



# PENGANTAR DESAIN PARAMETRIK

KULIAH 1

**Galaxy SOHO**  
Beijing  
by Zaha Hadid  
2012





**Metropol  
Parasol**  
Seville  
by Jürgen Mayer  
2011



**Museo Soumaya**  
Mexico City  
by Fernando Romero  
2011

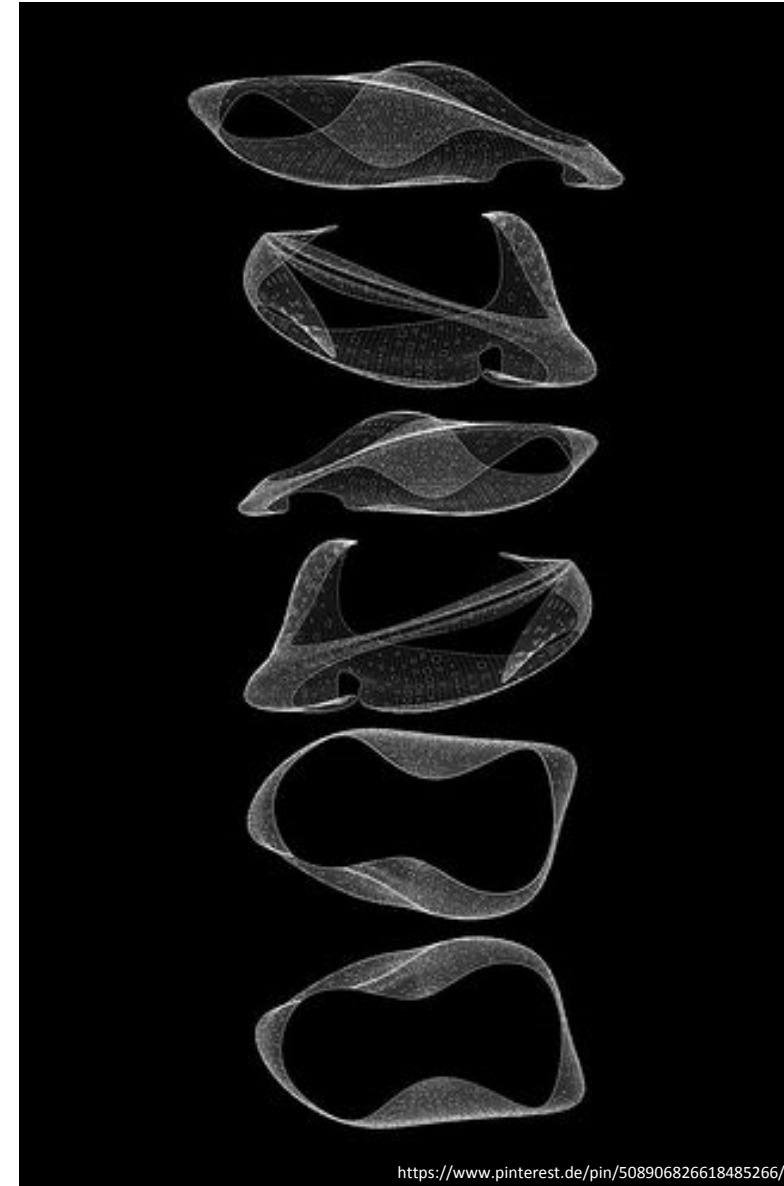
**Serpentine  
Pavilion**  
London  
by BIG  
2016



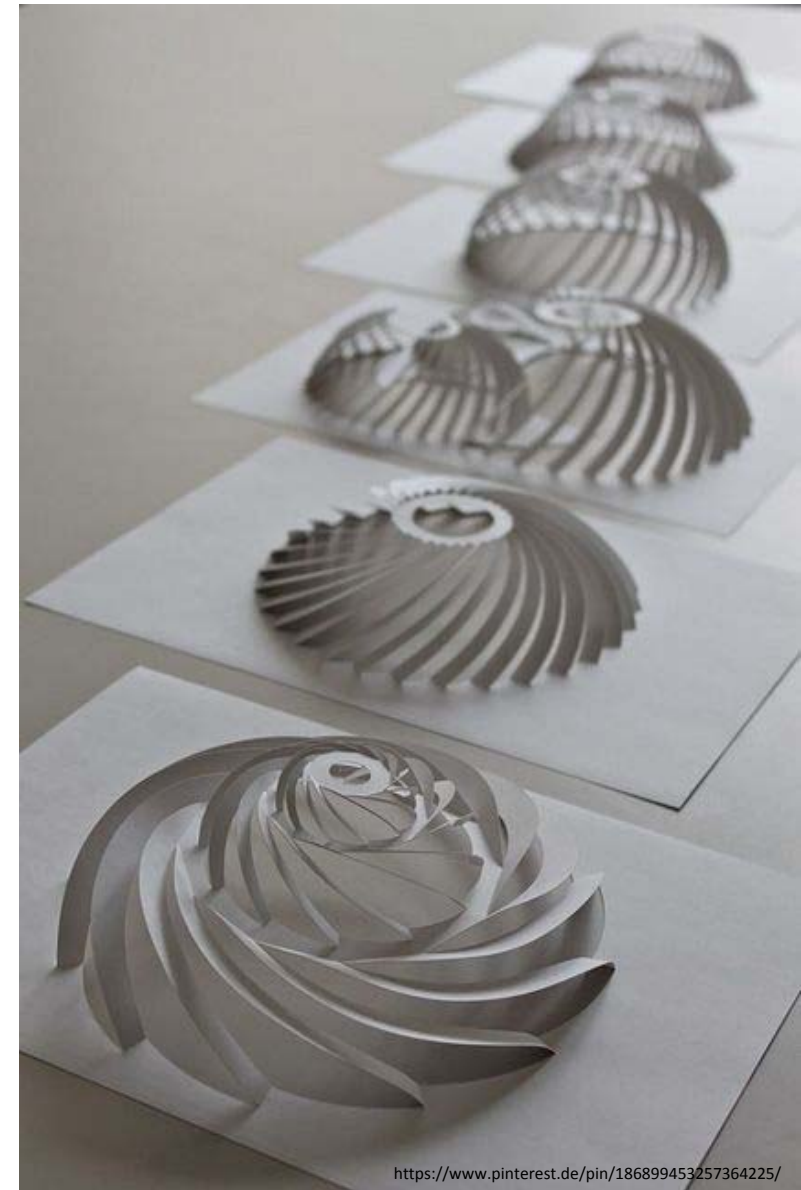
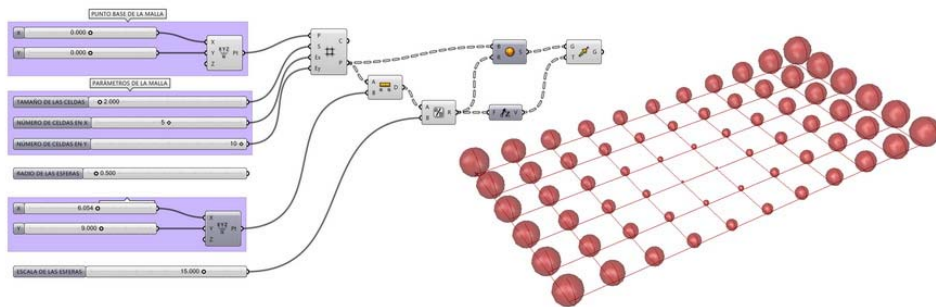
## WHAT IS PARAMETRIC DESIGN?

Parametric design is a process based on **algorithmic thinking** that enables the expression of **parameters** and rules that, together, define, encode and clarify the relationship between design intent and design response.

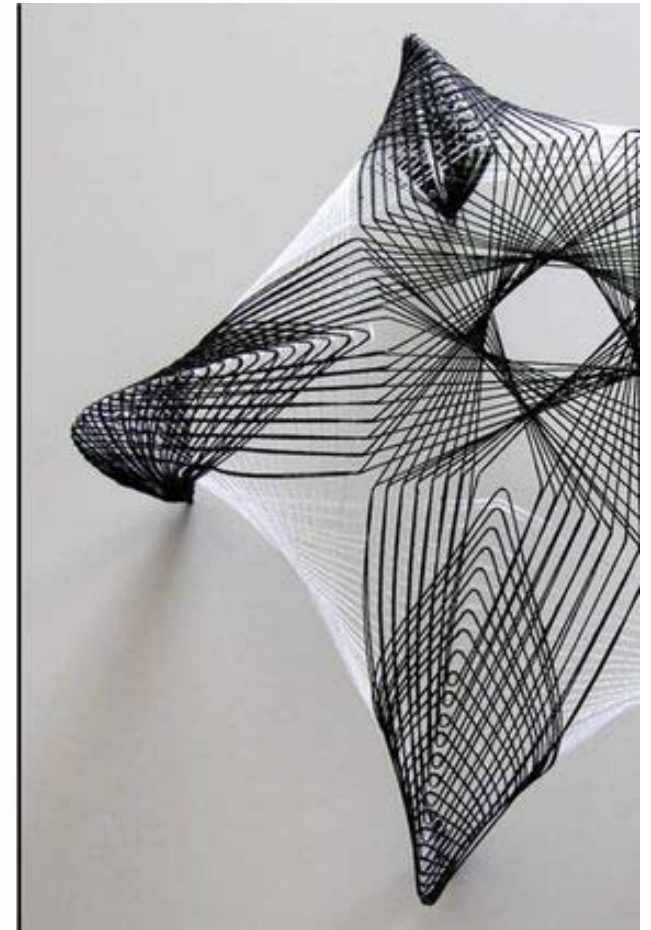
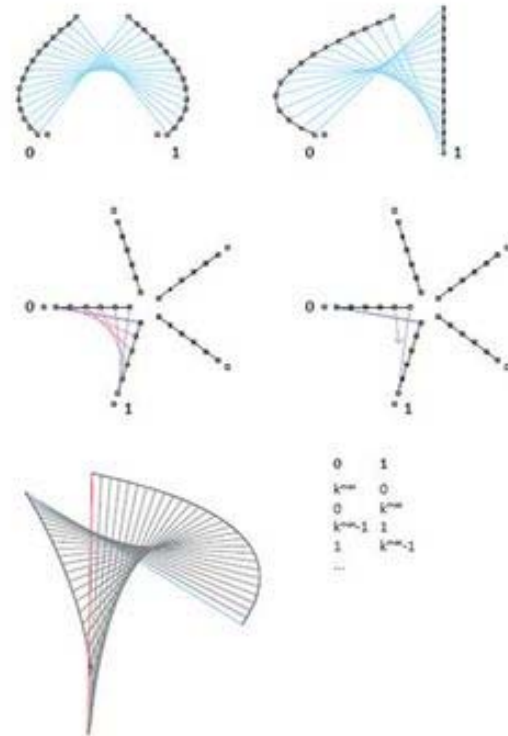
Parametric design is a paradigm in design where the relationship between elements is used to **manipulate** and **inform** the design of complex geometries and structures.



The ground of parametric design is the **generation of geometry** from the **definition of a family of initial parameters** and the design of the formal relations they keep with each other.

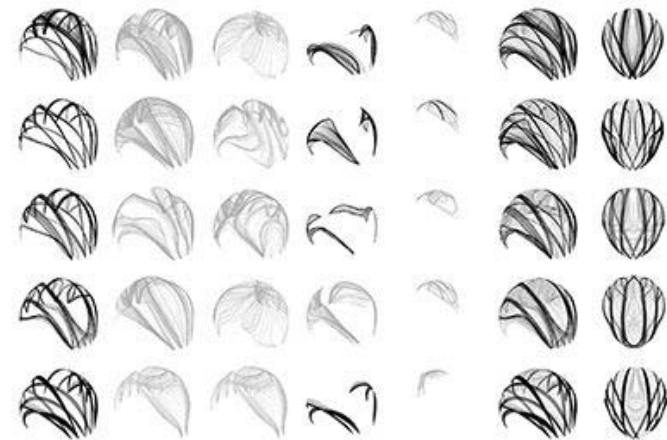
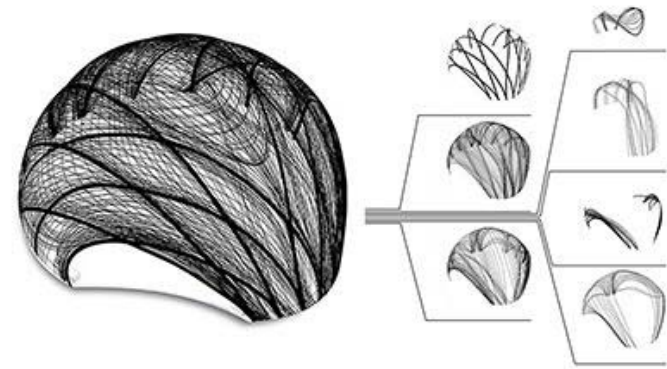


It is about the use of variables and algorithms to generate a hierarchy of mathematical and geometric relations that allow you to **explore the whole range of possible solutions** that the variability of the initial parameters may allow.

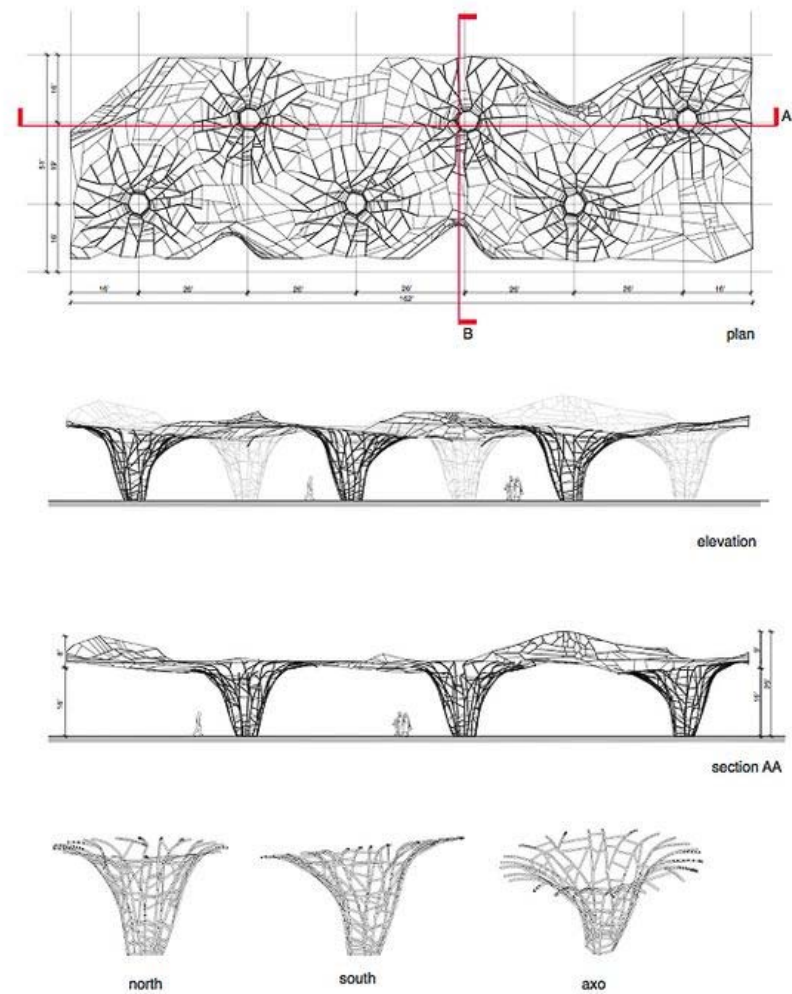




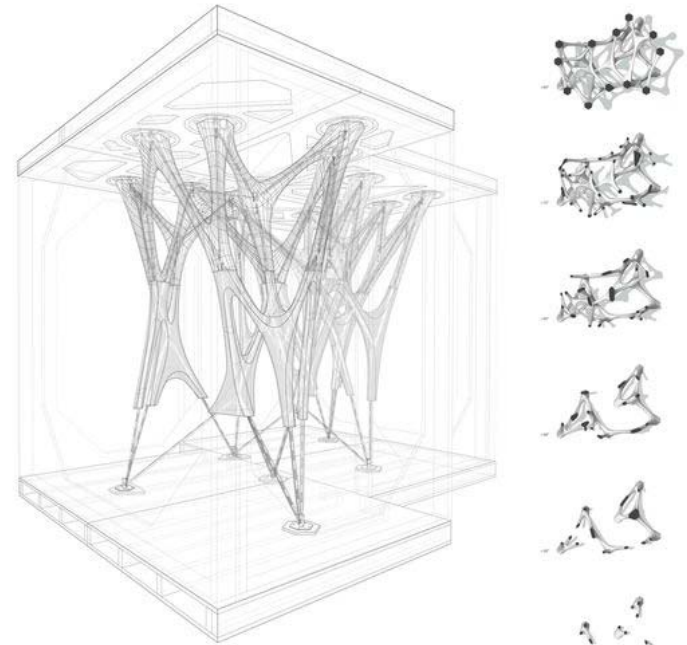
It is the use of algorithms and advanced computational techniques **not for the sake of drawing shapes, but creating formal possibilities.**



It is not about producing a solution, but **the family of possible outcomes.**



It is the shift from using CAD software as a representation tool, **to do it as a design tool.**



#### Form-Finding and Optimization



# BRIEF HISTORY OF PARAMETRIC DESIGN

## Analogue Parametric Design

Gaudi's analogue method includes the main features of a computational of a parametric model such as:

### **Independent Input Parameters:**

The string length, birdshot weight and anchor point location all form

### **Functions (to derive outcomes):**

Gravity or Newtons law of motion.

### **Model Outcomes:**

The vertex locations of the points on the strings



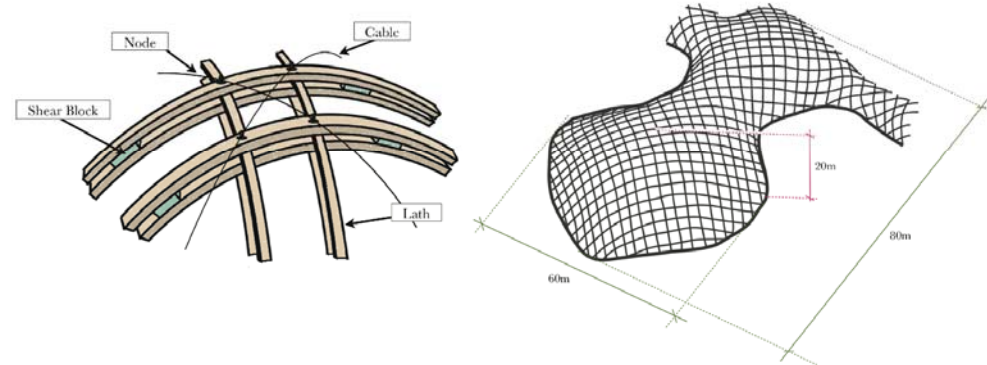
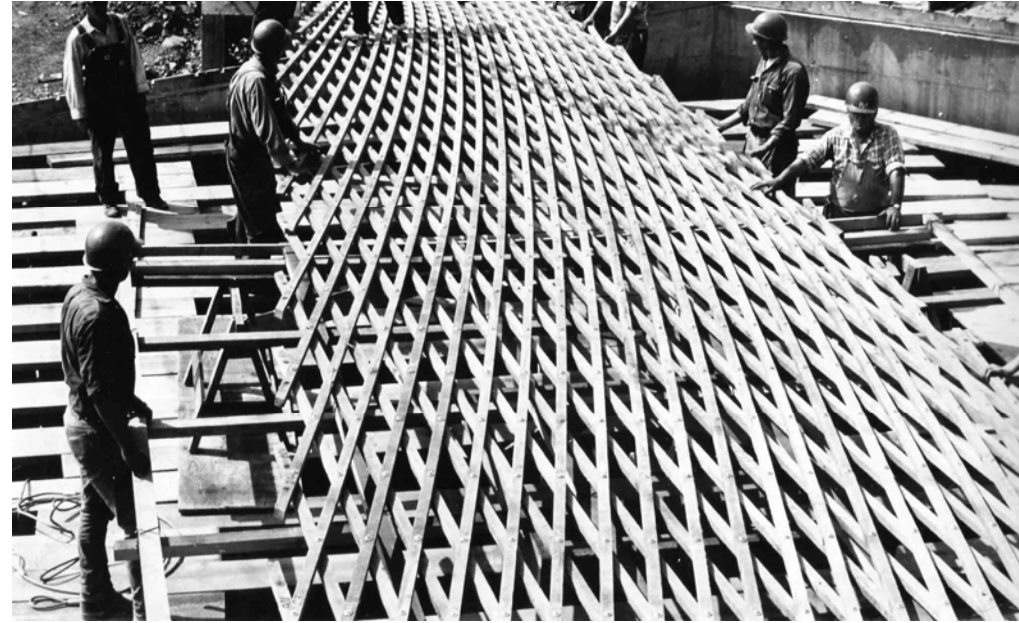
# Force Form Finding

## Gridshell Structure –

Multihalle in [Mannheim](#) by Frei Otto in 1975

"A hanging chain has at least four parameters: its length, its weight, and the two points it is attached to. Left to hang under the force of gravity, the chain makes a curved shape. This curve is an explicit function of the chain's parameters with the added property that when inverted the curve stands in pure compression. While there is no computer, the hanging chain is a parametric model due to the presence of parameters that control a shape derived from an explicit function (in this case calculated by gravity)"

Frei Otto's Contribution-Legacy to Parametric Design and Material Computation





**Multiplex** in [Mannheim](#)  
By Frei Otto in 1975

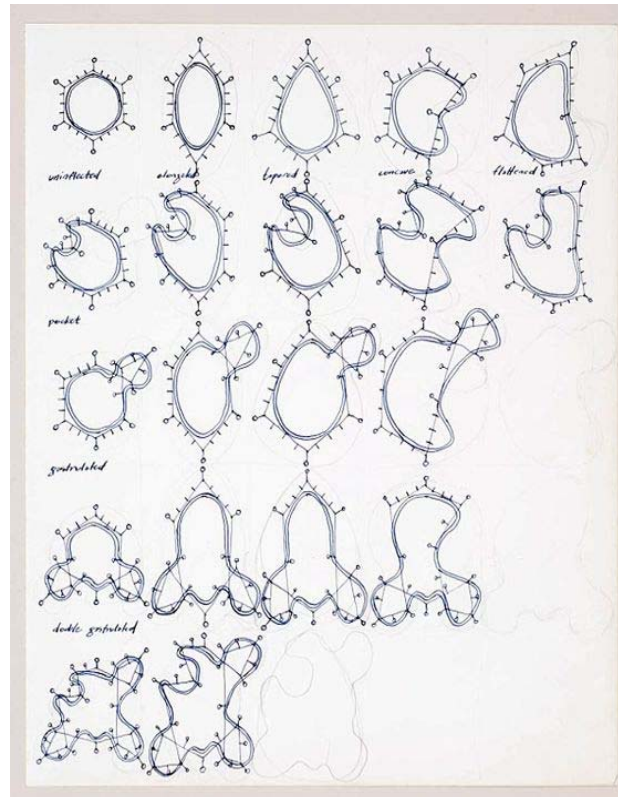


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[http://www.fastapp.com/media/djmediatools/cache/750x500-crop-90-images\\_slideshows\\_multiplexhallmannheim\\_2\\_multicreditfreewikimedia.jpg](http://www.fastapp.com/media/djmediatools/cache/750x500-crop-90-images_slideshows_multiplexhallmannheim_2_multicreditfreewikimedia.jpg)

## “Blob” and “Fold” Architecture - Greg Lynn (b. 1964)

Blob architecture is a type of wavy, curvy building design without traditional edges or traditional symmetric form. It is made possible by computer-aided-design (CAD) software.

**BLOB:**  
**B**inary **L**arge **O**bjects  
(large-scale single surfaces made out of many small components)





**Selfridges Department Store in Birmingham, England, 2003**

[https://ftmb.tqn.com/Y2vDErw3pyhZx-3nobPiQc0Ohs=/768x0/filters:no\\_upscale\(\)/selfridge-73009764-crop-56aadfd73df78cf772b49b79.jpg](https://ftmb.tqn.com/Y2vDErw3pyhZx-3nobPiQc0Ohs=/768x0/filters:no_upscale()/selfridge-73009764-crop-56aadfd73df78cf772b49b79.jpg)





**Guggenheim Museum,**  
Bilbao, Spain  
by Frank Gehry



**Galaxy Soho,**  
Beijing, China  
By Zaha Hadid

# Parametric design

- Parametric architecture
- Digital fabrication
- Partition architecture
- Cube design
- Column structure
- Shell structure
- Columns
- Arch light
- Line of light
- Partition design
- Q design
- Modular structure
- Building information modeling
- Conceptual architecture
- Fiber design
- Partition design
- Grasshopper 3d
- Resilient architecture
- Therapeutic architecture
- Steno architecture



# LATEST RESEARCH IN PARAMETRIC DESIGN

slow offbase on

# Generative Design

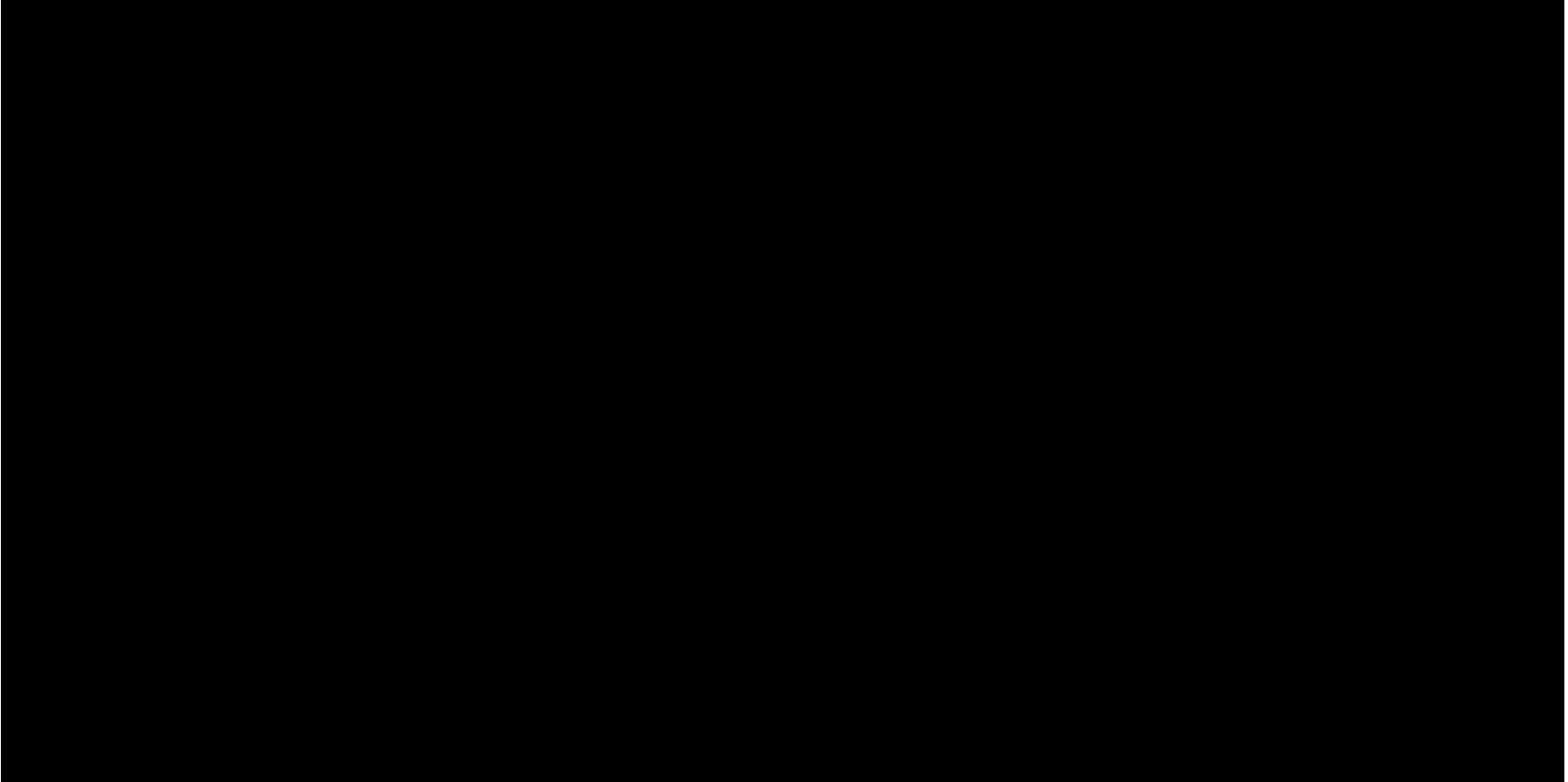
Generative design is a **form finding process** that can mimic **nature's evolutionary approach** to design.

"Generative Design is a morphogenetic process using algorithms structured as non-linear systems for endless unique and unrepeatable results performed by an idea-code, as in Nature,"

Celestino Soddu, 1992

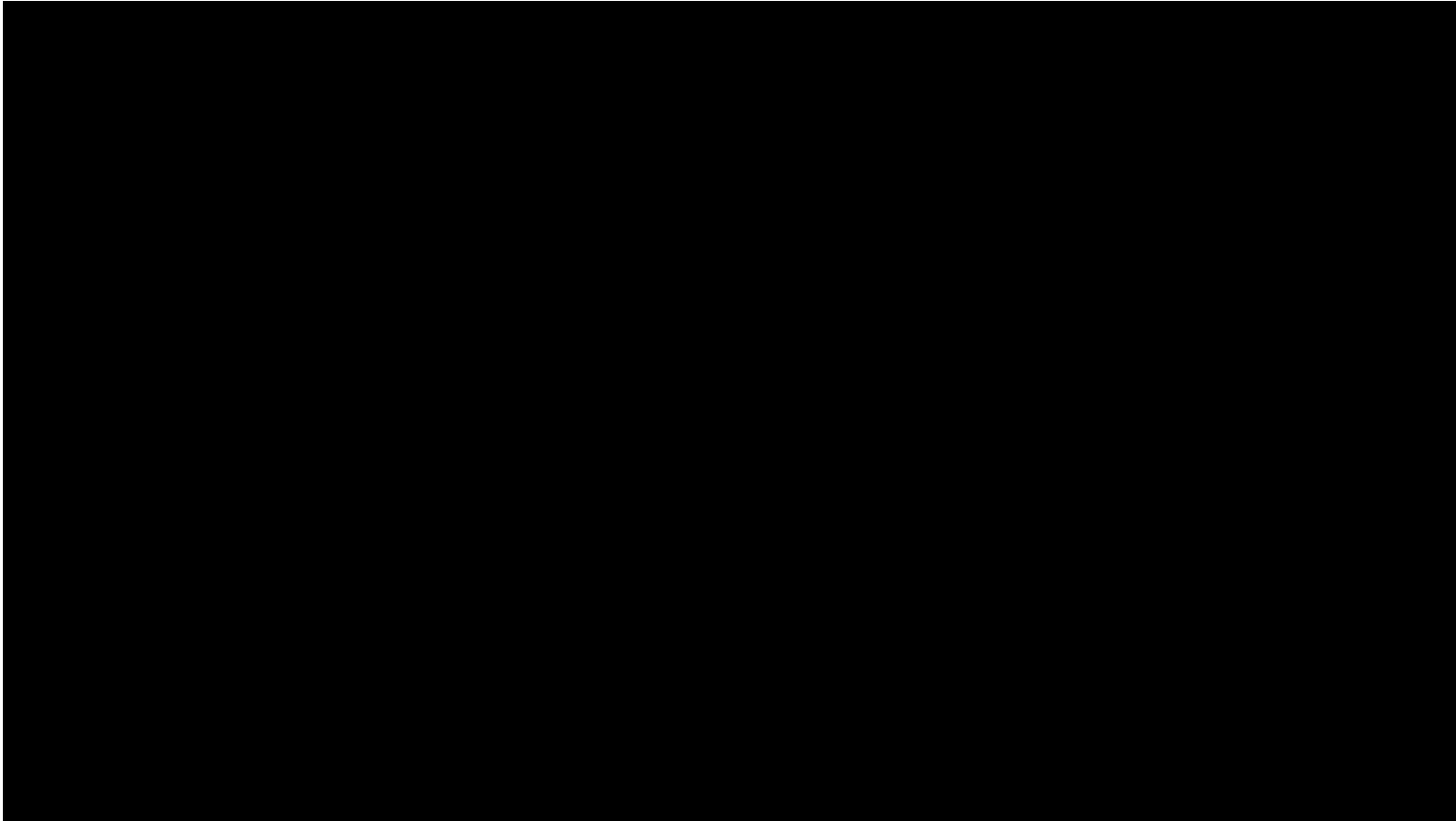


## Designing with Light using Luminous patterns



<https://www.youtube.com/watch?v=QLA2PzjTVBw&t=11s>

## Sun & Shade by Carlo Ratti



[https://www.youtube.com/watch?v=\\_gC7Z\\_3iye8](https://www.youtube.com/watch?v=_gC7Z_3iye8)

# TOOLS & SOFTWARE

## CATIA

CATIA (Computer Aided three-dimensional Interactive Application) was used by architect Frank Gehry to design some of his award-winning curvilinear buildings such as the Guggenheim Museum Bilbao



## Autodesk 3DS Max

3ds Max uses the concept of modifiers and wired parameters to control its geometry and gives the user the ability to script its functionality.



## Rhinoceros – Grasshopper 3D

A plug-in for Rhinoceros 3D that presents the users with a visual programming language interface to create and edit geometry



## Autodesk Revit - Dynamo

Revit was developed in response to the need for software that could create three-dimensional parametric models that include both geometry and non-geometric design and construction information.





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**In other industries ...**



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Ater Form



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