Study on the Skew Angles of Propellers Used in Ships

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Introduction

The characteristics and quality of a propeller can change the speed, fuel efficiency and livability of a ship drastically. The characteristics mentioned above includes, but are not limited to; the diameter, blade width, pitch and skew angle.

Many ships today are equipped with propellers that have large skew angles. They are called high skewed propellers and are said to improve the livability of a ship by suppressing vibration. However, it would be meaningless if these propellers lack the thrust to move a ship in exchange for smaller vibration.

In this study, I will compare the thrust of a high skewed propeller with propellers with normal ones. I will conduct an experiment using three propeller models with different skew angles. I will also run a simulation on Solidworks Flow Simulation to visualize the fluid flow around the propeller blades, and also compare the simulation results with the aforementioned experiment results.

All notes, 3D CAD models, blue prints etc. are available on my Github repository [2].

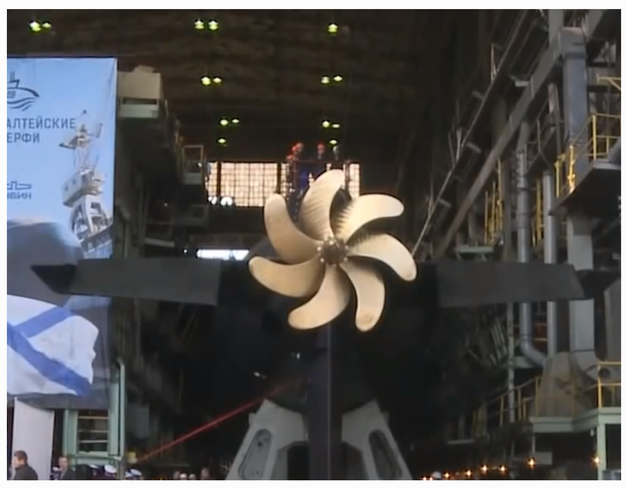

Figure 1: A high skewed propeller used in Russian Submarine "Rostov-on-Don"

Future Prospect

Tasks that remains to be done is listed below:

1. Produce the propeller models
2. Build the experiment device
3. Measure the thrust of each propeller model
4. Compare the experiment results with simulation results
5. Determine the skew angle that produce the largest thrust

References

[1] Image taken from youtube
"Russia: "Black Hole" stealth subs plummet to join Black Sea Fleet"
https://www.youtube.com/watch?v=hTrg2nhh0-E

[2] Github repository for this project:
https://github.com/sum-y/Study-on-the-Skew-Angles-of-Propellers-Used-in-Ships

Acknowledgements

I would like to thank the engineer staffs of the Manufacturing Center for their support and expertise.

Propeller Models

The 3D CAD models of the propeller blades I designed is showed in Figure 2. They will be inserted into the propeller boss, which is attached to the experiment device. Figure 3 shows the 3D CAD model of the built propeller.

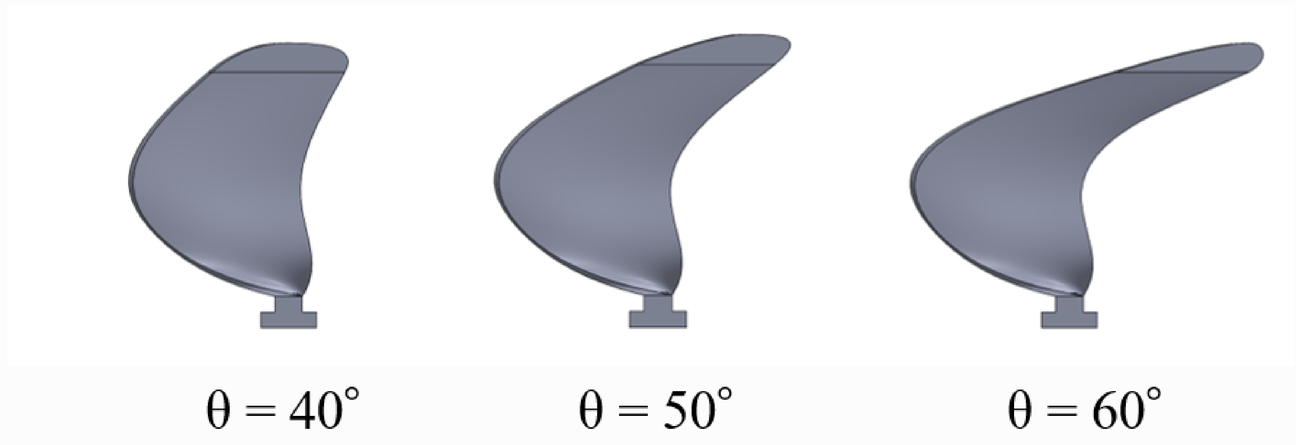

Figure 2: The 3D CAD models of the propeller blades

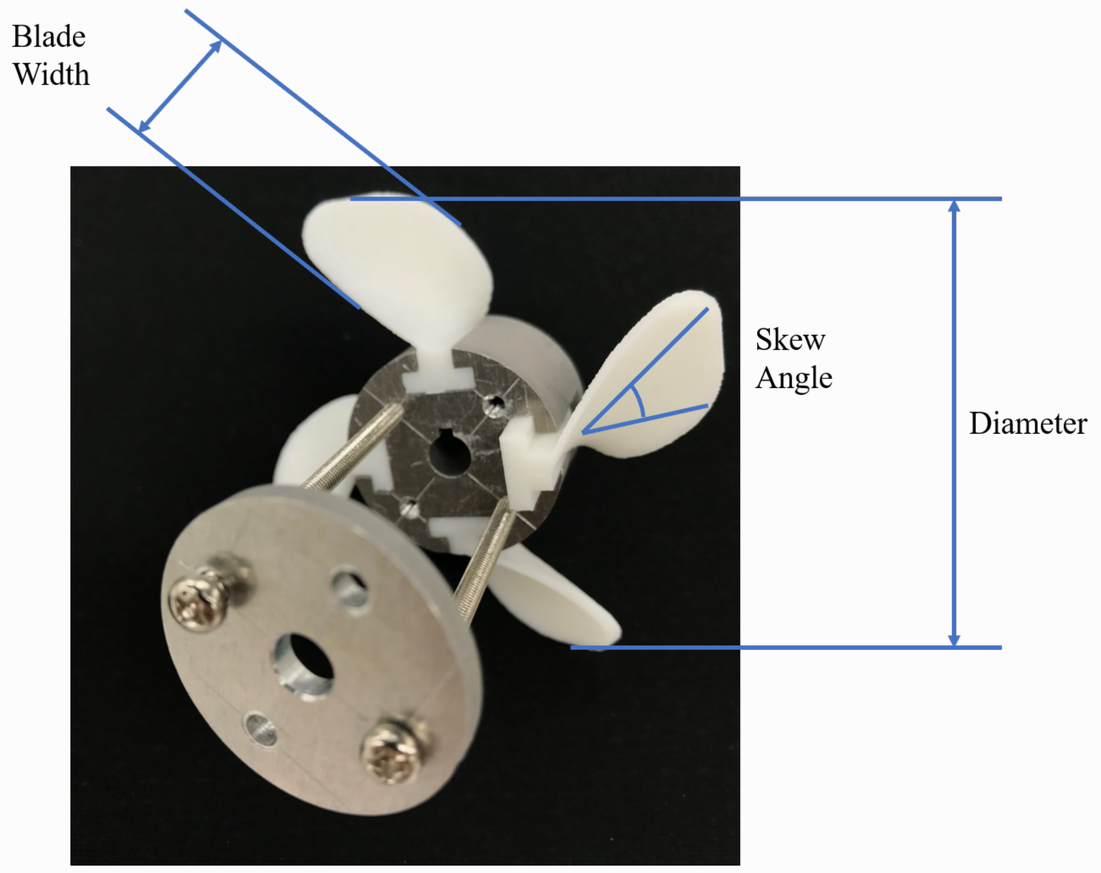

Figure 3: The 3D CAD models of the propeller blades inserted to the boss

The propeller blades will be produced using 3D printers. There are two reasons why I chose to use a 3D printer instead of a milling machine. First of all, it is expected to take less time to produce all three models. Second, even if one of the blades break during experiment, it will be easy to produce another blade.

Experiment Device

The 3D CAD model for the experiment device is shown in Figure 4. A sheet of aluminum plate moves vertically along the aluminum frames. The aluminum plate holds a motor, which is attached to the propeller axis. The propeller is attached to the other end of the propeller axis. A spring scale will be used to measure the thrust of the propeller.

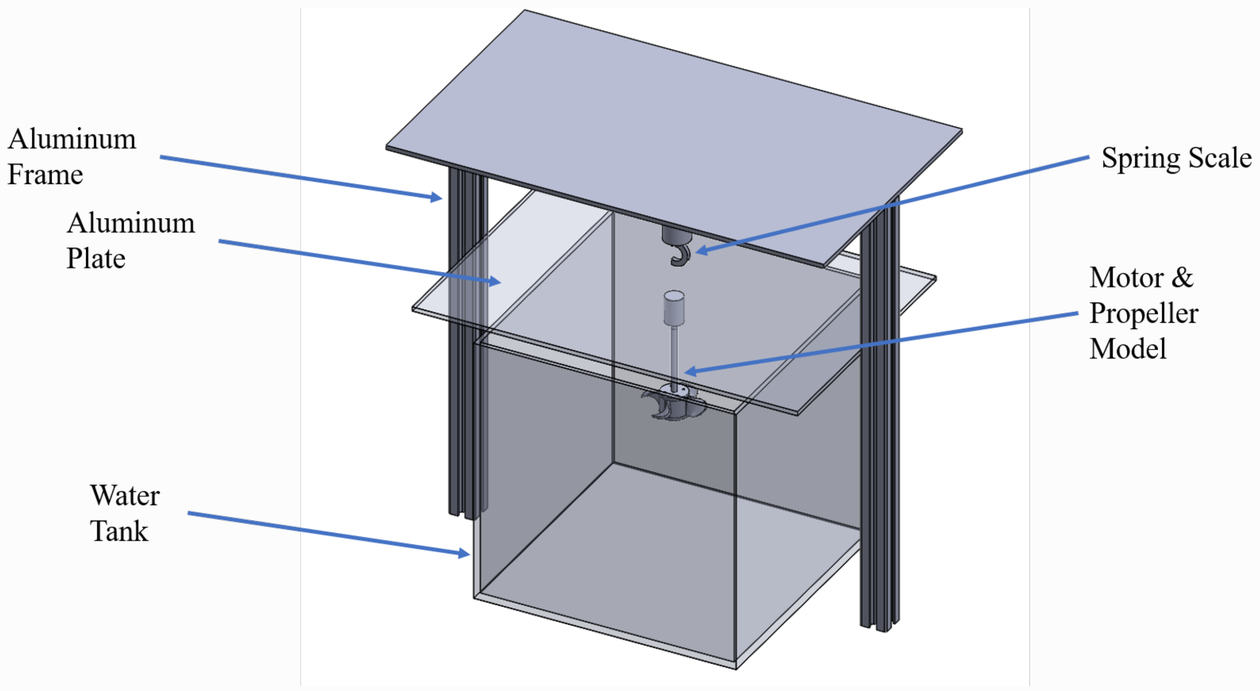

Figure 4: 3D CAD model of the experiment device