Waterborne

student

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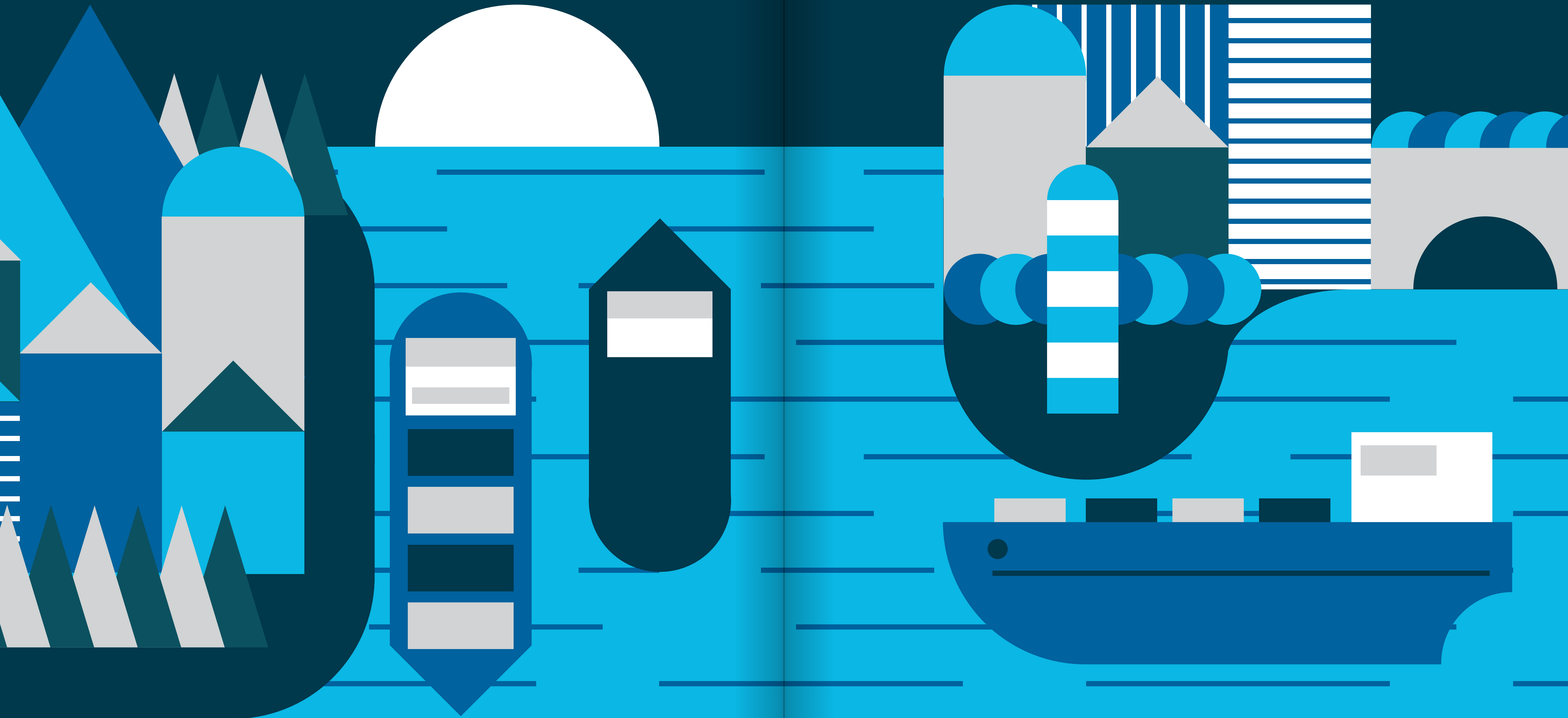


WINNER

N. project: L1-79 **category: Waterborne**

Members: Tin Yadanar Tun **University:** EMSHIP Erasmus Mundus master- ULG-ECN-URO (Belgium-France-Germany)

RA2 **Vehicles & Vessels Technologies, Design and Production**

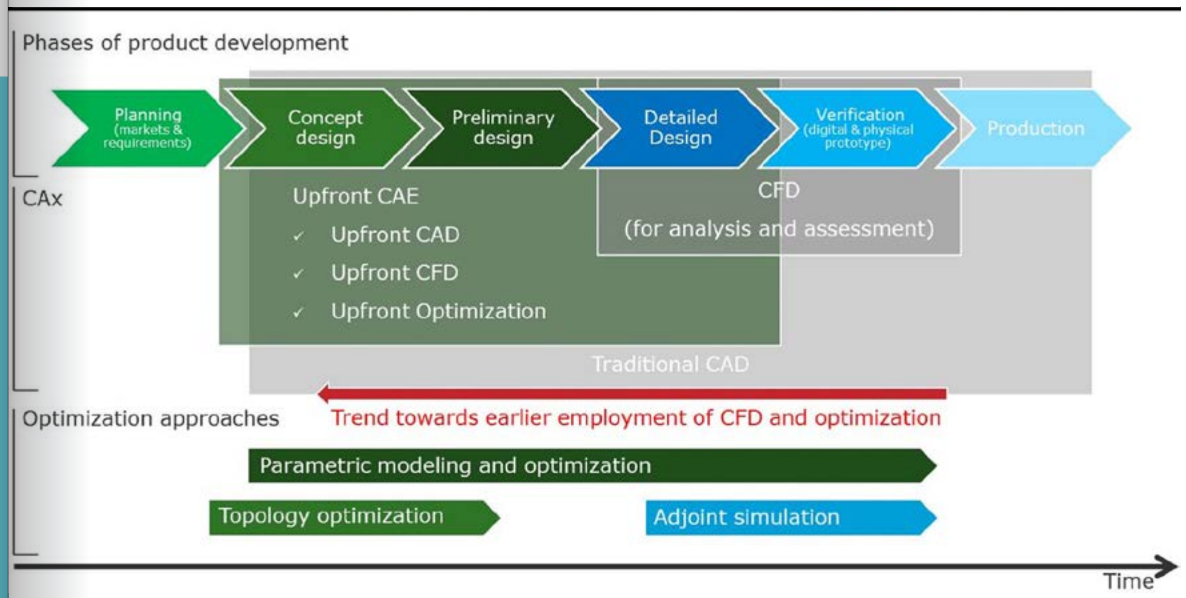
Key Characteristics: The genetic algorithm or SIMPLEX algorithm is linked to the computational method to obtain an optimum hull form by several geometrical constraints • Focus on the total ship resistance and seakeeping behavior in calm water and moderate sea states • Duisburg Test Case (an academic container vessel developed and tested by the University of Duisburg-Essen) •

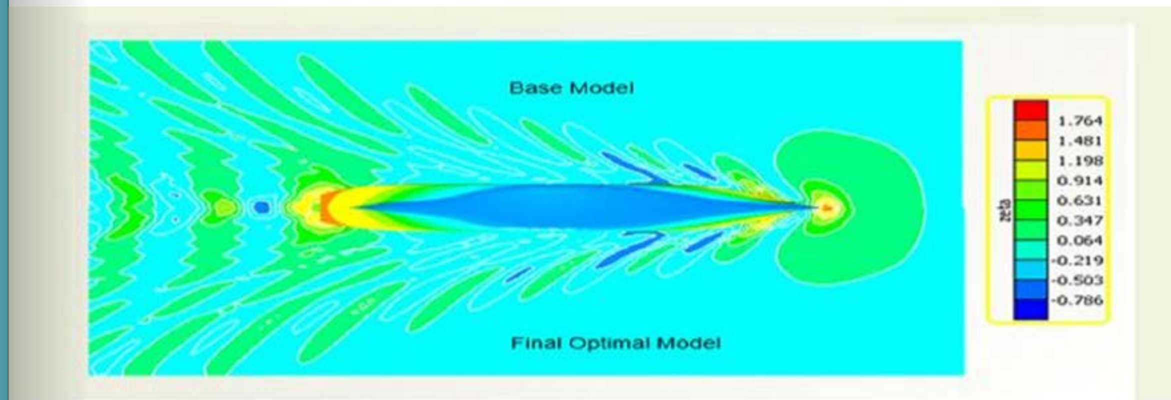
Approaches of Optimizing Ships in Calm Water

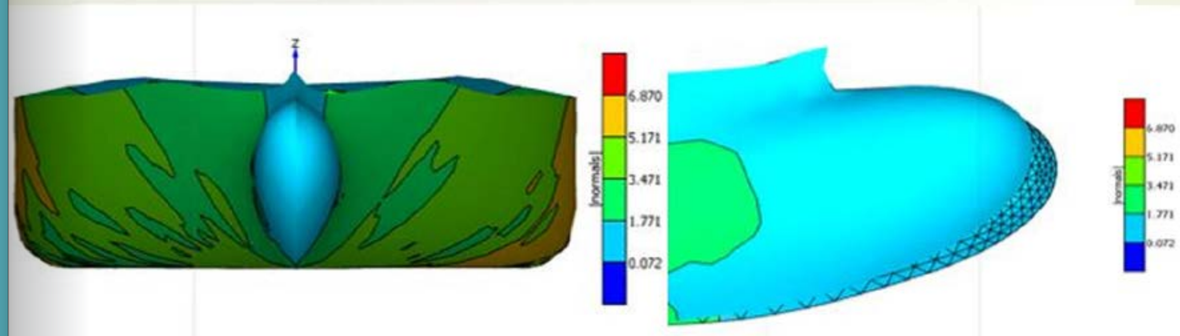
Optimization is human trait to get the best solution under the given circumstances i.e. getting a ship with lowest energy consumption in different sea states.

Mathematically speaking, it is minimizing (or maximizing) one or several objectives within a set of constraints. Hull form optimization from a hydrodynamic performance point of view in calm water and in moderate sea states is an important aspect in preliminary ship design. In the optimization process, the genetic algorithm or SIMPLEX algorithm is linked to the computational method to obtain an optimum hull form by several geometrical constraints such as internal fitting, displacement and stability. The prediction of ship hydrodynamic performances can be generally divided into resistance and propulsion, seakeeping and maneuvering. This study will focus on the total ship resistance and seakeeping behavior in calm water and moderate sea states and it will be carried out based on the FRIENDSHIP-Framework (FFW) software and RANKINE solver provided by DNV-GL. The existing ship, the Duisburg Test Case (an academic container vessel developed and tested by the University of Duisburg-Essen) will be taken for the study case. The optimization will be focused on the changes of the forward part of the vessel (Bulbous bow) by using Friendship Framework/CAESES. GL Rankine is coupled with CAESES and then, with different optimization approaches, optimal ship hull form will be obtained in calm water condition and will be checked wave added resistance and seakeeping behavior in moderate sea states.

Finally, the results are analyzed to compare the optimal hull form with original design. Optimization will be done especially on the fore body of the hull, (e.g. bulbous bow) because GL Rankine solver utilizes the potential flow code which is mainly effective for fore body flow of the ship and less effective for viscous flow occurred at the aft body.







2ND PRIZE

N. project: L1-21 **category: Waterborne**

Members: Petros Gemenetzis, Spyridon Selas,Emmanouil Vranakis,
Konstantinos Xydis, Nikolaos Sfakianos, Tsuyoki Sakaguchi **University:** U. of Newcastle Upon Tyne

RA6 **Transport Infrastructures**

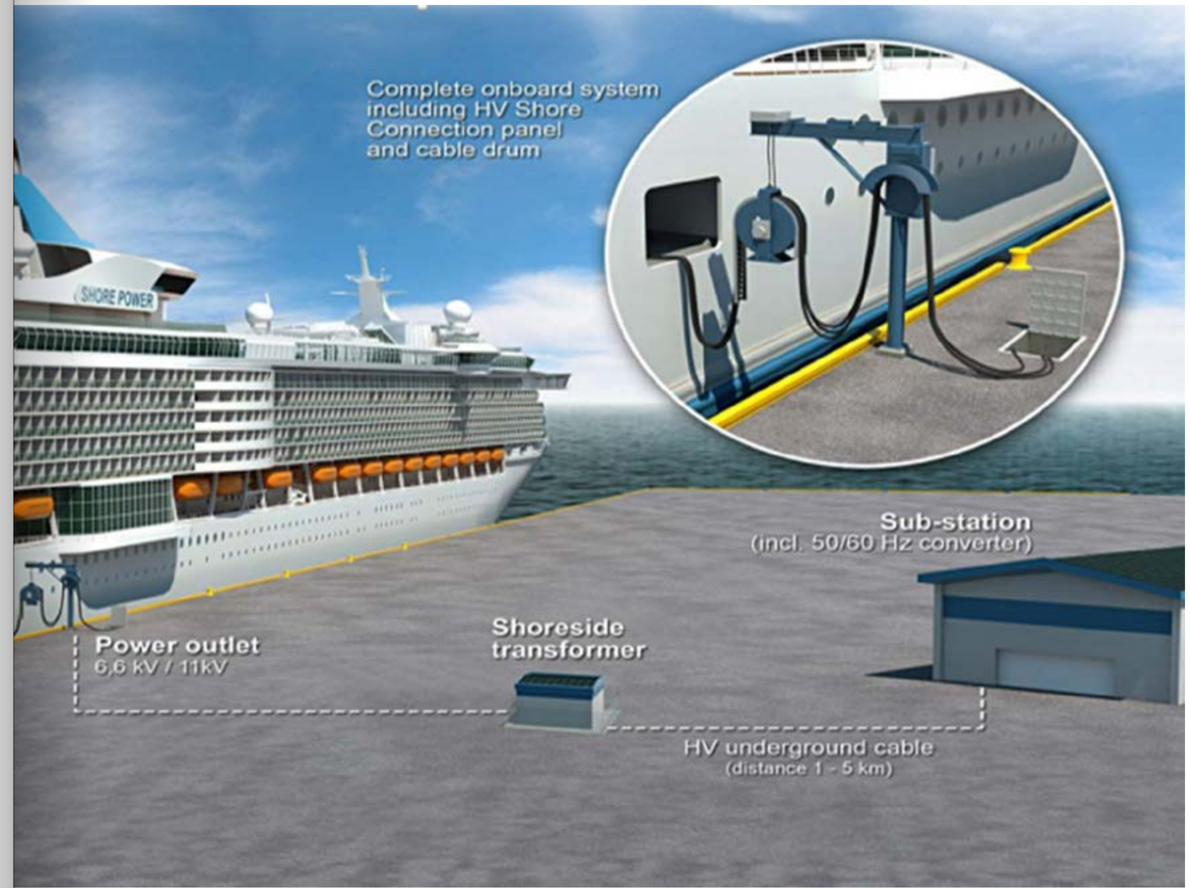
Key Characteristics: Development of a modified cold ironing system able to supply electrical power to an anchorage area • Case study Rotterdam Port • Analysis regarding the use of a bio-mass factory as a back-up plan •

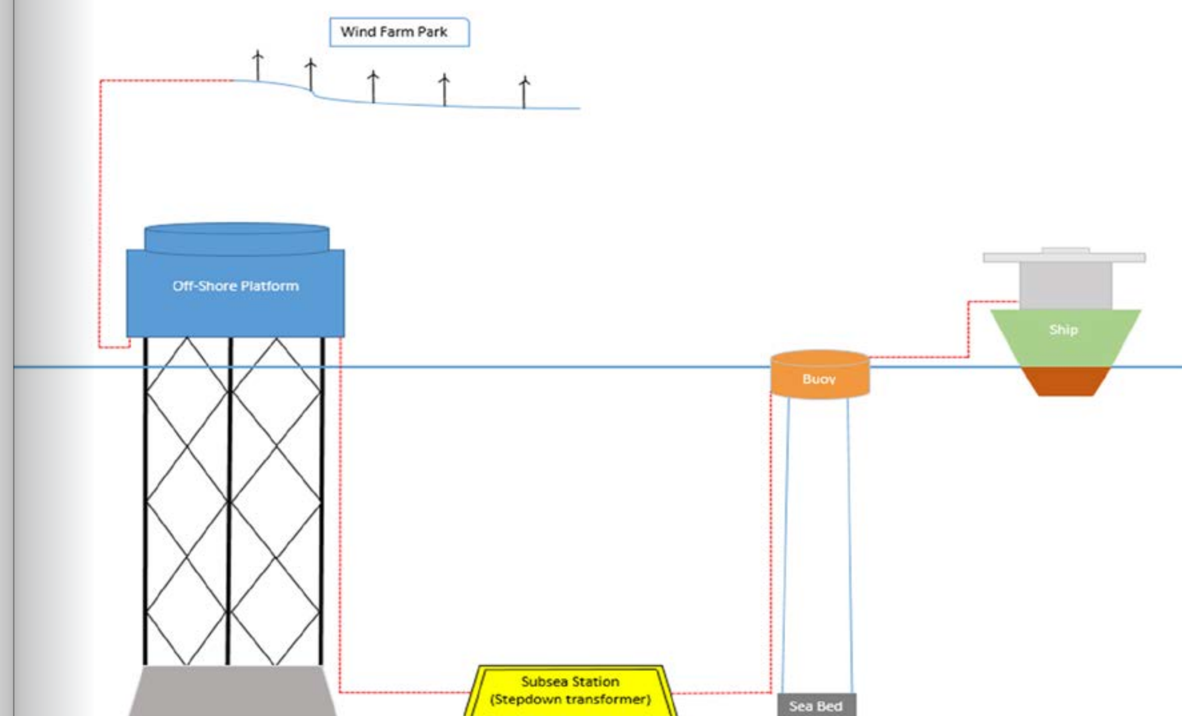
Cold Ironing at the Anchorage area of Rotterdam Port

Shipping is responsible for the transportation of 80% of global merchandise trade by volume and 90% by weight.

This growth is directly related to the increase in both fuel consumption and to the amount of emissions originated from marine shipping. The International Maritime Organization (IMO) implemented many regulations over the years, trying to set boundaries in the rise of global emissions. Cold-Ironing that is, the supply of shore side electrical power to a ship at berth while having turned off its auxiliary and main engines, has been considered to be one of the most effective methods, contributing to a vast reduction of air emissions. The purpose of this study is the development of a modified cold ironing system able to supply electrical power to an anchorage area of one of the busiest ports in Europe, Rotterdam Port. Electrical power produced by the wind farms will be stored in an offshore platform, already located close to the facility and distributed in a subsea station located outside the anchorage area No.1. The design and the exact position of four calm buoys within the anchorage area No.1, which will be connected to the subsea station and be responsible for the transmission of electrical power to the ships are shown on this study. Furthermore, the necessary equipment for each system component, including the offshore platform, subsea station and calm buoys as well as a detailed electrical diagram of the whole system design are described.

Finally, an analysis regarding the use of a bio-mass factory, already located in Rotterdam Port, considered as a back-up plan and calculations regarding the choice of the subsea cables employed for this study will be presented. It is estimated that the emissions generated from a tanker ship in the anchorage areas of Rotterdam Port can be as high as 247.400 kg of NOx per day, whereas through the design proposed by this study these emissions are almost eliminated.





3RD PRIZE

N. project: L1-83 **category:** Waterborne

Members: Jordan McRuvie **University:** University of Strathclyde

RA1 **Environment – Decarbonisation, Sustainability and Energy Efficiency**

Key Characteristics: Exploration of the simulation of three riblet structured configurations by computational fluid dynamics analysis • A conquering geometrical configuration allows further investigation of the particular structure towards application on a representative submarine hydroplane •

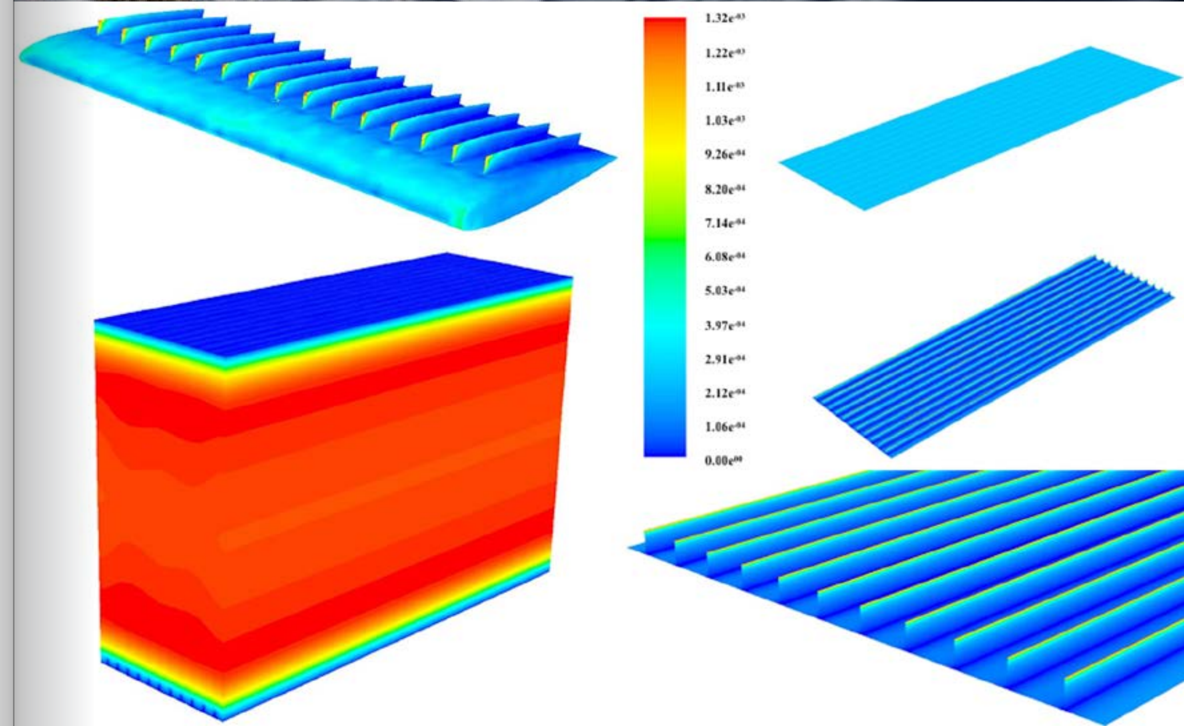
Bio-Mimicry and the use of Shark-Skin Inspired Technology For the Reduction of Surface Resistance of Submarines and Other Underwater Craft

The skin patterns of fast swimming sharks present varying configurations of interlocking microscopic scales, for the permission of increased efficiency between the interaction of the sharks surface and the surrounding fluid.

These patterns have been deemed to follow riblet structured configurations by multiple past researchers, with representative surfaces investigated in their individual emanation of specific shark skin properties, for the accumulative reduction of surface friction resistance. Previous research has recorded a notable reduction of surface friction resistance in the region of 10%, through optimization of the particular structures geometrical attributes, highlighting the desire for application within the commercial sector.

These studies have considered varying aspects of any riblet structures influence on drag reduction, however, they present multiple evaluations between the justification of any reduction and the instigation of fundamental characteristics within the fluid flow. In order to clarify the balance of characteristics required for presentation of any reduction in surface friction resistance, this study explores the simulation of three riblet structured configurations by computational fluid dynamics analysis, whereby, the endorsed drag influences of each case are evaluated in respect to their resultant fluid flow properties. In conclusion of this process, a conquering geometrical configuration is then apparent, allowing further investigation of the particular structure towards application on a representative submarine hydroplane to commence.

This secondary area of investigation is presented to relay the findings of simplistic riblet application towards realistic structures. Although the evidential restraints enforced on the final simulation prohibit any reduction in surface friction resistance to be taken from this analysis, this area of subsidiary investigation nonetheless contributes value towards the advancement of future shark skin study.



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