2.23 Hydrofoils & Propellers
SDV Propeller Design Project
Spring 2007

Introduction:

A design project for 2.23 Hydrofoils & Propellers entails the design of a propeller for a notional Seal Vehicle (SDV). The desire is to design a propeller for a relatively high speed SDV (4 m/s). Figure 1 shows the hull shape for the SDV. The design effort will include the parametric design of the propeller including sizing , powering and efficiency calculations. A blade design will also required for the propeller along with consideration regarding cavitation in the design of the blade sections.

Design Specifics:

The overall specifications for the project are outlined below:

- Design Speed 4 m/s
- Inflow wake velocity variation +/-0.3 m/s
- Hull length: 9.3755 meters
- Hull diameter: 1.5 meter
- Design depth: 3m to hull centerline
- Propeller speed: TBD, assume gearing can match motor
- Propeller type: free tip single screw (contra-rotating design optional)
- Hull drag coefficient Cd = 0.15 based on frontal area
- Hull offsets to be provided
- Inflow boundary layer to be provided

Design Methods:

The following computational tool will be available for the design of the propeller:

MPVL lifting line code for matlab (similar to your own lifting code written in class) crude but very fast for parametric design. Written by Lt. Chung, a 2.23 student from last year, as his thesis from last year.

You are also encouraged to use your own codes developed in class, especially in the early stages of the design.

The lifting line codes can be used to conduct the parametric design of the propeller to determine:

- Propeller diameter
- Blade number
- Initial chord distribution
- Powering
- Efficiency

After the parametric design is complete then the sectional design of the blades can be performed using XFOIL and 2D data. Cavitation considerations should be included here to ensure the blades to not cavitate at design conditions. At this stage the offsets for the initial blade design should be done.

In the final stages of design, PBD should be used to modify the initial design to achieve the desired loading distribution and performance. Also, skew could be explored as a way to improve cavitation performance if needed. The output from this stage should be a fully design propeller blade.

Final Report:

The final report should include a description of you design process and the results from each step including plots and summarized computer outputs for you design studies. The report is expected to be of the quality of a technical report and should be a complete description of your design process. Include plots of the initial and final propeller geometry as well as plots useful in showing the performance of the propeller.

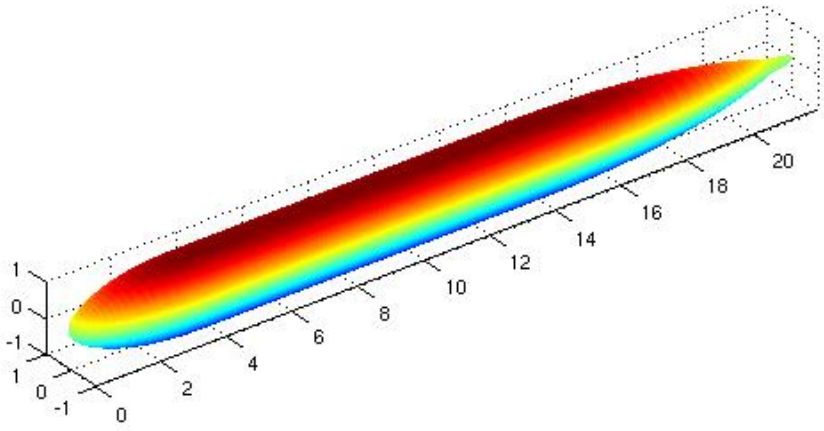

Figure 1: SDV Hull shape