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 high-skewed propellers, which are said to improve performance.

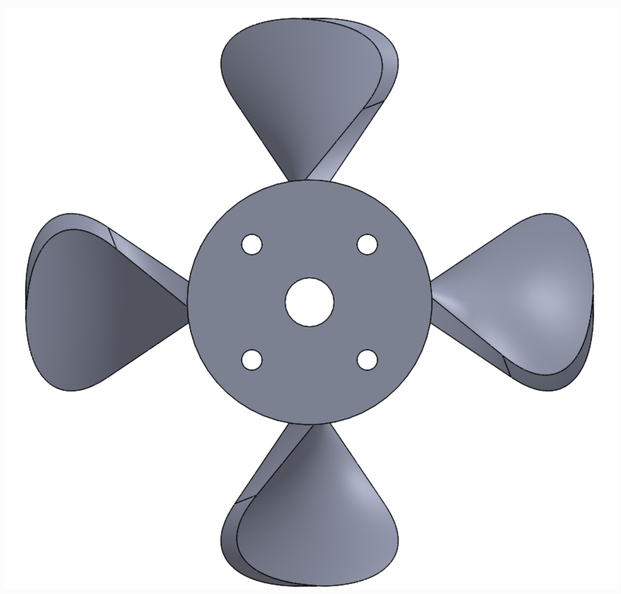

Figure 1: The parameters of a propeller

I will compare the performance of a high-skewed propeller with propellers with smaller skew angles in this study. In addition, I will determine the skew angle that produces the best performance.
All notes, 3D CAD models, blue prints etc. are available on https://github.com/sum-y/Study-on-the-Skew-Angles-of-Propellers-Used-in-Ships .

Materials and Methods

I have designed three propeller models that have the same propeller diameter and blade width, but with different skew angles. In order to compare the performance of each model quantitively, I have also designed an experiment device that will measure the thrust of a propeller.
I will also run simulations using 3D CAD models of the propellers. The purpose of this simulation is to check the accuracy of experiment results.

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 courtesy of Nakashima Propeller co., ltd: https://www.nakashima.co.jp/eng/product/fpp.html

Acknowledgements

Should I write one? And how?

Propeller Models

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

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

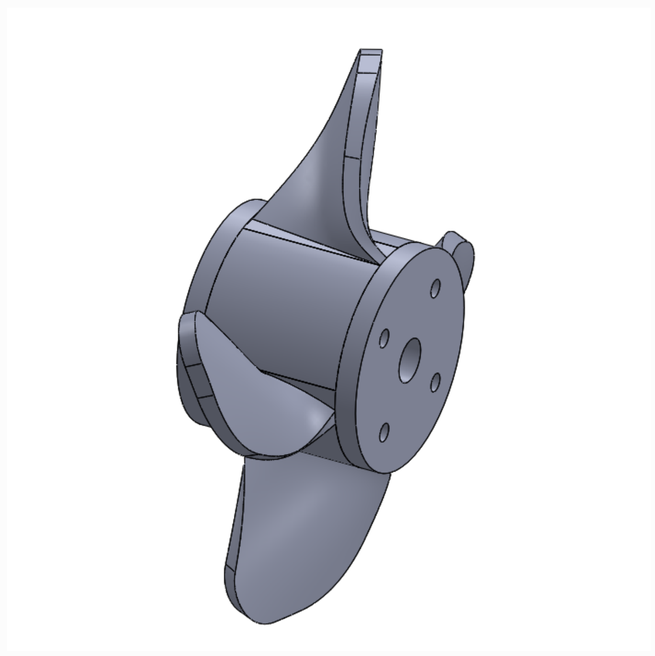

Figure 3: The 3D CAD models of the propeller blades inserted to the boss

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 **??**. A sheet of aluminium plate moves vertically along the aluminium frames. The aluminium 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.

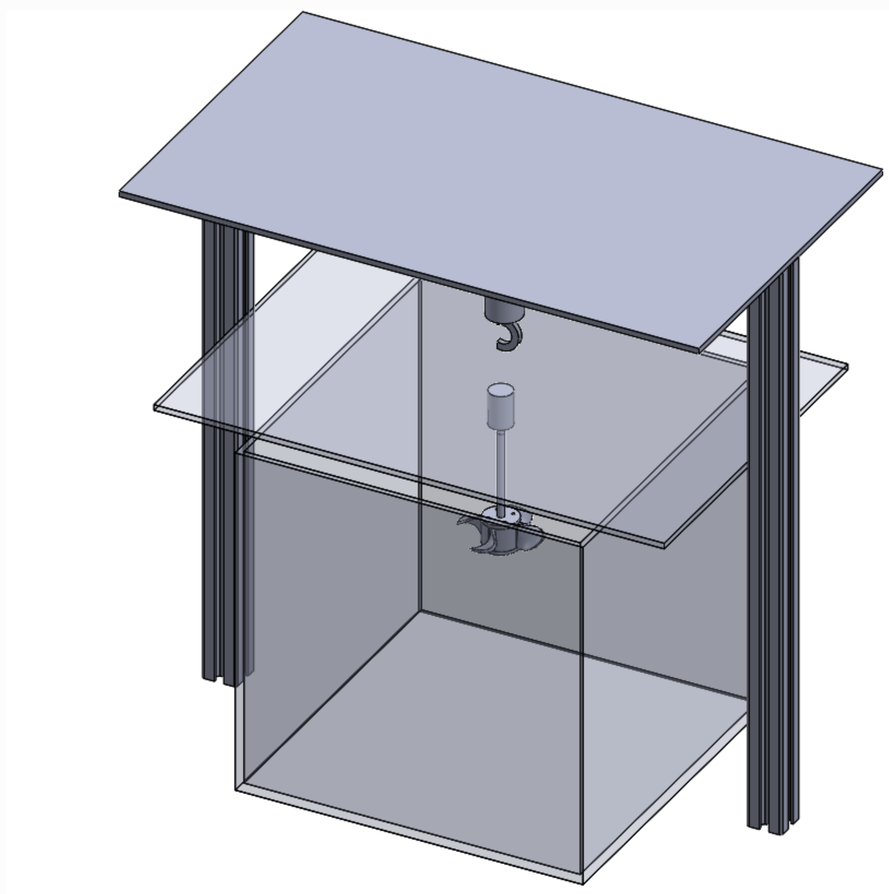

Figure 4: 3D CAD model of the experiment device