle Component** to the **"Boundary" input** of the **Voronoi Component**
14) Connect the **"Population" output** of the **Populate 2D Component** to the **"Points"** input of the **Voronoi Component**



15) The final step is to use the Map to Surface Component. This component requires three points: (Curves) The curves in the domain space to map to a target surface (Target) the target surface that the final curves end up on, and (Surface) a "source surface" representing the domain space.
16) To create the source surface we feed the rectangle curve defined earlier to a **Boundary Surface Component**. This component creates a planer surface that is bound by any closed planar curve, similar to Rhino's Planar Surface command.
17) Drop in a **Boundary Surface Component** (Surface tab, Freefrom panel)
18) Connect the **"Rectangle" output** of the **Rectangle Component** to the **"Edges" input** of the **Boundary Component**



19) Drop in a **Map to Surface Component** (Transform tab, Morph panel)
20) Connect the **"Surfaces" output** of the **Boundary Surface Component** to the **"Source" input** of the **Map to Surface Component**
21) Connect the **"Curve" input** of the **Map to Surface Component** to the **"Cells"** output of the **Voronoi Component**
22) Connect the output of the **Cylinder Component** to the "**Target" input** of the **Map to Surface Component**
23) Double-click on the **"Curve"** output of the **Map to Surface Component** and select "Graft"



What happens if your target input is connected to a Cone Component or a Sphere instead of the original cylinder?