The Times Eureka Pavilion at the RHS Chelsea Flower Show by NEX, Marcus Barnett & Buro Happold

Timber Tectonics in the Digital Age

ALDEN CARR'S PORTFOLIO

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UNIVERSITY OF OREGON

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An Introduction to Timber Tectonics

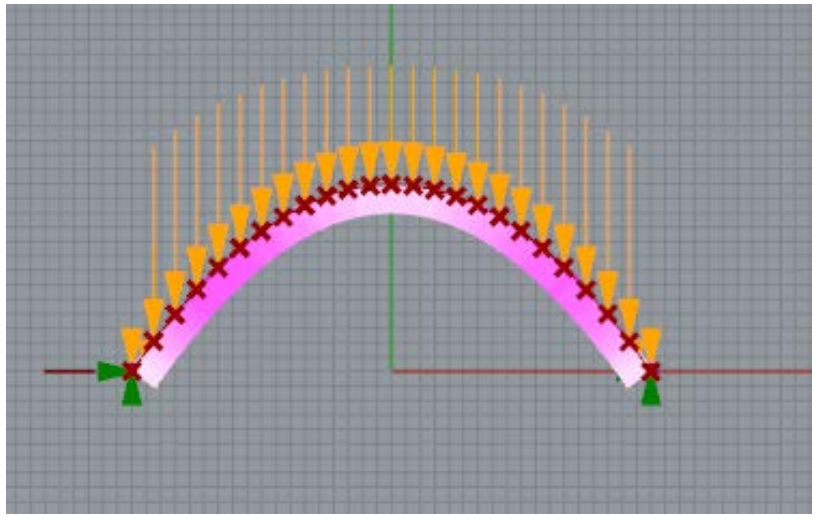
The first week of timber tectonics has been opened my eyes to the dynamic process of building with contemporary timber technologies. There is an assortment of alternatives to traditional framing methods, and each type presents unique capabilities while also requiring specific conditions and techniques to be utilized. For a project to maximize the use of timber products it is important to understand how each member interacts on both small (microscopic) scales to larger structural/unit scale.

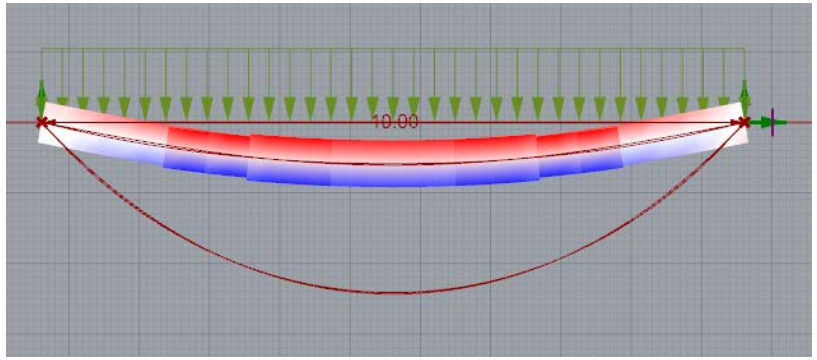
Reading about the material used for timber construction has been insightful to what I can learn from this class, and the roles in which parametric modeling can advance the “tectonic” building/fabrication of wood structures. Although I have heard in conversation of glue lam, it was beneficial to understand the different typologies can how the very in manufacturing. My knowledge of the variation of structural integrity and limitations is currently capped at the physics equations and models.

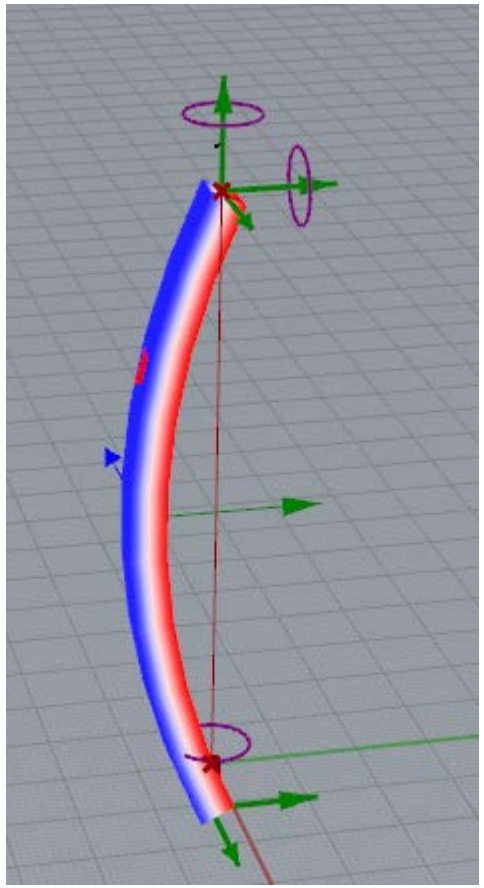
Beams and Column's

Beams and column's are a major component of structural systems and the most simple to model in Karamba.

Understanding how to control the points and axis for loads and stability is a continuing element for the evolving structural systems covered in this class.

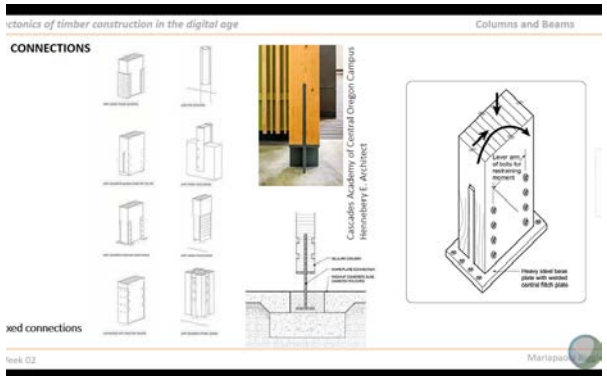






Connections: Beams and Column's

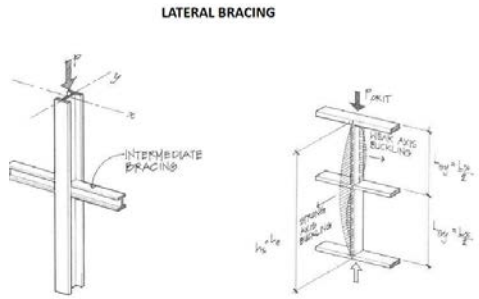
Ground Plan to Columns



Tamediea Headquarters
Shigeru Ban Architects
To add fire safety, the glue laminate beams were clad with gypsum.

Structurally the building is a series of timber frames comprised of four columns and generally five double beams figure 10.6 This project takes vertical loads very efficiently, however it was neccesarry to provice concrete cores at the end of the building to provide the lateral support.

Bracing of Vertical Members



As forces are placed on a member, they produce a behavior that can be predicted based on the material, and the fixed/supported planar movements which the member is allowed. Karamba allows the visualization of the member, based on the intended movement of the object.

Beams to Columns

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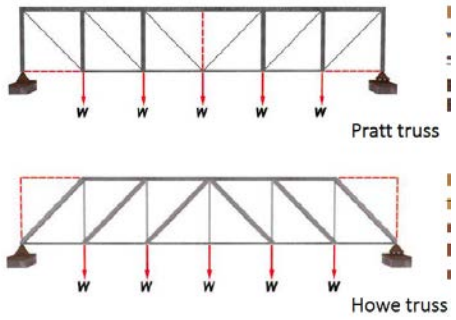
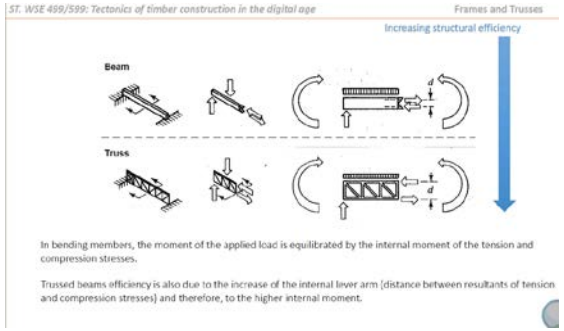
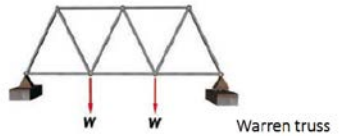
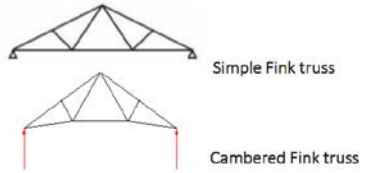
Frames and Trusses

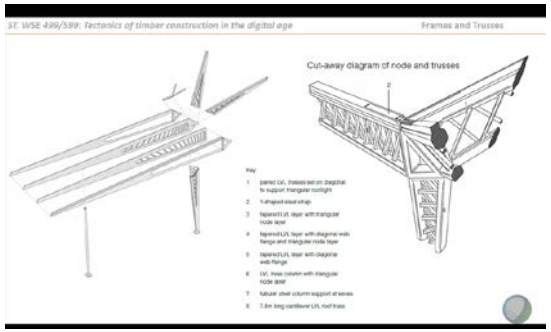
FRAMES and Trusses
A system members connected by rigid joints Traditionally plates are on outside of trusses, can be internalized, as well as steel bolts.





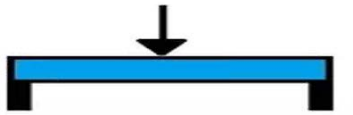


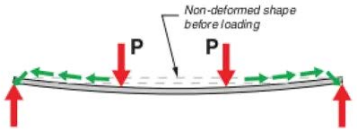


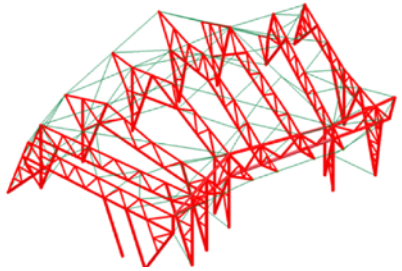


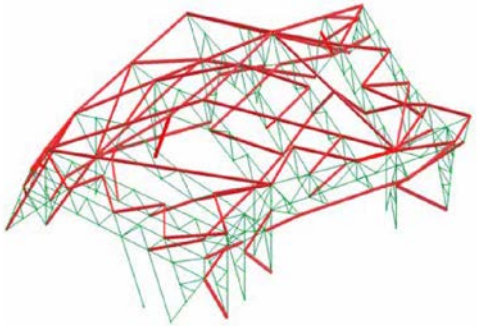
Frames and Trusses

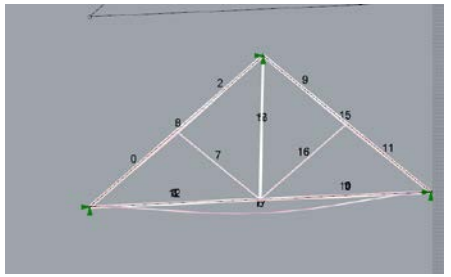
Trusses are structural members that allow thin materials to make long linear expanses and carry loads. Traditionally they are planar to either and XY or YX grid. They are commonly seen in bridges, and houses and are efficient at dispersing loads. They are assembled in a variety of joining patterns to resist tension and sheer forces. Trusses are always constructed with triangles, and are more efficient in compression than tension





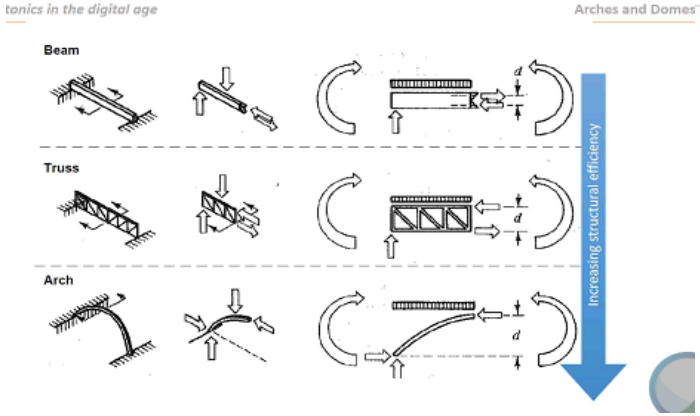


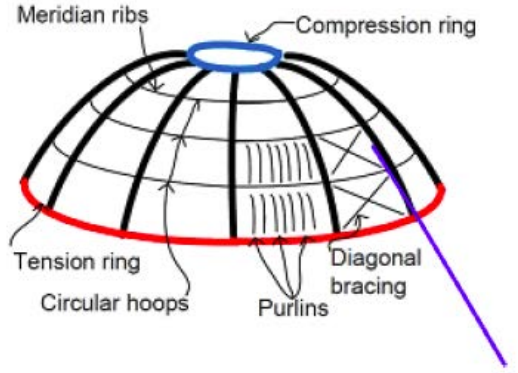




Arches and Domes

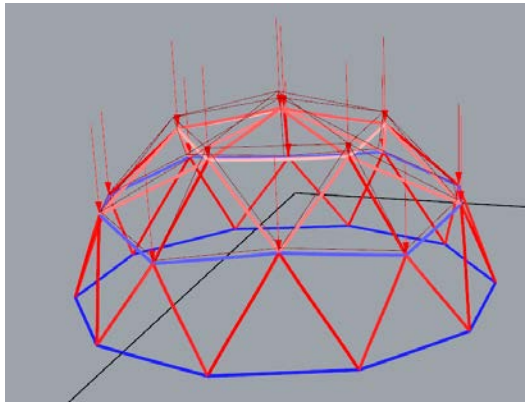
Arches use more slender members and are prone to bucking. Additionally they require lateral stability through members known as Perlin's. These Perlin's connect arches to additional adjacent arches that allow the structures to maintain stability without using unreasonably large foundations/footings. Using this structural behavior will be helpful in generating our pavilions as they may have multiple curves that span from the ground plane.

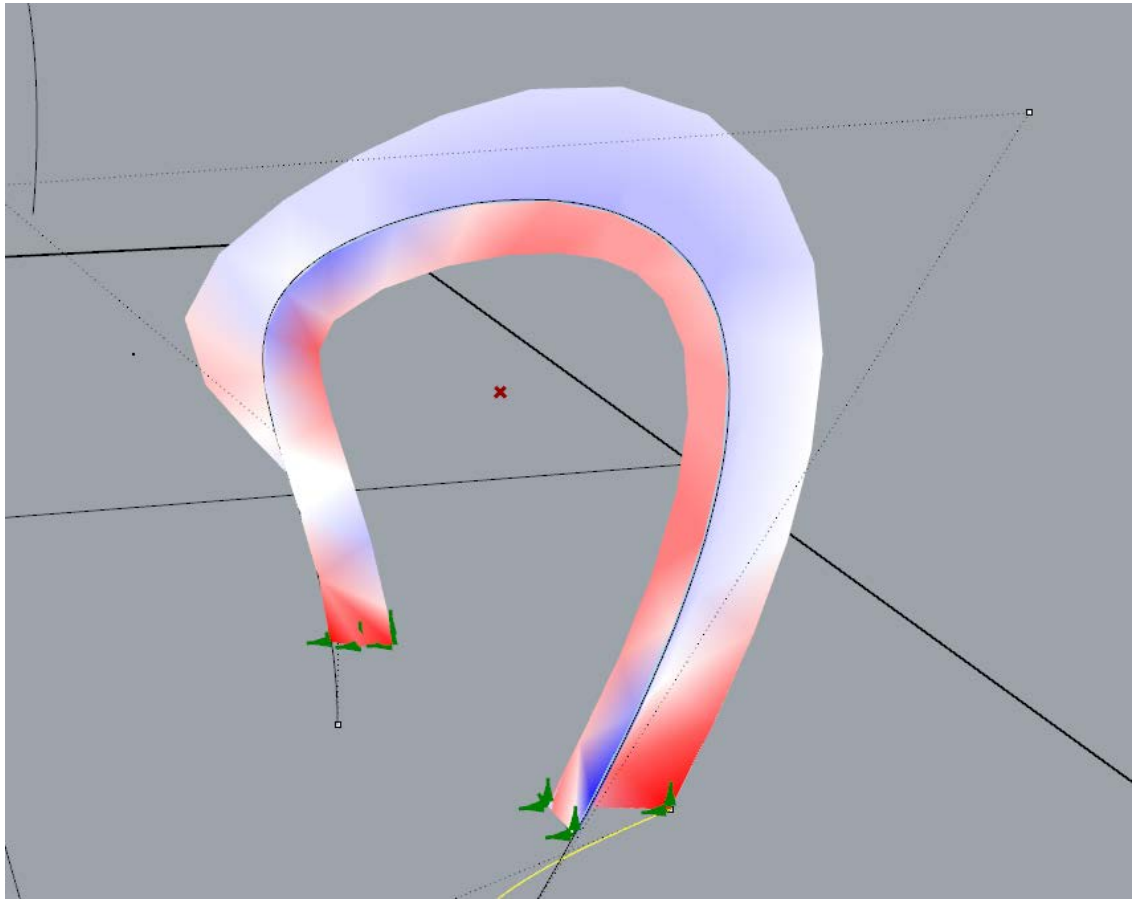




Arches and Domes

Our team is working through how to integrate an arched entrance-way to the pavilion. In breaking the mobius form into different systems we can use the Mesh to shell definition to create a curve definition with a cross section to provide the twist and refine towards a more structurally sound system.





Grids, Shells,….. GRIDSHELLS

By understanding the shape and form of a structure, the efficient design and appropriate grid system can be implemented. The Manheim shell structure: Three dimensional Structure Resists applied loads through its inherent shape due to membrane forces. Carry loads by tension, compression, and shear forces in the plane of the shell. To make a shell in timber three dimensional frameworks are needed as wood is anisotropic. Double layer grid shells allow the form to reach desired curvatures that extend beyond the length ability of wooden lathes bending ability. The ability to remove material makes for an inherently light structure.

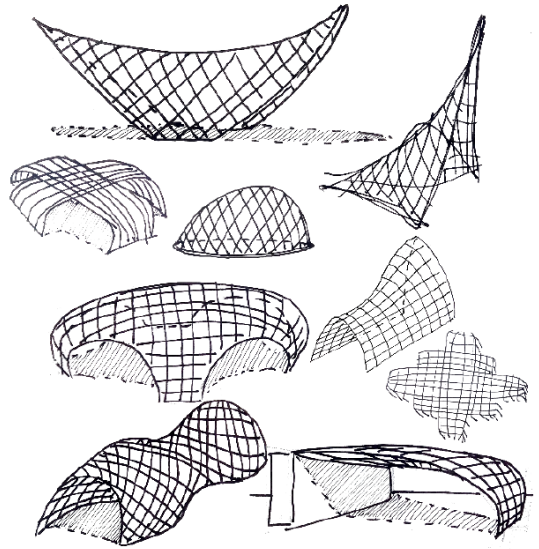


Figure 2- *Regular in Compression examples*

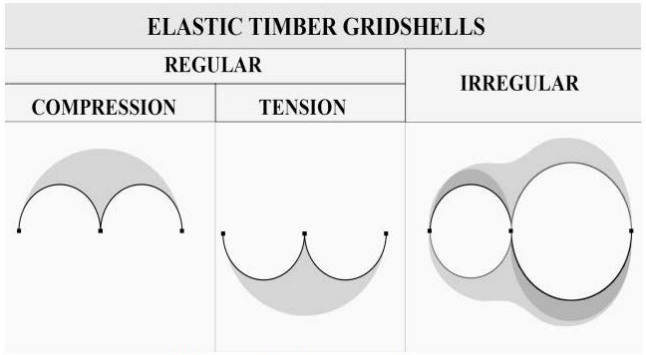
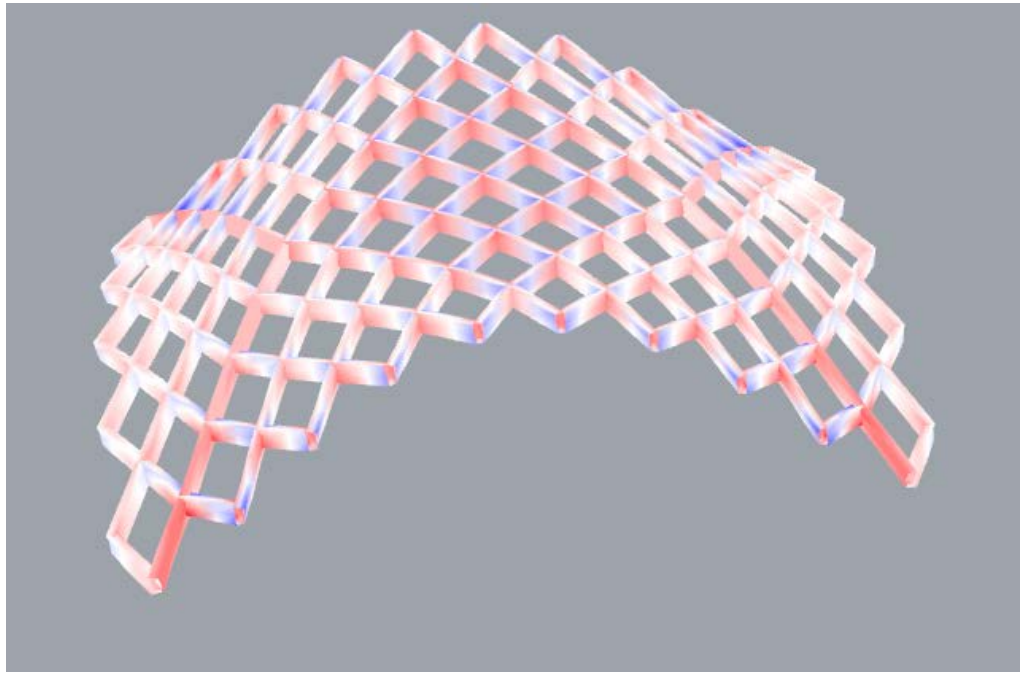


Figure 1-*Clusters Concept*

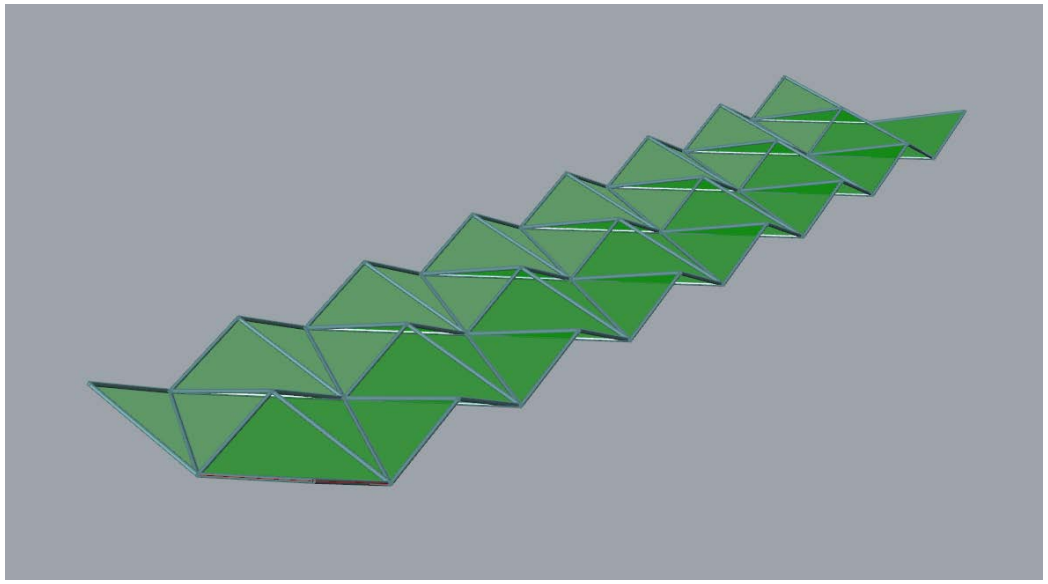
Gridshell - analysis

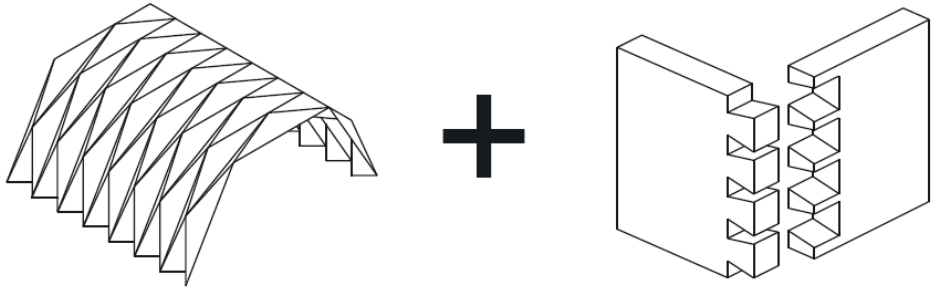
I found this week to be some really interesting management of list items, branching and points. I think that there was a lot to be learned for myself from using dots, and the Find closest members. Although I understood the logic of the scripts, I was unable to apply towards our mobius project currently.

Surfaces with double curvature present strength from their structure: from stress into the shell during the "Load Transfer"



Plates and Folded Plates





The culmination of this course presented a fascinating insight of interdisciplinary collaboration. The role of parametric allowed for form and structure to be simultaneously explored and evaluated. There is a wealth of knowledge and resources which was provided to us in the form of case studies, grasshopper definitions, as well as the willingness of the instructors to evolve the course material to adhere to discoveries and development. In previous professional experiences I have worked on the development of small exterior structures, and was limited by standard materials, and simple engineering solutions. I am now comfortable in engaging with engineers to develop unique design solutions. Additionally I am going to advocate for the use of new Engineered Timber products when possible.