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# Optimizing Trimaran Yacht Hull Configuration Based on Resistance and Seakeeping Criteria

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## Abstract

An investigation into the optimization of a trimaran yacht, which is equipped with axebow, was carried out numerically. The study was focused on the analysis of resistance and seakeeping which can provide the best performance to the yacht, based on those two criteria. The numerical study used Ansys Fluent code for resistance analysis and seakeeper from Maxsurf for seakeeping analysis. The overall results were compared with published data for validation purposes. The results are believed to be useful for the development of the marine-tourism, which is now growing quite rapidly in Indonesia.

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**Keywords:** Trimaran; CFD;Axebow; Resistance; Seakeeping

## 1. Introduction

The use of multihull vessels, including catamaran and trimaran, has received considerable attention in the last 40 years due to its better transverse stability and providing wider deck area compared to monohull vessels [1]. Furthermore, multihull vessels show unique resistance characteristics in a way to reduce total ship resistance. Multihull vessels have been applied for various applications such as for passenger ships, fishing vessels and warships.

One of the multihull vessels is called trimaran, which is a multihull boat that comprises a main hull and two small outrigger hulls attached to the main hull with lateral beams. In general, the trimaran hulls are determined into two kinds [2], namely symmetric and asymmetric hull.

One of the most trimaran application is called yacht, which is a recreational boat or ship. The term originates from the Dutch word *yacht* "hunt", and was originally defined as light and fast sailing vessel used by the Dutch navy to pursue pirates and other transgressors [3]. In modern use, yacht designates into two different classes of watercraft: sailing and power boats. Yacht is different from working ships mainly by their leisure purpose, and it was not until the rise of steamboat and other types of power boat that sailing vessels in general becoming perceived as luxury.

In order to reduce drag and improve seakeeping quality on trimaran, some work showed the effective use of axebow [4]. By definition, axebow is the wave-piercing type of a ships bow, characterized by a vertical stem and a relatively long and narrow entry (front hull).

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## 2. The Design

In order to satisfy the needs of a comfortable vessel and help tourist in marine-tourism transportation sector, a design model of trimaran based on resistance and seakeeping criteria is developed. The principal particulars and body plan of model are shown in Figs. 2 and 3 and Tables 1 and 2. Separation between hull is made fixed based on the length of main-hull and the S/L is 0.078.

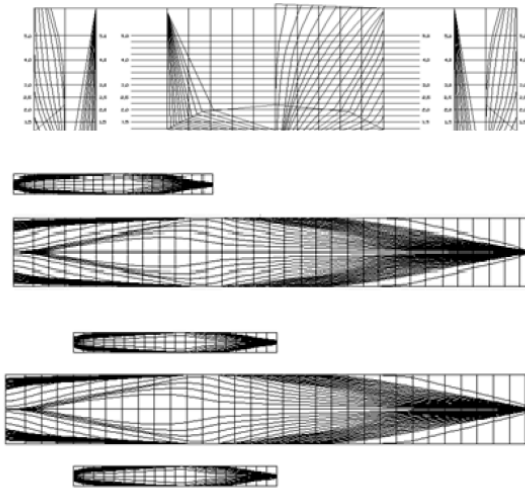


Fig. 1: Trimaran Model A and B.

The first and second models are technically the same model. The difference lies on the position of outriggers as shown in Fig. 2. Meanwhile, the third model uses asymmetrical (flat-side outside) outriggers (see Fig. 3).

Table 1: Trimaran Vessel A and B Principle Particulars

Designation	Model A	Model B	Model C
Length Over All	54.5 m	54.5 m	54.5 m
Breadth Moulded	15 m	15 m	13.59 m
Draught	1.6 m	1.6 m	1.6 m
Displacement vessel	100.6	101.2	83.91
Cruising Speed	17.5 knots	17.5 knots	17.5 knots

Table 2: Trimaran Vessel C Principle Dimension

Designation	Symbol	Value
Length Over All	LOA	54.5 m
Breadth Moulded	Bmld	13.59 m
Draught	d	1.6 m
Displacement vessel	$\Delta_A$	83.91t
Cruising Speed	V	17.5 knots

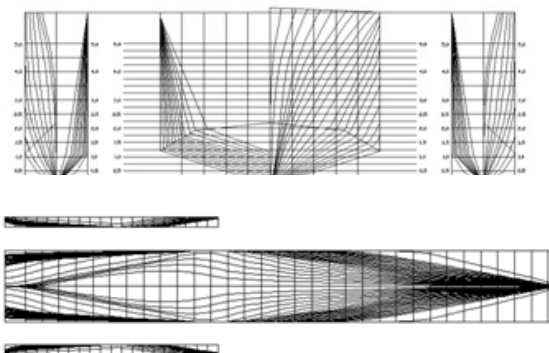


Fig. 2: Trimaran Model C.

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