

Final reflection

This chapter is the reflection of my master thesis. The idea comes from Christian Louter's topic "Thin glass composite with 3D printed spacer pattern". Based on the Christian's introduction about thin glass and 3D printing technology combination, I introduced my proposal about thin glass embedded with pneumatic soft robotic technology, which uses air pressure changing to manipulated curving geometry adapting to thin glass curvature.

The main goal of my graduation project is to design a thin glass window bending by the soft pneumatic actuator for natural ventilation. To achieve this design, a lot of research on different aspects should be done. Based on the design objective, there are three main research areas which are thin glass technology, soft pneumatic actuator technology, and indoor comfort. Each research area will support and improve my design process.

Basically, this project is a window design integrated with structure design, geometry generation, production process, material properties and climate design knowledge. The integration and computational design mindset come from my master track-Building Technology. The knowledge gains from Bucky Lab, I learned computational design, production, structural mechanics and building physics in the first semester. After that, I chose façade design, climate design, design informatics and structure design in semester 2 which helps me create the computational design and integration design mindset. It seems complicated to combine many aspects together and use them in one graduation project, but it is how the world in building environment will look like, also it is my interest.

Since my graduation topic includes three main research areas which I am not familiar with, additionally, this topic is new and never be researched before, these external factors and my own limited knowledge make me do research by design. In other words, I kept doing research when the design is stuck even after P2. With the help of Christian Louter and Tillmann Klein, research and design process went very well.

In the scientific framework, thin glass technology and soft robotics technology are newly coming. More and more pioneers are willing to spend time on both applications. However, both two technology did not meet in the building environment. In my graduation project, I created a platform and integrated both technologies and made a bridge between both technologies for the purpose of adapting indoor comfort and decreasing window weight and cost. This project results will belong to TU Delft, but I would love to continue this research after graduation if this project can be funded.

This design and research is just a start of this project, there will be a long way to go. Based on the main research question and sub-questions, the main challenge in the next two months will be window detail design and soft robotics production. Normally, soft robotics can be 3D printed or cast by silicon, however, because of the 3D printer size limitation, and vacuum machine size limitation, producing large size soft robotics will be a challenge.

Overall, this research and design help me strengthen my research skills and systematic thinking. Also, this research created a bridge between two new technologies. I hope this design can inspire other graduation students