

Improvement of the ship's energy efficiency using a machine learning code

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INTRODUCTION

A machine learning code is developed to optimize the fuel consumption of the ship. To achieve this, real data is collected, the relationship between the real and simulated data is studied, and the code is created based on these procedures. A reference ship is the Barcelona, the university vessel.

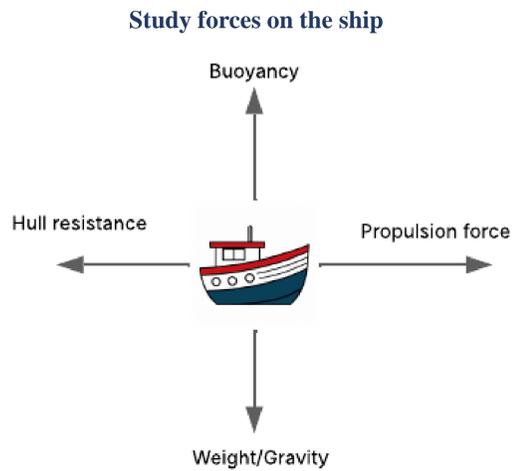
OBJECTIVES

The main objective of the research is to create a machine learning model that maximizes fuel efficiency by combining real-time ship data, including oscillations, revolutions, wind direction and ship velocity, and actual fuel use. The additional objectives involve collecting real data, comprehending how machine learning works, examining the connections between the data and the equations that connect them, and validating that the code is operating correctly.

EMPIRICAL DATA

Rpm	Windy(deg)	Windy (m/s)	Speed (m/s)	Yaw	Pitch	Roll	Cons.(l/h)
1400	133	1,028888	2,3000	34,2237	0,2670	2,8627	0,6234
1400	133	0,8745548	2,4200	35,3066	-0,0185	-0,2326	0,6234
1400	133	1,800554	2,5000	35,4886	0,6082	4,8449	0,6234
1400	133	1,1317768	2,4300	36,2822	0,2849	2,0065	0,6234
1400	133	0,9259992	2,3000	37,0218	-0,2313	-0,4427	0,6234
1400	133	2,0063316	2,3300	37,4873	0,5245	0,4095	0,6234
1600	133	1,5947764	2,6000	35,0961	0,3766	3,9185	1,0130
1600	133	1,28611	2,3500	34,8623	0,7366	0,8587	1,0130
1600	133	2,1092204	2,5900	33,8472	0,2888	3,5267	1,0130
1600	133	2,057776	2,5000	33,7763	-0,3820	3,5808	1,0130
1600	133	1,4404432	2,5400	31,9258	0,4664	1,4478	1,0130
1600	133	1,028888	2,3400	31,9196	0,3709	7,7833	1,0130

THEORETICAL DATA



Study equations

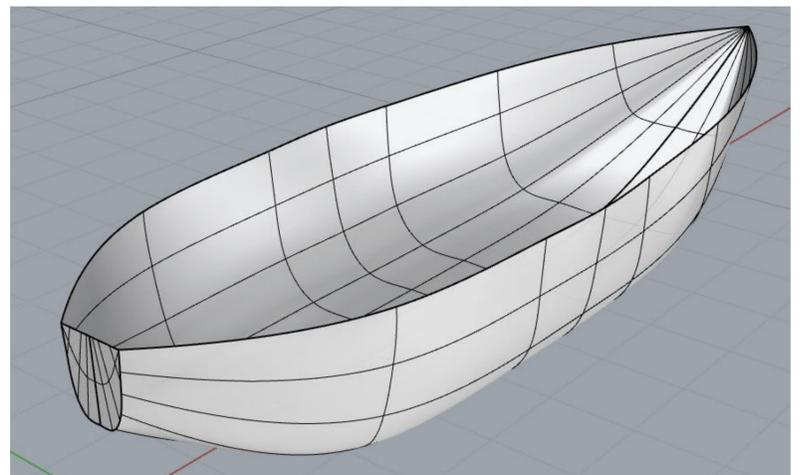
$$F_{\text{propulsion}} = \frac{P}{v}$$

$$R_{\text{TS}} = \frac{1}{2} C_{\text{TS}} \rho A v^2$$

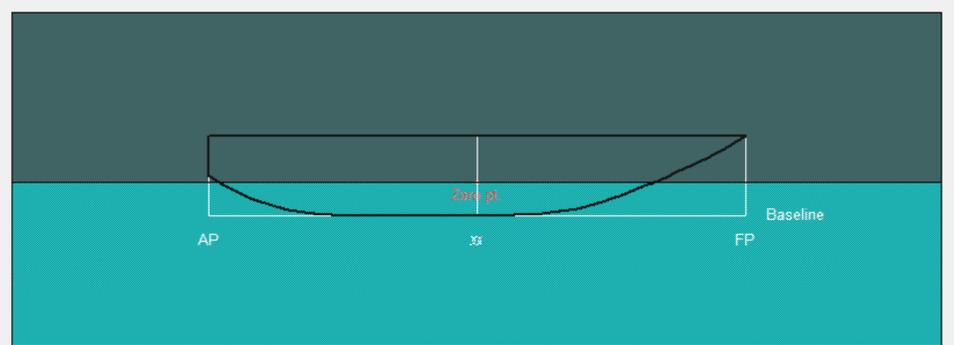
$$P = \frac{1}{2} C_{\text{TS}} \rho A v^3$$

$$C_{\text{TS}} = (1 + k) C_{\text{FS}} + C_{\text{WS}} + \Delta C_{\text{F}} + C_{\text{AA}}$$

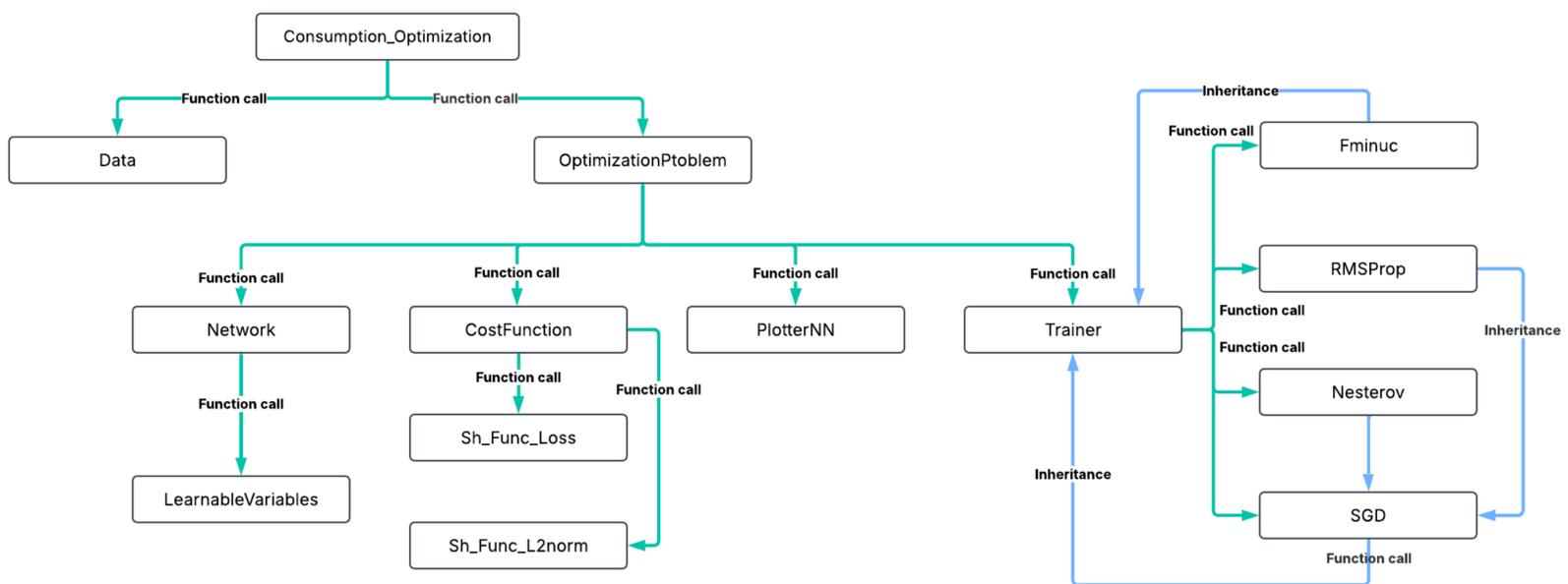
3D hull design in Rhino



Maxsurf simulations



MACHINE LEARNING CODE



RESULTS

