



Improvement Seaworthiness by Hydrofoils Support

Camilo Mejía Jaramillo
Master Thesis Defense
Supervisor: Prof. Dr. Ing Nikolai Kornev
Rostock, February 2017

Description of the problem



Offshore Oil Platforms & Wind Turbine Farms

Description of the problem

At Rough Seas



Description of the problem

At Calm Water

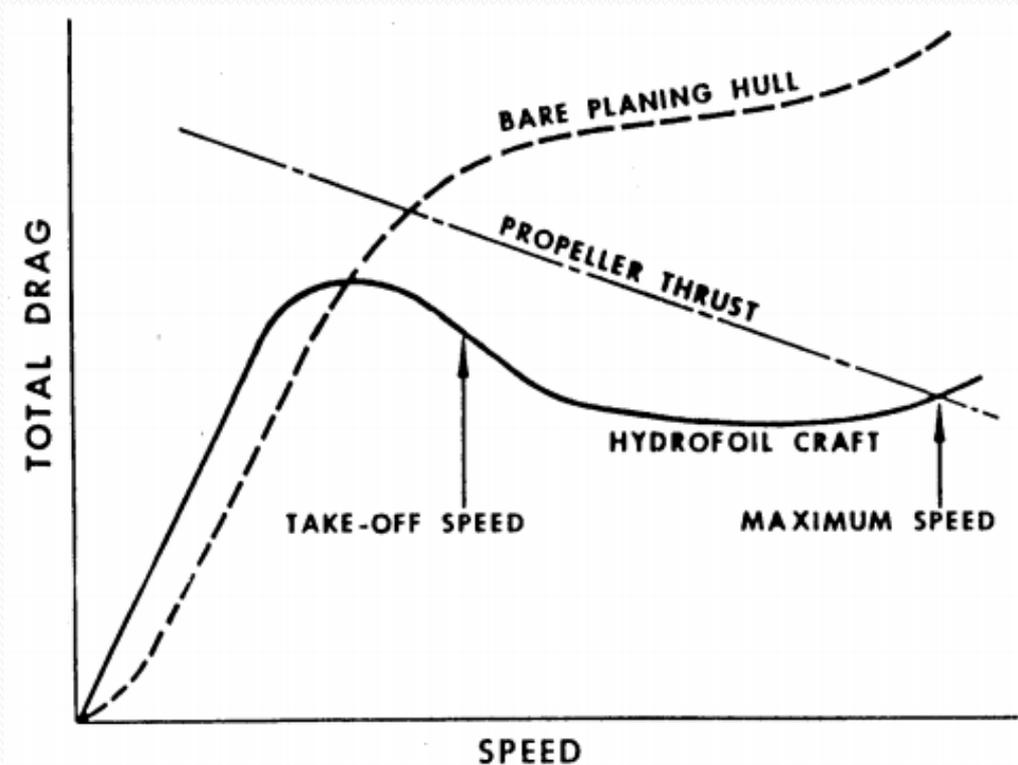


Solution, Hydrofoils Support



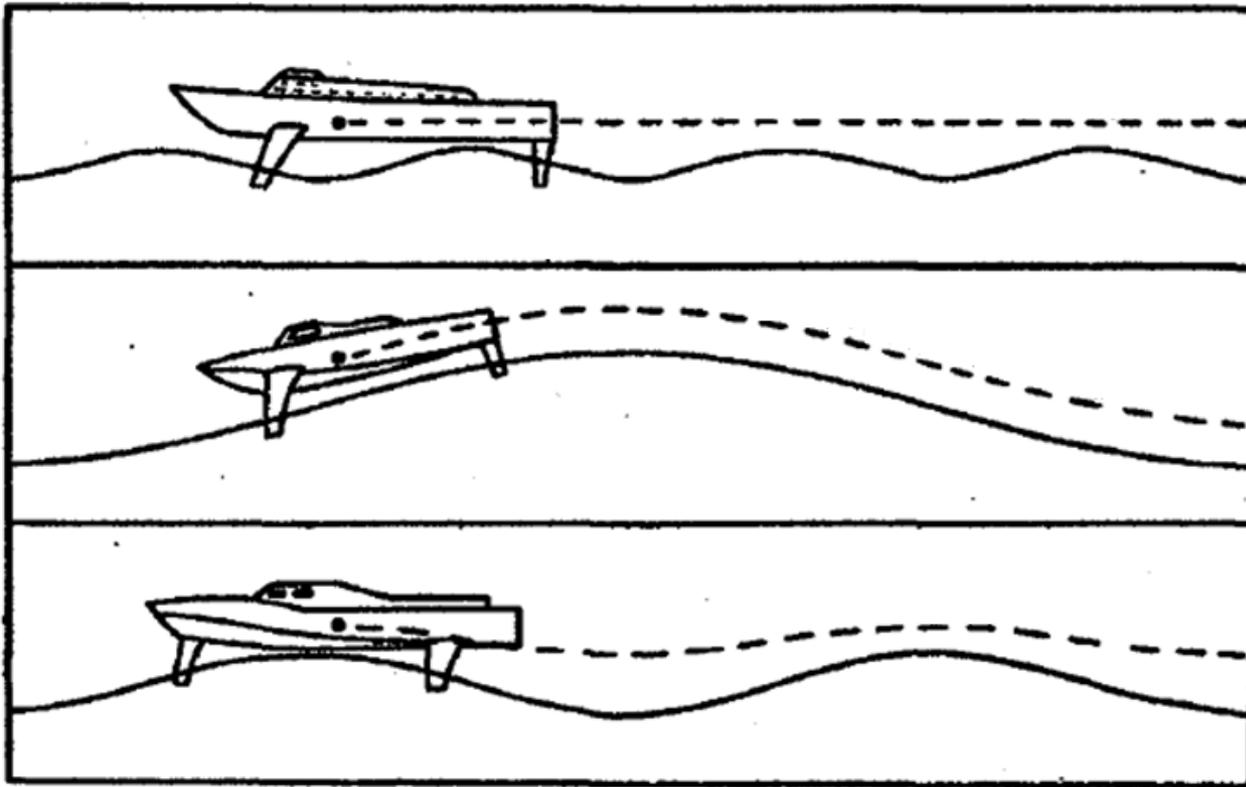
State of the art

Typical Hydrofoil Hump Drag Curve at Calm Water



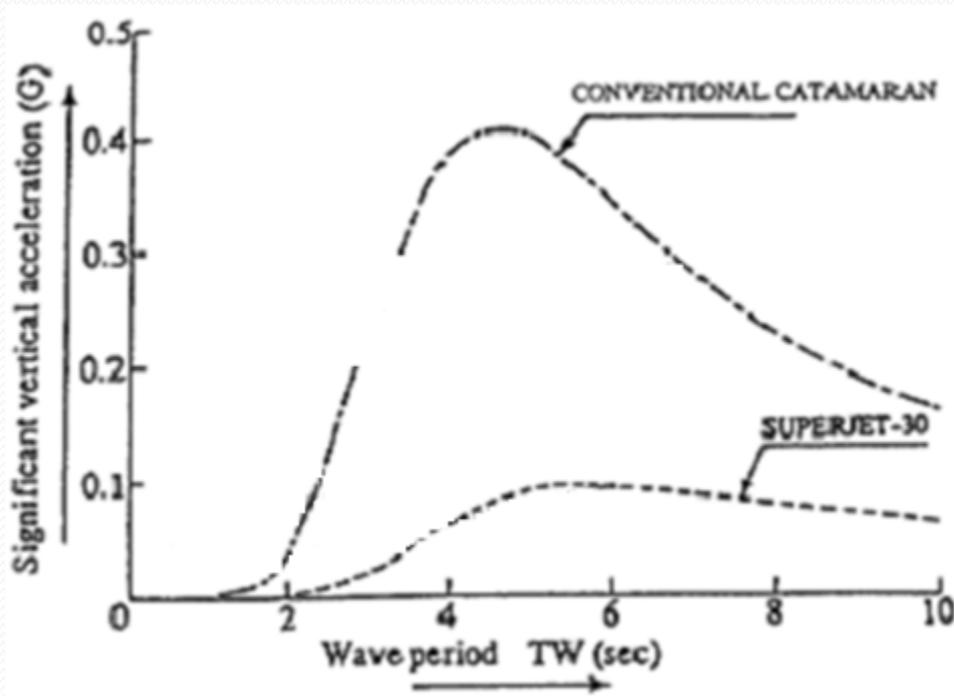
State of the art

Typical Hydrofoil Response at Different Wavelengths

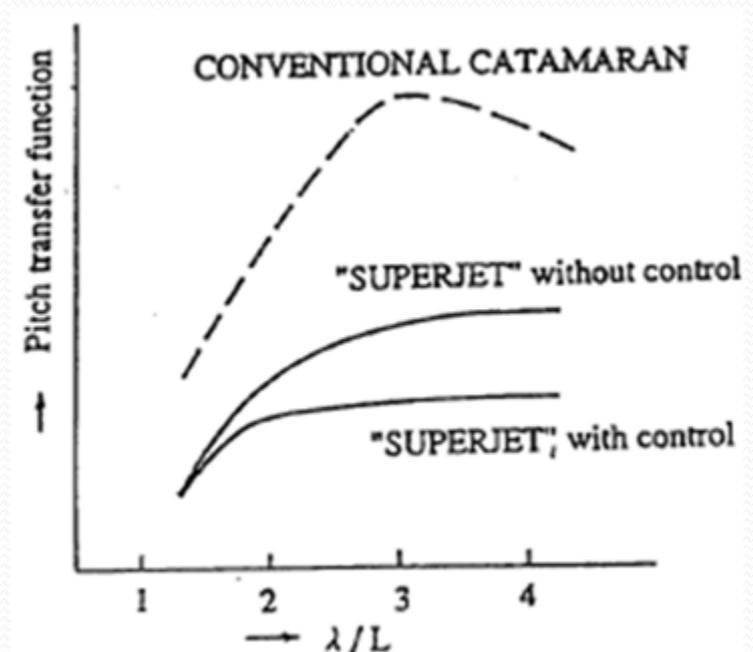


State of the art

Vertical Acceleration RAO

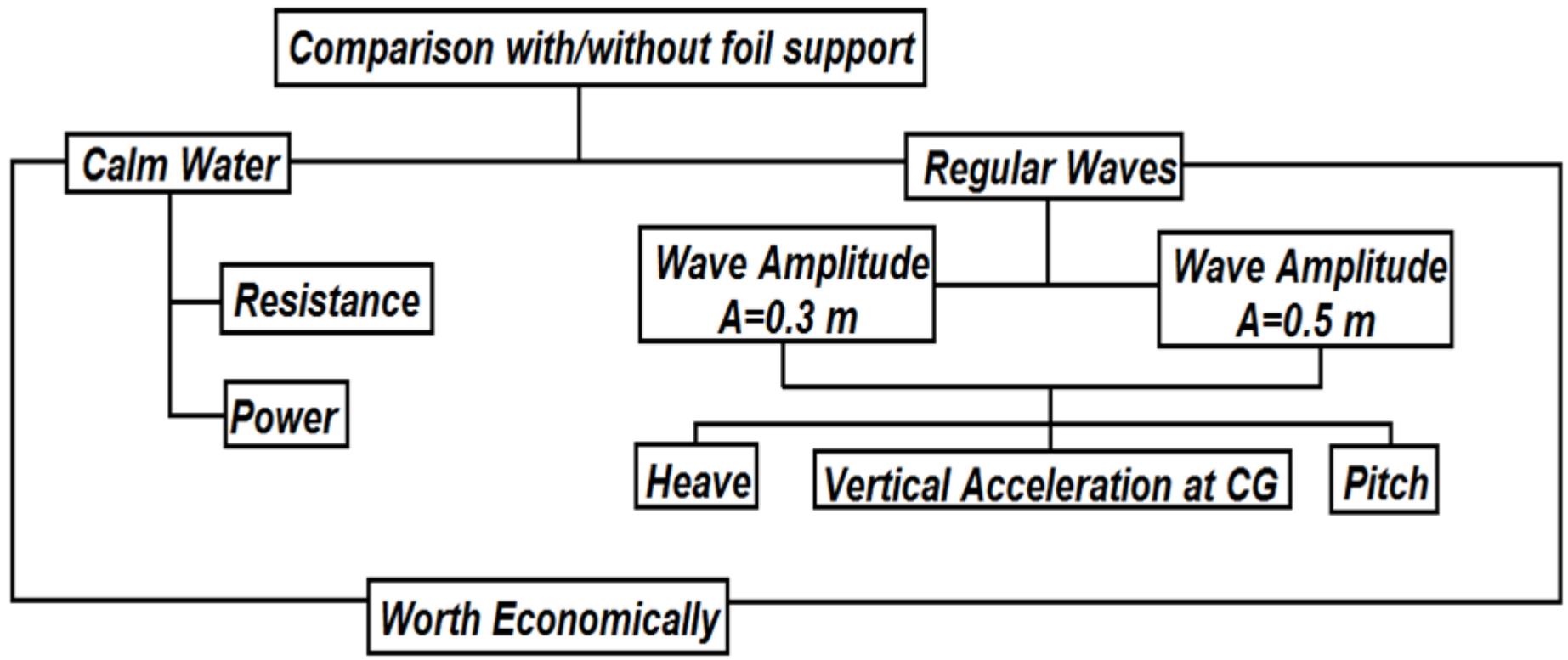


Pitch RAO

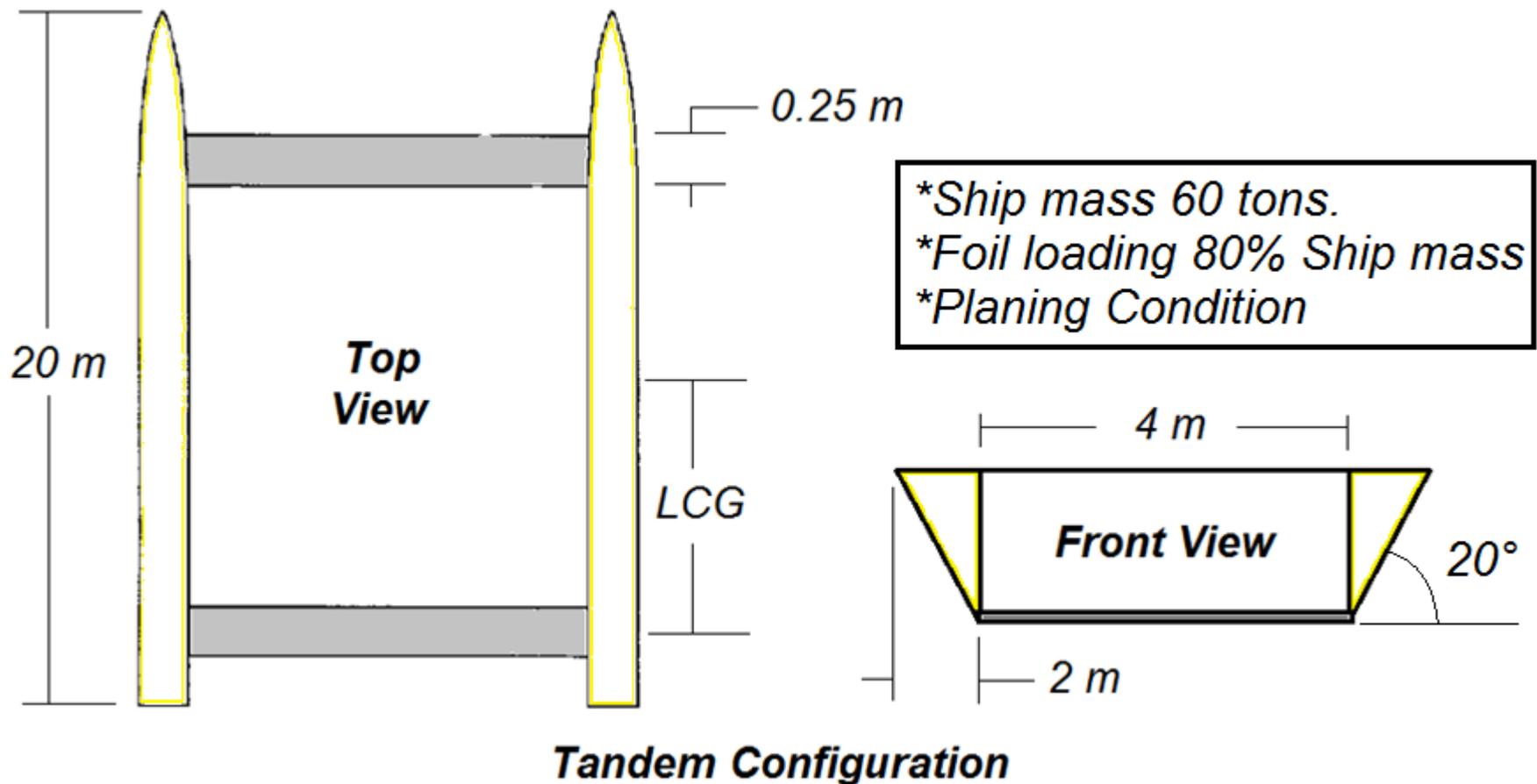


SUPERJET 30 – Hydrofoil Assisted Catamaran

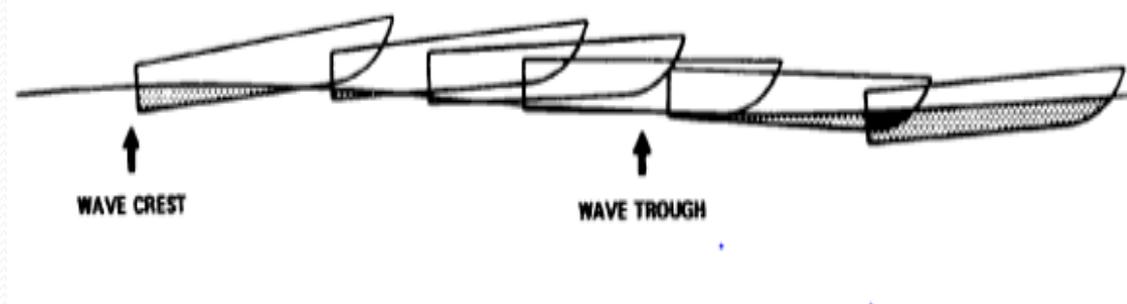
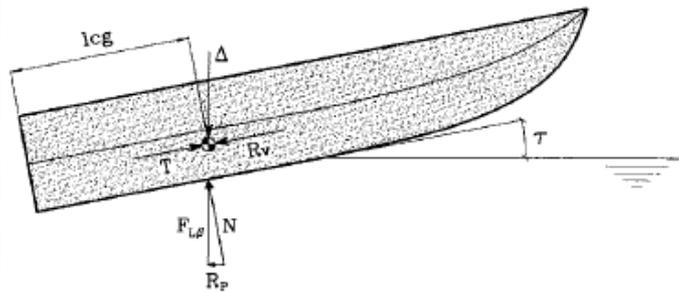
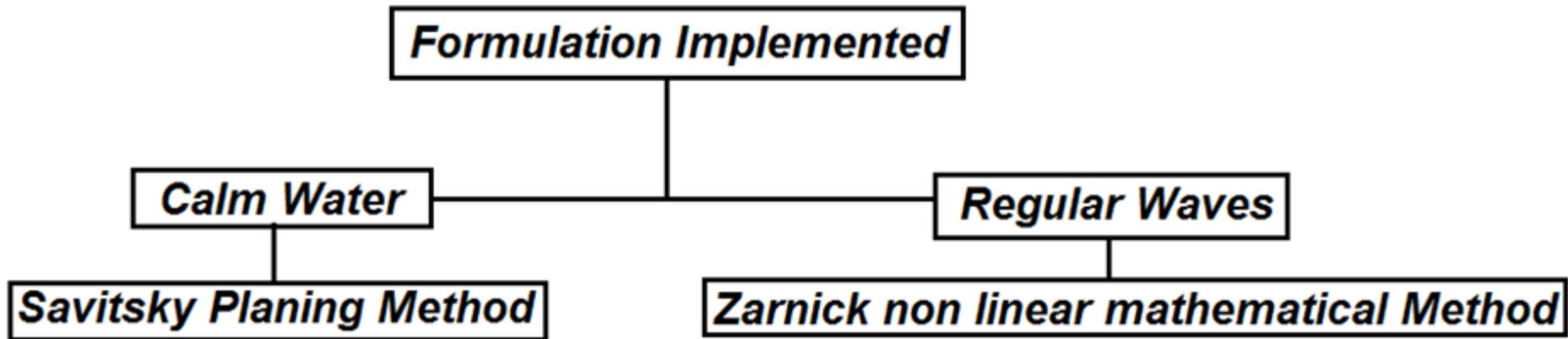
Work performed



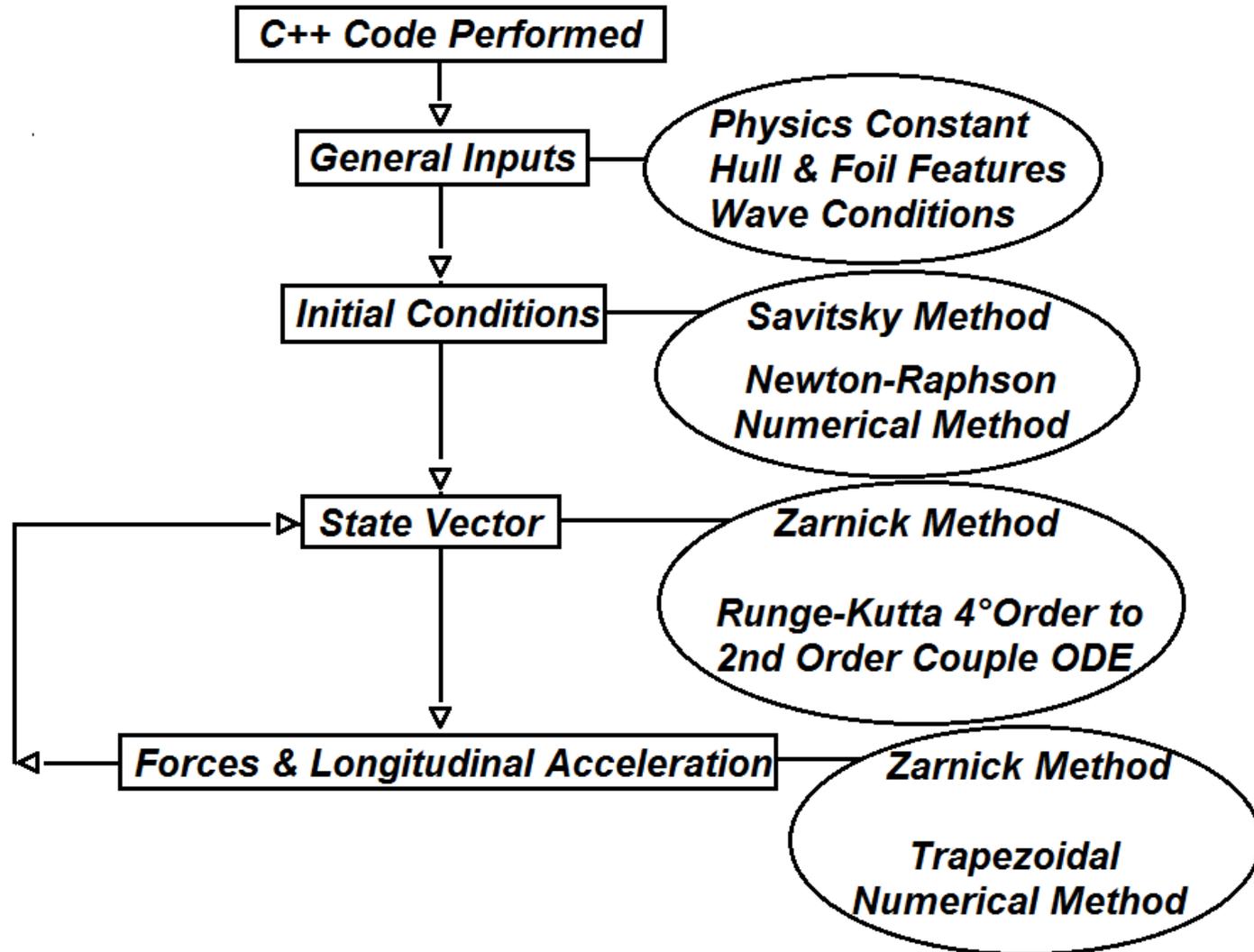
Hull & foil features



Mathematical models used



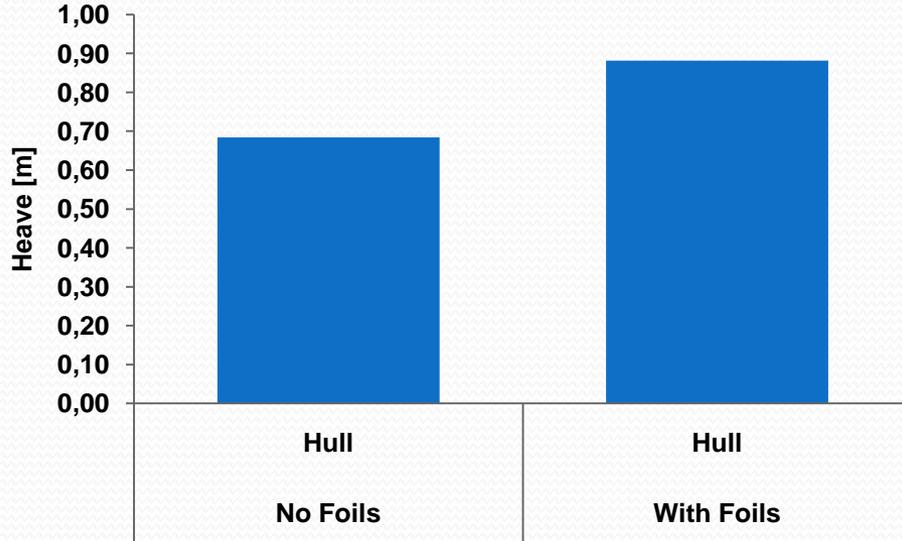
Flowchart of the code



Calm water comparison results

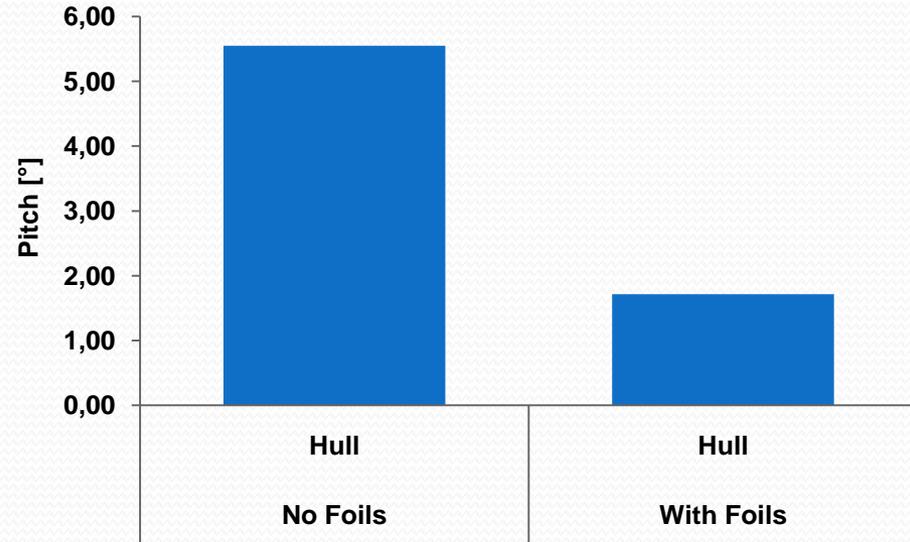
Ship Attitude Comparison

Initial Heave



20%

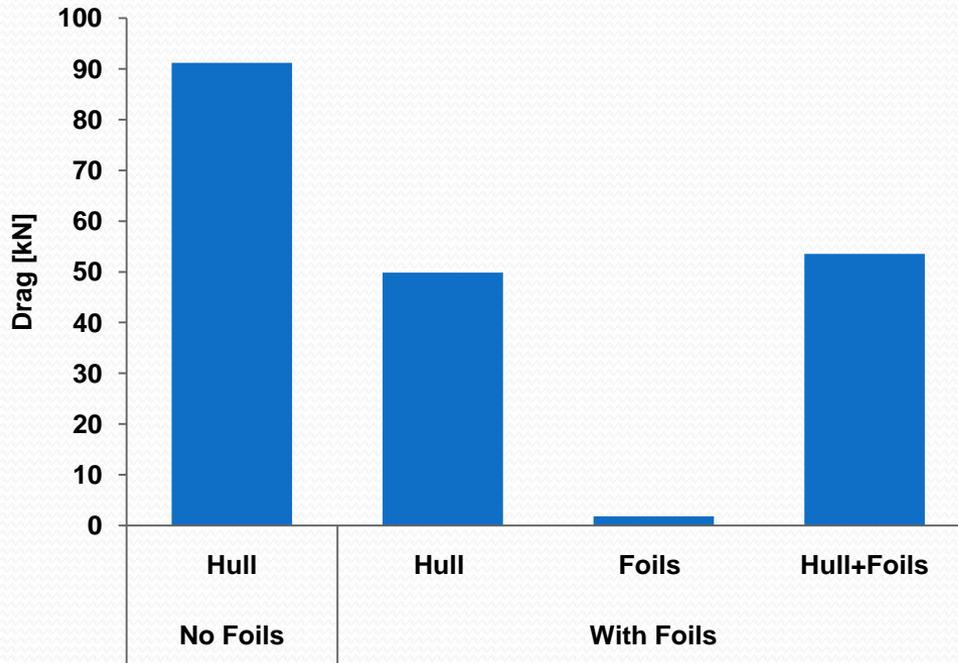
Initial Pitch



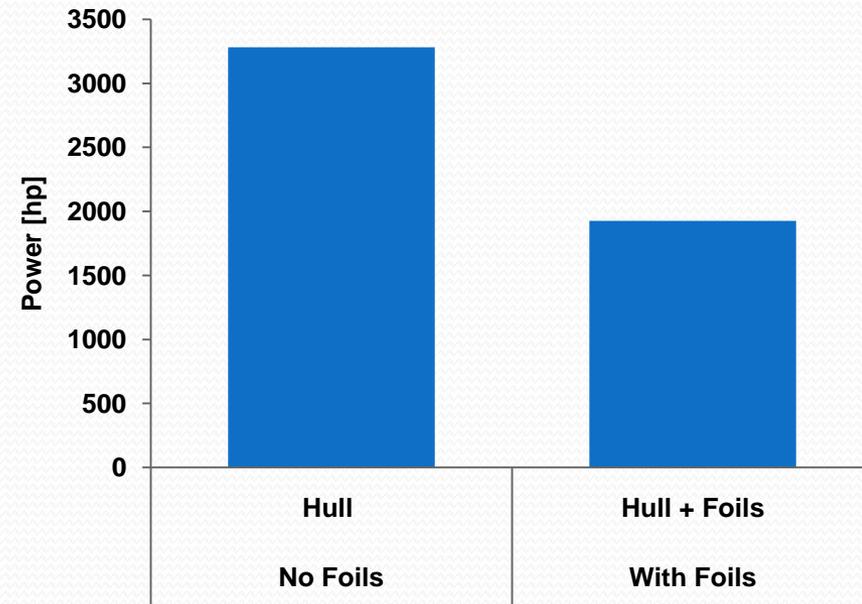
70%

Calm water comparison results

Resistance Comparison

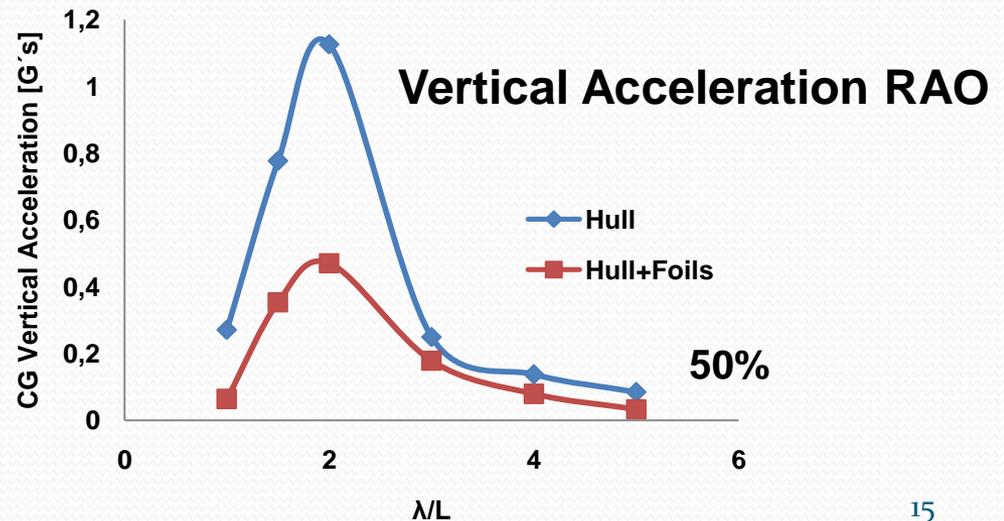
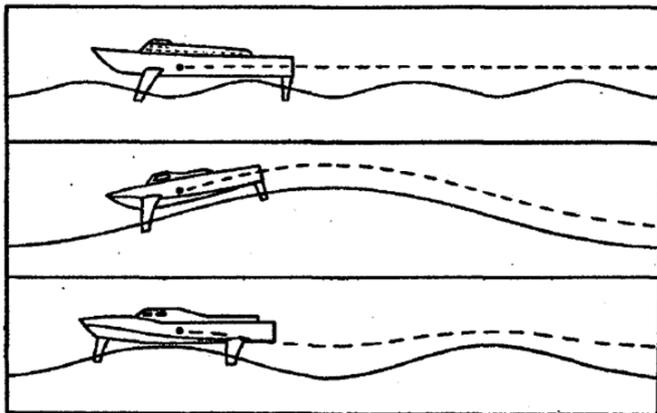
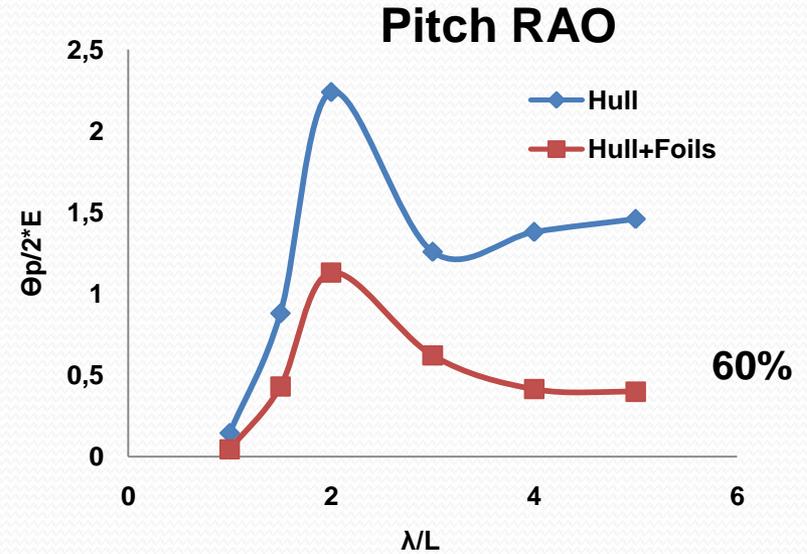
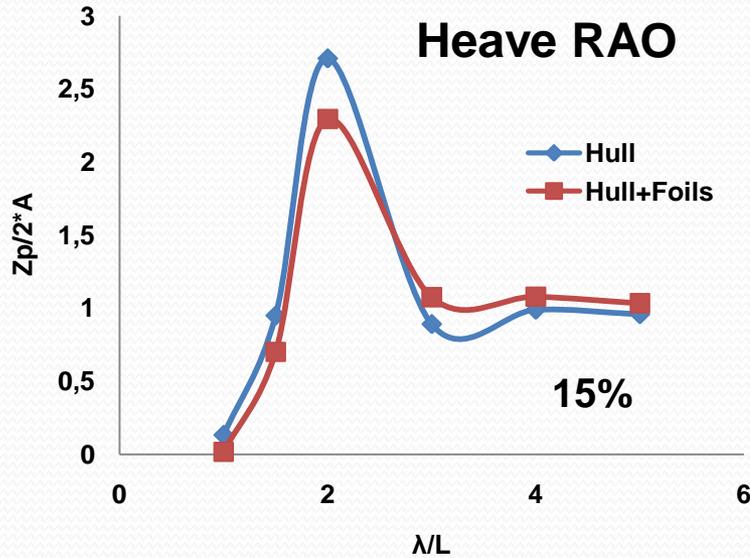


Power Comparison



40%

Regular wave comparison results $A=0.3m$



It is worth economically

- Different parameters are involved.
- Calm water resistance was reduced by 40%.
- CG vertical acceleration was reduced 50%.
- From physics point of view, the retrofit is feasible economically.

Recommendations

- Validate results with towing tank experiments or RANS simulations.
- Simulate different velocities & sea states.
- Analyze different foil shapes, configurations & foil load percentage.

Conclusions

Hydrofoils support can:

- Improve performance in calm water.
- Enhance seakeeping due to longitudinal oscillation damping.
- Decrease operational cost, both calm water & regular waves.