SMiA
Structural Morphology in Architecture

LiTA. Architecture Technology and Innovation Laboratory
UNIVERSITAT POLITÈCNICA DE CATALUNYA
Structural Morphology in Architecture

TREE LIKE STRUCTURES
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OBJECTIVE

Understand the concept of reciprocal structure

Study the morphology

Explore the formation of structural systems with a groupings modules reciprocal
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TREE LIKE STRUCTURES

TOPICS

1. Concept: Tree like structure
2. Background
3. Morphology - iterations
4. Different Branching Patterns
5. Groupings of Tree like structures
6. Knots
7. Recent Research- Form finding
1. **DEFINITION:**

Reciprocal frame structure
1. Concept: Tree-like structure

Treeform architecture is based on natural forms such as where a tree's foliage serves as the roof. The branches and trunk are the support structure.
Branched supports are flat or spatial structural systems which consist of separate branches, each one of which forks out at a specific point (knot) into at least two other branches. Such structures can be subjected to tension, to compression, to flexion and to torsion.
Tree structures provide an efficient way to transfer large surface loads to a single point on the ground.
1. Concept: Tree like structure

The use of branched structures enables the use of thinner structural members and covering larger spans (Otto, F. and Rasch, B., 1995).
2. BACKGROUND
2. Background

In post-Roman periods, we find many other examples of mimicking trees and plants as esthetic and decorative features.

Source: Tree-inspired dendriforms and fractal-like branching structures in architecture: A brief historical overview Iasef Md Rian, Mario Sassone
2. Background

One of the first examples of a true wooden dendriforms are the Chinese Dougong Brackets,
2. Background

King's College en Cambridge. Fan vaults were inspired by the structural appearance of a tree.

Source: Tree-inspired dendriforms and fractal-like branching structures in architecture: A brief historical overview Iasef Md Rian, Mario Sassone
2. Background

Gaudi's treelike. Sagrada Familia

Source: Tree-inspired dendriforms and fractal-like branching structures in architecture: A brief historical overview by Iasef Md Rian and Mario Sassone
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2. Background

Gaudi's treelike. Sagrada Familia
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Otto's experiments with ‘branching’ structure: 1970s

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Stuttgart Airport Terminal building built in 1992

Source: Tree-inspired dendriforms and fractal-like branching structures in architecture: A brief historical overview Iasef Md Rian, Mario Sassone
3. MORPHOLOGY
3. Morphology - iterations

(a) Iteration 0  (b) Iteration 1  (c) Iteration 2  (d) Iteration 3  (e) Iteration 4  (f) Iteration 5  (g) Iteration 6
3. Morphology - iterations
4. DIFFERENT BRANCHING PATTERNS
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4. Different Branching Patterns
4. Different Branching Patterns
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4. Different Branching Patterns
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TREELIKE STRUCTURES

5. GROUPINGS OF TREELIKE STRUCTURES
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5. Groupings of Tree like structures
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6. KNOTS
6. Knots
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6. Knots
6. RECENT RESEARCH- FORM FINDING
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6. Recent Research - Form finding
6. Recent Research - Form finding

Branching studies
http://morphocode.com
6. Recent Research - Form finding
6. Recent Research- Form finding

**DESCRIPTION**

This is the description of a method for tree-shaped structures. Mathematically, the proportion of the different branches, corresponding to the different displacements, will be used to determine the loading of the tree. The objective is to control the output of a single load of the top structure, the partial and total loads, of each of the four sides, and the inclination. The final structure is oriented over a pre-determined grid to generate robust architectural structures from an element, the tree.
6. Recent Research - Form finding
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THANKS FOR YOUR ATTENTION !!