

Practical Evaluation of Tensegrity Structures

Team Members: Akihito Kawachi Sojun Takano Rui Kurata Hinata Morishita

Advisor : Mr. Sokichi Kodama

Motivation & Objectives

○We aimed to understand the complex concept of tensegrity structures through self-directed research and study, and to explore potential applications.

○The limited number of prior studies made this a worthwhile topic for independent investigation.

What is a Tensegrity Structure?

A tensegrity structure is composed of elastic rods and tensioned wires, forming a self-supporting system that maintains balance.



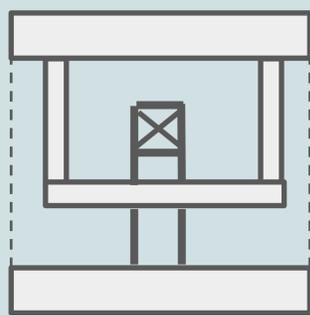
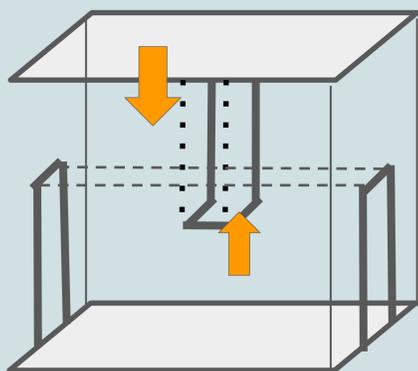
Left: Tensegrity table / Right: DNA model

Research Method

<How to research>

We conducted experiments using simple tensegrity models

1. Prepared two structures with different top surface areas (see diagram below).
2. The experimenter stood on a scale and applied weight to the structure.
→ Tried to minimize any moment (torque) from the load.
3. Calculated the effective load
→ Compared weight before and after loading the structure.



<result> ※See result figures in top right corner.

However, since the tensegrity structure is inherently unstable and difficult to stand on its own, support pillars were used to counteract the moments that would cause it to tilt.

Results

○There was no significant difference in load capacity based on the size of the structure.

○The results varied depending on the materials used.

→ For example, when cardboard was used as the board material, deformation made the structure non-functional.

Top surface are	Load when the top surface sinks
5.0cm ²	0.70kg
10.0cm ²	0.71kg

Hypotheses & Considerations

- ①The less the strings stretch (i.e., the more rigid they are), the greater the load capacity.
- ②More rigid board materials or increasing the number of supporting strings could increase load capacity.
- ③It is difficult to evenly distribute tension across the structure, making it vulnerable to external forces (e.g., lateral forces), thus challenging for practical use.
→ Possibly due to inappropriate materials.
→ Rubber bands or adjusters could help as countermeasures for(③)



↑ Self-made tensegrity structure

Conclusion

- While practical applications of tensegrity structures are difficult, the principles behind their construction are potentially useful.
- Since this experiment was beyond the scope of high school-level studies, we deviated from the original plan and ended up with somewhat inconclusive results.