Digital Fabrication

From Micro to Macro

CADlogic 2016-2017

DIA

Digital Fabrication

From Micro to Macro

CADlogic 2016-2017

Karim Soliman

DIA Series

This book is part of a series of scientific publications, which, at loose intervals, will publish the results of thematic studio projects as a reflection of the work accomplished within the DIA master course. As such, they will reveal a panorama of architectural discourse about the city, society, history as well as the tectonic object as perceived through the eyes of students from all over the world.

Alfred Jacoby, Director DIA
Johannes Kister, Director Public Affairs DIA

#1 Amsterdam Housing (2012)	Arie Graafland
#2 Jerusalem: The Damascus Gate (2013)	Arie Graafland and Alfred Jacoby
#3 After Geometry (2015)	Attilio Terragni
#4 Redesign (2015)	Gunnar Hartmann
#5 Vorkurs / Pre-Course 2015 (2016)	Johannes Kister
#6 DIA@Delhi (2016)	Martin Rein-Cano
#7 History of the European City (2016)	Alfred Jacoby
#8 After Geometry II (2016)	Attilio Terragni
#9 Critical Regionalism	Johannnes Kalvelege

Introducing Digital Fabrication

Prof. Alfred Jacoby (Director DIA)

As this is the last publication under my directorship at DIA, I am pleased to write the introductory text to Karim Soliman's book "Digital Fabrication"

It is a compilation of his work done at DIA as well as for the Faculty at large over the past six years.

Digital Fabrication deals with objects at different scales, ranging from jewelry to pavilions.

In each of the scales the path of translation from design to the finished product by using computer skills as well as various fabrication methods is explored.

The introduction of parametric design thinking came to DIA in 2006 with the arrival of Neil Leach and has been a steady academic concern of the school ever since.

Additionally, activities have lately shifted into a new Robotics Lab, which will enhance the translation from digitally steered design to robotically manufactured product yet at a different scale.

Karim Soliman has provided important inputs to the field of Parametric Design which this publication attempts to show.

The book demonstrates his teaching method as well as the way it leads to good results.

Prof Alfred Jacoby

Dipl.Arch.ETH, MA Cantab.

Director DIA

Acknowledgments

After 8 years at DIA as both a student and teacher, I would like to express my gratitude to a number of people.

Starting with the first face I met in Dessau, Beeke Bartelt and all the DIA coordinators, Ulrike Jost, Larisa Tsvetkova and Sandra Giegler; thank you for making everything a little easier.

I would like to thank the Dean of Architecture Department Prof. Axel Teichert for making all the following projects possible over the past 2 years. Also I would like to mention Nadine Schulz and Simone Wagner from the Dean's Office for their patience and cooperation.

I am in debt to Prof. Alfred Jacoby. I am so thankful that he accepted me 8 years ago to study in DIA and continued to believe in my work that he has endlessly supported through my teaching years.

My professors who made my study in DIA fruitful: Prof. Omar Akbar, Prof. Matias Del Campo, Prof. Arie Graafland, Prof. Andrea Haase, Prof. Gunner Hartmann and Sandra Manninger. Special thanks to Prof. Neil Leach, it was inspiring to assist you in DIA. Thanks to Behnaz Farahi for the Body Architecture Workshop you gave to my class 2 years ago.

I would like to thank my partner Marina Morón Frápolli, this work wouldn't happen without her advice and support. Also thanks to Henry McKenzie who helped me to put this book together. I would like to thank Laurian Ghinitoiu, Pavel Babienko, Mohamed Eid, Mohamed Adel and Esther Pua Wan Ling for the stunning photos featured in this book.

For the Jedi Master who I am in the greatest debt to, Prof. Christos Passas. You have enlightened, inspired and taught a generation of Jedi that I am lucky to be part of. I would like to dedicate special thanks to my teacher and big brother Alexander Kalachev and also Tudor cosmatu, Olga Korvikova, Maira Jose Rubiera Martinez, Mircea Mogan and Alexandra Virlan.

Finally for all the brilliant minds I have taught in DIA, it was a pleasure to work with you, I have learnt as much from you as I hope you have from me. This book documents just some of your achievements there are dozens more that space will not allow for but are equally brilliant. I would like to thank you all.

Berlin, September 2017

Contents

Preface

We are currently witnessing a paradigm shift in Architectural design. The shift can be likened to a sine-wave, design movements reach their peak before fading away to make room for the next shift.

We are currently on the upward trajectory of this sine wave – with the processes and characteristics of the movement still being defined. In order to take part in this current movement, one needs to understand exactly what trough we are moving out of. This book is my own attempts at examining the need for an overhaul of the design process, using the design of a building as an example.

A building has been always a result of 3 factors equation.

1. We identify a need for the building,
2. We design a volume specific to those needs, and,
3. We realize that design through its construction. (Implementation)

Design for a need

When designing buildings, architects have the unsettling responsibility of designing for the future. A building's construction can take several years to realize and as a result can shape the built environment for decades.

During the late 90's we saw the beginning of the information era, and with it, the end of the industrial revolution's hold on our lifestyles. The Victorian educational system was coming to an end; we no longer grew up as a gear that can easily fit in society's machine. The time is ripe for a new generation to begin expressing their own unique and creative identities. This new generation is capable of creating and developing new technologies that can transform lives. Today, learning to code and in doing so communicating with each other and machines is more important than learning any spoken language.

Our life style has changed completely since the dawn of the technological age and it will continue to do so. Designers are further challenged to create buildings that can easily adapt to the changing needs of individuals rather than proposing a prototype that suits the average need of the masses. It is clear that now is the time to customize and personalize our designs and methodologies to suit each unique individual in the society.

Design a volume / spaces

After defining a building's needs, we look for inspiration to design a volume (with the tools available). A volume that can contain several spaces to accommodate several needs. For a long time, designers have been bounded by Euclidian geometry to create these volumes. These volumes have seen a plethora of different applications throughout the centuries, we have adorned them with portraits from nature and at other times we have stripped them bare. We have been through many architecture styles that have evolved from Euclidian geometries and only recently have begun to find our way out of them.

This move from traditional techniques did not happen in the blink of an eye, but rather as a result of all previous architectural styles and technological innovations. In the early 30's and 40's, many attempts to create a digital computer for massive computing operations was developed. The first ever 2D CAD (Computer Aided Design) software was created in the 70's. It was modified and revised until it became affordable and convenient for use in the office. Although 3D wireframe features were developed in the late 60's, 3D CAD wasn't used widely until the late 80's, when a new mathematical representation of free form surfaces (NURBS) was developed in Germany. Soon after CAD replaced the drafting table as the primary design tool.

Computational tools were introduced to accelerate the design process – by the time they were widespread, design was no longer dependent on Euclidian boundaries and instead was based upon variable parameters. By using scripting languages, architects in the new millennium (2000) were able to go behind the software interface and take control of every design aspect. Algorithms, parameters and many other computational tools helped us observe natural phenomena- instead of simply replicating its outward appearance, for the first time designers could simulate nature's behavior. The result being a naturally occurring, organic design. It wasn't until later that the construction industry would be able to realize these unprecedented designs.

Design implementation

For thousands of years, the construction of buildings was based on skilled labor with few variations of materials or traditional construction techniques. Its own revolution appeared when new technologies that were being developed for other industries were adopted in the building sector. This, coupled with the new design tools of the 21st century pushed the boundaries of design to an extent we have never seen before.

These technologies were first designed for automotive and aerospace industries in order to mass produce identical parts. We started to use them in the building industry as CNC machines, robotic arms and 3D printing technologies; using the latest materials to create structures with huge spans and double curvature surfaces (impossible to build using traditional means) along with and CAD/CAM models and BIM to translate these designs into numerical language for machines to interpret.

The result is a complete automation of the design process, going through many digital simulations until it is digitally fabricated by machines. Today's architects need to be aware of the whole procedure in order to design not just the buildings, but also its fabrication process.

These technologies have changed the design equation forever; and continue to set the limits of design to our imagination.

Digital fabrication from Micro to Macro

Digital fabrication has revolutionized the architecture industry; but what is 'digital fabrication?' What are the different fabrication methods and techniques? How can it be applied at various design scales? The answers to these questions were the core of my course "Introduction to Digital fabrication" for two years.

Digital Fabrication: is "The making of physical objects through the use of computer-controlled tools" (by Dianna Pfeitter), or "the use of computer-controlled fabrication, as instructed by data files that generate tool motions for fabrication operations" (by Marcin Jakubowski).

Digital Fabrication Methods:

1- Additive manufacturing: such as 3D Printing (3DP), Selective Laser Sintering (SLS), Stereo-lithography (SLA), Fused Deposition Modeling (FDM), and Laminated Object Manufacturing (LOM), among others.

2- Subtractive manufacturing: such as computer numerically controlled machining tools (CNC).

3- Multi functional: such as robotic arms capable of both additive and subtractive methods, depending attachments.

Digital fabrication techniques: vary between sectioning, contouring, tessellating, forming and folding.

"Digital fabrication from Micro to Macro" documents innovative design projects realized through digital designing and constructive processes. The work was completed between 2016 and 2017 at the Dessau International Architecture Graduate School. This publication features a selection of the students' work, organized in three different chapters: "Micro", where we refer to 'Body Architecture' projects; "Meso", where we refer to Furniture projects; and finally "Macro", referring to Pavilions.

Students have completed intensive research on each fabrication technique and fabrication method to understand their potentials, their capabilities and restrictions. This research will be released in a separate publication.

All the work shared in this book, including the graphics and images, are the work of students of the Dessau International Architecture Graduate School.

How to use this book

Each project presented in this book is shown for educational purposes. A step by step procedure for each project is also included. You will notice a small QR code attached to each project. This can be scanned using a smartphone or tablet to access the full grasshopper definition and further details for each project.

It is my sincere wish that both students and professionals interested in digital fabrication and digital modeling will find something of use in this publication.

Body Architecture

micro

“Nothing is art if it does not come from nature“

Antoni Gaudi

Hex

A handcuff that wraps around lower half of the arm. A semi matte finish cuff with a honeycomb generated design

Size

90X70X5.7mm

Student

Stefánne Samuels (Jamaica)

Year

Summer Semester 2016

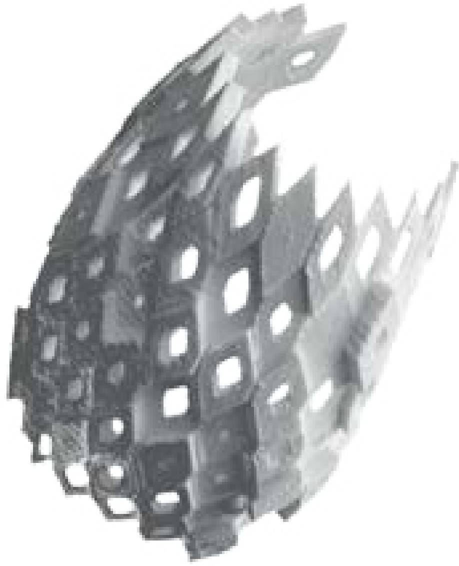
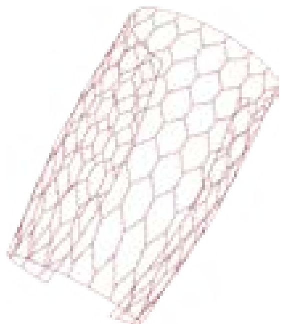
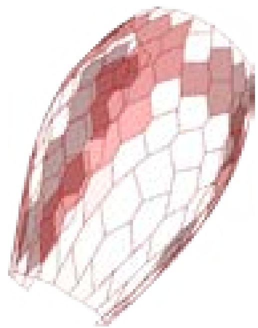


Photo by Mohamed Adel

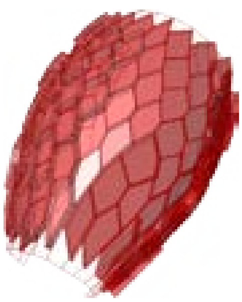
Form Generation



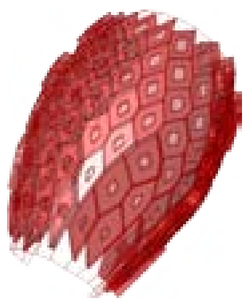
1- Project grid on Surface



2- Planner the sub division using Kangaroo



3- Extrude Hexagons with random values in direction of surface norm



4- Subtract the holes with gradual size

Marina

Photo by Mohamed Adel

Inspired by water-weathered rocks.

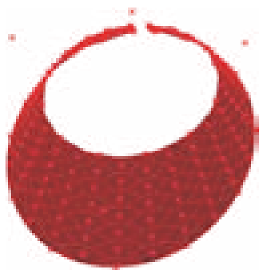
Size
170X180X40mm

Student
Maria del Pino Rodriguez (Spain)

Year
Summer Semester 2016

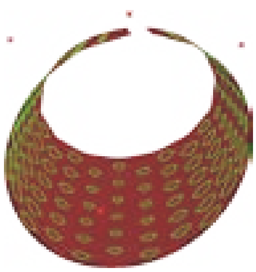
Form Generation

1- Create a surface with desired form

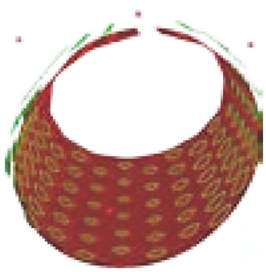


2- Subdivide surface into hexagons

3- Remove incomplete hexagons



4- Scale hexagons gradually



5 Offset hexagons in direction of surface norm

6- Loft hexagons to create the necklace

Arca

Inspired by repetitive structures found in nature

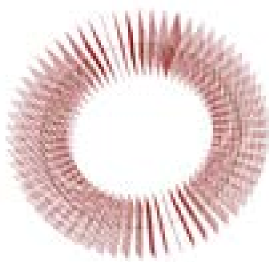
Size
120X120X50mm

Student
Pavlo Babiienko (Ukraine)

Year
Summer Semester 2016

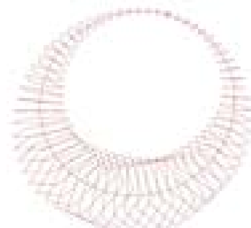
Photos by Pavlo Babiienko

Form Generation

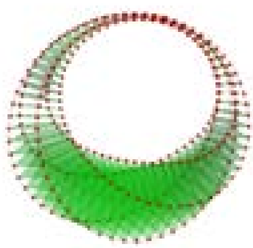


1- Equally distribute frames on a curve

2- Place a pentagon on each plan with gradual radii

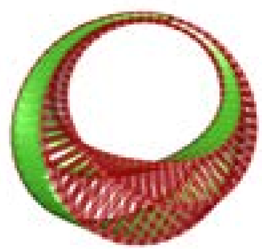


3- Rotate the pentagons gradually around the x axis



4- Deconstruct the pentagons

5 Pipe all curves



6-Create 2 surfaces by lofting the edges' curves

Allie

Composed of a Necklace & Pair of Earrings with customised voronoi Pattern

Size

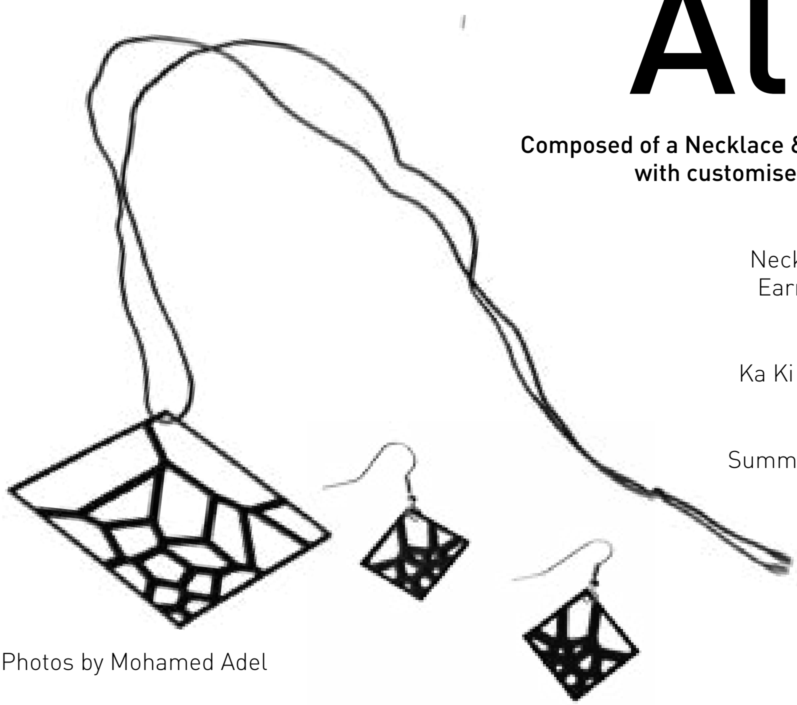
Necklace 60X60X2mm
Earrings 20X20X2mm

Student

Ka Ki Lam (Hong Kong)

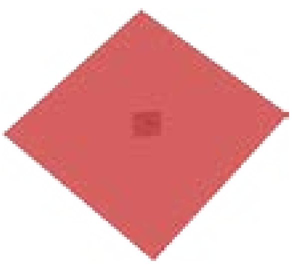
Year

Summer Semester 2016

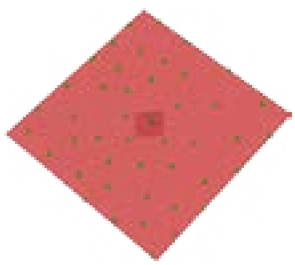


Photos by Mohamed Adel

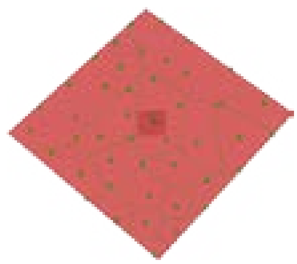
Form Generation



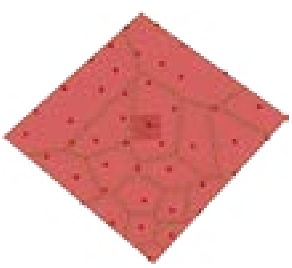
1- Define the boundary



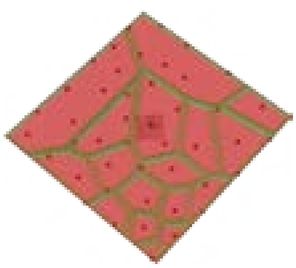
2- Randomly populate points



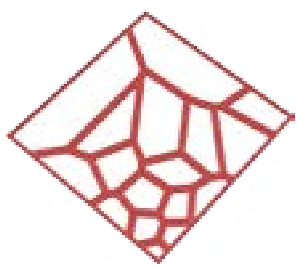
3- Create Voronoi around the points



4- Offset curves



5- Extrude the curves



6- Cap the curves to create solids

Coral Spine

Coral Spine is a custom made jewelry design which adapts itself to the body.

Size

85X60X30mm

Student

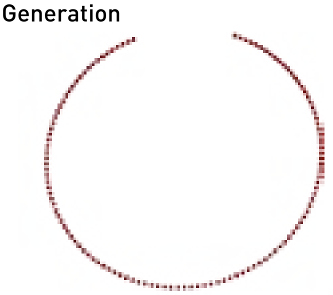
Deniz Kozluca (Turkey)

Year

Summer Semester 2016

Photo by Mohamed Adel

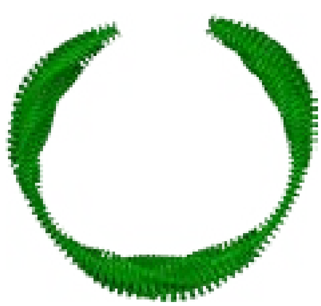
Form Generation



1- Subdivide curve into vertical frames

2- Orient profile geometry on each frame

3- Rotate the profile around the curve with gradual angles



4- Scale each profile using graph mapper

Succulent

Photo by Mohamed Adel

A wearable geometry inspired from nature.

Size

77X69X48mm

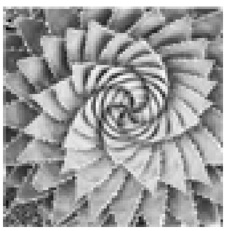
Student

Tina Neskovic (Macedonia)

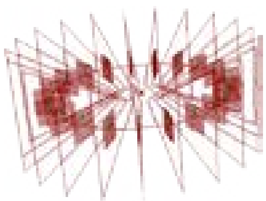
Year

Summer Semester 2016

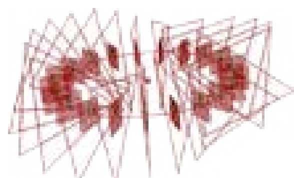
Inspired by nature



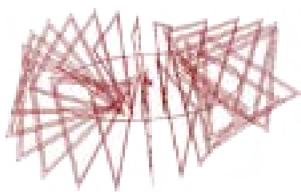
Form Generation



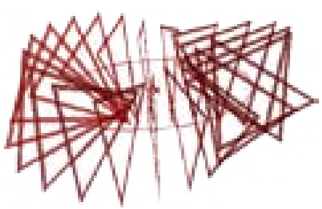
1- Orient triangles on a curve



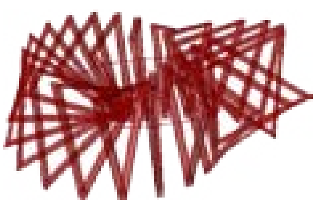
2- Rotate triangles along the curves



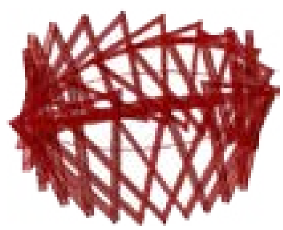
3- Scale the triangles



4- Loft triangles to create surfaces



5- Extrude along the surface norm



6- Final rotation around the center

Cnidaria

Coral's growth process; water temperature, salinity and turbulence.

Size

210X180X30mm

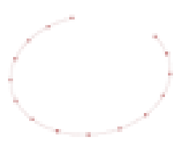
Student

Ivan Ribeiro Kuhlhoff (Brazil)

Year

Summer Semester 2017

Form Generation



1- Equally distribute per frames on a curve

2- Create spheres with gradual radii on the points

3- Pull the end of the spheres in the same direction

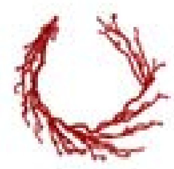
4- Rotate the whole collar to be placed on a body

5- Get the surface points of the spheres

6- choose these points

7- Create lines between points based on distance

8- Find the shortest walk between these lines and the end points of the initial curve



9- Pipe the result curves and add spheres on its end point

Crassula

Succulent ring inspired by the unique "Buddha's Temple" plant.

Photo by Mohamed Adel

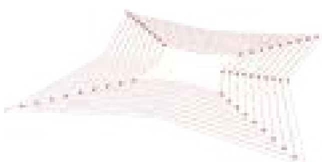
Size
450X450X275mm

Student
Mija Petreska (Macedonia)

Year
Summer Semester 2016

Form Generation

1- Create a series of curves

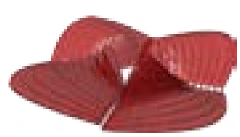


2- Divide the curves into 4 points

3- Use attraction point to pull the points toward it

4- Use the points to create closed parallel curves

5- Use the curves to create surfaces



6- Give thickness to the surfaces

Bionic Ring

Inspired from grass growing under the sea.

Size

90X70X5.7mm

Student

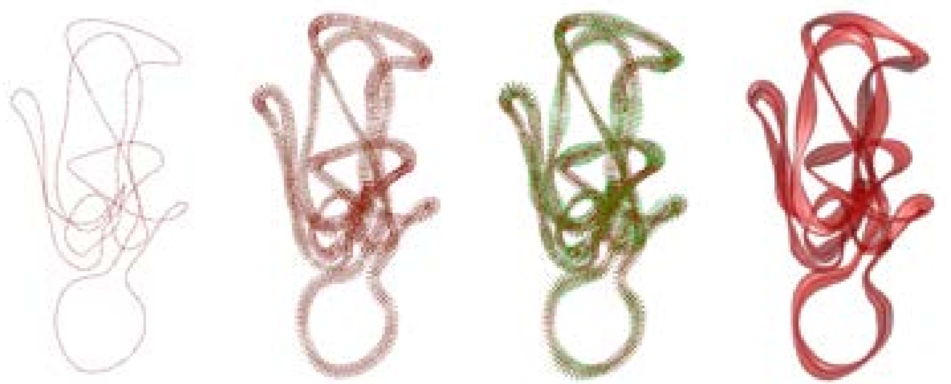
Biayna Khachik (Armenia)

Year

Summer Semester 2016

Photo by Mohamed Adel

Form Generation



1- Curve mimic sea grass

2- Array rectangle profile

3- Gradual rotation and scaling

4- Loft final profiles

Natur[mort]

An imitation of nature in an item closest to the human body.

Size

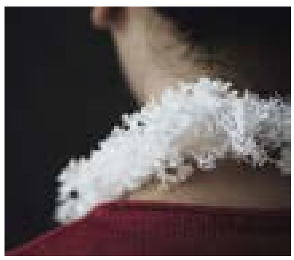
210X180X30mm

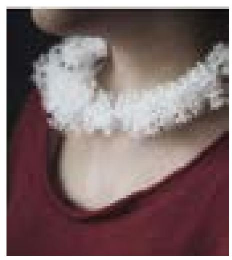
Student

Arpi Mangasaryan (Armenia)

Year

Summer Semester 2016





Photos by Mohamed Adel

Form Generation

1- Sub-divide the curve equally with perpendicular frames

2- Rotate the frames randomly around its center & create a cloud of points

3- Use the points and the planes to create branches using rabbit plugin.

The Cyclone

The framing of sections is realized by pipes which give the impression of the cyclone which starts with a drop and it turns till it comes back to the first quite position.

Size

80X70X50mm

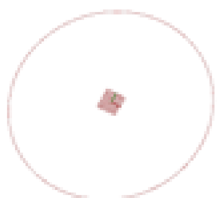
Student

Flaka Tahiri (Albania)

Year

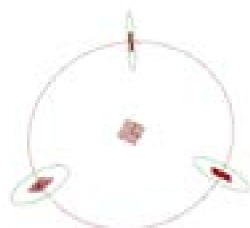
Summer Semester 2017

Form Generation



1- Start with simple curve

2- Align 3 frames on the circle



3- Create 3 circles on the frames

4- Create 3 circles on the frames

5- Create interpolate line through points

6- Pipe the curves

Amethyst

Inspired by the shape of the amethyst quartz. The idea is a reinterpretation of the quartz in a modern way.

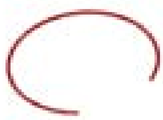
Size
90X70X5 mm

Student
Marina Panceri (Brazil)

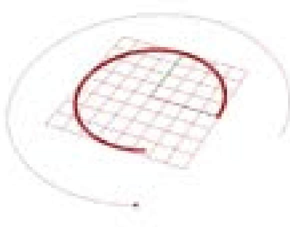
Year
Summer Semester 2017

Photo by Marina Panceri

Form Generation

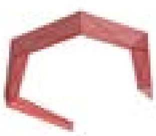


1- Create a curve and subdivide it to 100 points.

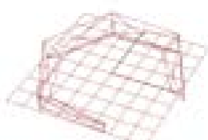


2-Offset the curve and place a point on it.

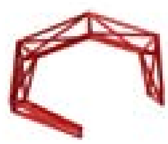
3- Place circles on the curve with radii size based on attraction point



4- Create triangular panels on the surface.



5- Isolate the panels edges



6- Pipe the edges

DNA Bracelet

Deoxyribonucleic acid is a molecule that carries the genetic instructions used in the growth, development, functioning and reproduction of all known living organisms and many viruses.

Size

77X70X90mm

Student

Loh Pei Zhen (Malaysia)

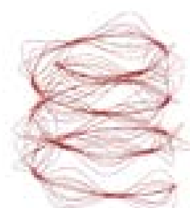
Year

Summer Semester 2017

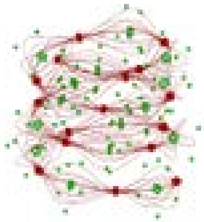
Form Generation

1- Starting from a spiral

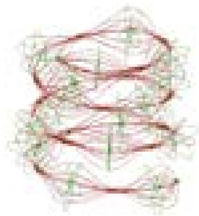
2- Subdivide the spiral & use even number points only



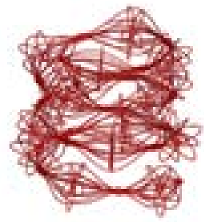
3- Create interpolate curve through points



4- Flip the matrix to choose points in other direction

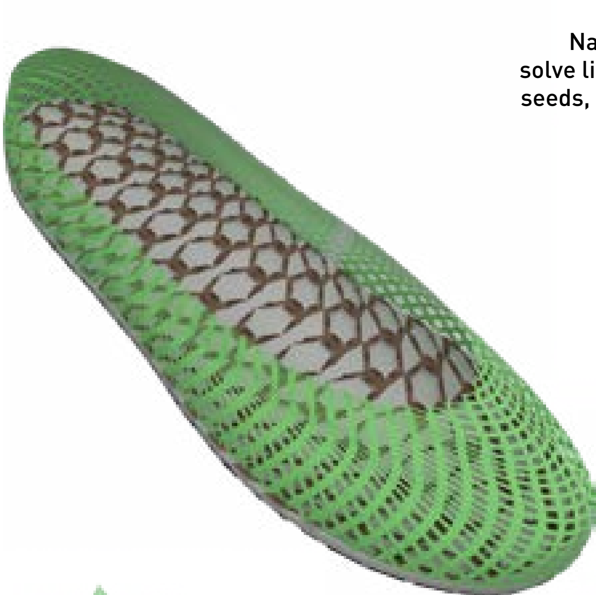


2- Subdivide the spiral & use even number points only



3- Create interpolate curve through points

Pine Cone



Nature always finds an amazing way to solve life's problems. In order to protect its seeds, pine cone has the ability to open and close in reaction to the water.

Size

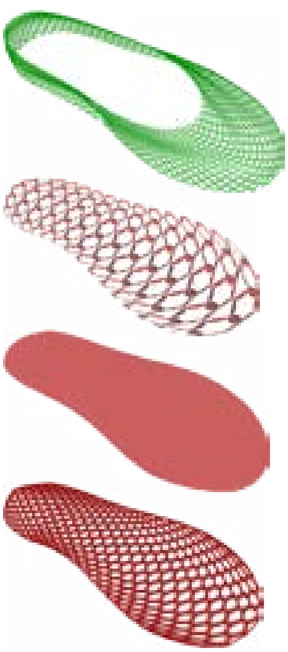
150X50X10mm

Student

Anahita Soleymani (Iran)

Year

Summer Semester 2017



Form Generation

Upper shoe:
made of Polyamide, comfort and dynamic

Bio insole
wooden cells react naturally to the moisture from feet. by opening the cells, circulation will happen and prevent to sweat the feet

Top sole:
mainly rubber, provide the contours of the foot maximum comfort

Lower sole:
the densest rubber available to ensure protection and from for the foot.

Furniture

meso

*“Structure is not just a means to a solution;
it’s also a principle and a passion”*

Marcel Breuer

Raising Bench

The raising bench can be deployed from a surface which was cut by different parts. Using cutting and folding method to create different shapes of bench.

Size

2000X1500mm

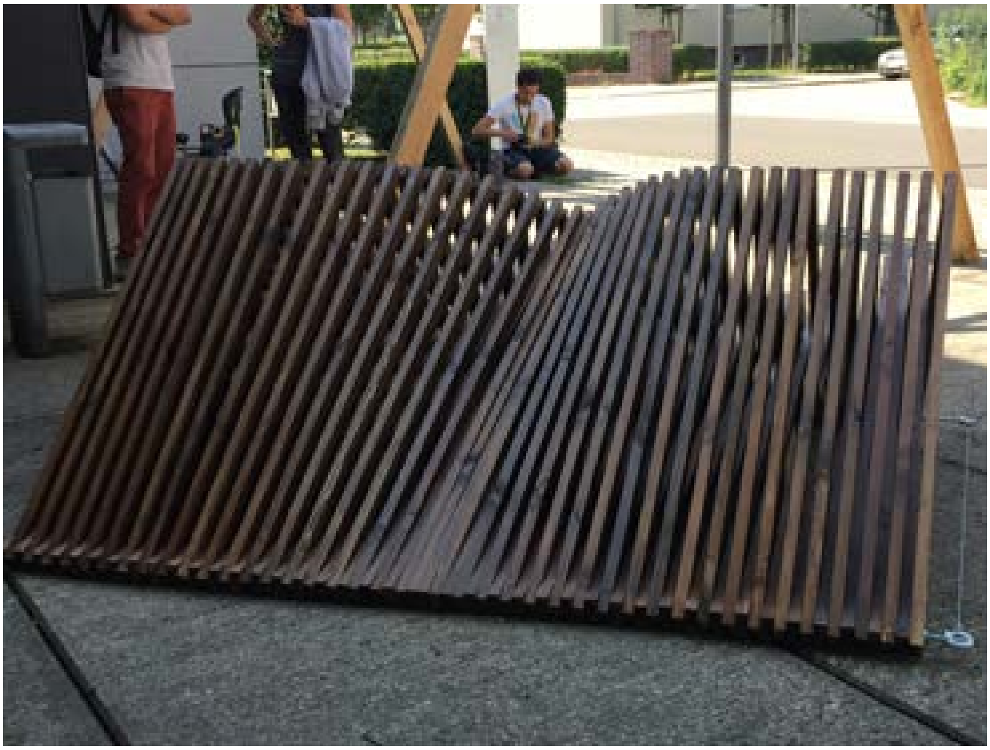
Student

Le Ngoc Anh (Vietnam)

Year

Summer Semester 2017

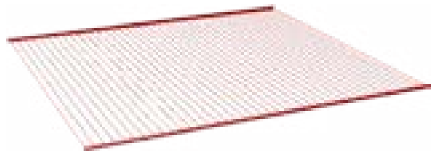
Photo by Marina Moron Frapolli



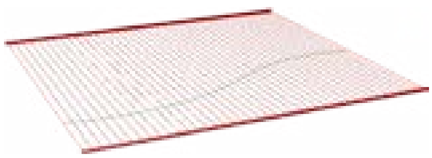
Photos by Karim Soliman

Form Generation

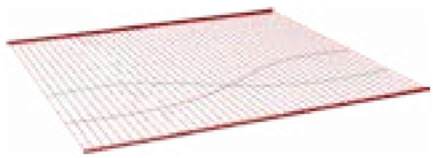
1- divide 2 Parallel lines into 80 different segments



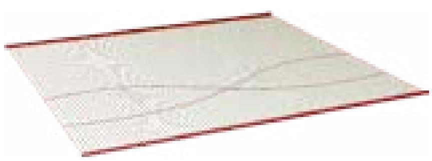
2- connect each 2 corresponding points on to create a line



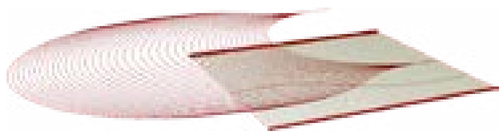
3- Use graph mapper to create an intersected curve



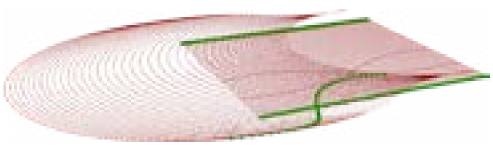
4- mirror the intersected curve using midpoint line as axis of rotation



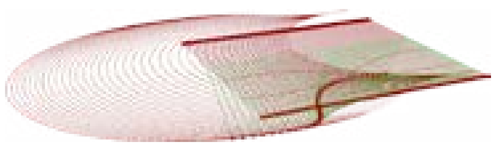
5- select all even number cures only



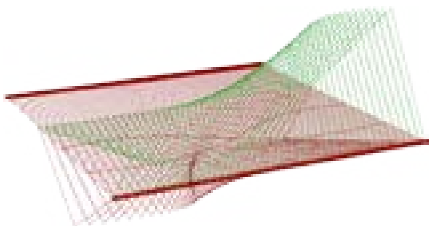
6- Creating arc using the corresponding points in each curve



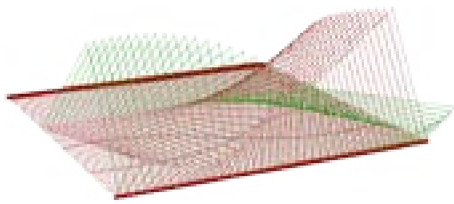
7- Select the intersecting points between the arcs and original curves



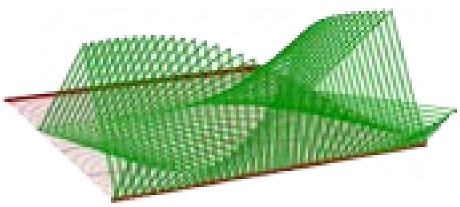
8- create lines using the 3 corresponding intersection points on the 3 curves



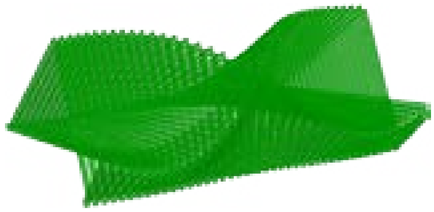
9- Rotate the curves 90 degrees



10- repeat the same process to the odd curves

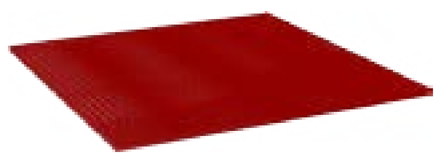


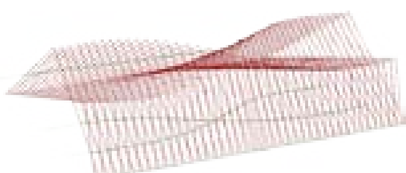
11- extrude the curves in direction of x axis

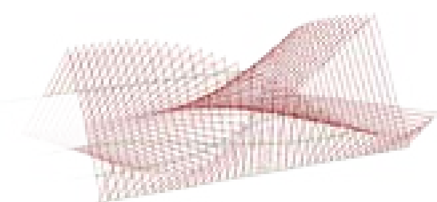


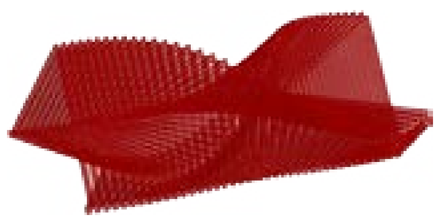
12- extrude the surfaces in direction of Y axis

Simulation for the folding mechanism









Butterfly Bench

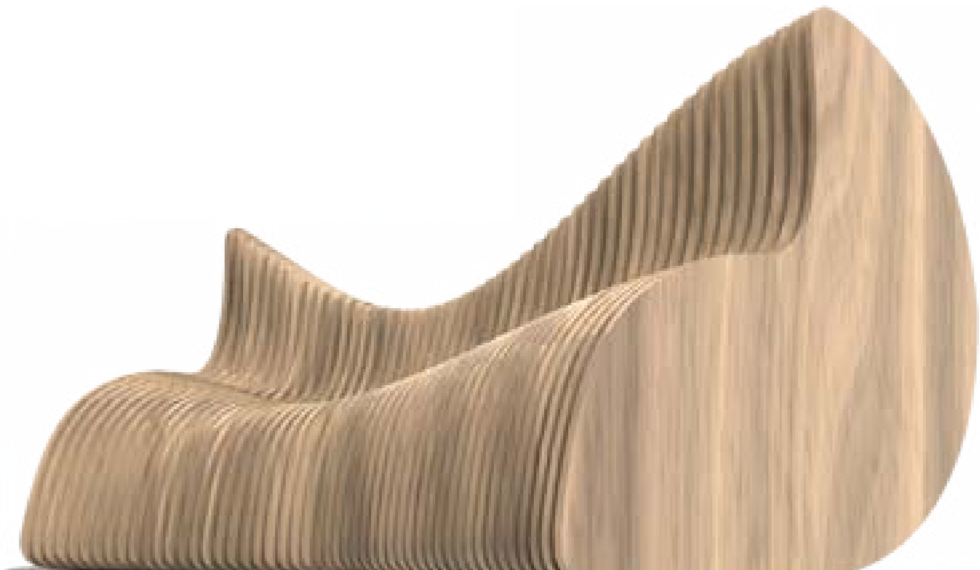
Modeling origin is the butterfly - the two wings to rely on the main back, we can control the parameters by sitting comfort. The middle part of the lower, can be used to place items or sit, lying. The parameters control the length of this part and the shape of the bench.

Students

Yong Han (China)
Xiaoyi Zhang (China)
Feier Ma (China)

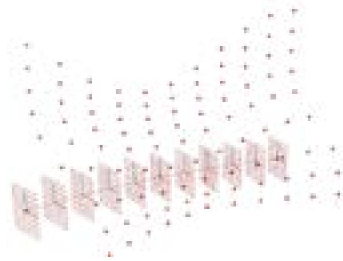
Year

Summer Semester 2017

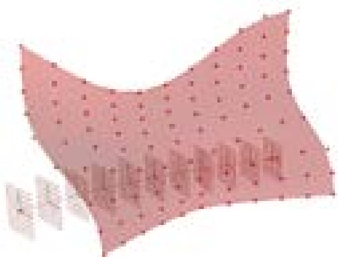


Form Generation

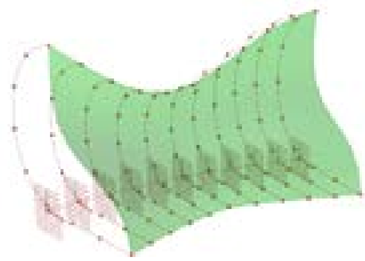
1- start by dividing a curve into equal distances by using v frames



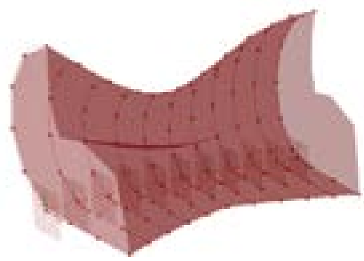
2- place curve on each vertical frame and divide the into equal number of points



3- Make a mesh out of the points

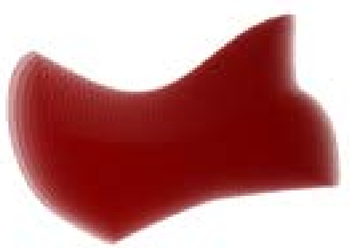


4- create the back of the bench using curves placed on the v frames

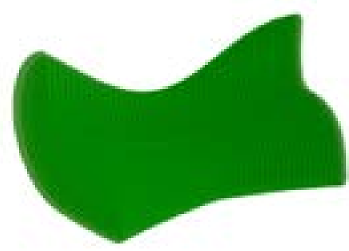


5- Create a mesh from all the points again

6- contour the mesh with equal vertical cross sections



7- create a surface out of each closed curve



8- extrude the surface with the thickness of the wood

Urban Carpet

The Urban Carpet provides a digitally fabricated surface that allows various organic postures while also allowing grass to grow through. It will provide a unique perspective of the iconic Bauhaus from a "worm's eye".

Size

2000X1200mm

Students

Rumi Singh Maharjan (Nepal)
Prana Shrestha (Nepal)

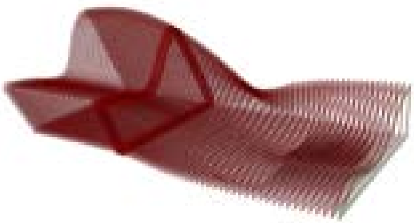
Year

Summer Semester 2017

Form Generation

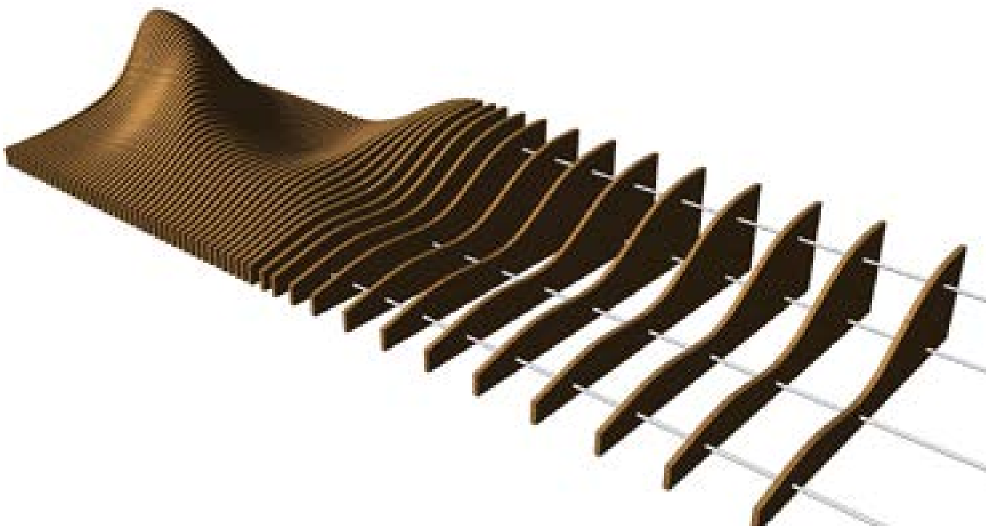
1- Starting with a pre-modelled surface in Rhino

2- Contour the surface every certain distance



3- offset the curves to give the cross sections thickness

4- Extrude the surface with the side of the wood will be used



Result is a multi functional seating element

Park 'n' Seat

The Park ‘n’ Seat bench is a parametric design based on the sectioning principle of parametric designing and conceptualized from the means of merging bike stand and seating together in a public space (parks, street, school etc.) hence the derivative of the PARK n SEAT name of the design.

Size

2000X1500mm

Student

Obayanju Oluwapelumi (Nigeria)

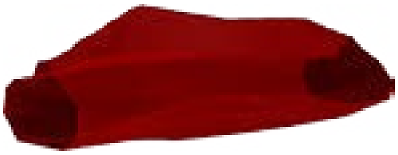
Year

Summer Semester 2017

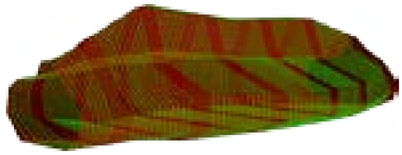
Photos by Karim Soliman

Photos by Karim Soliman

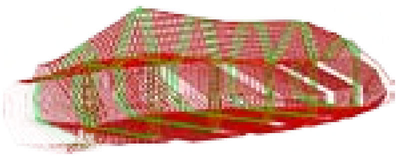
Form Generation



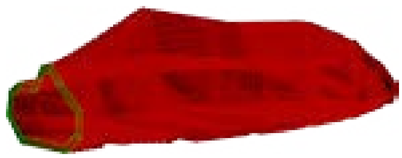
1- Starting from Surface



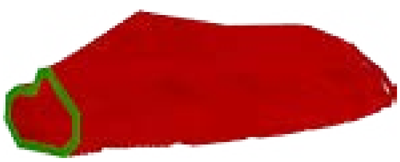
2- Contour the surface with equal distances



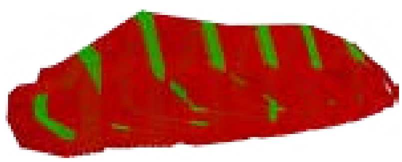
3- Subtract the distance for bikes



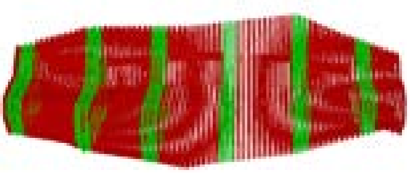
4- Offest the curve s inward then loft them



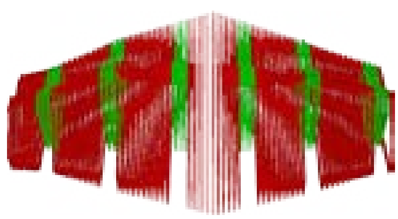
5- Extrude the lofted surface according to the wood thickness



6- Same process with the bike racks

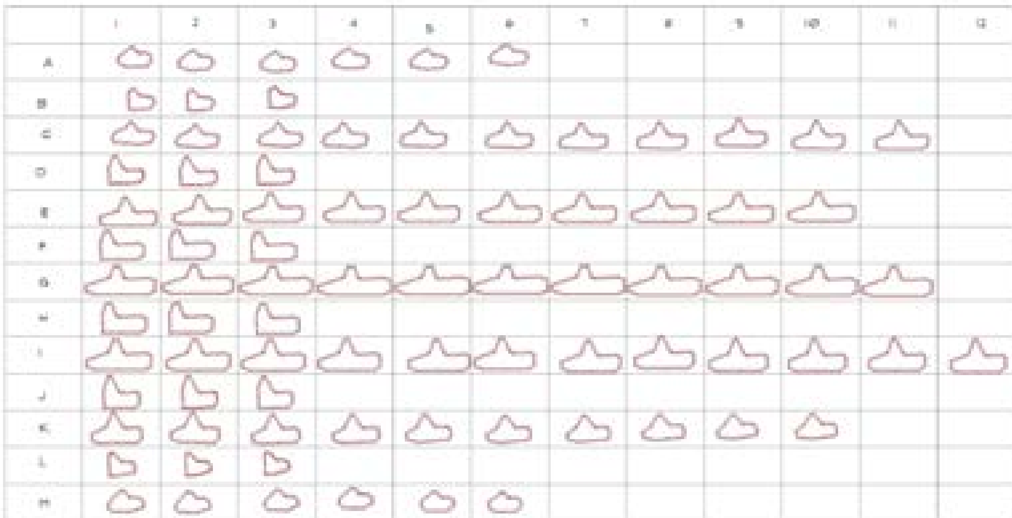


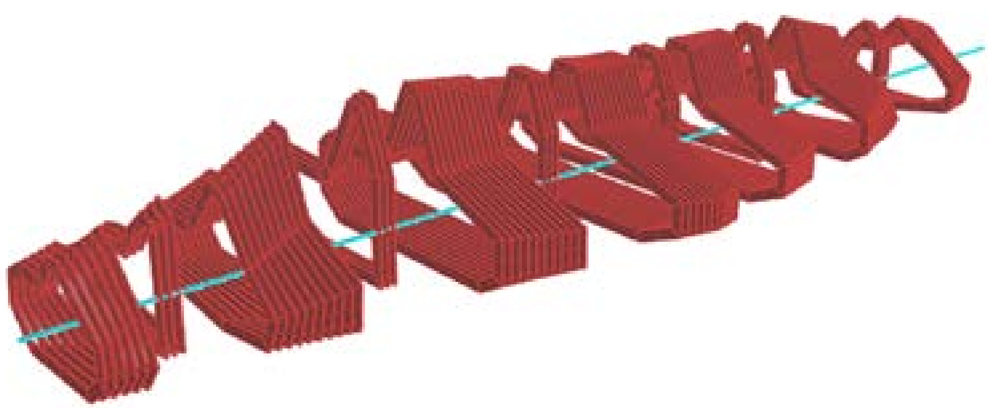
The final look from the bench side



The final look from the bike racks

Sheet ready to send CNC machine to cut profiles





It´s comprised of 65 wooden sections which are digitally fabricated with CNC Milling machine, these section are connected together with bolts and nuts to form the bench

Pavilions

macro

"You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete"

Buckminster Fuller

Photo by Mohamed Eid

Hex-316

"HEX 316" - A pavilion designed to exhibit 12 parametrically designed Jewelry pieces designed by students during the 2017-year end campus festival. It is designed concentrically on site with a cantilevered entrance. The parametric structure is made out of 316 hexagonal shaped cells with 3 different types of modules each serving a different function. The cells were generated with patterns to create internally and externally faces. The openings gradually increase toward the cantilevered structure in order to create openings at eye level and reduce the weight on the cantilevered structure. The cells are built from 6mm thick corrugated cardboard. All the cells consist of two components - the facing and the framing. Cardboard is cut, scored and folded to create these components and bolted together.

Size

5500X6000X3300mm

Students

Michelle Chung Chien Yin (Malaysia)
Leong Chee Chung (Malaysia)
Pua Wan Ling (Malaysia)
Lee Xiao Hui (Malaysia)

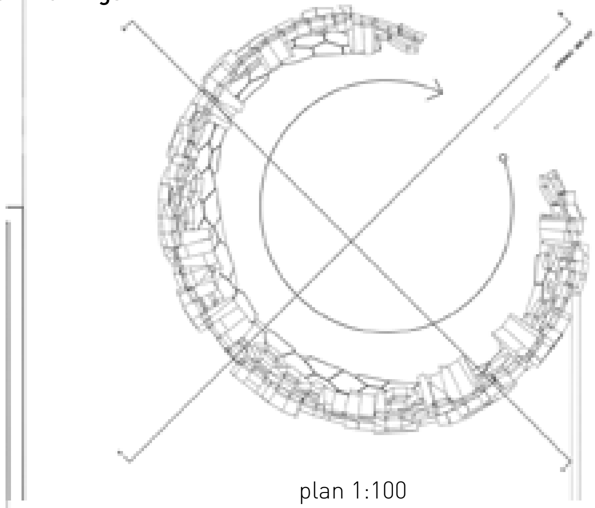
Year

Summer Semester 2017

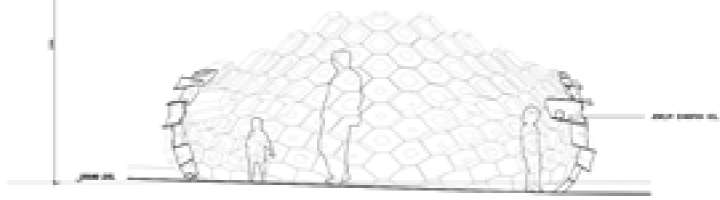
Construction Team

Teh Tsu Tsen
Li Chen Yu
Anh Ngoc Le
Bao Ngoc Tran
Anahita Soleymani
Loh Pei Zhen
Joann Liew Yii Ning
Zhang Xiao Yi
Feier Ma
Yong Han
Choong Wan Huey
Lee Kim Yong
Martin Wong Tuong Ying
Matthias Liew
Arise Wan
Alex Sia Hong Rui
Amily Tan Woan Tyng
Prana Shrestha
Rumi Singh Maharjan
Olumide Damilola Ogeye
PardisZarghami
Luke Kam Lung Kong
Boo Chie Ping
Chin Yan Jun
Lim MengYeow
FlakaTahiri
Keerthna Raveendran
Kanika Talwar
Obayanju Oluwapelumi
Marina Panceri de Souza
Polina Moskalenko
Loo Man Lok
Daniel Ciepelinski
Rami Ali
Hopeton Bartley
Fan Zi Ming
Joao Pedro Chaves Hauer

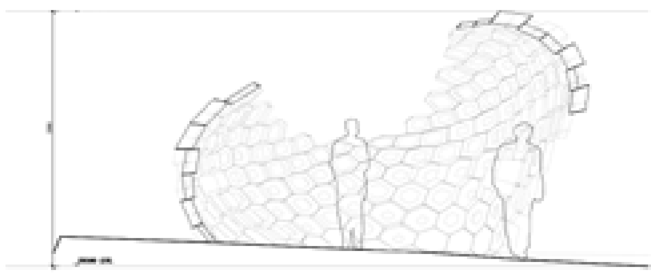
Architectural Drawings



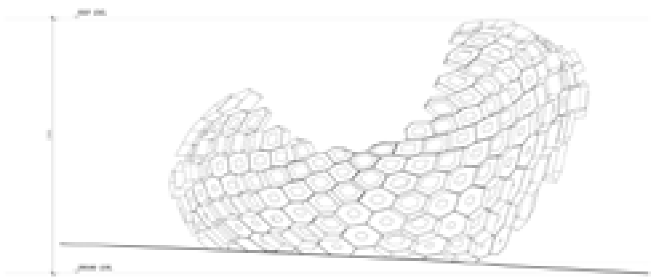
plan 1:100



Section AA

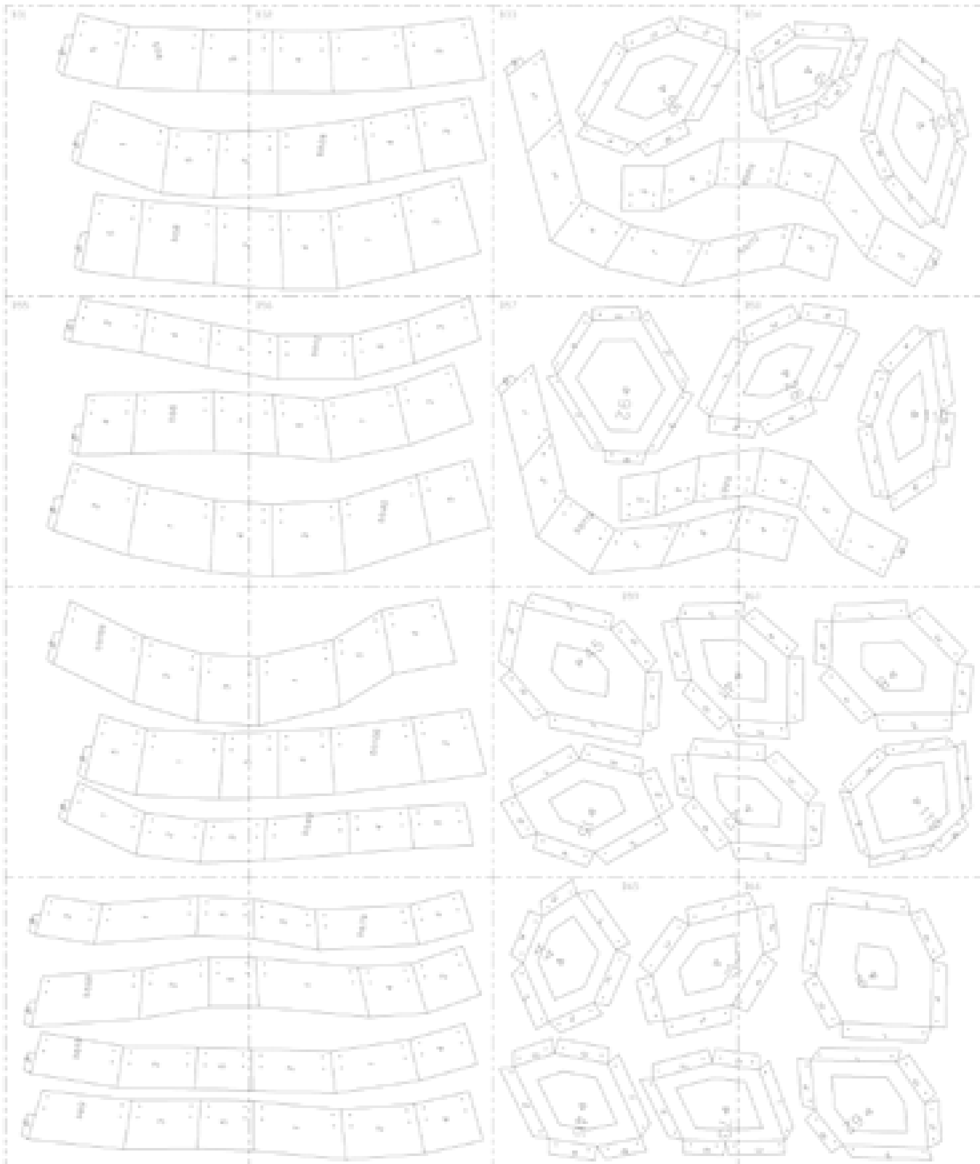


Section BB



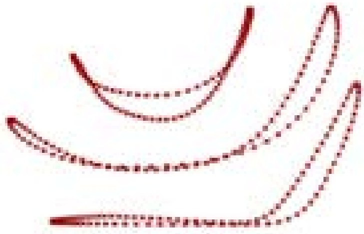
Side Elevation

Cutting Sheets sample

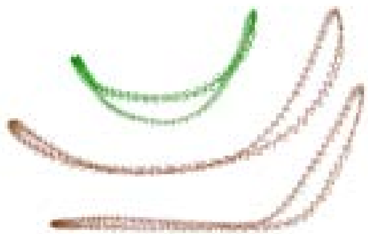


Form Generation

1- Create 3 curves defines the structure outline

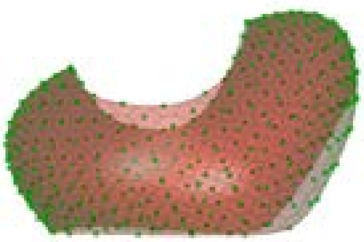


2- divide each curves to equal number of points

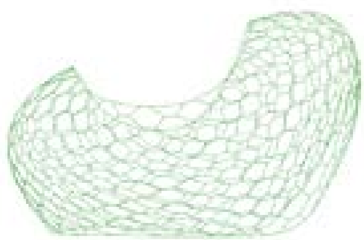


3- control the order of points to make sure they have the same order in 3 curves

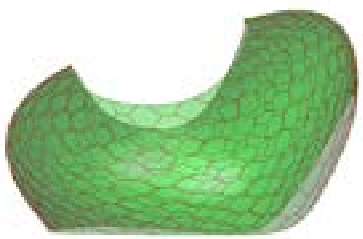
4- after rebuilding the curves , we loft them



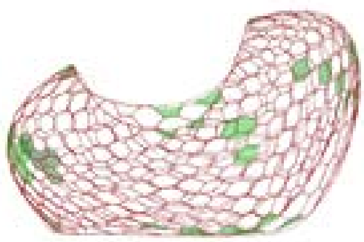
5- divide the surface to hexagons using lunchbox



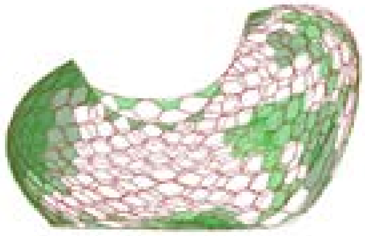
6- remove the duplicated curves and convert them into one net



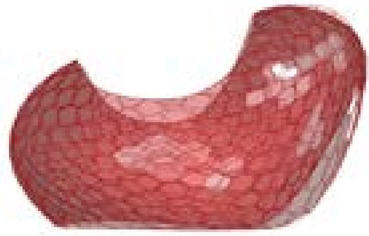
7- using the net and the surface as inputs to Kangaroo



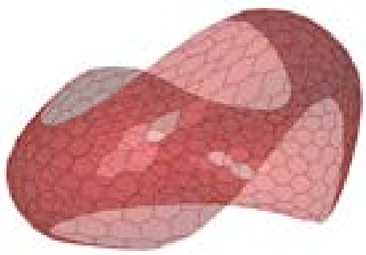
8- define the affecting forces on the structure to use in Kangaroo



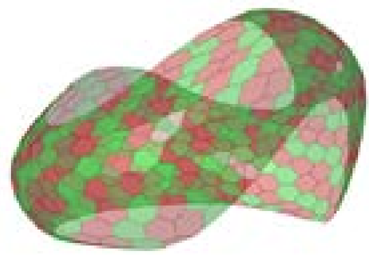
9- Run simulation in Kangaroo to plannar each hexagon



10- the process take some time to calculate

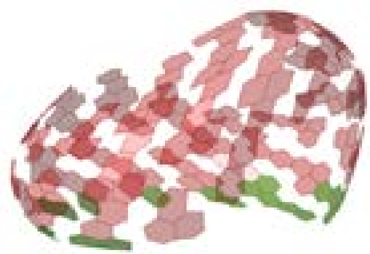


11- Once all hexagons are planer we are ready to create the cells



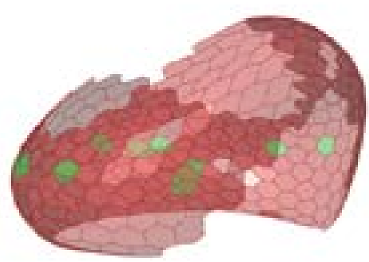
12- divide the cells into 2 groups using pattern

13- Isolate the base components in one list



14- now the 2 groups doesn't include the bas cells

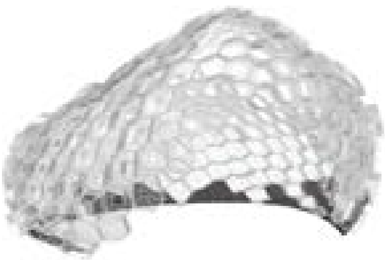
15- repeat the same process to isolate the showcases cells



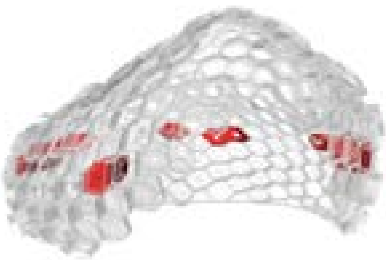
16- the result we have 4 different list to design

Pavilion Anatomy

Digital 3d model for the pavilion



Location of the double faced base



Location of jewelery showcases

Location of inward components

Location of outward components

Photos by Mohamed Eid


Photo by Mohamed Eid

Photos by Mohamed Eid

Photo by Esther Pua Wan Ling

Photo by Esther Pua Wan Ling


P

Weave

Students

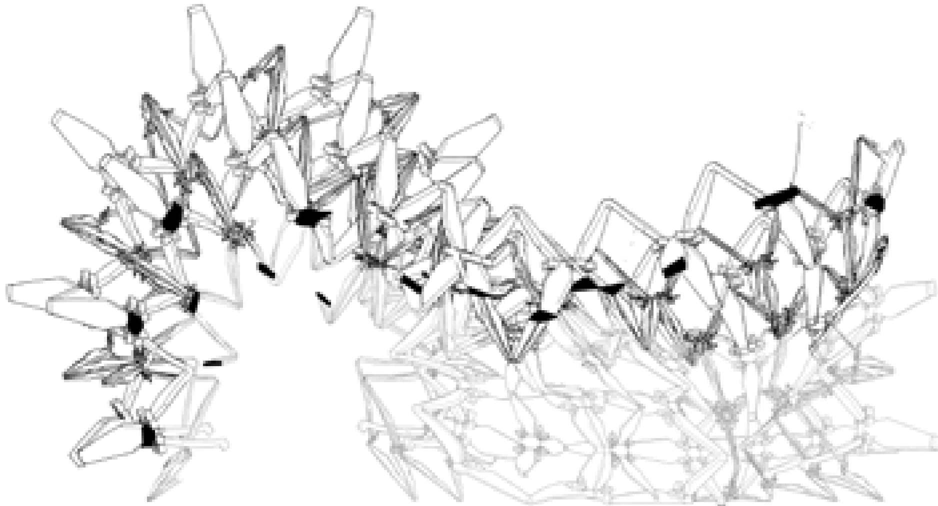
Khai Wei Tan (Malaysia)

Lora Krannich (Germany)

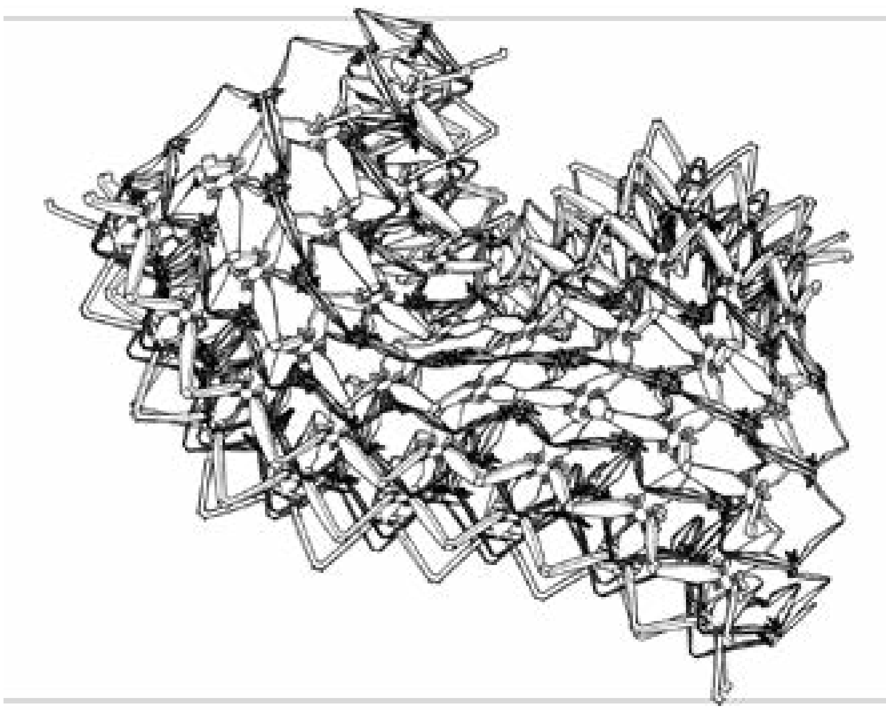
Tsz Ming (Matthew) Wong (Hong Kong)

Year

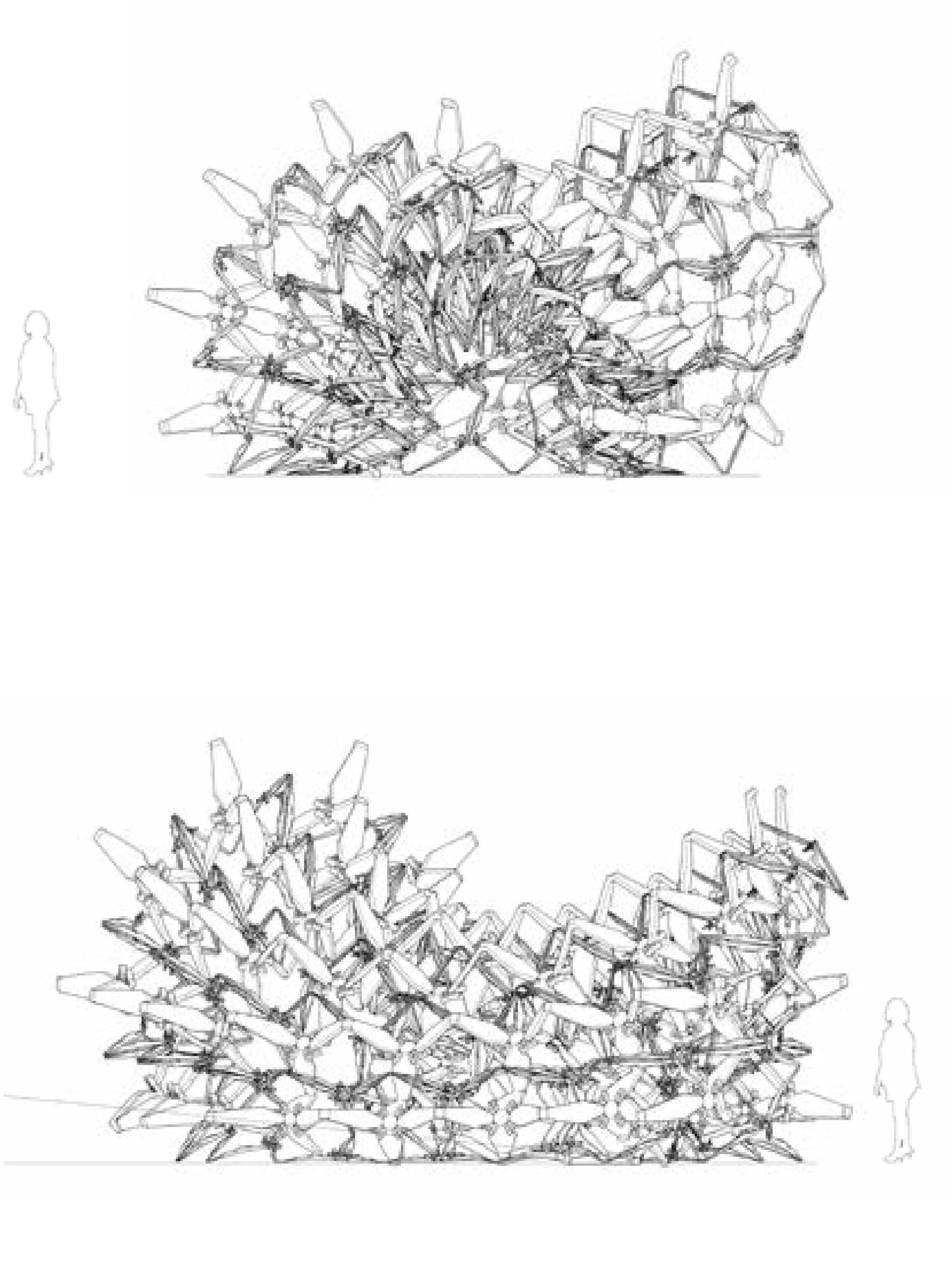
Summer Semester 2016



Section



Plan



Elevations

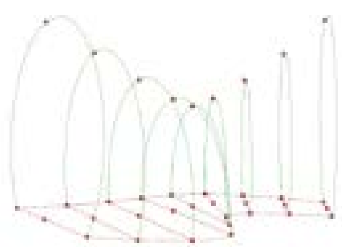
Form Generation

1- Create 2 curves defines the structure outline and divide them into 10 parts

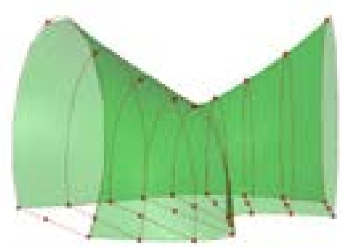
2- create a line between every 2 corresponding points

3- find the mid point of these new lines

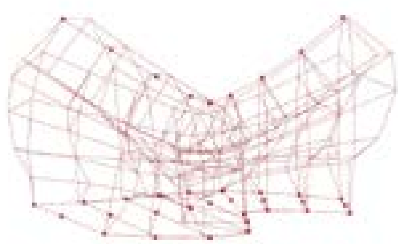
4- move the mid-points using a graph mapper in direction of Z axis



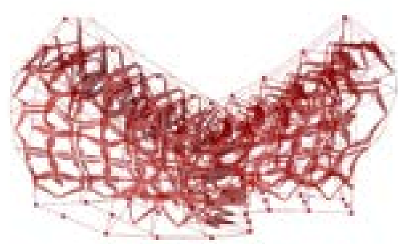
5- create an arc between the 3 points



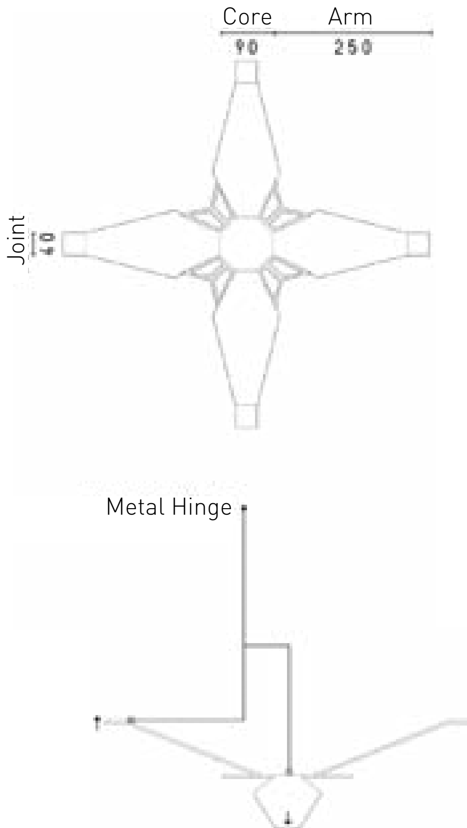
6- loft the curves to get a surface

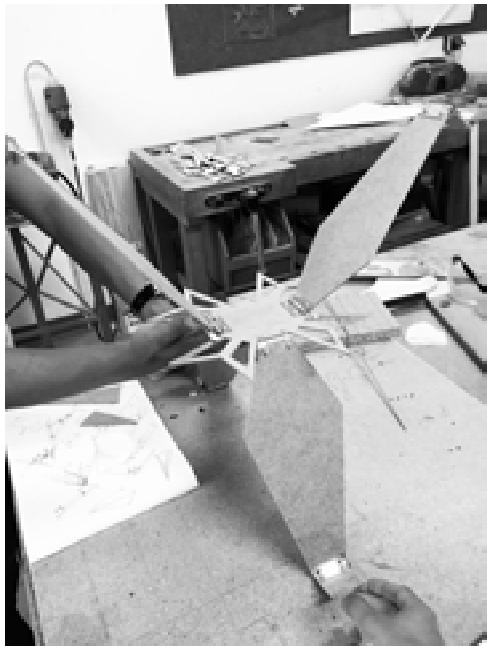


7- divide the surface into equal domains and place rectangular boxed on these domains

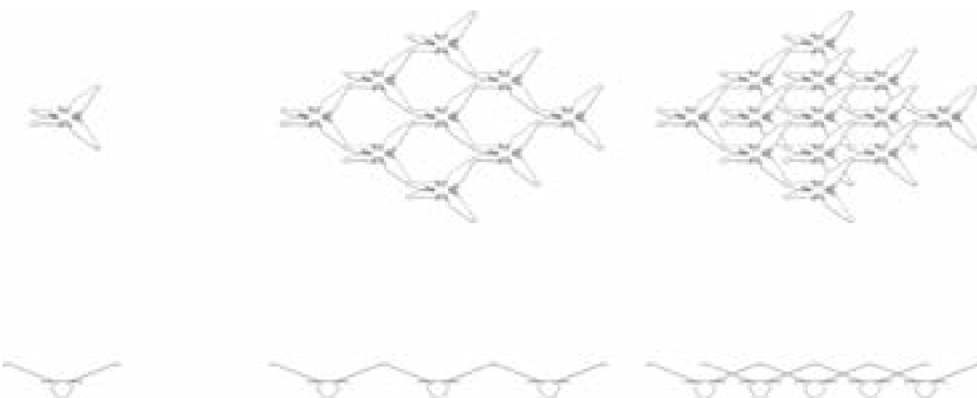


8- morph the component that have been designed earlier on the surface





Component dimension



Modular weaving

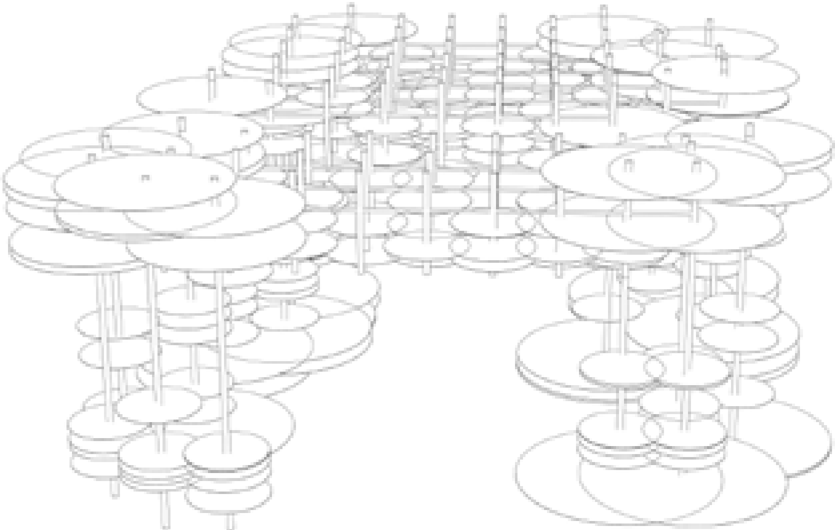
Surfaces Pavilion

Students

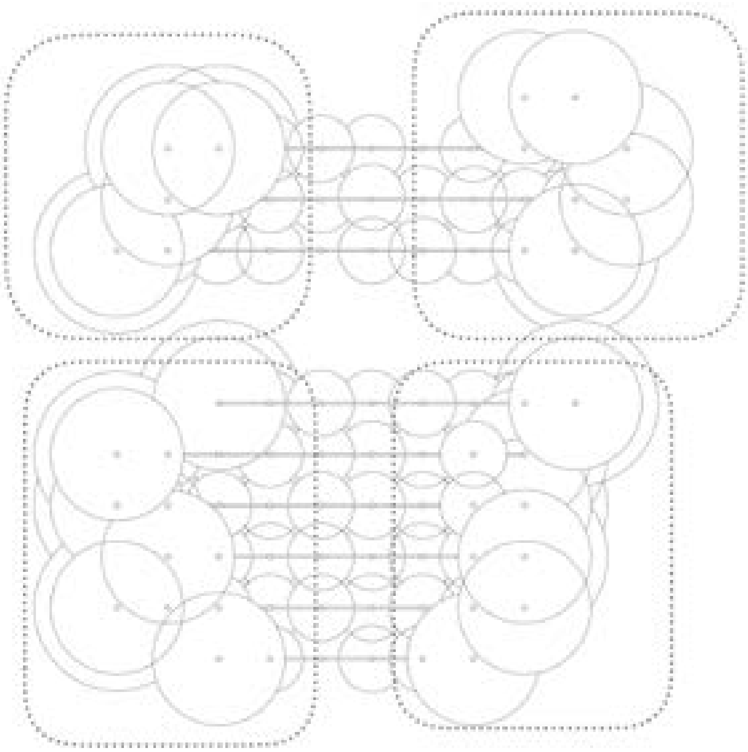
Luis Cedeno Cenci (Panama)
Jeng Foong Low (Malaysia)
Chan Hon Yoon (Malaysia)

Year

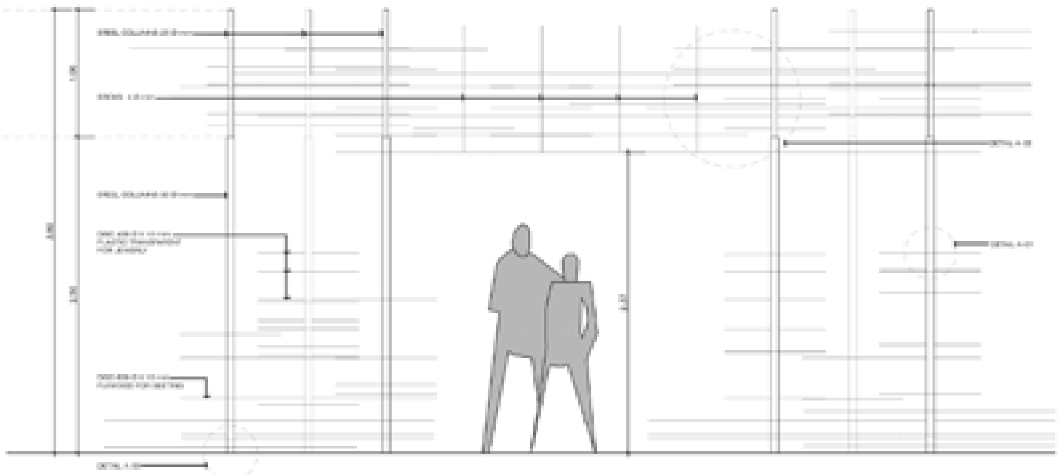
Summer Semester 2016



Perspective



Plan



Elevation

Looking up through the transparent plates

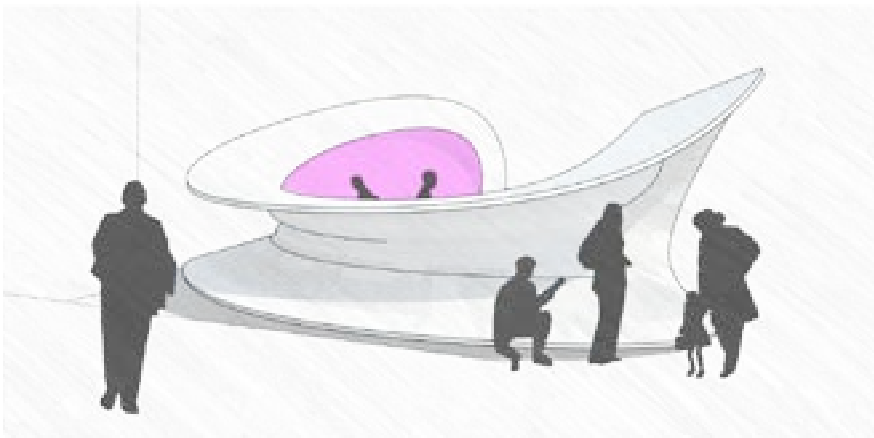
In & Out Pavilion

Students

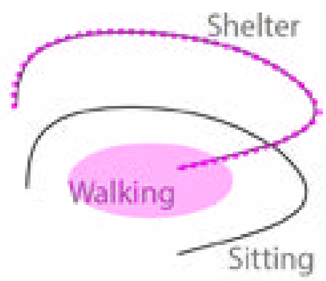
Minjeong Kang (South Korea)
Mohamed Ied (Egypt)
Mohamed Abdelmonem (Egypt)

Year

Summer Semester 2016

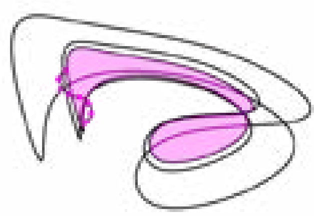


Define the area according to a circulation

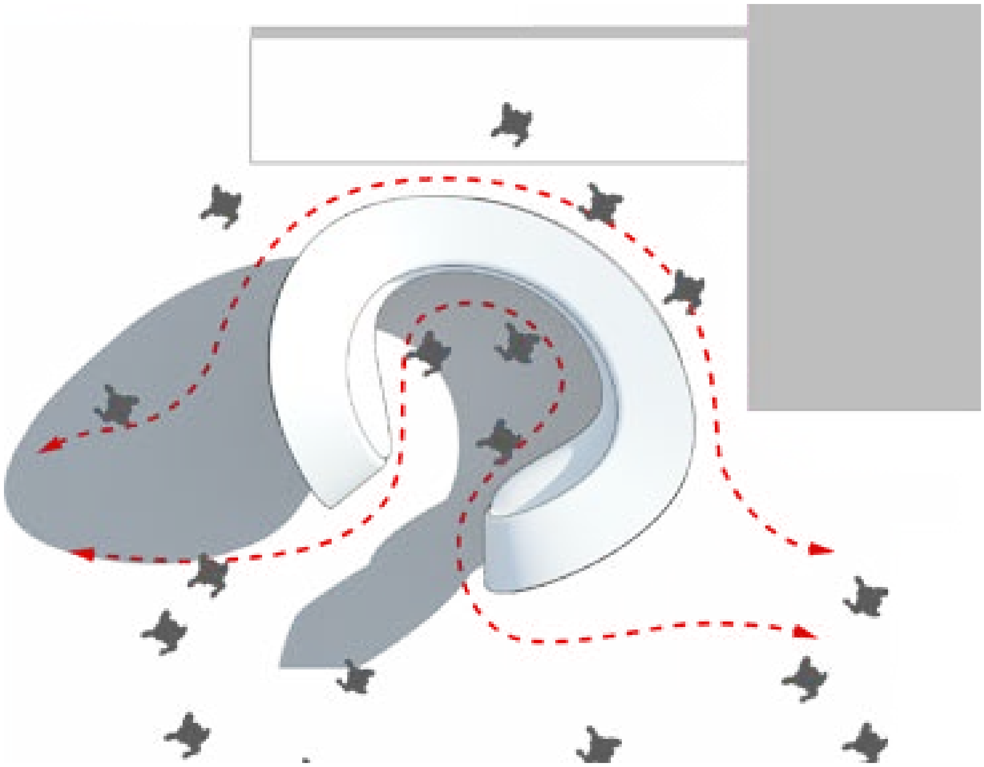


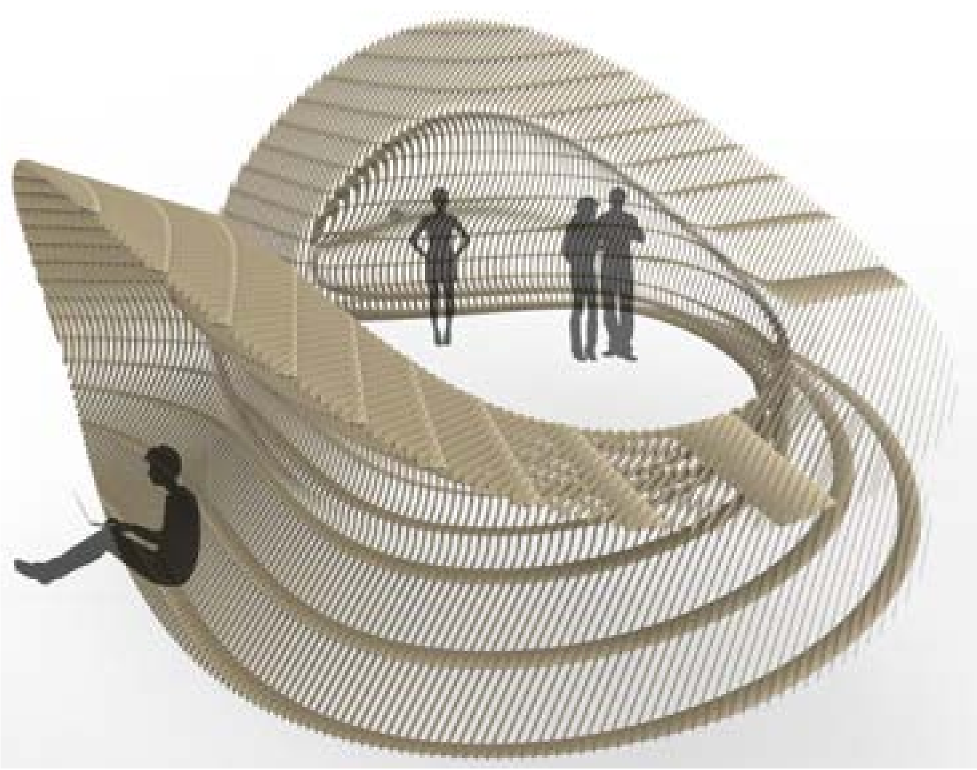
Creating shade

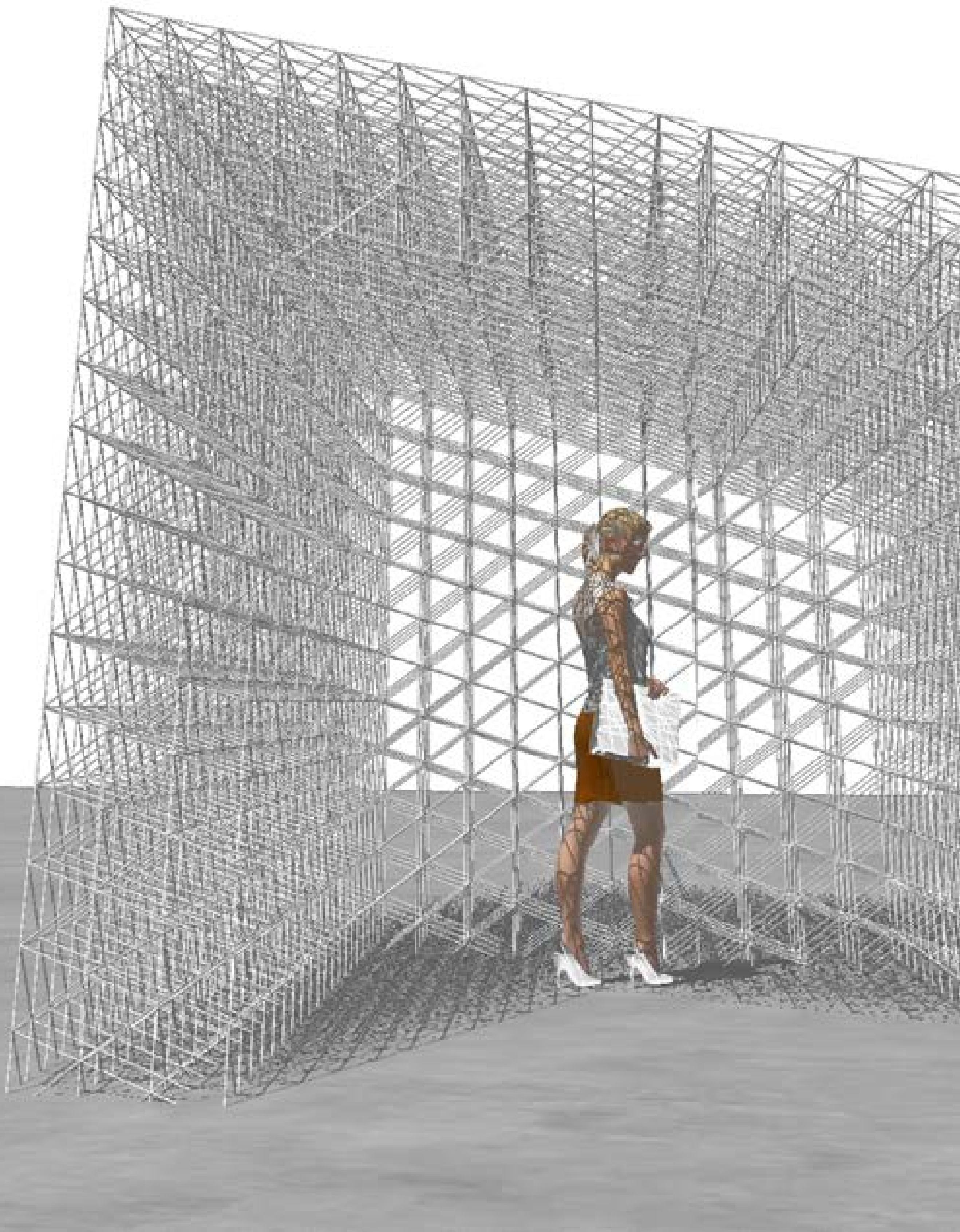
Continuity

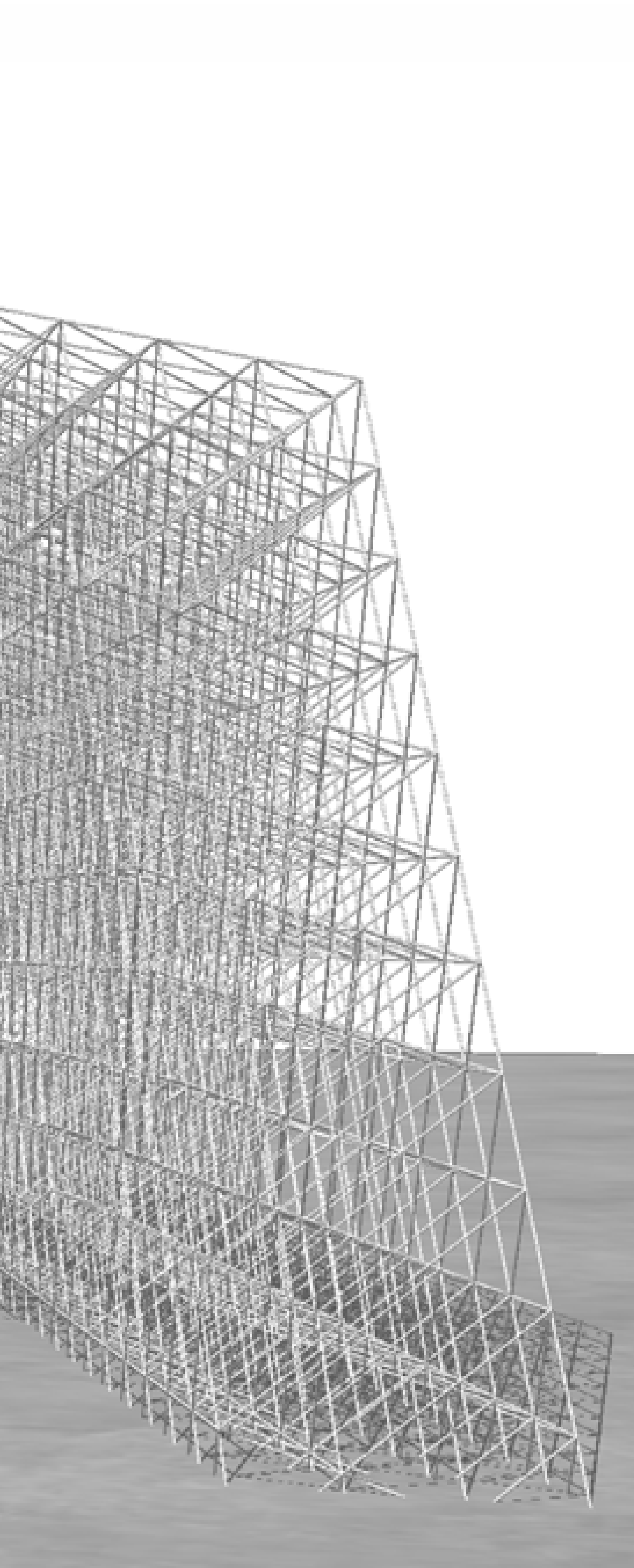


Jewelery exhibition









Straw

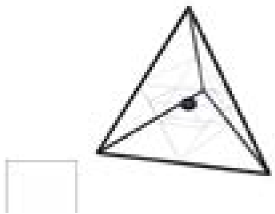
Students

Elena Shepeleva (Russia)
Ryan Gustafson (United States)
Gabriel Traknyak (United States)

Year

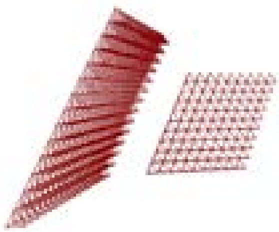
Summer Semester 2016

Form Generation

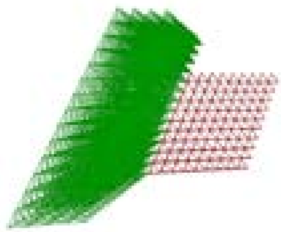


1- starting from a wireframe pyramid

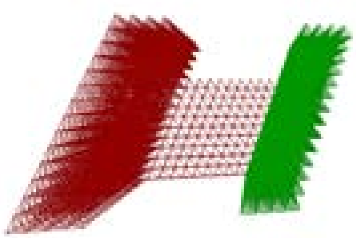
2- array the pyramid in one direction



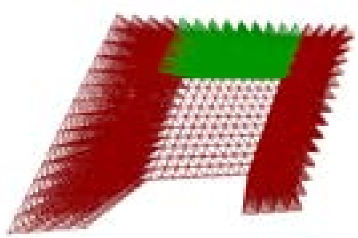
3- Array the row of pyramids in Z axis



4- copy the wall of pyramids to create one side

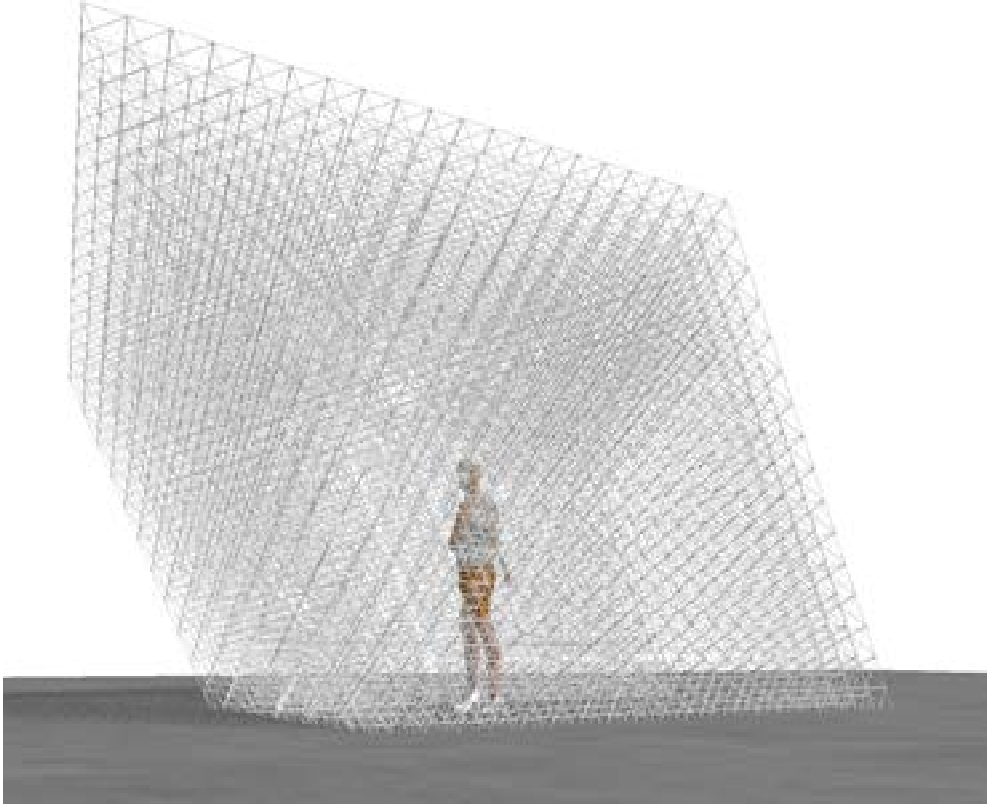


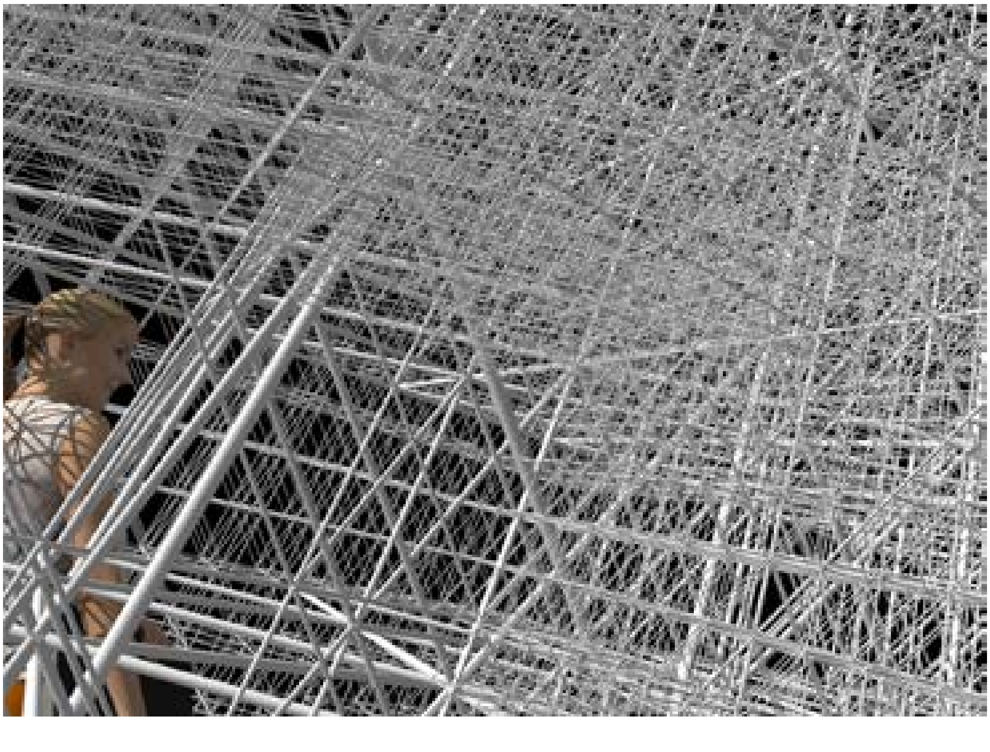
5- move a copy of the first side to create the second side



6- create the roof with another wall of pyramids straws

This is how are the joints between straws are made





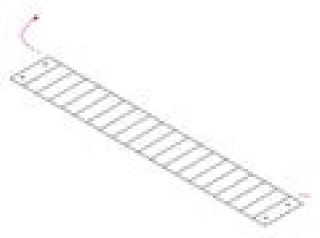
Roll

Students

Ali Shujaat Naqvi (Pakistan)
Tuğçe Kuruçay (Turkey)
Yiğit Tuncel (Turkey)

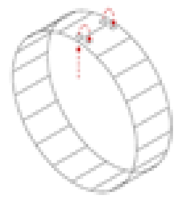
Year

Summer Semester 2016

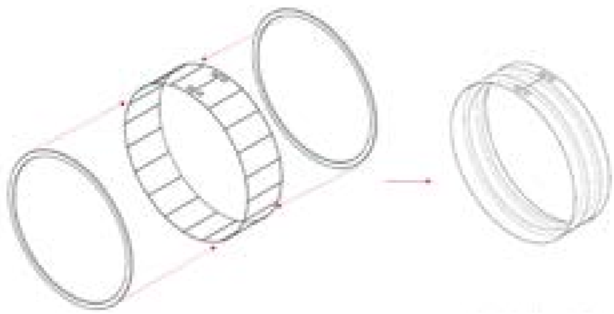


Laser cut cardboard strips

Creating proposed geometry

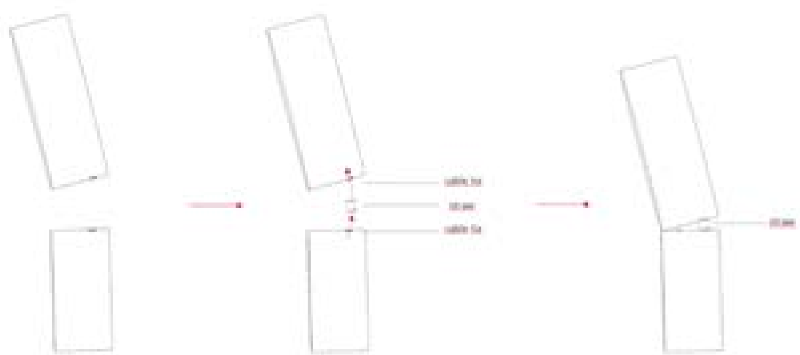


Linking up with cable ties

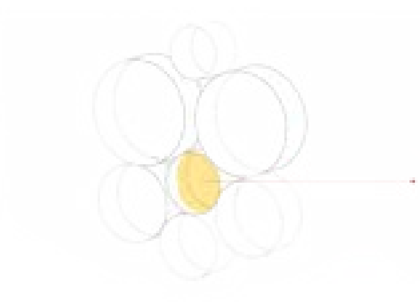


Adding two profiles into the circle

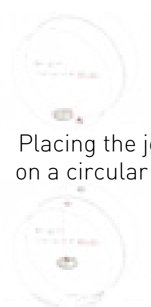
One circle with two profiles



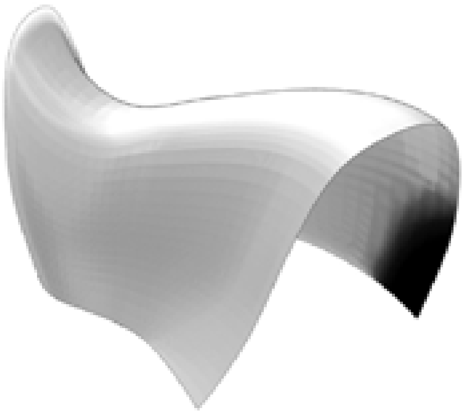
Connecting modules with straw to make the
modules angled



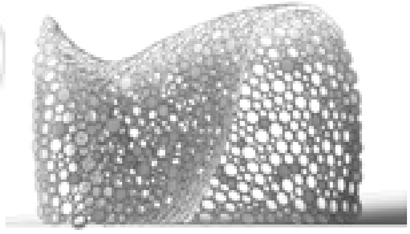
Four types of module
with different diameter

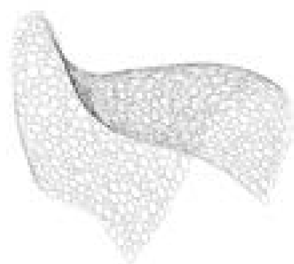


Placing the jewelery
on a circular surface



Base Surface





Profile curves

The Surface

Circle Packing

Photo by Pavel Babienko

Jewelry Pavilion

'DIA 3D-Jewelry pavilion' is a low cost cardboard pavilion parametrically designed to exhibit 20 sets of 3d Printed prototypes jewelry. Printed in plastic. The fabrication process was manually cutting and assembling 215 A0 cardboard sheets to create 215 unique components which are the pavilion build from.

The materials that were used consist of 215 sheets of 6mm thick cardboard, and for the joint we used plastic zip ties and clippers.

Size

6000X6500X3600mm

Students

Nabil Rajjoub (Syria)
Ilya Safronov (Russia)
Orlen Ramzoti (Albania)

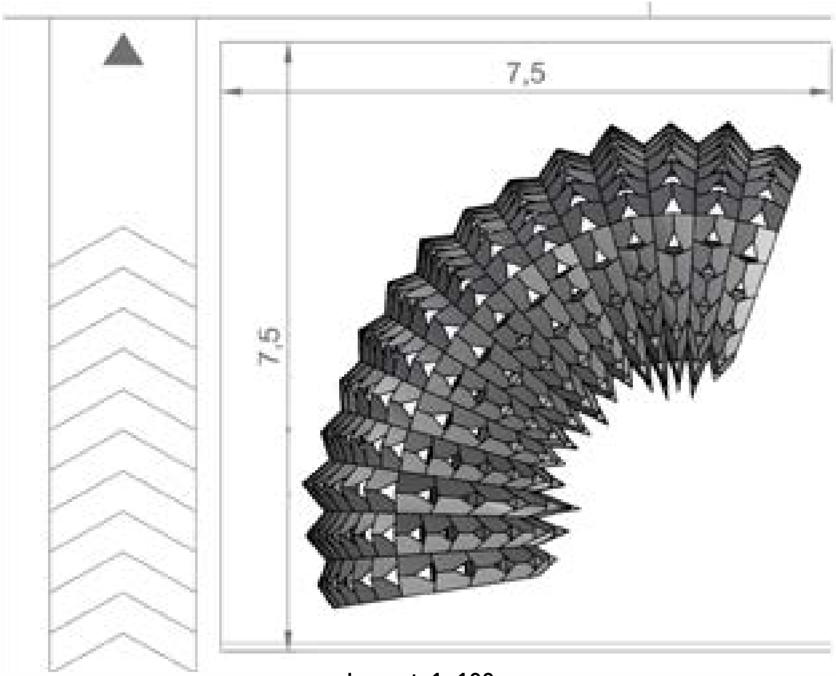
Year

Summer Semester 2016

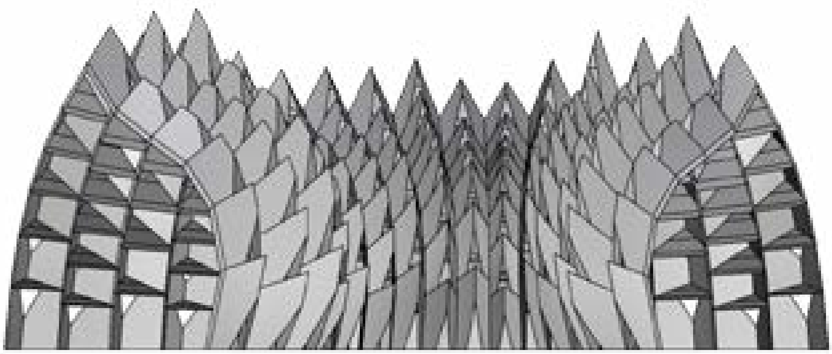
Construction Team

Luis Alberto
Chan Hon Yoon
John Barry Gimutao
Alina Safiullina
Hanna Maksymenko
Juan Pablo Lee Becerra
Blanca Tovar
Zachary Wilson
Anjali Ramachandran
Anastasija Palagina
Arian Sefiu
Bardhil Kasami
Teya Koleva
Mohamed Abdelmonem
Mohammed Eid
Minjeong Kang
Ryan Gustafson
Gabriel Traknyak
Elena Shepeleva
Tugce kurucay
Ali Shujaat Naqvi
Khai Wei Tan
Larissa Krannich
Nathan Ashton
Gulce kurucay
Ka Ki Lam

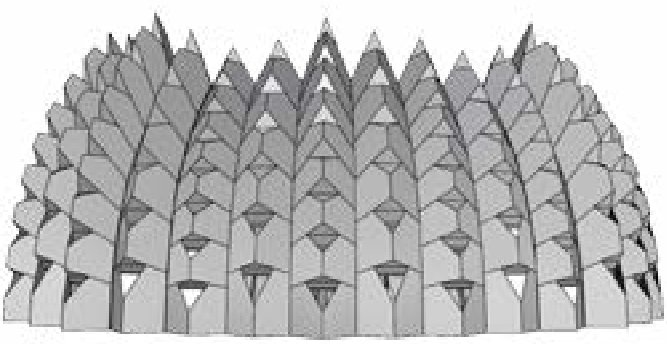
Architectural Drawings



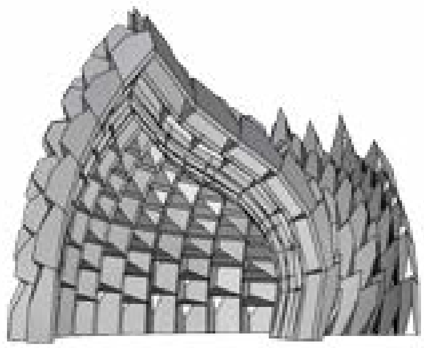
Layout 1: 100



Main Elevation 1:100



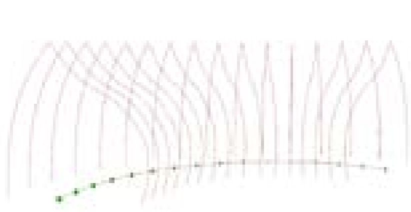
Back Elevation 1:100



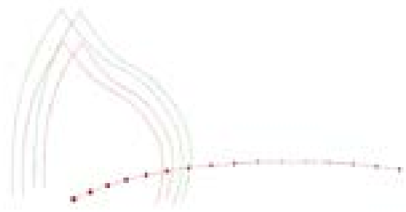
Side Elevation 1:100

Cutting Sheets sample

Form Generation



1- place 16 profile curve along the curve represent the path

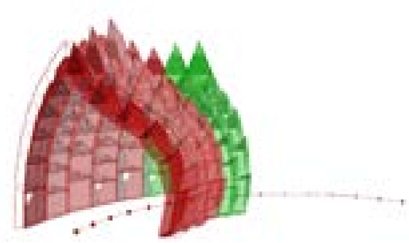


2- scale these curve up to create another set of 16 curves

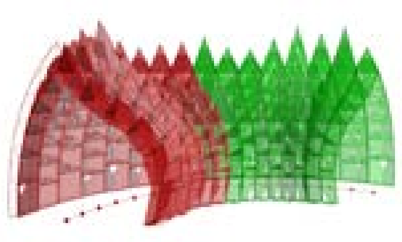
3- create a surface with every 2 sequenced curves in the 2 sets

4- place a bounding box along the 2 surfaces

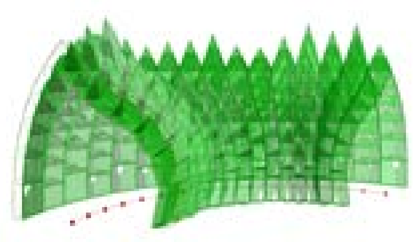
5- place the pavilion component in each bounding box



6- repeat the same process with each curve of th 16



7- make sure that all components facing the same direction



8-as a result you have 216 component creating 16 arches




Photos by Laurian Ghinitoiu


Photo by Laurian Ghinitoiu

Photo by Laurian Ghinitoiu

Photo by Laurian Ghinitoiu

Photo by Laurian Ghinitoiu

Photo by Pavel Babienko

Photo by Pavel Babienko


Dann kommen Sie

Work Process

Photos by Karim Soliman


Photo by Karim Soliman


Photo by Karim Soliman


Photo by Karim Soliman


Photo by Mohamed Eid


Re-assembly the Hex 316 Pavilion inside the foyer of building 8 Bauhausstrasse, Dessau
Photo by Esther Pua Wan Ling

Photo by Karim Soliman

Photo by Mohamed Eid

Photo by Mohamed Eid

Photo by Marina moron Frapolli

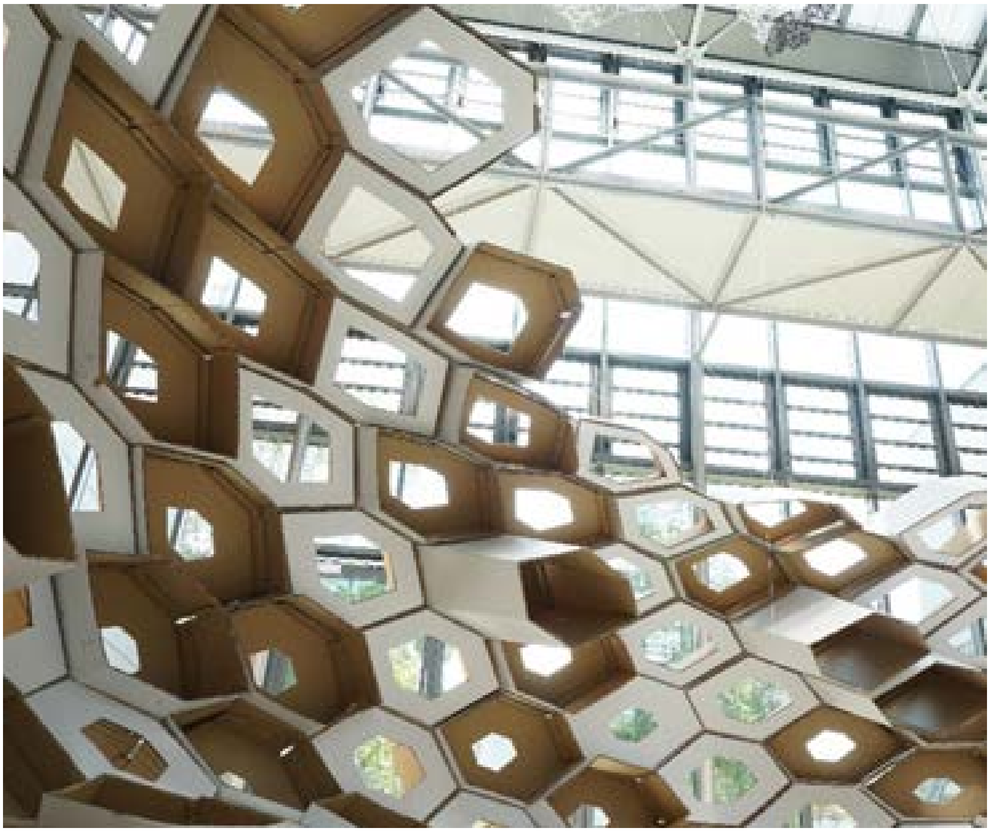


Photo by Esther Pua Wan Ling


Photo by Pavel Babienko


Photo by Pavel Babienko


Photo by Pavel Babienko


Photo by Pavel Babienko


Re-assembly of the Jewelry Pavilion in Kothen for the 25 anniversary of Hochschule Anhalt - Photo by Karim Soliman

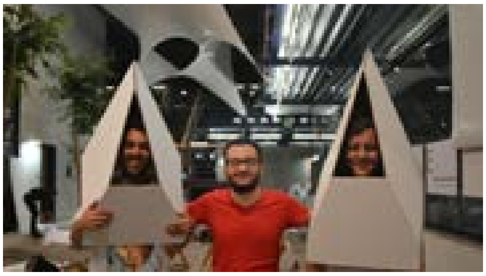


Photo by Mohamed Adel

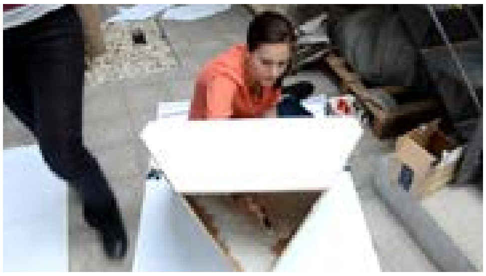


Photo by Mohamed Eid


Photo by Mohamed Eid


Photo by Marina moron Frapolli

Source Files

Micro (Jewelery)

QR Code no. 1, Page 12, Project Hex Bracelet :
https://drive.google.com/open?id=0B0FyNSTpzKvqSFNxck9xa3BNWWM

QR Code no. 2, Page 13, Project Marina :
https://drive.google.com/open?id=0B0FyNSTpzKvqQ1BldzBBT2dUb2s

QR Code no. 3, Page 14, Project Acra :
https://drive.google.com/open?id=0B0FyNSTpzKvqdWdjdXhDRG5ESFU

QR Code no. 4, Page 15, Project Allie :
https://drive.google.com/open?id=0B0FyNSTpzKvqeE5FSzJ0dDRKdEU

QR Code no. 5, Page 16, Project Coral Spine :
https://drive.google.com/open?id=0B0FyNSTpzKvqZkxiR1JuZ3MxMTA

QR Code no. 6, Page 17, Project Succulent :
https://drive.google.com/open?id=0B0FyNSTpzKvqc1BnNURaNnVsQkk

QR Code no. 7, Page 18, Project Cnidaria :
https://drive.google.com/open?id=0B0FyNSTpzKvqVDVMWGxPeFV4X0U

QR Code no. 8, Page 19, Project Crassula :
https://drive.google.com/open?id=0B0FyNSTpzKvqcE9seW9rTnBZUHc

QR Code no. 9, Page 20, Project Bionic Ring :
https://drive.google.com/open?id=0B0FyNSTpzKvqNk1lSFpXN1EzSkk

QR Code no. 10, Page 21, Project Natur[mort] :
https://drive.google.com/open?id=0B0FyNSTpzKvqa0FzTmpiTG5IMTg

QR Code no. 11, Page 22, Project The Cyclone :
https://drive.google.com/open?id=0B0FyNSTpzKvqOUVCNU9sSnhwSjQ

QR Code no. 12, Page 23, Project Amethyst :
https://drive.google.com/open?id=0B0FyNSTpzKvqNlphUlY0bGNkZ1U

QR Code no. 13, Page 24, Project DNA Bracelet:
https://drive.google.com/open?id=0B0FyNSTpzKvqd1BjazVfYW9VcVE

QR Code no. 14, Page 25, Project Pine cone :
https://drive.google.com/open?id=0B0FyNSTpzKvqdG1xUGJhbTVLczg

Meso (Furniture)

QR Code no. 15, Page 28, Project Raising Bench :
https://drive.google.com/open?id=0B0FyNSTpzKvqR2xHSDVva1ZYaGc

QR Code no. 16, Page 32, Project Butterfly Bench :
https://drive.google.com/open?id=0B0FyNSTpzKvqbHYyd015Y3dOQzA

QR Code no. 17, Page 34, Project Urban Carpet :
https://drive.google.com/open?id=0B0FyNSTpzKvqZDB3N0dsWW9mRGM

QR Code no. 18, Page 36, Project Park 'n' Seat :
https://drive.google.com/open?id=0B0FyNSTpzKvqS0hRWXlLMG5pX3M

Macro (Pavilions)

QR Code no. 19, Page 43, Project Hex-316 Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqRXp1dVoyWkJPZUk

QR Code no. 20, Page 57, Project Weave Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqUjhqVVVOR3ZwYms

QR Code no. 21, Page 63, Project Surfaces Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqc1F6U2pjWUF4M2M

QR Code no. 22, Page 67, Project In & Out Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqQjNjQkI3aDc1ams

QR Code no. 23, Page 71, Project Straw Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqTkVSRmVfN0pzNG8

QR Code no. 24, Page 75, Project Roll Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqQjNjQkI3aDc1ams

QR Code no. 25, Page 79, Project Jewelry Pavilion :
https://drive.google.com/open?id=0B0FyNSTpzKvqa2ZkSmZTOFh2Z0E

Publisher

DIA Architecture School
Anhalt University Department 3
Bauhausstraße 5
06844 Dessau

Fon +49(0)340 - 5197 1531
Fax +49(0)340 - 5197 1599

info@dia-architecture.de
www.dia-architecture.de
www.afg-hs-anhalt.de

Editor

Karim Soliman

Layout/Design

Henry McKenzie

Printing

Lieblingsdrucker GmbH

ISBN

978-3-96057-033-2

ISBN 9783960570332

ISBN: 978-3-96057-033-2 (Druck)
ISBN: 978-3-96057-034-9 (Interent)

DIA series