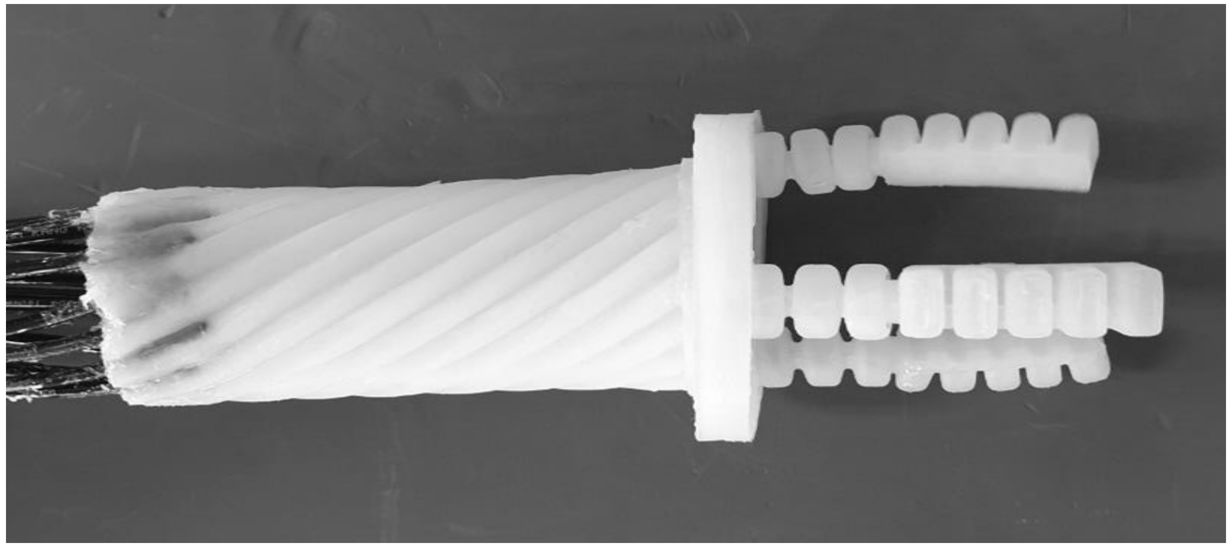
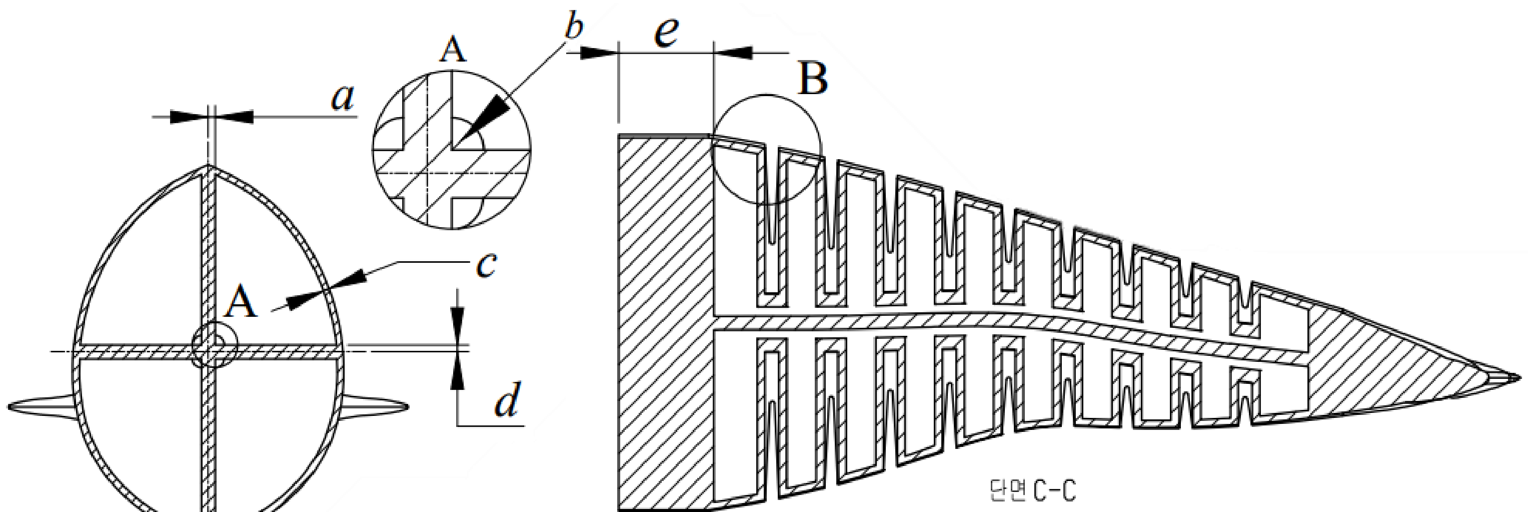


- Material test
- 2D/3D CAD
- Computational analysis
- Mockup fabricate
- Experiments
- Product development
- Patent development

Taehan Kang

Mechanical Engineering Portfolio



Contact:
kangtaehan32562@gmail.com
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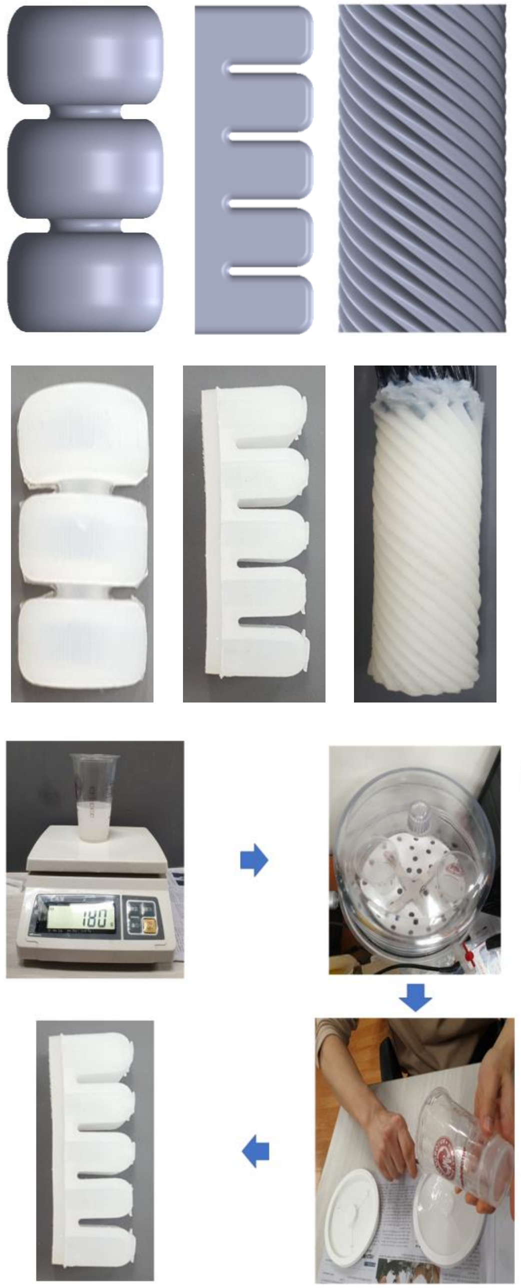
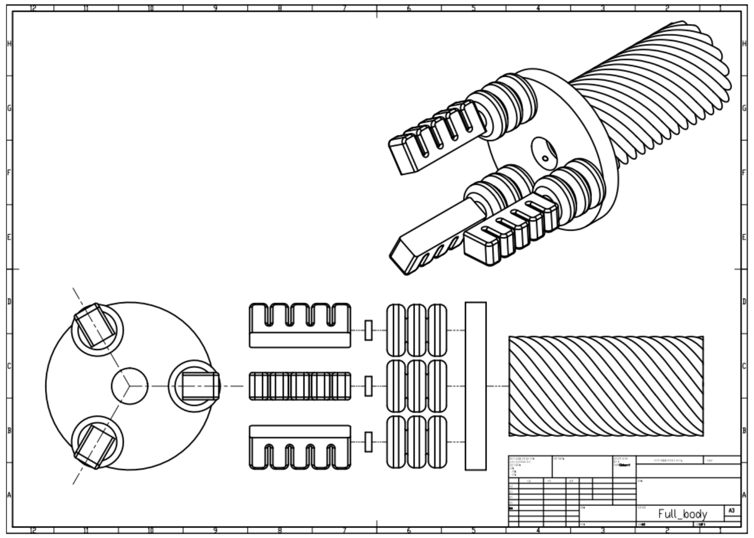
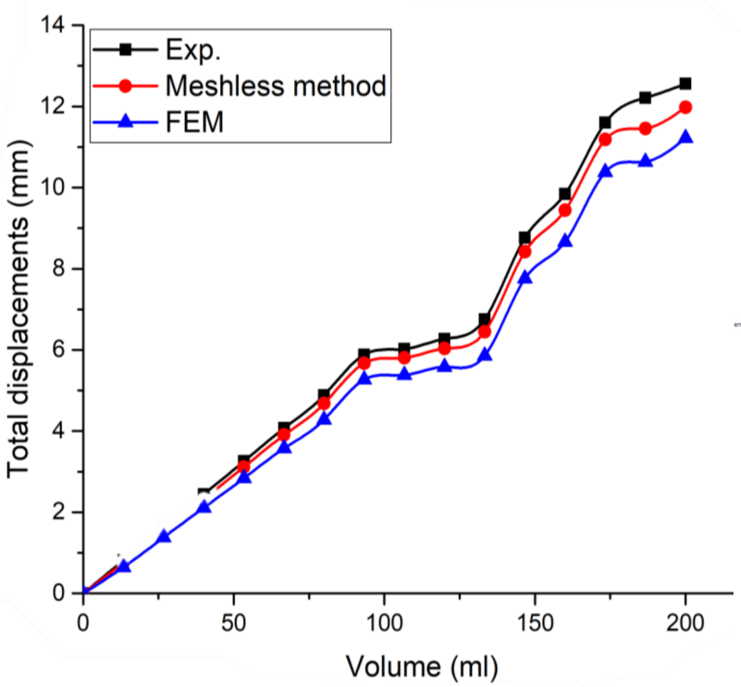
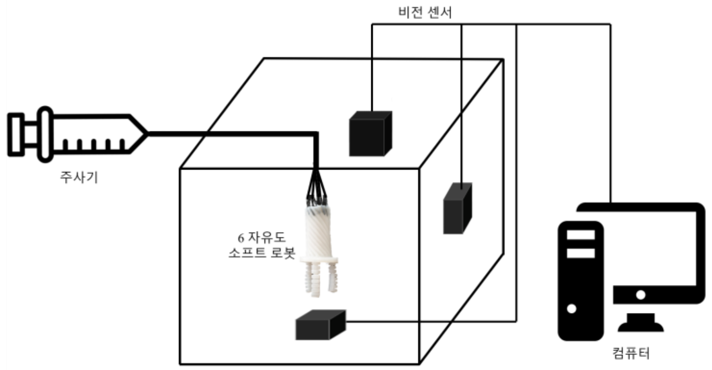
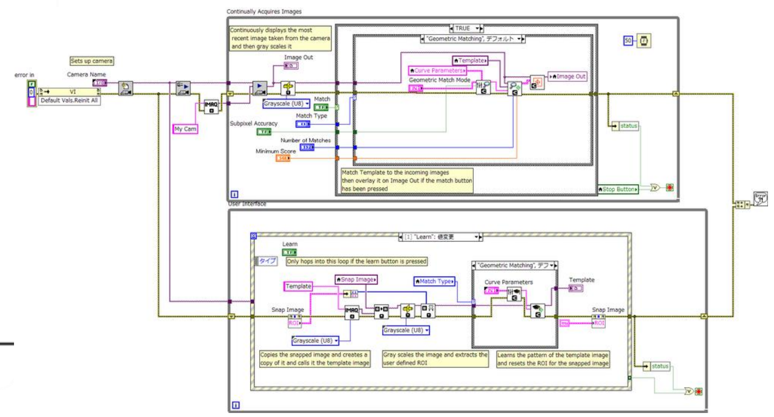
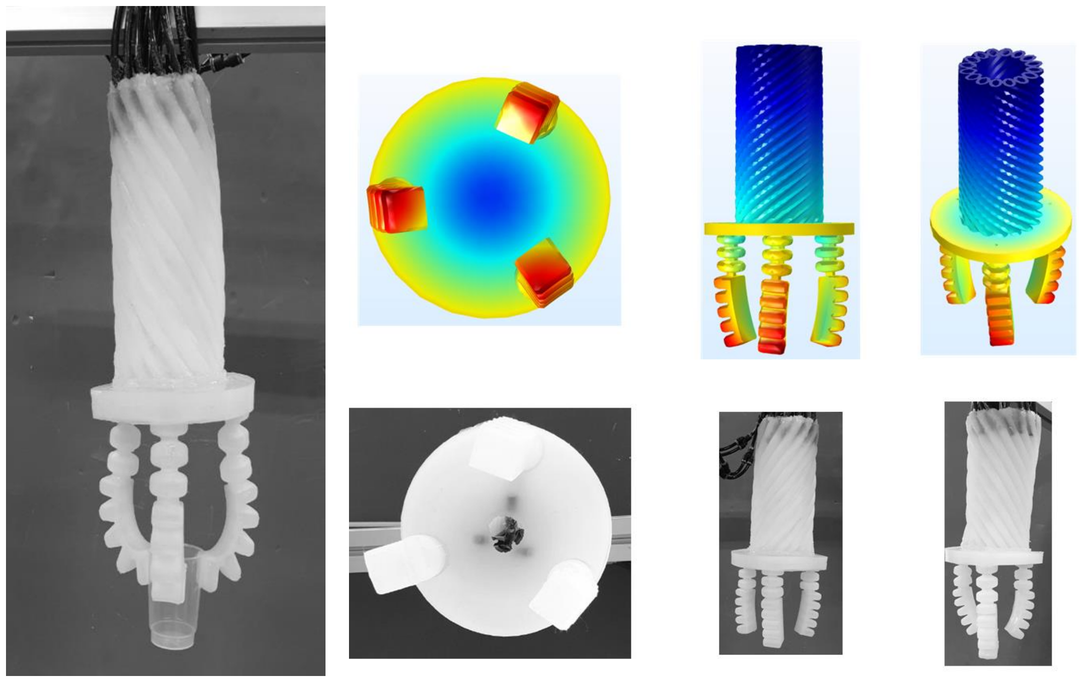


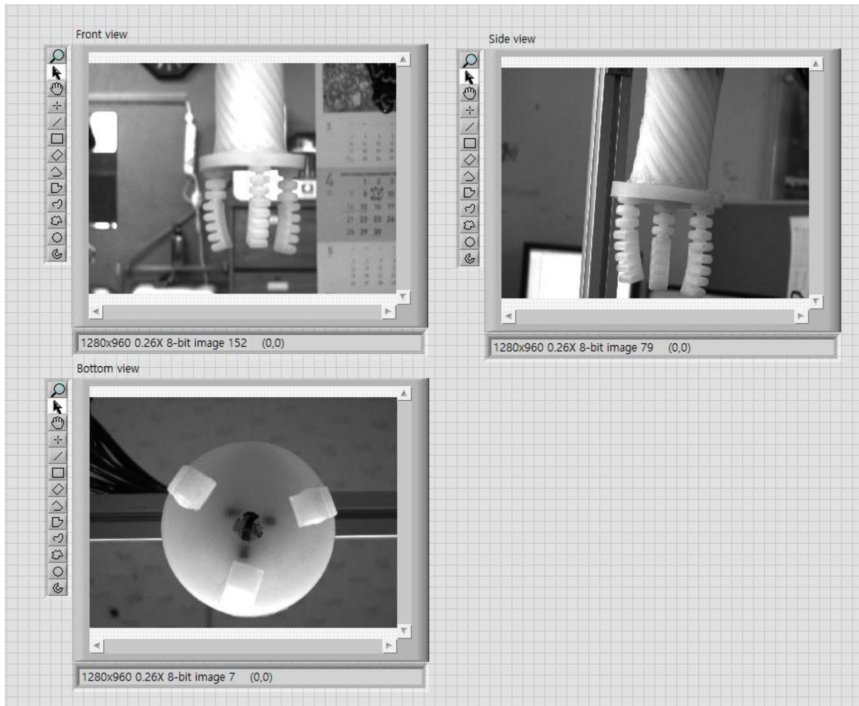












6-DOF Soft robot

Confirmed the error rate of 4.961% by comparing machi ne vision-based behavior experiments with 2-way FSI simulation

Performance check through cup holding experiment

I developed a 6-DOF soft robot for the purpose of developing a robot that is safer than conventional rigid-body robots. It consists of 3 modules: bending, torsion, and tension, and the behavior of each module and complex behavior in combination are possible. Through the research, I have improved my understanding of materials through material property tests of hyper-elastic materials. And I developed my design ability through 2-way FSI using Solidworks and ANSYS and gained know-how in manufacturing soft robots using 3D printers. Moreover, using LabVIEW, machine vision-based underwater behavior experiments were performed and know-how on underwater experiments was acquired.

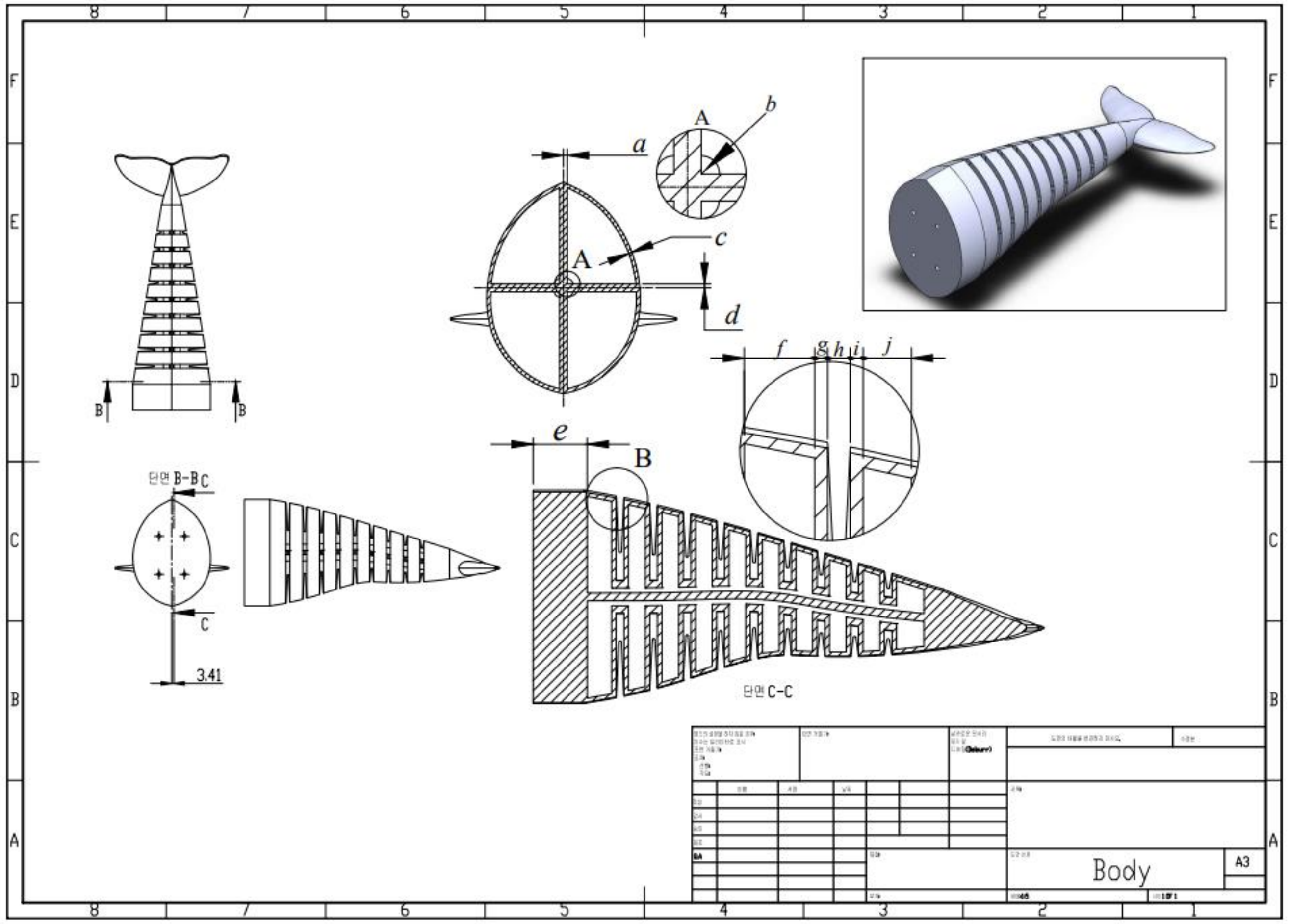
- **Material property test**
- **2D/3D CAD**
- **FEA simulation**
- **2-way FSI simulation**
- **Using 3D printing**
- **Fabricate soft robot and molds**
- **Using Machine vision tech**
- **Behavior test**
- **Product development**
- **Using LabVIEW**

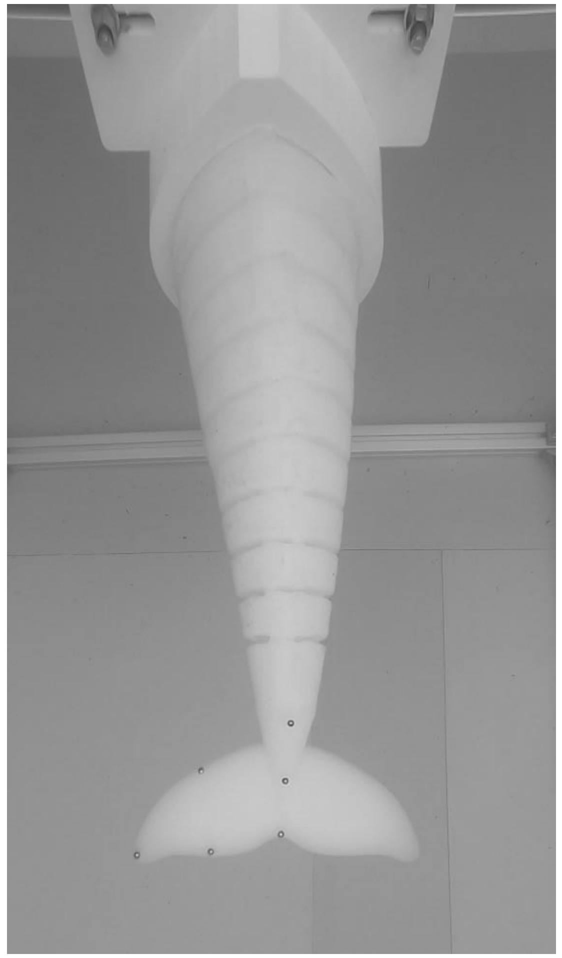
Underwater Soft robot

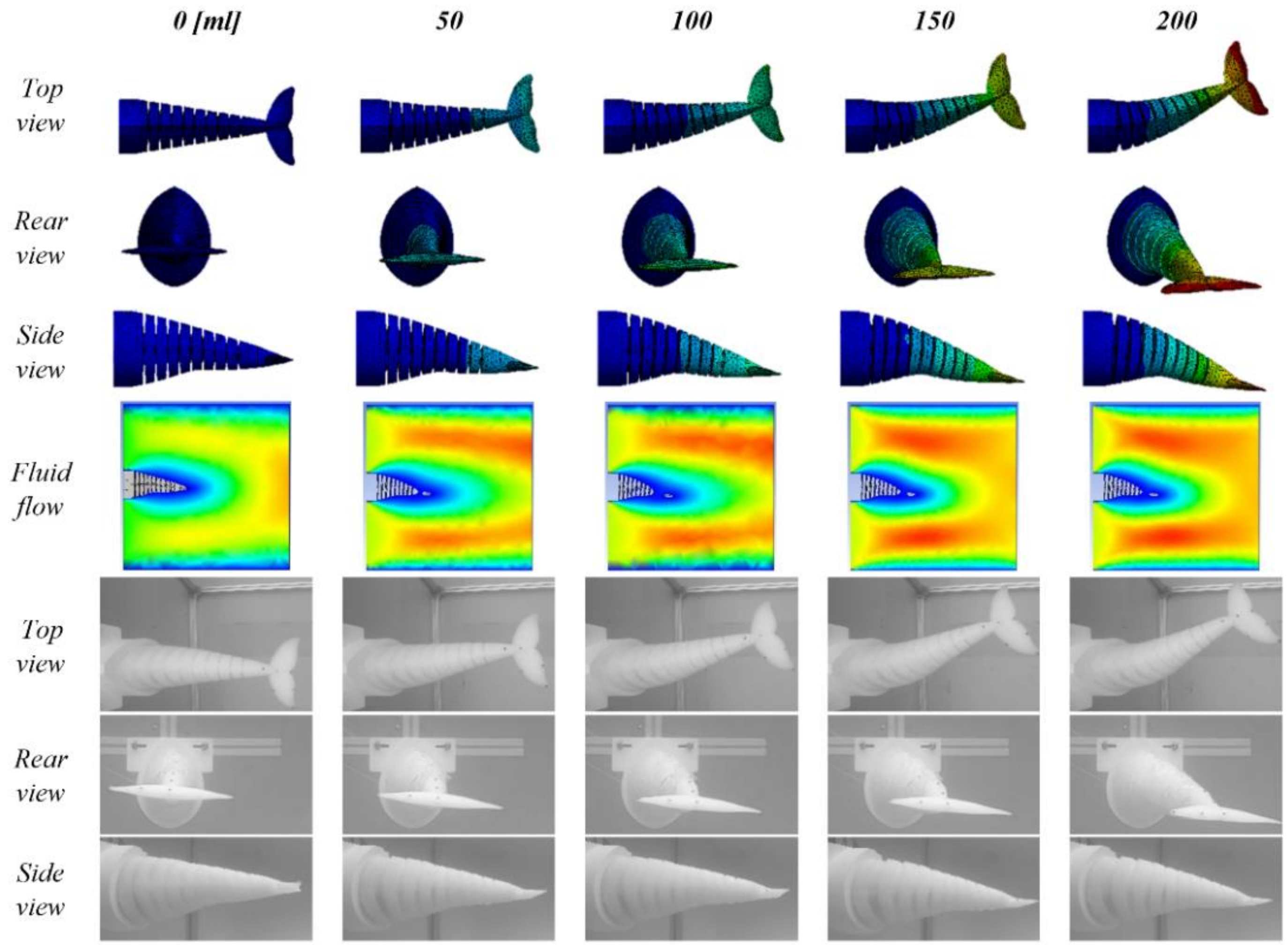
Confirmed the error rate of 3.74% by comparing machine-vision-based behavior experiments and 2-way FSI simulation
Received the paper presentation award at the 2018 spring conference of the KSMTE through related research

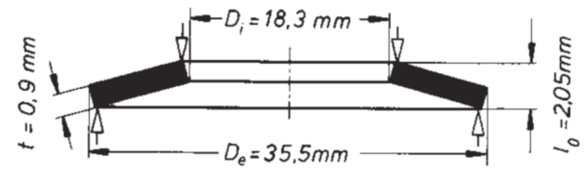
The underwater soft robot was developed for the purpose of preventing conventional rigid-body robots from causing environmental pollution while performing exploration. The soft robot is composed of 4 chambers, and each chamber can be pressurized separately, and complex behaviors are possible by combining them up, down, left, and right directions. Through the research, I improved my understanding of the material property test of hyper-elastics and developed my design capabilities through 2-way FSI using Solidworks and ANSYS. Moreover, I acquired know-how in underwater experiments through machine vision-based underwater behavior experiments.

- **Material property test**
- **2D/3D CAD**
- **FEA simulation**
- **2-way FSI simulation**
- **Using 3D printing**
- **Fabricate soft robot and molds**
- **Using Machine vision tech**
- **Behavior test**
- **Product development**
- **Using LabVIEW**

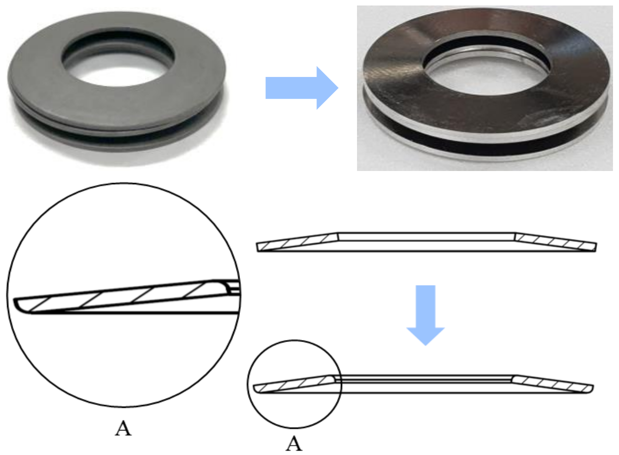


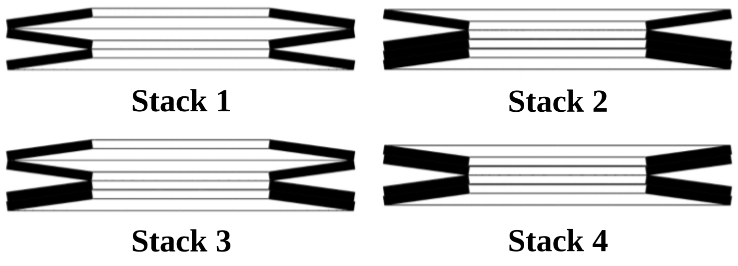






Parameters (mm)	t	D_e	D_i	l_0
Case 1	0.8	31.5	16.3	1.85
Case 2	1.0	34	12.3	2.0
Case 3	0.9	35.5	18.3	2.05
Case 4	1.0	40	20.4	2.3



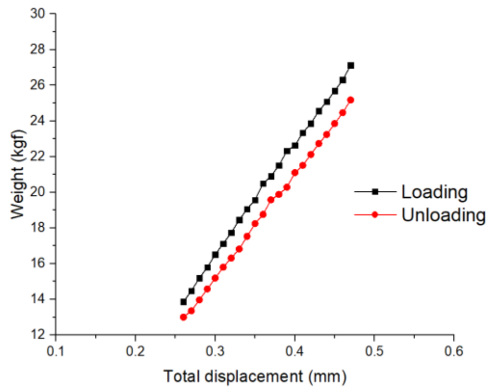


Specimen	Peak_UB300g Res. (rpm)	CR (%)	Vibration (µm)	CR (%)
Conv Leg	**1028**	-	**257**	-
SUS301 + EP	661	35.7 ↓	386	50.2 ↑
SUS301_ER + EP	730	29.0 ↓	360	40.1 ↑
SUS304 + EP	606	41.1 ↓	415	61.5 ↑
SUS304_ER + EP	**763**	**25.8 ↓**	**204**	**20.6 ↓**
51CrV4 (Mubea)	803	21.9 ↓	577	124.5 ↑
51CrV4_ER (Mubea)	750	27.0 ↓	719	179.8 ↑

Washing machine leg based on Disc spring

Reduced vibration by 20.6% in dehydration that the highest vibration

I developed to reduce the amount of vibration applied to the legs by increasing the durability of the washing machine with high damping and high efficiency. The developed leg was made through a combination of stacked disc springs, and the optimal combination to withstand load and vibration was selected through load tests. Afterwards, through an actual washing machine attachment experiment, the optimal spring material and shape with less vibration than the target and designed to avoid resonance were selected. Through this study, I understand how AutoCAD can be used to create drawings for production and know-how for material load tests.

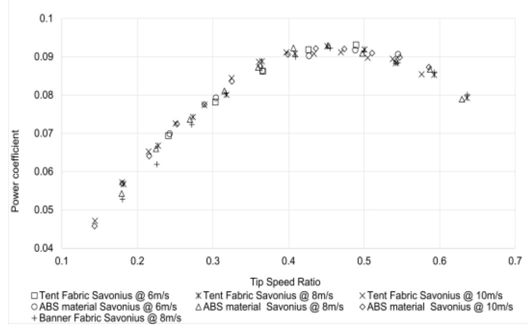


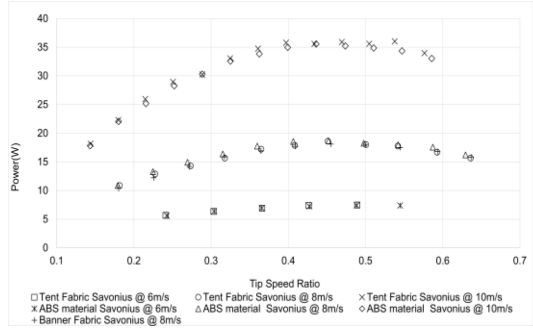
- **Material test**
- **2D CAD**
- **Fabrication**
- **Product development**

Small-scale Vertical Axis Wind Turbine

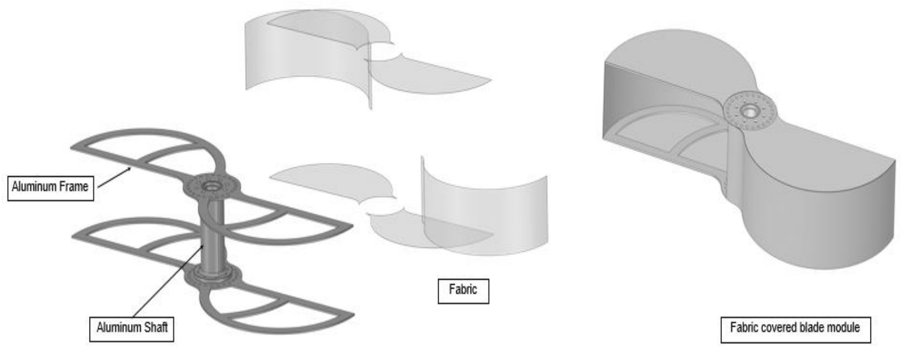
22.6% improvement in power performance
performance verification with power efficiency error rate of 1.09%

I conducted research to improve the power performance of small-scale Vertica-Axis Wind Turbine(VAWT). I designed a turbine using CATIA and developed a wind turbine with a 22.6% improvement in power generation performance through a wind tunnel test of a turbine attached to blades of new materials. Moreover, the fabricated hardcover blade using a 3D printer and the performance of the fabric blade was verified with a power efficiency error rate of 1.09%. Through this research, I learned the know-how of wind tunnel tests and the development process of wind turbine products.





- **2D/3D CAD**
- **Using 3D printer**
- **Fabrication**
- **Wind tunnel test**
- **Product development**

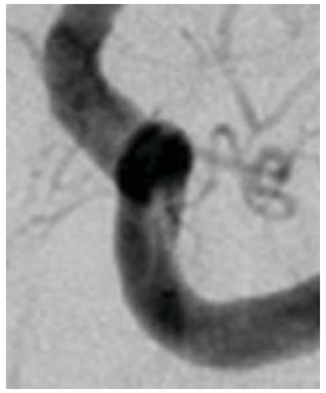


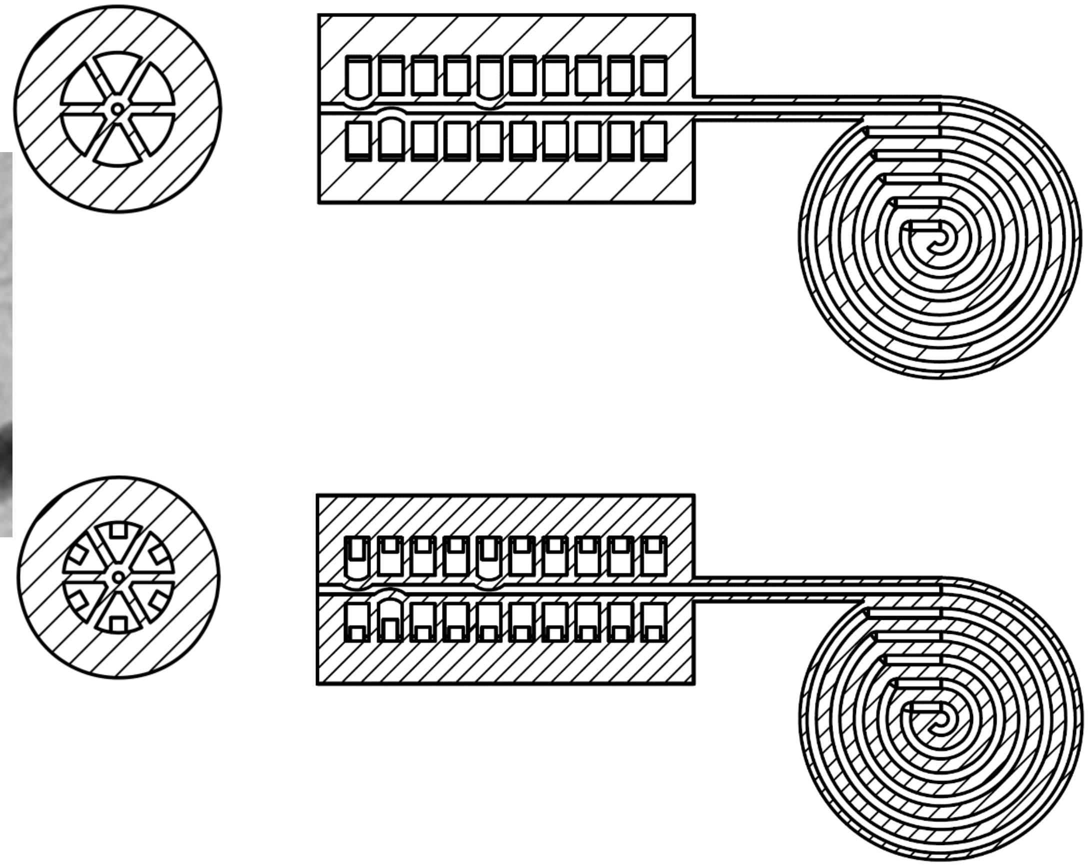
Wind speed (m/s)	Max. power (W) Tent fabric	Banner fabric	ABS plastic	Max. Cp Tent fabric	Banner fabric	ABS plastic
6	7.4	-	7.4	0.093	-	0.092
8	18.6	18.1	18.7	0.093	0.092	0.093
10	35.9	-	35.2	0.091	-	0.092

Catheterization simulator

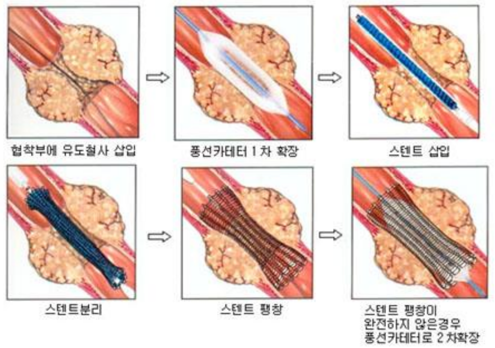
Patent development to improve inconvenience through interviews with 11 residents' doctors

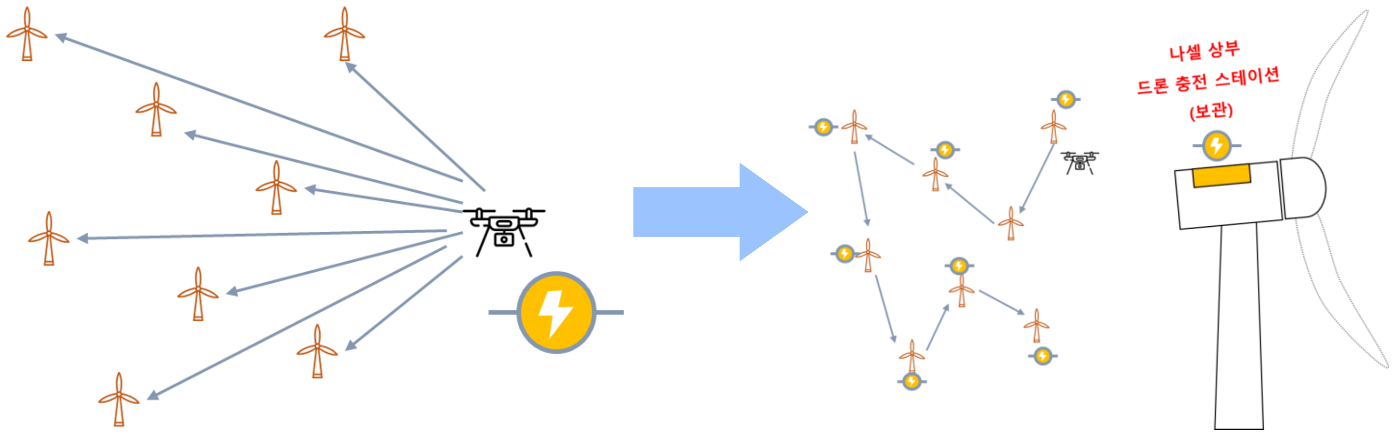
Catheters are used for vascular insertion without surgical intervention. While researching the field of application of soft robots, I conducted research by judging that they could be used in the medical field through examples such as artificial hearts and rehabilitation treatments. I interviewed 11 residents at 3 large hospitals in Seoul to hear about the inconvenience of the equipment to practice vascular implantation and carry out improvement design. In the conventional equipment with only one internal space, the internal space was divided into 5 sections in the cross-sectional direction and 12 sections in the longitudinal direction, for a total of 60 sections, so that complex blood vessels can be realized.





- **Concept design**
- **2D/3D CAD**
- **Patent development**

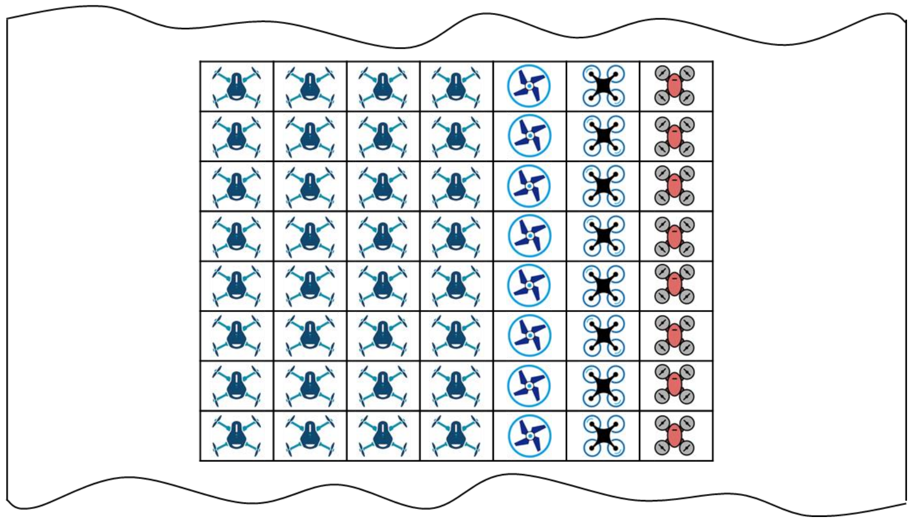




Drone-based blade inspection system

Development of drone charging system to improve inspection efficiency

Blades in wind turbines are parts that generate electrical energy in the wind power system, and there is a risk of damage during operation for various reasons, so periodic inspection is required. In recent years, inspections using drones have been used, but there is a problem that long work and large-scale operation inspections are impossible due to drone battery problems. In order to improve this, I developed a system that can always store and operate drones by manufacturing a drone charging station with buried structure on the top of nacelle instead o the conventional method.



- **Concept design**
- **Patent development**