Automated Spaceframe Design (42)

INTRODUCTION

We are Guus, Remco, Gijs, Steven, Harm, and Thijs, students of Mechanical Engineering and Industrial Engineering & Management. We are working on a project for *De Ideeënfabriek*, an initiative by Royal Kaak and Van Raam. Our research focuses on the possibility of automatically generating spaceframes with nodes using Generative Design, and developing these from their organic form into manufacturable designs.

When properly implemented, this approach could offer several advantages, such as reducing material usage, increasing reusability, and lowering engineering and assembly time. We have investigated the feasibility of this approach and analyzed its financial advantages and disadvantages.

JOURNEY & LEARNINGS

The journey had a somewhat slow start; we first had to get to know each other, as well as each other's strengths and qualities. Our initial task was to determine what exactly the client expected from us and from the project. This took a few weeks—longer than we had initially anticipated.

Once we gained momentum, our progress accelerated significantly. A major portion of our time was spent getting the necessary software programs up and running. It took a lot of testing to find the best combination of tools and workflows that suited the project.

If we were to start over, we would begin testing much earlier in the process. We didn’t experience many setbacks, and the process developed in a fairly linear fashion. One important takeaway is the value of maintaining good communication within the team regarding who is responsible for which tasks.

OUTCOME & IMPACT

We developed a method consisting of several steps using different software programs:

1. The Generative Design is created using Fusion 360.
2. A voxelized file is generated in MATLAB.

3. This file/drawing is skeletonized in MATLAB.
4. The locations of the junctions are verified in MATLAB.
5. The junctions placed by MATLAB are manually checked and adjusted if needed using Excel.
6. The final step involves manually defining the connections between junctions and endpoints, also in Excel.
7. The coordinates from steps 5 and 6 are uploaded into SolidWorks to model the spaceframe and joints.

Eventually, these steps will be integrated into a single program, allowing mechanical engineers to significantly reduce manual labor time—thereby saving the company money. Once our project is completed, it is likely that a follow-up project group or intern will continue the work and further develop it for implementation.

As a proof of concept, we created a real-life test case: a table. With certain limitations, we challenged the Generative Design process to utilize only a small portion of floor space on one side of the table.

Companies such as Royal Kaak and Van Raam may benefit from this method in the future. Advantages include reduced engineering time and improved sustainability, as the joints are designed to be detachable, allowing for easy disassembly and recycling of materials.

At the symposium, we are proud to present our test case and a metal-printed prototype/test joint. And of course, we are excited to demonstrate the method we used to realize the test case.

[Upload an image that brings your project to life.]
Choose a photo, render or visual that really captures the essence of your project. This could be your final prototype, a moment from the process, or something that tells the story in one glance. Make sure it sparks curiosity – this is the first thing viewers will see!

Note: Please write your text between the [brackets] and remove the *cursive* instruction once your story is complete.