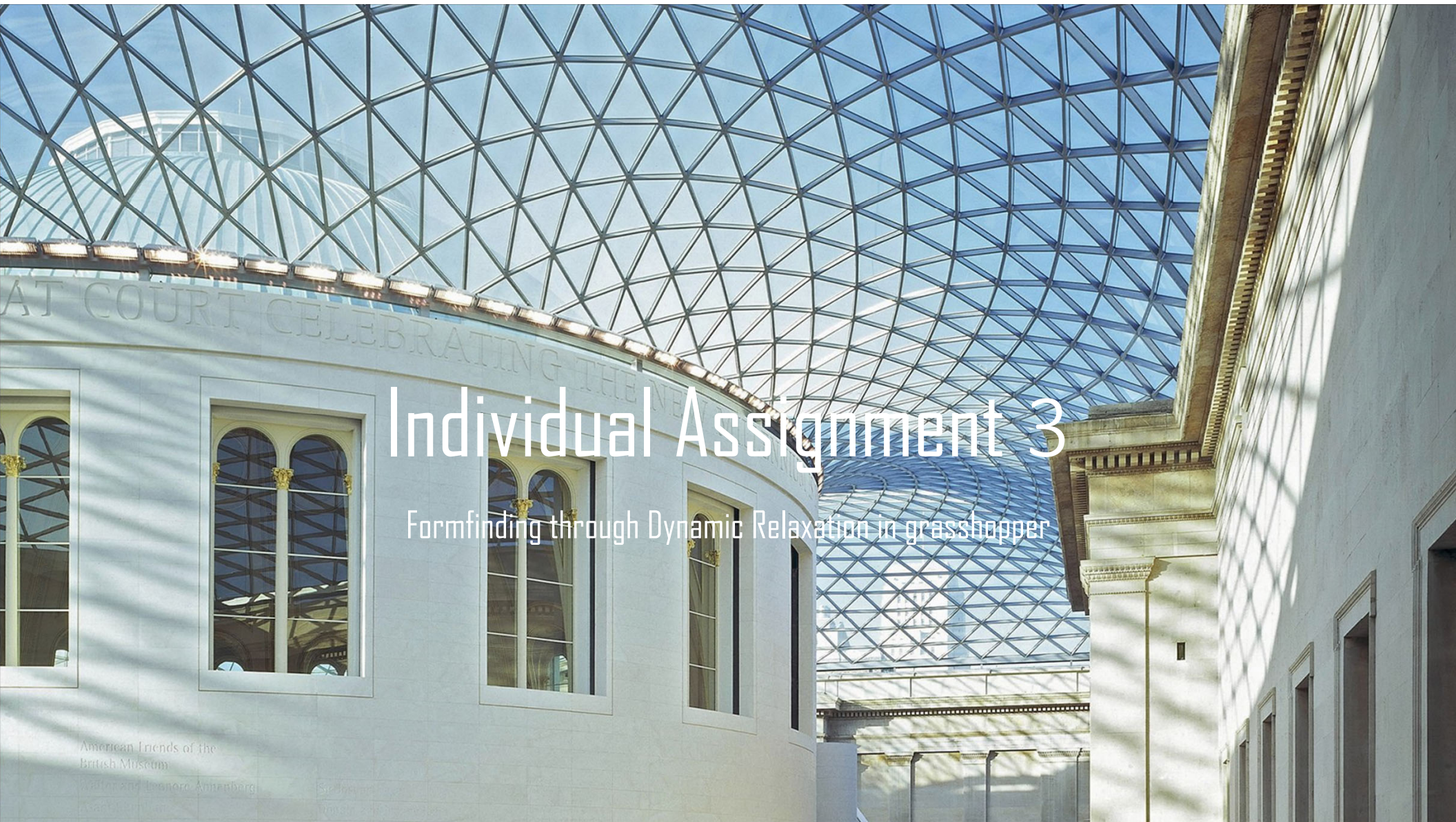


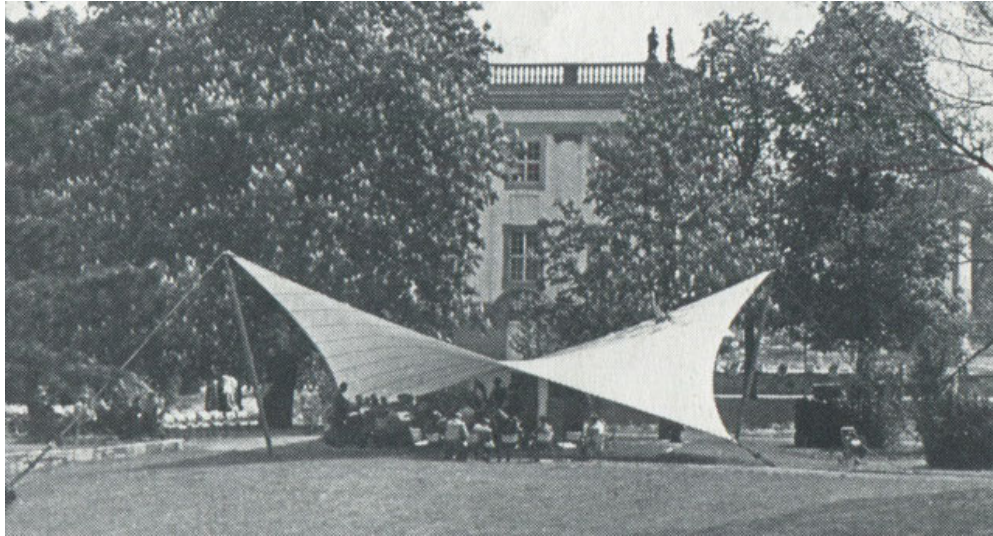


Individual Assignment 3

Formfinding through Dynamic Relaxation in grasshopper

American Friends of the
British Museum
Robert and Leonore Annenberg
Foundation

Sir John
Guthrie



Aim

Learn how to handle data structures when creating discretized geometry.
Learn the basics of dynamic relaxation and the parameters involved.
Learn the basics of how grasshopper can be used as an engineering engine.

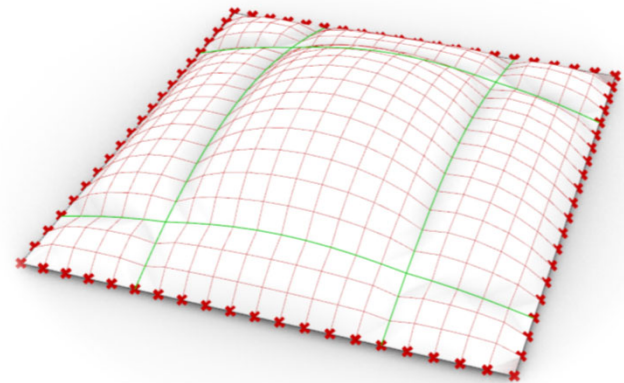
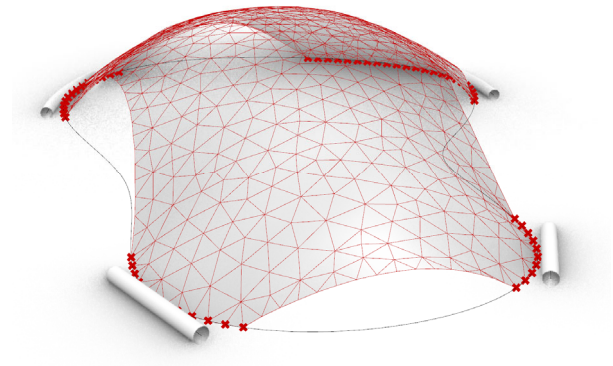
Objective

Create a network of lines subdivided so that each line segment ends wherever it crosses another line.
Turn the network into a physical model using Kangaroo2 spring elements (called length) and relax it for a given set of applied loads and boundary conditions.

By controlling the initial geometry as well as the spring element parameters and loading the network will take different shapes.

Results

Explore the different design parameters and what it does to the resulting network and shape. How does these shapes compare to shapes derived from mathematical functions?

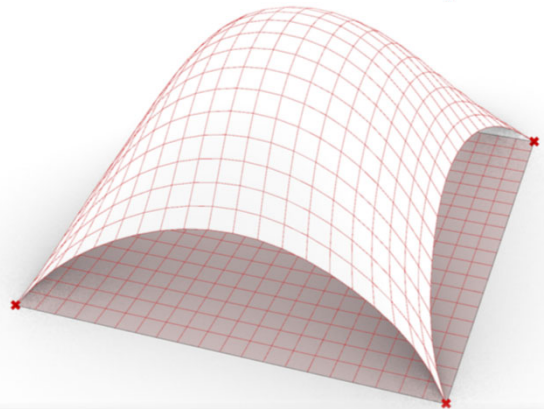
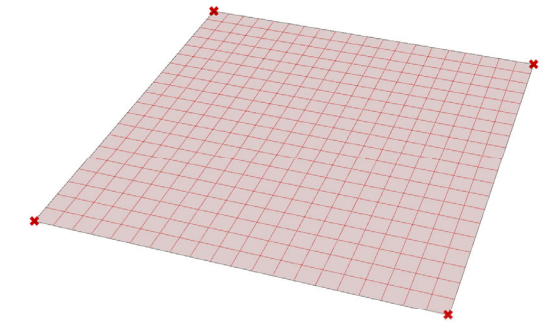
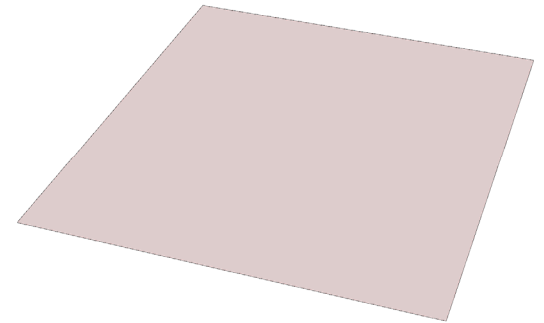
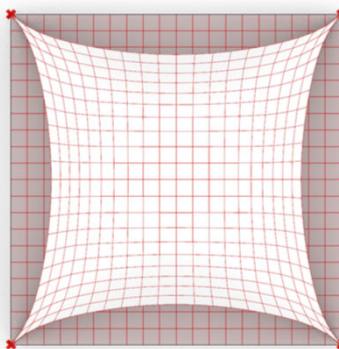
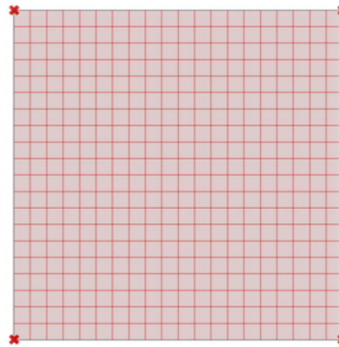
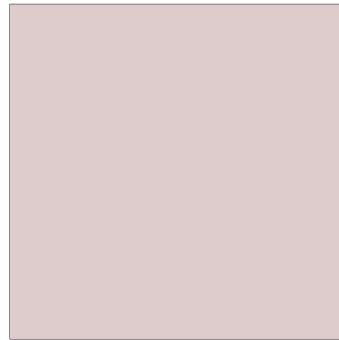


Inputs

- A network of lines built up from some initial geometry (the networks constructed under data structures in the assignment sheet may be used for this).
- A set of fix boundary points.
- A set of applied loading

Controls

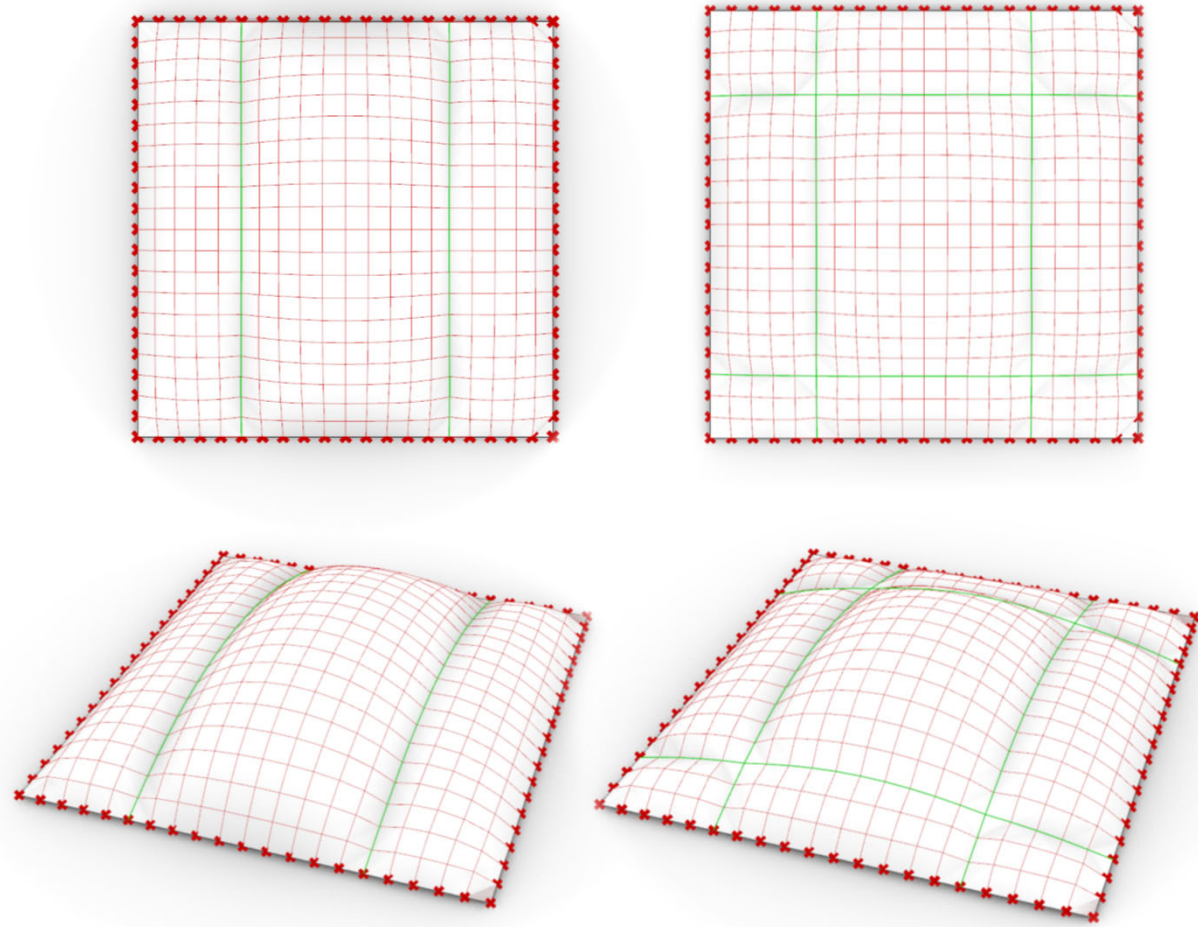
- Initial geometry
- Element properties
- Boundary conditions
- Applied loading



Approach

Start simple, with a network, boundary and loading you can understand. Check if you can understand the resulting geometry and the force pattern it implies.

Then start experimenting with varying things as stiffness and initial length of the different segments, as well as the applied loading and boundary conditions.

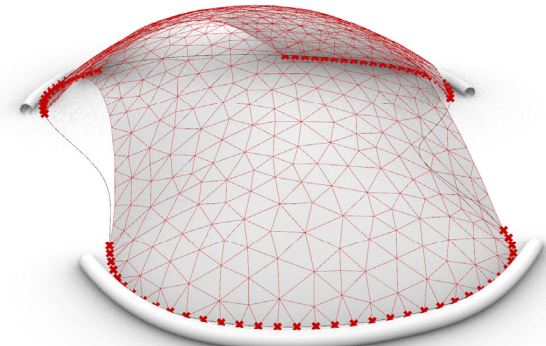
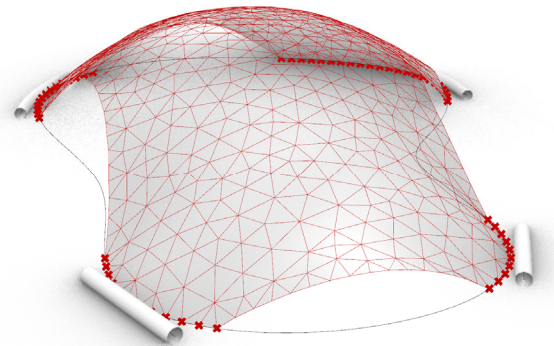
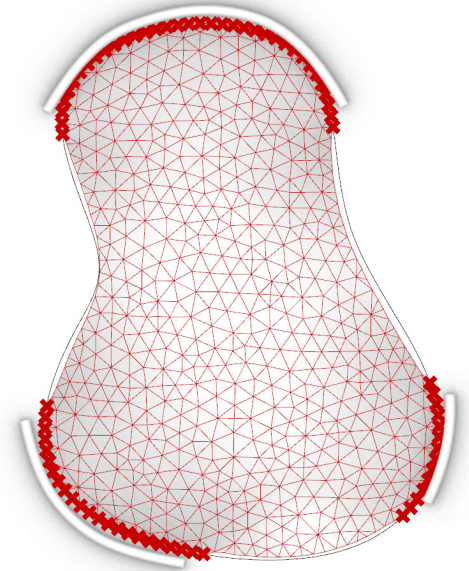
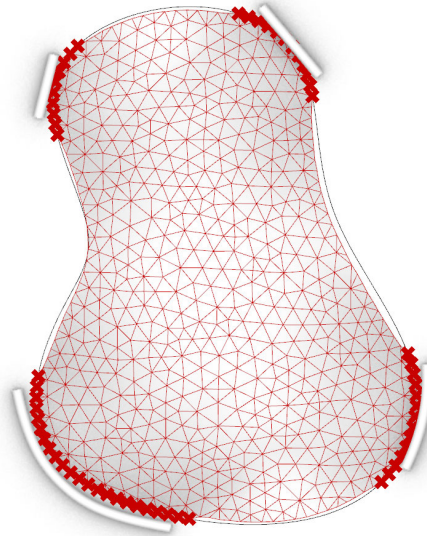


The green lines consists of stiffer springs and therefore attracts more force than the red ones.

Further studies

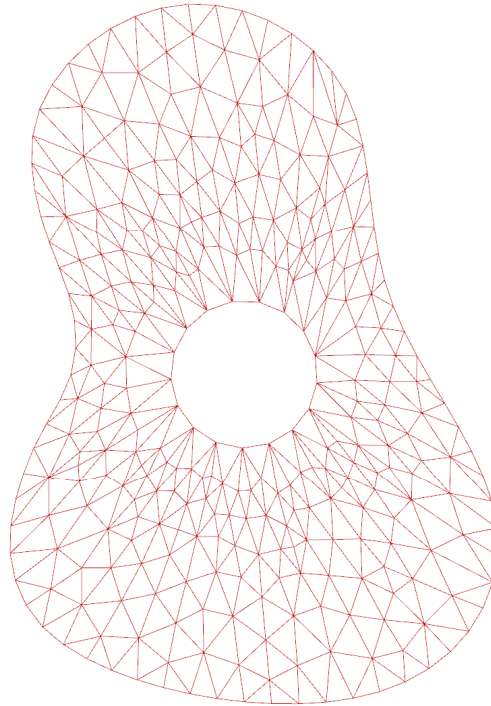
Make an interactive script that can take in curves from Rhino which sets different parts of the boundary to fixed and free. This way you can more quickly try out different options.

To mesh a surface with triangular meshes you can use Karambas “Mesh Breps” component.

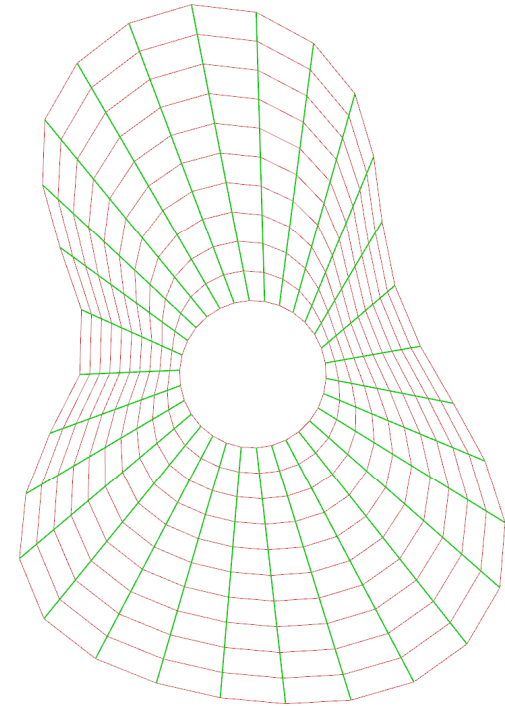


Further studies

What is the difference between the different grids and patterns? How does his pattern influence of the designer to adjust the shape?



Triangular mesh generated arbitrarily.



A mesh generated using radial and angular lines

Useful components



Divide Curve - splits a curve into a list of points



Divide Surface - splits a surface into a data tree of points



Flip Matrix - Shifts the branch numbers with the list indices and vice versa



Shift List - Shifts the index of each item in a list



Line - Creates a Line



Kangaroo Length - Creates a kangaroo spring element from a line



Kangaroo Anchor - Creates a kangaroo anchor point, or "fixed" point, from a grasshopper point



Kangaroo Load - Creates a kangaroo point load from a point and a vector



Kangaroo Solver - Kangaroo Physics solver. Runs the dynamic relaxation algorithm

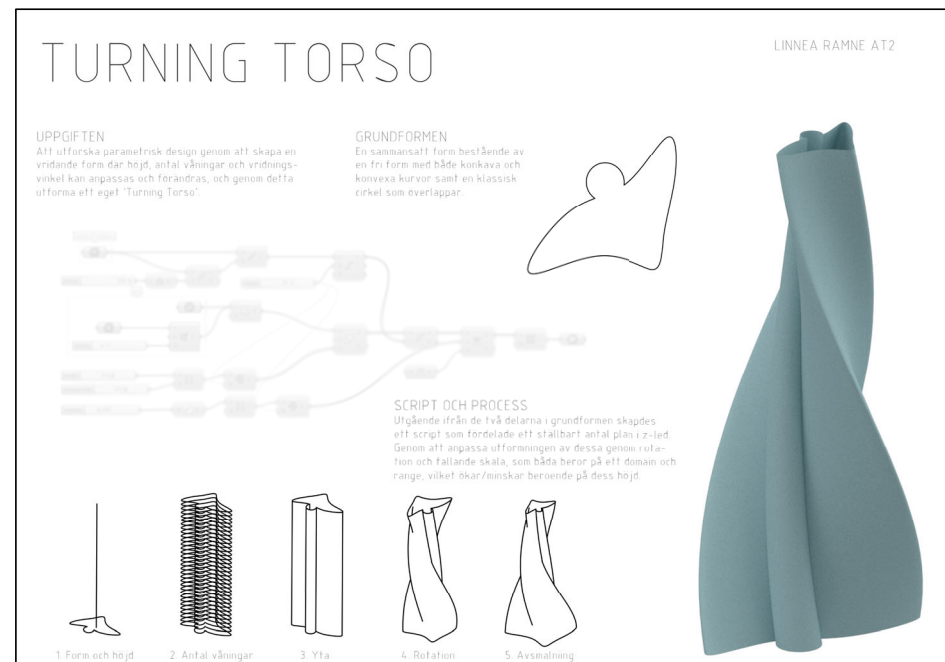


Mesh Breps (Karamba3d) - Creates an unregular triangular mesh on a Brep. Mres changes the size of the triangular elements.

Examination – Inlämningsformat individuella uppgifter

Inlämning bör innehålla:

- Uppgiftsbeskrivning
- Angreppssätt, hur tog jag mig an uppgiften.
- "Designen var uppbyggd med de här parametrarna... som kontrollerade designen på detta sätt" etc etc
- Bild av koden/scriptet, eller delar av den om det är för mycket kod för att kunna läsa (Use high res export in Grasshopper)
- Diagram eller bilder på olika variationer av din design möjlig med de parametrar ni har satt upp.
- Grasshopper koden/filen lämnas in separat.
- Deadline enligt Canvas



Exempel på inlämning, A3 format