
Image by Andrés Flajszer

Alan Rynne

2018 Portfolio

Image by Andrés Flajszer

Hi! My name is Alan Rynne, I am a building engineer from Spain with a recently obtained Master’s Degree in Parametric Design for Architecture. I am passionate about bringing together Architecture and technology to improve the way we work and design on a daily basis.

Projects

Geodesic Patterns for Freeform Architecture

Master Thesis - C# Implementation for Grasshopper

Details

Author
Alan Rynne

Date
September 2018

Website
http://bit.ly/geoPattrn

Grade
10/10

University
ETSAV - UPC

Full Text PDF
missing link!

Disclaimer
This research will be part of a larger book on the topic of Surface Rationalization that will be published during 2018/2019.

Implementation and analysis of different existing techniques to obtain cladding solutions using exclusively straight planks, either wood or metal, in order to weight their benefits and weaknesses from an architectural standpoint. The research was mainly centred on the generation of geodesic curves, more specifically straightest geodesics, which minimize distance between two points on curved surface. For cost and manufacturing reasons, geodesic planks are favorable for cladding solutions, as they can be manufactured and assembled using inexpensive construction techniques. We will also explain some basic structural analysis concepts to check the admissibility of the generated solutions.

Architectural Geometry

Fabrication-aware design

Freeform architecture

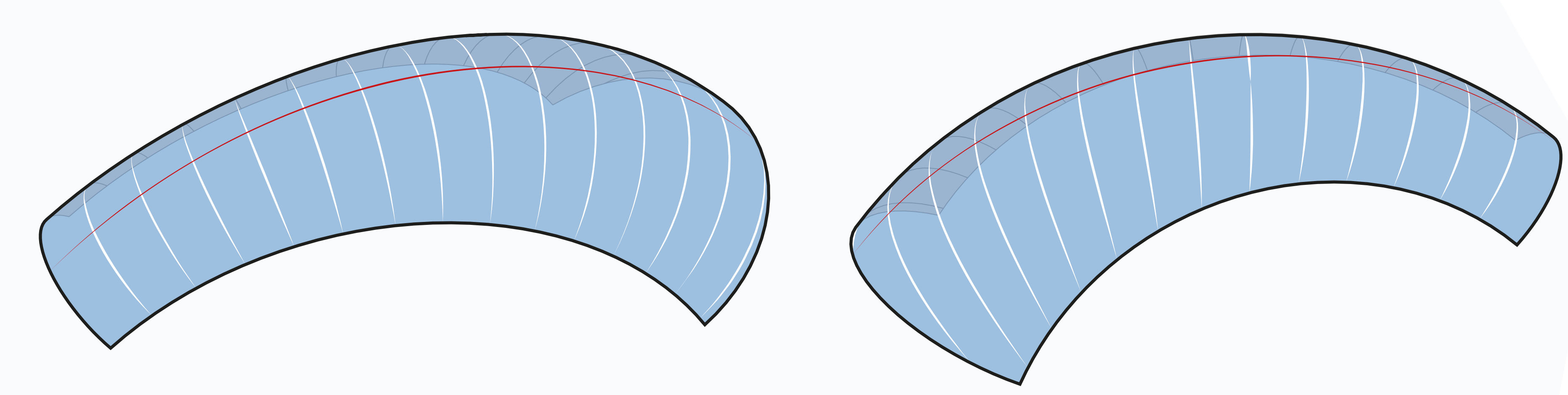


Fig. 1.1 - Computed pattern using the Evolution method

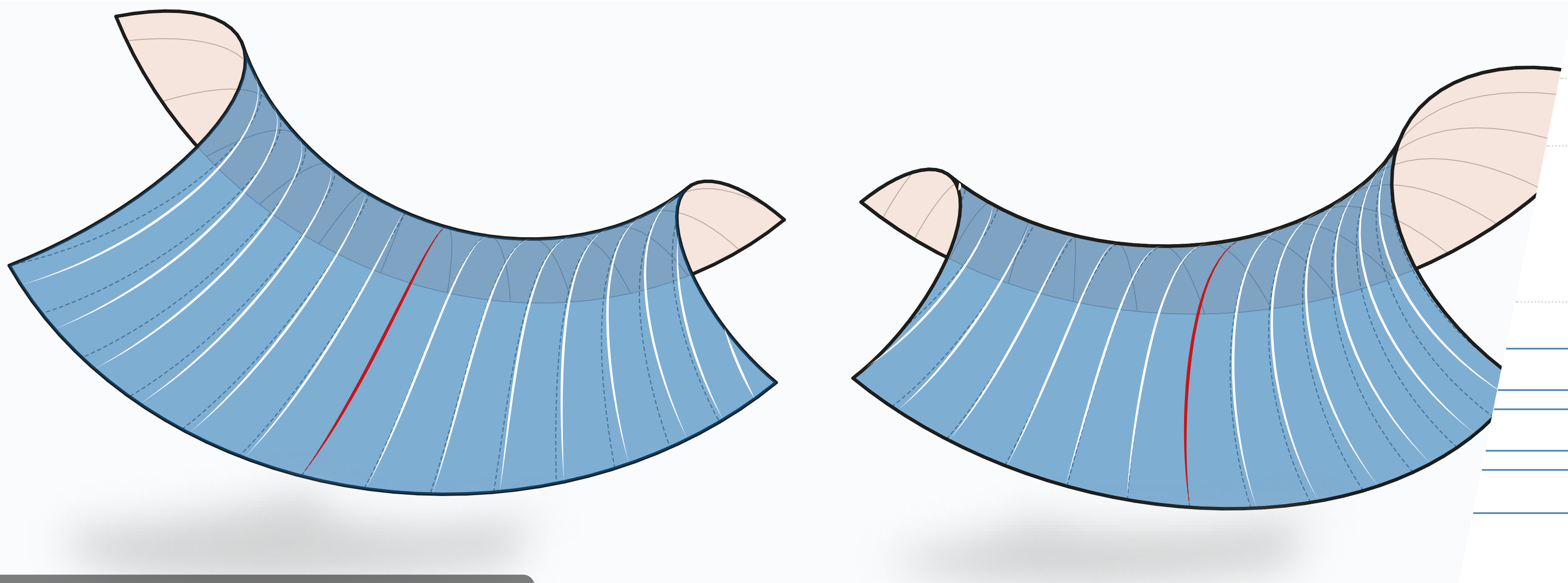


Fig. 1.2 - Geodesic pattern computed using the Piecewise Evolution method

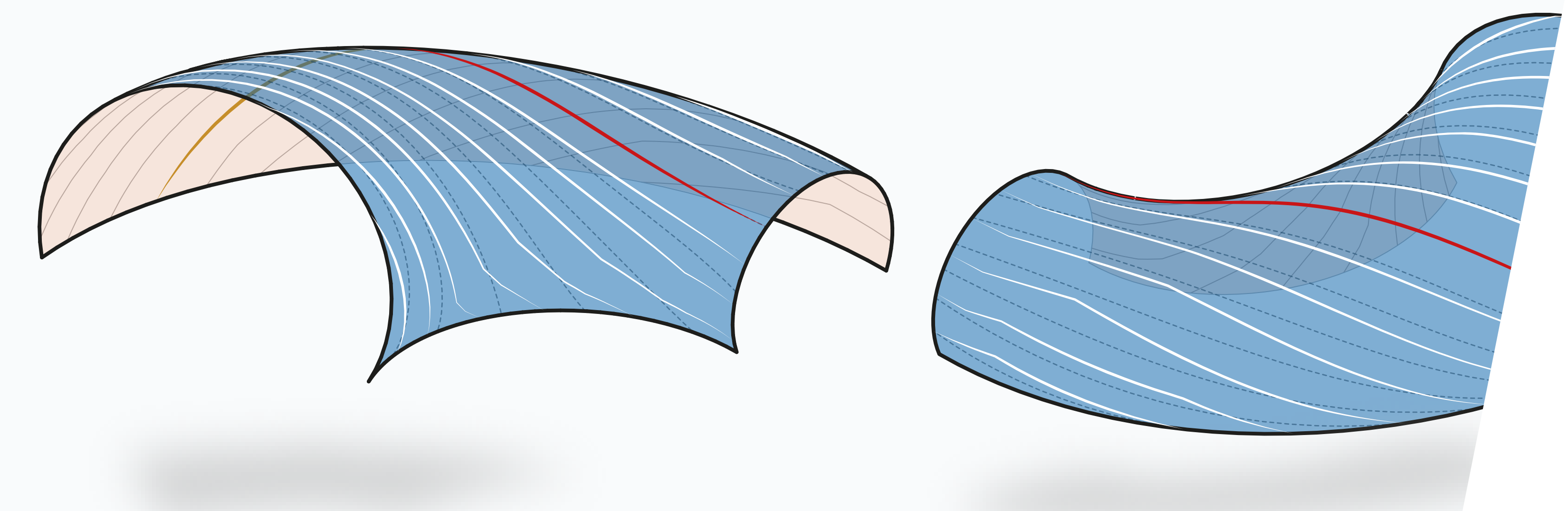


Fig. 1.3 - Geodesic pattern computed using the Piecewise Evolution method

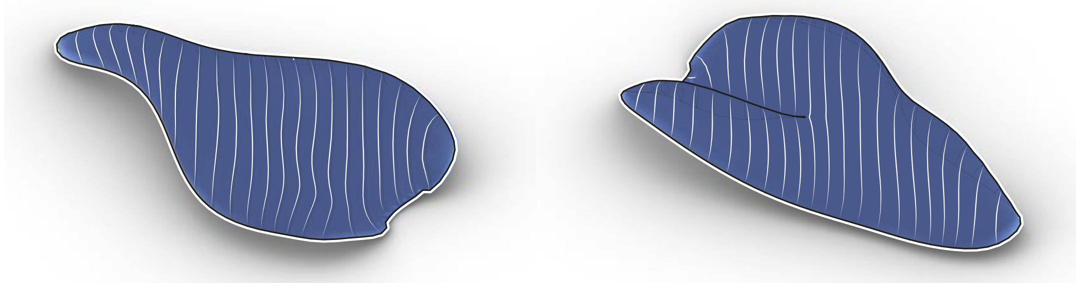


Fig. 1.4 - Level-set method starting configuration

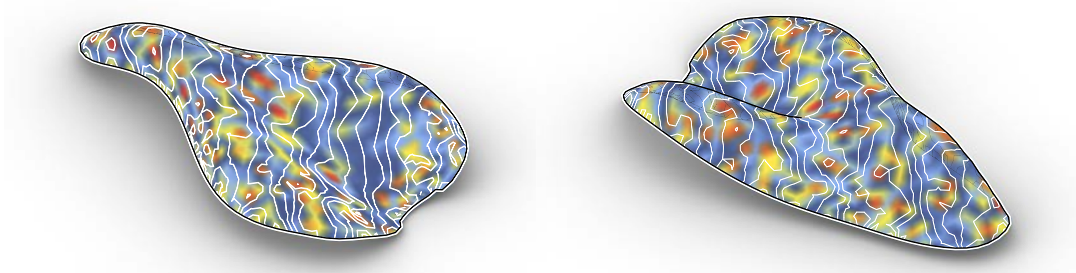
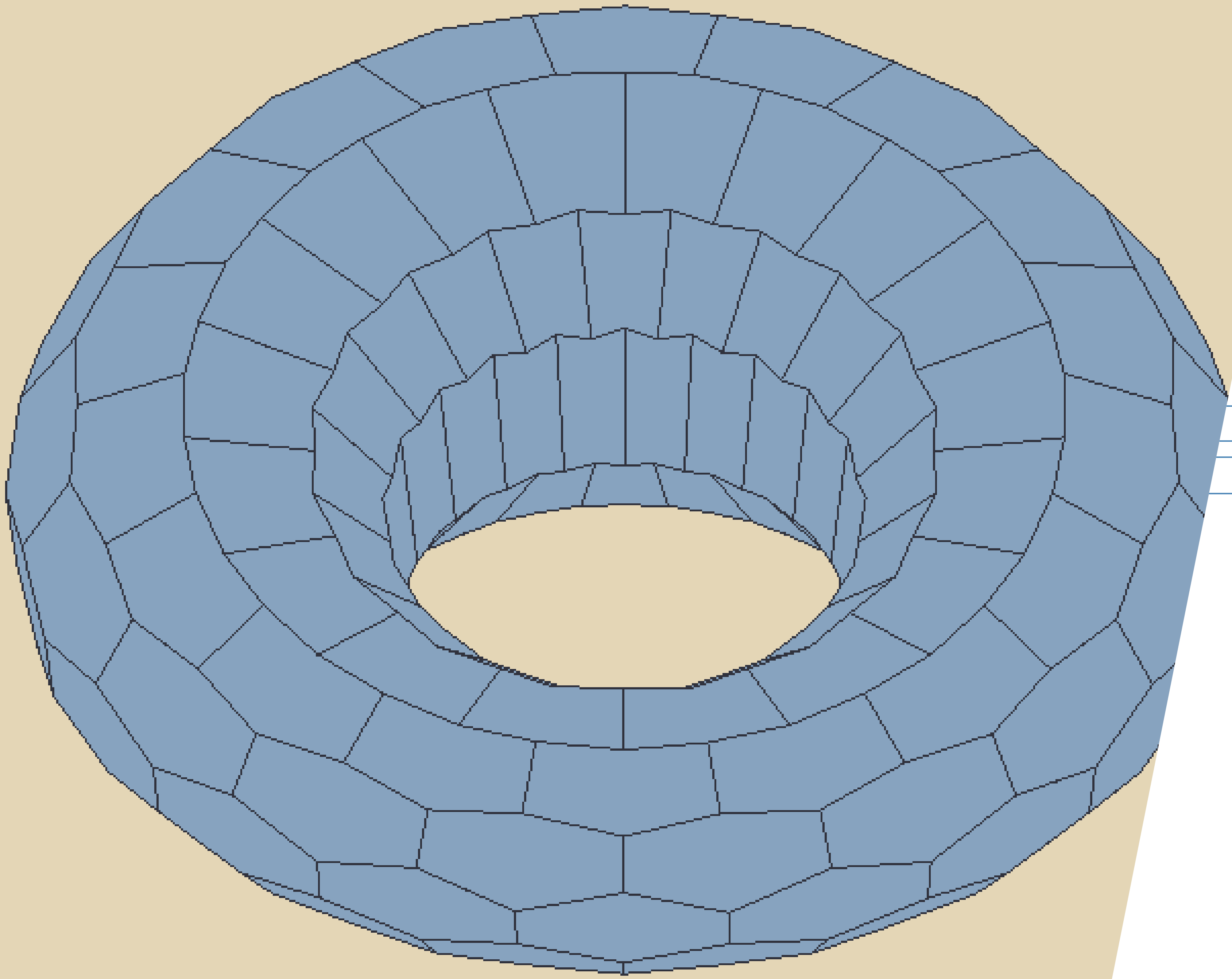


Fig. 1.5 - Computed geodesic pattern using the level-set method

Panneling with Planar Hexagons



Details

Author
Alan Rynne
Thiago Medeiros
David Granzewich

Date
September 2017

Website
www.rynne.es

Location
Barcelona (Spain)

Det.title
Some detail...

Complex panneling solutions

Architectural geometry

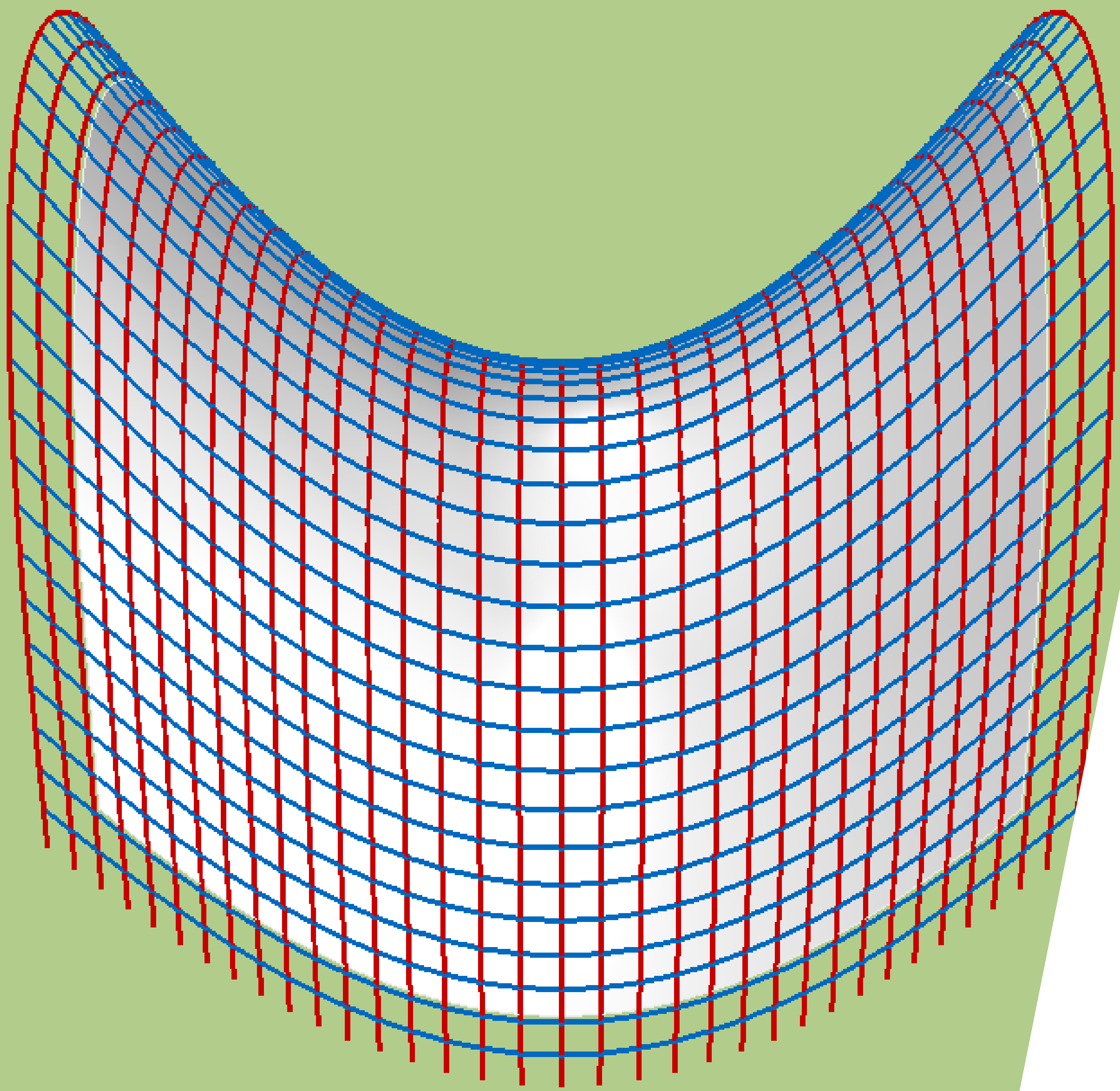
The goal of this research is to understand and expand upon the computational strategies behind planar hexagonal-dominant (PHex) surfaces. Initial exploration was based on several existing techniques: Edge Offset mesh, the Duality approach and the *singularity placement* method.

Out of the three explored methods, the Edge Offset method (which is based on the principle of plane intersections) proved to be the most reliable for generating planar panels, although for complex surfaces this technique needs to be coupled with complex shape optimization algorithms to succesfully generate a watertight panelization.

Both the singularity placement method and the duality approach require the use of planarization algorithms or their conversion into as a *cyclidic or conical meshes* in order to achieve acceptable results. It would also be possible to panelize this solutions with non-planar panels via clustering techniques, which would also dramatically increase the cost of the solution. The obtained Edge Offset solution was then processed and fabricated at 1/100 scale using digital fabrication techniques.

This small research paper was elaborated during my attendance at the MPDA'18.

Fig. 2.1 - And another one



Chebyshev Net Generation

Grasshopper component implemented in C#

Details

Author
Alan Rynne

Date
January 2018

Website
http://bit.ly/chebNet

Programming lang.
C#

Developed as
Grasshopper Component

Status
Pending release

Gridshell design

Active-bending structures

Chebyshev nets are a spetial kind of 3D grid composed only of segments of equal length. They are of special interest when designing elastically-bent structures such as gridshells, since the equal length property of these nets guarantees that the grid could be assembled 'flat' on-site, and later bent to it's final shape by either manual or mechanical means.

Developed as an Open Source project, the implementation was made as Rhino+Grasshopper Component since, at that time, there was no available open source tool for the platform.

The initial code is uploaded to my Github account, and the final release will be available at food4rhino.com in the near future.

More info on the link in details.

Fig. 4.1 - Image by Andrés Flajszer

Triangular Gridshell

Design & Construction of an actively-bent dome

Details

Author

Alan Rynne
Martina Fabré
Jatziri Rodriguez
Noelia Rodriguez
Christian Dimitri
Martí Sais

Date

June 2018

Photo cred.

Andrés Flajszer

Active-bending
Dome structure
Elastic membrane

The aim of this study is to design and build a 6 m diameter dome structure covered by a stretchable membrane; using the previously published work in Chebychev Net gridshells, the introduction of singularity points in the grid design, analyzing the behavior of the structure on different configurations and the relation between each 'patch' to each other.

A special case exists when introducing a single valence 3 singularity on the center of a spherical dome: the bracing of each patch follows the same direction as the rods of its neighboring patches, leading to the assumption that structure and bracing could effectively be the same element. With this assumption, a number of new constructive problems arise when trying to erect the structure: Bracing joint should be left to slide freely in order to keep the structure flat during assembly, and would be fixed in place after the erection process.

Fig. 4.2 - Image by Andrés Flajszer

Fig. 5.1 - Render Image of the Cutty Sark Pavillion adaptation

Cutty Sark Pavillion

Building adaptation study

Details

Author

Alan Rynne
Uri Lewis

Date

February 2018

Hybrid structures

Building adaptation

Lightweight construction

The purpose of this study was to analyze in depth an already existing building solution, in this case: The cutty sark pavilion. The building is an effimeral Lightweight structure that was designed for the purpose of the Cutty Sark boat refurbishment. The building solution is comprised of 3 kinds of elements, wood beams which are in pure compression, the membrane which is in pure tension, and the cast steel nodes which connect both elements together.

Once the key parts where identified, a parametric design was implemented using Rhino+Grasshopper® in order to adapt the solution to a completely different shape: *A dupin cyclide*. You can find more info about this project on my website.

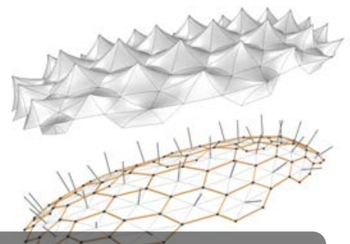


Fig. 5.2 - Surf: Initial U=18 V=6 Dir=Across

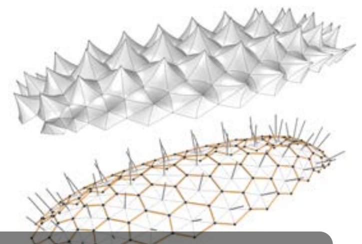


Fig. 5.3 - Surf: Initial U=18 V=6 Dir=Over

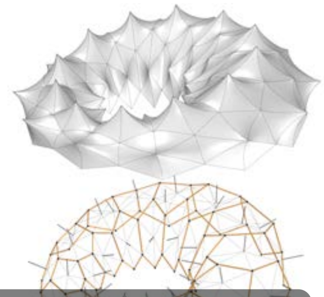


Fig. 5.4 - Surf: Dupin Cyclide U=18 V=6 Dir=Across

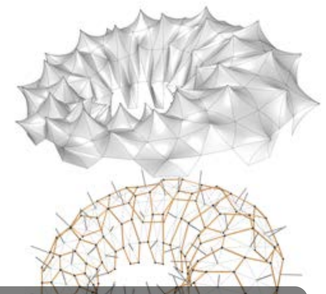


Fig. 5.5 - Surf: Initial U=18 V=6 Dir=Over

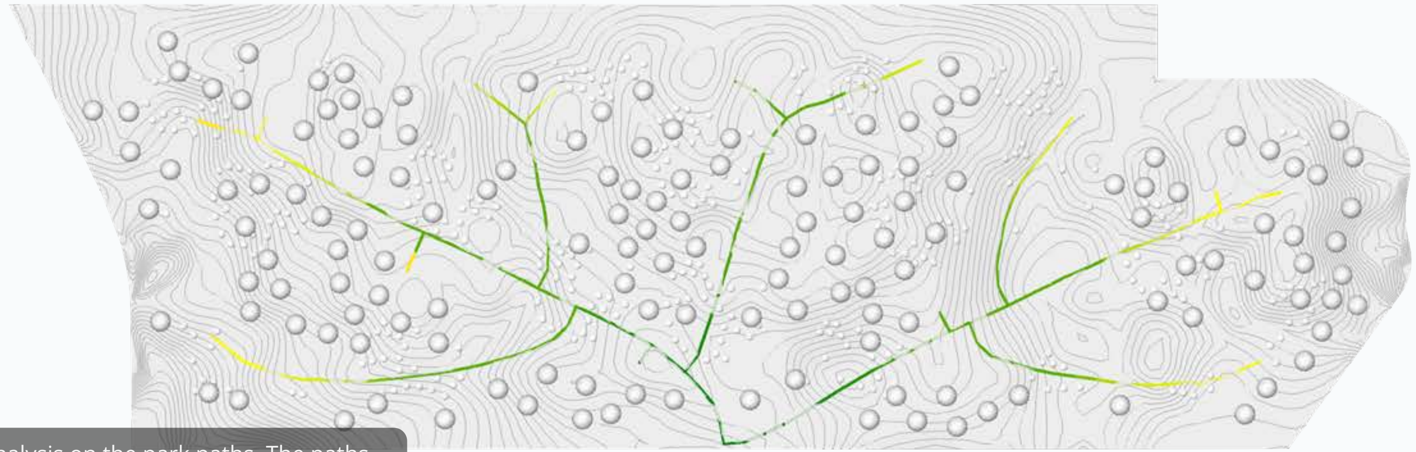


Fig. 6.1 - Slope analysis on the park paths. The paths where generated using a growth algorithm.

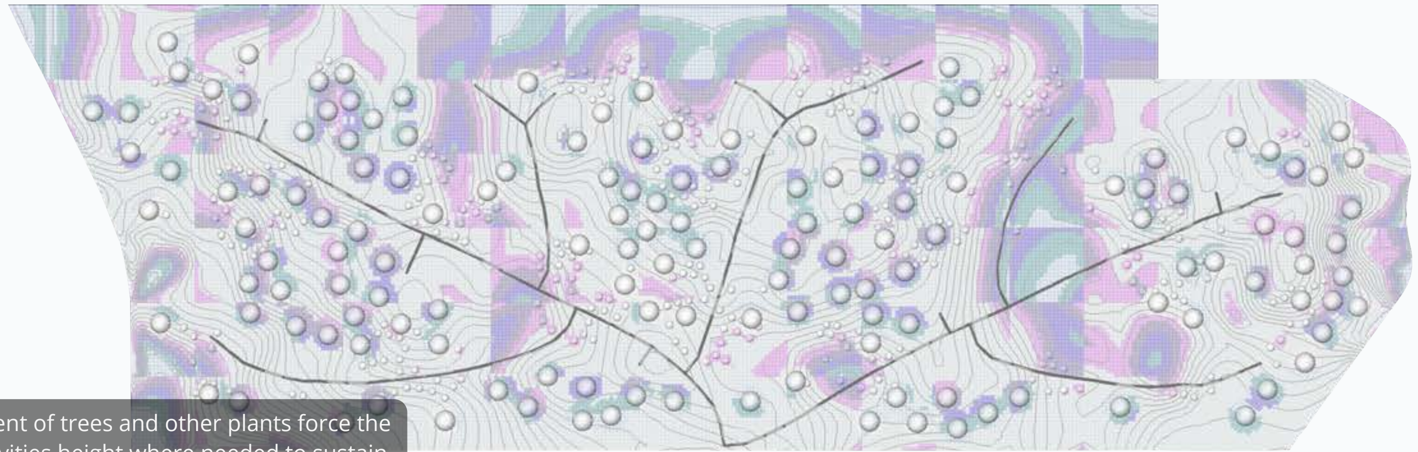


Fig. 6.2 - Placement of trees and other plants force the adjustment of cavities height where needed to sustain vegetation.

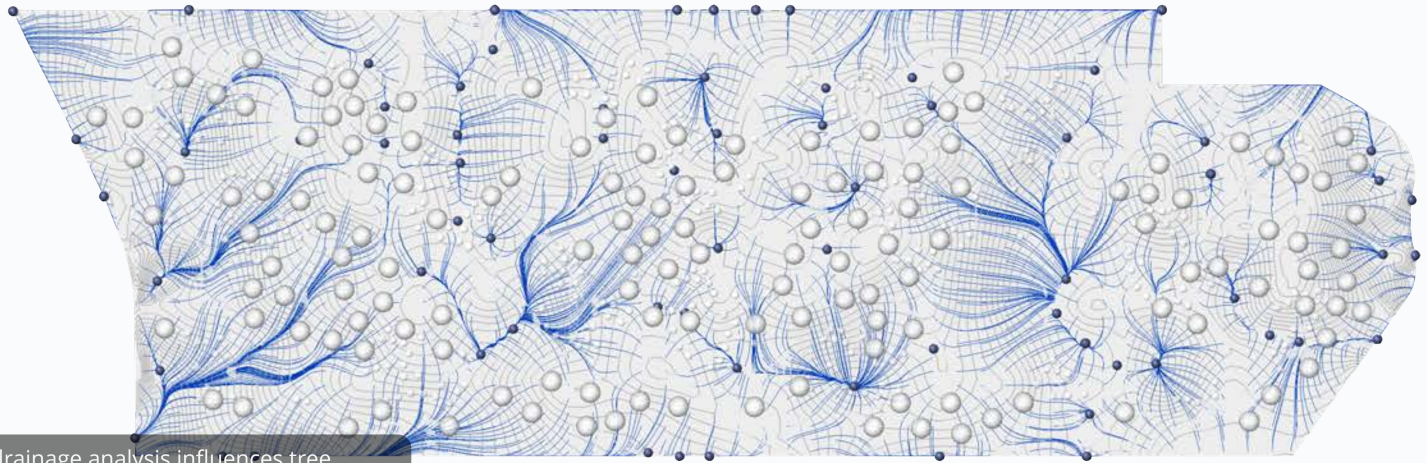


Fig. 6.3 - Water drainage analysis influences tree positioning, eliminating trees in unsustainable areas.

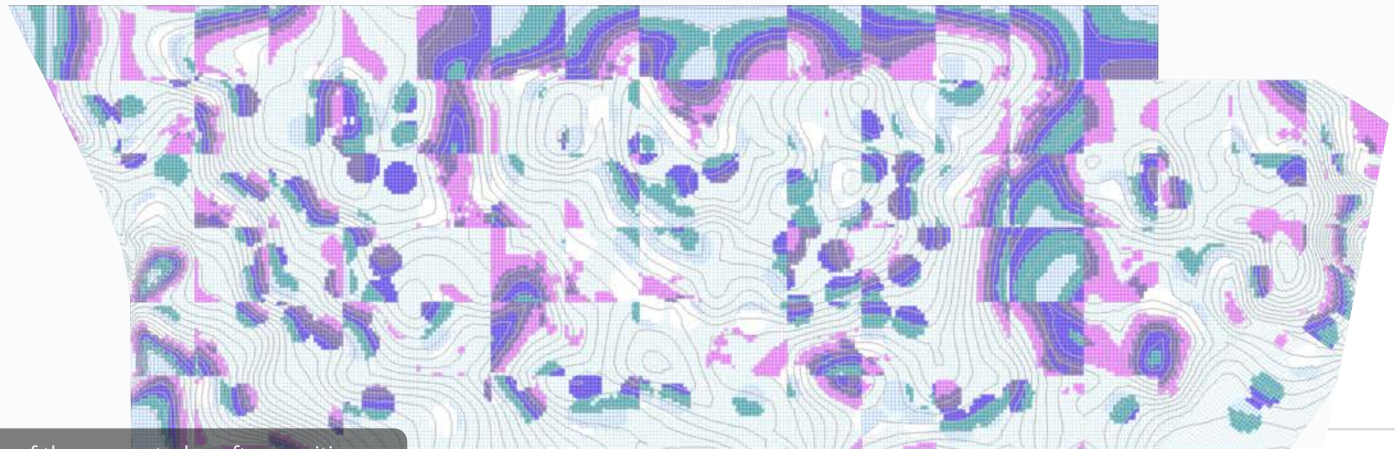


Fig. 6.4 - Top view of the computed rooftop cavities colored by height

Urban Landscaping

Rooftop park generator

Details

Author
Alan Rynne

Date
May 2018

Rooftop garden

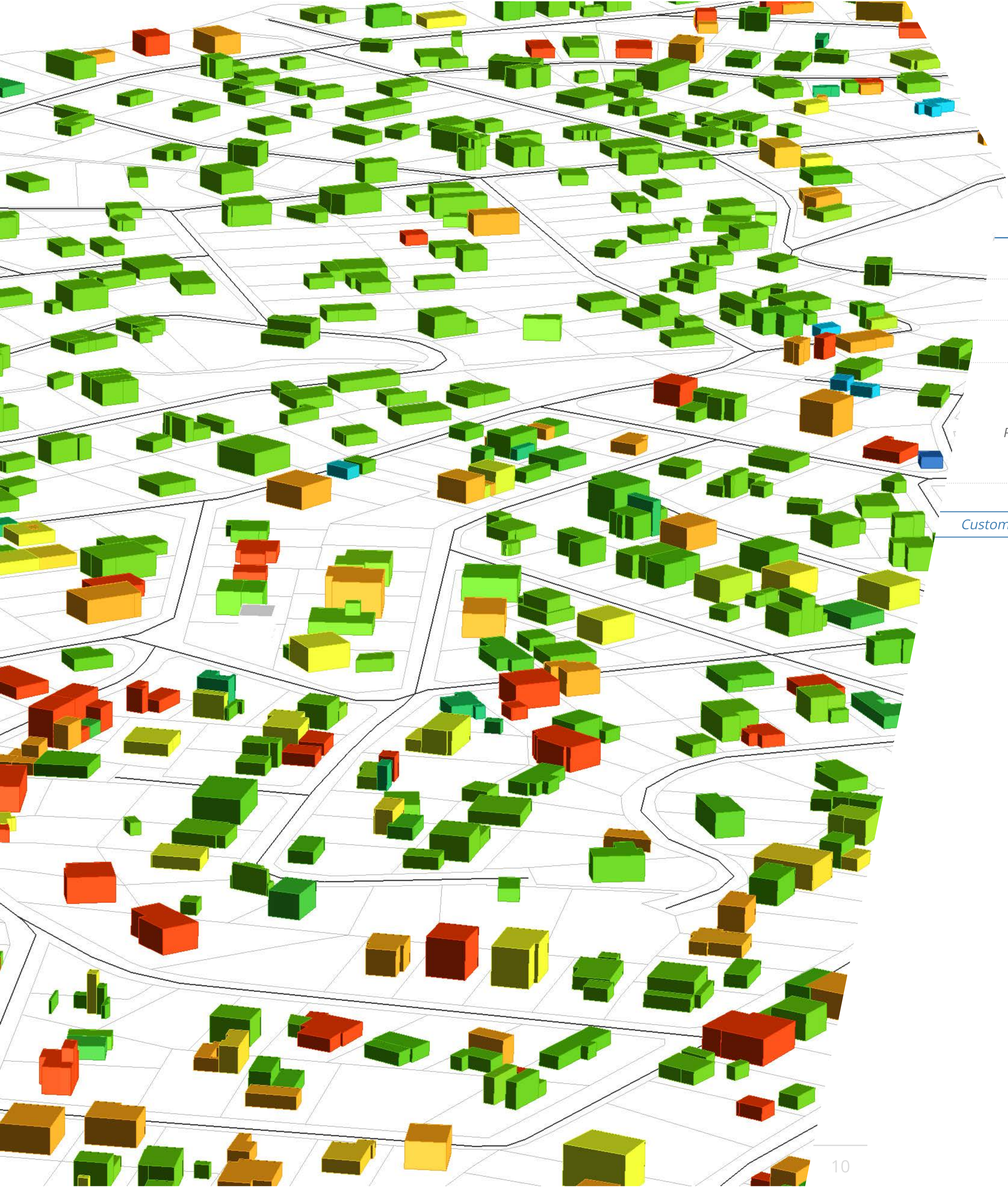
Optimization

Randomness

In this case, we looked into the problematic of buiilding uban rooftop gardens: How to relicate a given topography on a rooftop, without overloading the structure nor adding unwanted filtrations to the underlying building floors? we opted for a 'hollow box' solution, that would allow us to raise the initial slab level in order to optimize for weight.

The height of this boxes was calculating taking into account the different vegetation that would exist in each area and their specific soil + watering needs in order guarantee their survival. Water drainage was also taken into account (Fig 6.3) when placing the different species.

The result is an underlying topography between the desired one and the original slabs, creating more soil height around trees, while minimizing it on grass areas.



Urban Data Exploration

Extraction and Analysis of urban public records in Vacarisses.

Details

Author
Alan Rynne

Date
May 2018

Location
Vacarisses (Spain)

Data collected from
Catastro
Lidar Scans
Property Registry
Idealista
Fotocasa

Custom CAT reader

With the expansion of digital technologies and the growing access to public databases, it is more necessary than ever to be able to take advantage of every bit of information to empower our decision making. In this case, Vacarisses, a small town in the Barcelona area (Spain), was chosen as the object of the study in order to analyze the energy efficiency of the towns buildings and it's possible repercussions.

Public and private databases where used in order to cross information that resulted in the graph bellow, although data was severely limited due to privacy regulations in Spain, it was possible to visualize the correlation of the different energy qualifications (A to G) to the existing legislation in spain on that matter, and also quantify average emissions for each household per year.

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</page>
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Fig. 8.1 - HTML5 Pandoc template

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- link: https://assets.bwbx.io/images/users/iqjWHBFdfxIU/iNEv2lX15yAI/v1/-1x-1.jpg
- link: http://openjournal.com.au/wp-content/uploads/2017/03/71UTS23115.jpg
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details:
- name: Grade
  data: 10/10
- name: University
  data: ETSAV - UPC
tabs:
- Rhino
- Grasshopper
- C#
- Optimization

keywords:
```

Fig. 8.2 - YAML data

```
    You, 16 hours ago • Not working print
@media screen{
    body{
        background: rgb(204,204,204);
    }
  page {
    background: white;
    display: block;
    margin: 0 auto;
    margin-bottom: 0.5cm;
    overflow: hidden;
    z-index: -10;
    box-shadow: 0 0 0.5cm rgba(0,0,0,0.5);
  }
  page[size="A4"] {
    width: 21cm;
    height: 29.7cm;
```

Fig. 8.3 - CSS styles file

Fig. 8.4 - PDF/HTML Output

Reproductible Research

Working smarter (and faster) with Pandoc

Details

Author
Alan Rynne

Date
2018

Website
http://bit.ly/sciPub

GitHub

Markdown

Pandoc

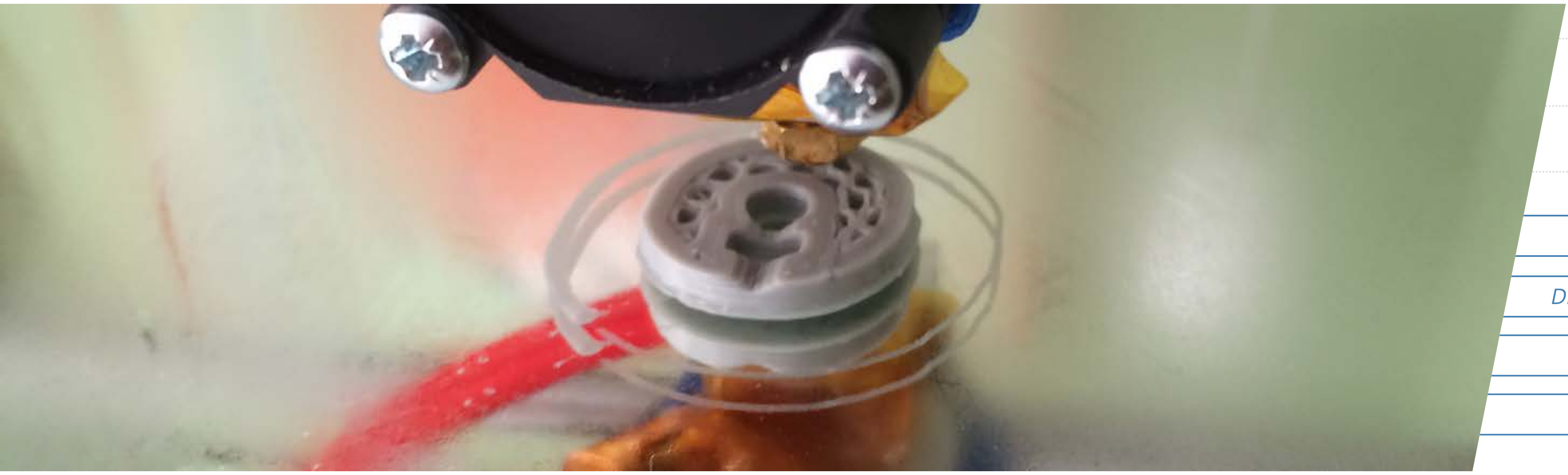
LaTeX

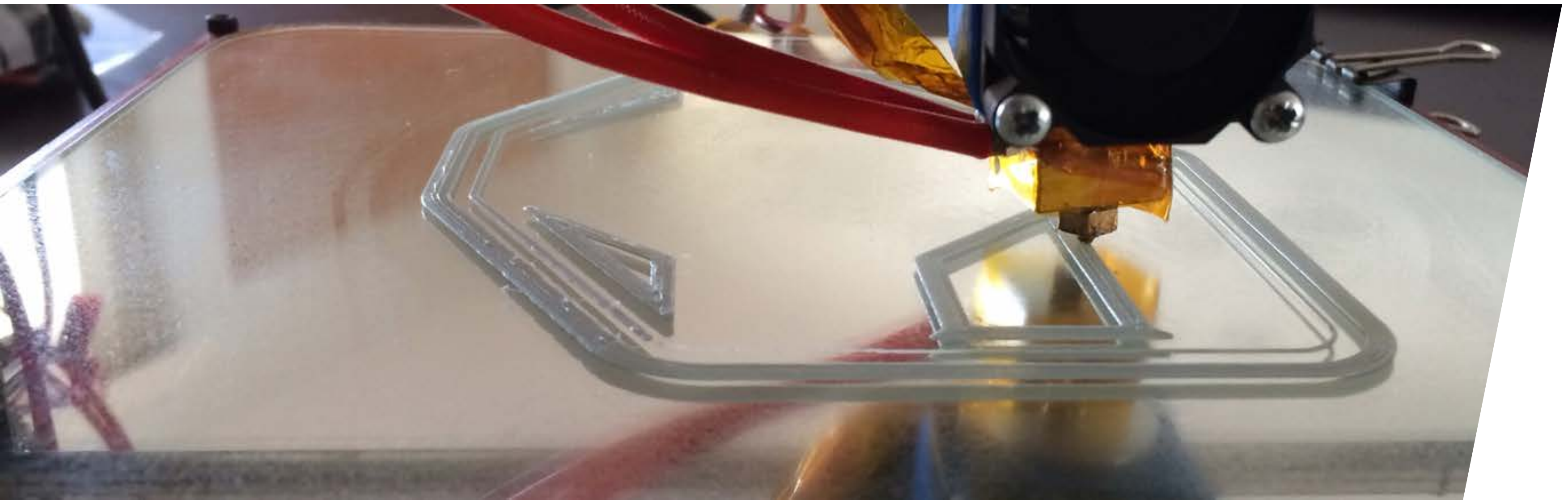
During my year at the MPDA'18, there was a need to write our work as a set of scientific publications.

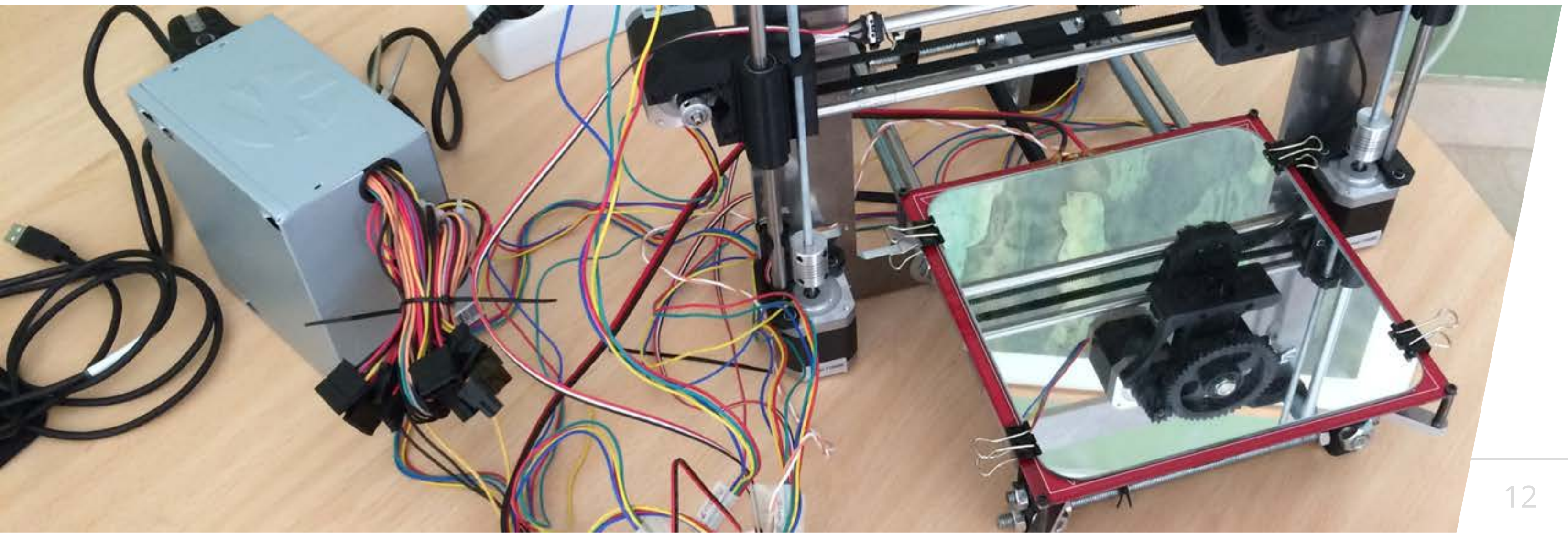
A scientific publication usually exhibits a very strict format, with very little space for the final appearance of the publication. I decided to adopt a new workflow based on GitHub (for version control and co-authoring), Pandoc (a conversion library for Markup formats), LaTeX templating and finally, some Markdown and YAML files to store the data.

I was extremelly satisfied with the result, since it allowed me to concentrate fully on my research, leaving the more 'tedious' parts (bibliography, cross referencing, formating, etc) to an automated process controled by a Makefile. The result was an easily updatable research paper that could also be published in different journals with little to no effort.

This portfolio was also generated using the same workflow, enabling the release concurrent HTML and PDF versions. I also wrote a quick tutorial on how to set this workflow up, which you can find at this project's website link.







3D Printing & CNC Machining

DIY build for hobby purposes

Details

Author
Alan Rynne

Date
2014-2016

CNC Machine
Shapeoko

3D Printer
Prusa i3

Do It Yourself

Digital Fabrication

Electronics

Technology

I have always been intrigued and driven by technology and during the years I have embarked in several hobby projects to investigate new (and not so new...) available technologies like 3D Printing and CNC machining.

I started building my first 3D printer in 2014, eventualy abandoning that project in 2015 in favor of a DIY Prusa i3 model which was Open Source.

In 2016, I took on the challenge of building my own home CNC machine (50x50cm bedsize), which was also Open Source. Both 3D printer and CNC machine were used to build many of the parts of my other 2016 hobby project, a fully automous UAV (see project on the next page).

I also posess experience in handling industrial sized CNC machines and professional Laser and Knife 2D cutters.

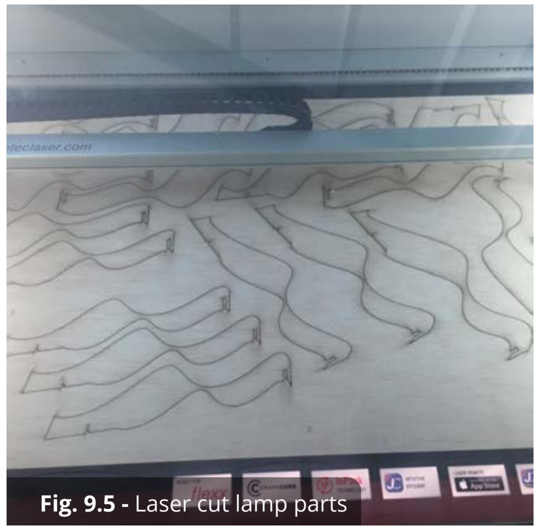


Fig. 9.5 - Laser cut lamp parts

Fig. 9.6 - Lamp prototype

DIY Autonomous Drone

Construction of a UAV

Details

Author
Alan Rynne

Date
2015-2016

UAV Platform
Ardupilot

configuration
Tricopter

Do It Yourself

UAV

Electronics

Technology

Arduino

Building my own drone has been one of the most challenging and fun experiences of my hobby projects so far. It is the perfect combination of electronics, design and engineering and IT FLIES! What else could I wish for?

Leaving the excitement behind, building it required an insane ammount of time and effort, having to learn from flight mechanics to electronic soldering, chip programming, wireless comunications and a very long list of other tangentally related topics, and tons of hours spent on trial and error.

The drone was fully designed in 3D using Rhino+Grasshopper inspired by previous designs uploaded to Thingiverse.com, and it was created as a Tricopter configuration, which added some extra complexity with the Yaw mechanism. Whle initially built with plywood,all the complex body parts in the final design where either 3D printed in ABS or CNC'd out of carbon fibre using the machines I built myself.

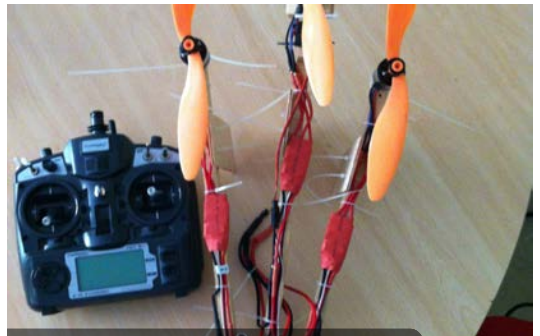


Fig. 10.3 - Drone in folded configuration


Image by Andrés Flajszer

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/alanrynnevidal

/AlanRynne

... or download my updated documents from:

cv.rynne.es

portfolio.rynne.es