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Faculty of Engineering
Diponegoro University

Samuel - <samuel@ft.undip.ac.id>

[Sinergi] #13209 Editor Decision

Dr. Hadi Pranoto <hadi.pranoto@mercubuana.ac.id> Fri, Oct 15, 2021 at 5:06 PM
To: Samuel Samuel <samuel@ft.undip.ac.id>
Cc: Sam Timoty Frans Evan <timotyfransevan@gmail.com>, Andi Trimulyono <anditrimulyono@lecturer.undip.ac.id>, Muhammad Iqbal <muhammad-iqbal@strath.ac.uk>

Journal Name: SINERGI
Article Title: AN ANALYSIS OF THE EFFECT OF THE BOW ENTRANCE ANGLE ON SHIP RESISTANCE

Dear Samuel Samuel:

We have reached a decision regarding your submission to SINERGI, "AN ANALYSIS OF THE EFFECT OF THE BOW ENTRANCE ANGLE ON SHIP RESISTANCE".

Our decision is: Revisions Required

Please revise your paper according to the reviewers' comments. List down revision that you have done in a list correction table. Send the revised paper and a list correction table file in Journal System and cc to andi@mercubuana.ac.id.

We look forward to hearing from you soon.

Best regards,

Dr. Hadi Pranoto
(Scopus ID: 57201692910) Universitas Mercu Buana
hadi.pranoto@mercubuana.ac.id

Reviewer B:

Abstract: it is necessary to clearly state the parameters that become variations in the research

In the method: it is necessary to add an explanation regarding the five speed variations in question

on the results and discussion : the explanations between figures can be made more coherent and complementary

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#13209 REVIEW

SUMMARY **REVIEW** EDITING

SUBMISSION

Authors	S. Samuel, Sam Timoty Frans Evan S., Andi Trimulyono, Muhammad Iqbal
Title	An analysis of the effect of the bow entrance angle on ship resistance
Section	Articles
Editor	Hadi Pranoto

PEER REVIEW

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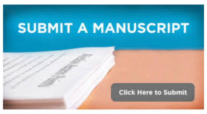

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INFORMATION

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KEYWORDS

AHP ANFIS Arduino Artificial Neural Network CFD DME FMEA Framework Genetic Algorithm Kansei Engineering Kualitas LTE Microstrip Antenna NBM OEE Overshoot PID Performance Simulation Vibration analysis Wall-Following Robot

Reviewer B :

1. Abstract: it is necessary to clearly state the parameters that become variations in the research
   First of all, we deeply appreciate your helpful comments.
   We've added sentences to explain this issues.

   "*Parameters used in the five-speed numerical simulations. This research indicated that a change in the bow angle of the ship results in a 5% change in the ship's resistance for every change in the bow entrance angle. Prediction of total resistance shows significant results in planing conditions. When compared to another bow entrance angle at low Fr, there are no noticeable differences in total resistance. Changes in the angle of the entrance of the ship's bow also had a significant effect on the trim conditions on the ship according to the speed of the ship. At Fr 1.03, the stern trim angle tended to decrease dramatically. As a result, it is probable that the trim by stern under porpoising oscillates considerably.*"

2. In the method: it is necessary to add an explanation regarding the five speed variations in question
   OK. We've added sentences to explain this issues.
   "Numerical analysis tests were carried out at five-speed to predict the ship's drag characteristics. This research will concentrate on planing circumstances, as the primary goal of this ship is to be employed at high speeds."

3. on the results and discussion : the explanations between figures can be made more coherent and complementary

   We thank the reviewer for pointing this out and we have added the following this issue. We added some sentences to make it clear.

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AN ANALYSIS OF THE EFFECT OF THE BOW ENTRANCE ANGLE ON SHIP RESISTANCE

Abstract
Modification of the hull shape is one of the challenges in designing a ship. The angle of the ship's entrance is a significant determinant of the total resistance of the ship. This research aimed to analyze the total resistance of the ship due to changes in the shape of the ship's bow. This research used the Computational Fluid Dynamics (CFD) method with overset mesh technique to predict the ship's total resistance and trim angle. This research indicated that a change in the bow angle of the ship results in a 5% change in the ship's resistance for every change in the bow entrance angle. Significant results occurred at Fr < 1. In detail, the smaller the bow angle of the ship, the smaller the value of the ship's resistance. Meanwhile, for Fr > 1, the greater the bow angle of the ship, the more modest the ship's resistance. Changes in the angle of the entrance of the ship's bow also had a significant effect on the trim conditions on the ship according to the speed of the ship.

Keywords:
Ship's Bow;
Hull Entrance;
Drag Force;
CFD;

Article History:
Received: May 2, 2019
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Accepted: June 2, 2019
Published: June 2, 2019

Corresponding Author:

Commented [HE1]: This term sometimes make misinterpretation. Which is the correct one of the bow angle or thee bow entrance angle?

Commented [Ma2R1]: First of all, we deeply appreciate your helpful comments. We have fixed the error, we mean "the bow entrance angle"

Commented [HE3]: This interpretation should be followed by the parameter indicator that how can be this resulted?

Commented [Ma4R3]: We thank the reviewer for pointing this out and we have added the following this issue. We added new sentences.

INTRODUCTION

A planing hull ship is a ship that has more than one Froude Number (Fr). The high speed of a ship is directly related to the characteristics of the drag and shape of the hull. A planing hull ship is designed at speed and can be lifted to reduce frictional resistance and wave resistance [1]. Ships with high speed cause a dynamic effect on the hull, namely trim. It happens because of the hydrodynamic characteristics of the hull geometry [2]. Planing hull ships are designed by taking into account their hydrodynamic characteristics. Modifying the shape of the hull can improve the drag and maneuverability of the ship [3].

The modification or engineering of the hull shapes reduces the ship's resistance and the main propulsion energy of the ship, which will impact economic and technical factors when the ship is operating [4]. The shape of the ship's bow is critical, especially the ship's speed [5]. The angle of entry (α) is the angle formed by the horizontal axis factor or the centerline, which is the longitudinal line of the ship with the ship's waterline when the ship is fully loaded [6].

Research conducted by Eko et al. regarding the hull entrance [4] showed that each modification of the angle of 3^0 changed the resistance by approximately 3.5%. Meanwhile, in the research of Yu et al. [7], the optimal shape of the bulk carrier ship that did not use a bulbous bow reduced 13.2% wave resistance and 13.8% additional resistance.

Commented [HE5]: What is the correct, Jin-Won Yu et al. or Yu et al.?

Commented [Ma6R5]: We have fixed the error. We mean Yu et al.

Trim is a physical understanding related to the dynamic response of ship dynamics at high speeds. It required a trim control device [8]. This research aimed to analyze the ship's resistance by engineering the bow angle on a planning-type ship based on previous research. Changes in the trim value had a significant effect on the total ship resistance so that this research analyzed the effect of the trim angle on the ship's resistance.

METHOD

Ship's Geometry

The research object was the planing hull ship. The analysis of this research aimed to predict the value of total resistance and trim. The main dimension of ships can be seen in Table 1.

Table 1. The main dimension

Parameter	Description
Scale	1 : 1
Type	Planing Hull
Length Overall	15.00 m
Length of Waterline	13.35 m
Length of Perpendicular	13.25 m
Breadth	4.00 m
Draft	0.76 m
Depth	2.13 m
Displacement	16.26 ton
Coefficient Block	0.41
Entrance Angle	22^0

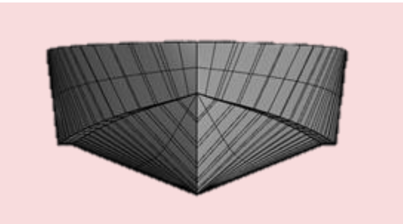


Figure 1. Body Plan of Ship

Figure 2. Half Breadth Plan View

Figure 1 was a ship in 3D as the initial design. The initial design of the ship used the bow entrance angle of 22^0. Changes in the ship's hull entrance were done by engineering the ship's lines plan on the draft. Figure 2 was a half breadth plan with a change in the ship's hull entrance of 3^o. By changing the angle of the bow entrance, the ship's volume displacement will change less than $6x10^{-4}$ %. The modified ship displacement value showed a similar value.

Hull Variation

The variation used in this research was based on the Lackenby method with a curve relationship, namely DWL (Draft water line) and SAC (Sectional Area Curve) [9]. Engineering was done using the variables of α and β as shown in Figure 3. The values of α and β had the same value.

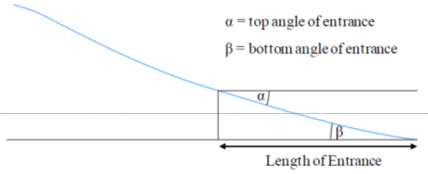


Figure 3. Variation of Hull Entrance

Ship modeling was done by making 2-D and 3-D models. The modeling used NURBS as a representation of the ship's geometry. NURBS is a mathematical model to help interface ship's geometry.

Computational Fluid Dynamics (CFD)

Computational Fluid Dynamics (CFD) is a computer-based fluid simulation. The two-phase flow of air and water is modeled using a Fully Eulerian formulation for fluid-structure-interaction. Problems involving immiscible fluid mixes and free surfaces are solved using the VOF multiphase model. The DFBI (Dynamic Fluid Body Interaction) module is used to calculate the motion of a vessel in response forces. Heave and trim are set to be free, but roll and sway are fixed.

The analysis used in this research used the Reynolds-Averaged Navier-Stokes (RANS) equation based on the laws of physics, Newton's second law equation, and the first law of thermodynamics. Numerical calculations in solving this problem using equation (1).

$$\frac{\partial F}{\partial t}+\frac{\partial uF}{\partial x}+\frac{\partial vF}{\partial y}+\frac{\partial wF}{\partial z}=0 \quad (1)$$

This research used an overset mesh to model the ship on the moving fluid problem [2] [10]. When dealing with fluid-structure interactions involving moving bodies, an offset grid is advantageous. In the overset grid system, the overlapping mesh was used, and an overlapping grid block that surrounds the planing hull was put on top of a background grid, which moves together with the ship's motion. Using an overset mesh involves the creation of one or more overset regions, which contain the physical bodies, and one or more background regions, which are closed surface solution domains. On top of the background region, more than one overset region can be employed. These overset sections may also be overlapping. The way this system works is to find donor cells for each acceptor cell. The amount of active cells in the donor zone around the acceptor cell centroid

Commented [HE7]: Author(s) should use main dimensions or main particulars.

Commented [Ma8R7]: We fixed it. We mean "main dimensions"

Commented [HE9]: Planing hull is not dimension one. If it use "Description", is it possible?

Commented [Ma10R9]: Yes, it is.

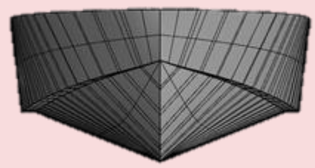
Commented [HE17]: This one should be in the form of present tense.

Commented [Ma18R17]: Thank you for your suggestion. We revised it.

Commented [HE19]: This one should be in the form of present tense.

Commented [Ma20R19]: We rebuild the sentences to make clear definition.

Commented [HE11]: Author(s) should use this picture without the bacground color, for instance as follows:



Commented [Ma12R11]: OK. Thank you. We fixed it.

Commented [HE21]: Author(s) should the definition for each parameter in this equation. Also, please elaborate the derivative equations of this equation, for instance the continuity equation, the momentum equation, the distributed resistance term etc.

Commented [HE13]: Half breadth line is in deck, is not it?

Commented [Ma14R13]: Yes, It is.

Commented [HE15]: This is the bow entrance angle, is not it?

Commented [Ma16R15]: Yes. It is.

determines the number of donor cells, as shown in Figure 4.

The overset mesh better captures the large motions of the planing hull at high Froude numbers. However, The rigid body motion system is incompatible with substantial hull motions caused by flow misalignment. Omer Faruk Sukas [12].

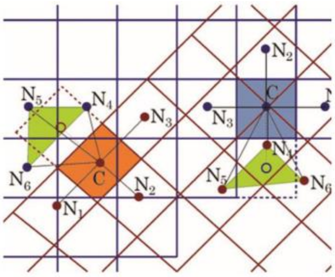


Figure 4. Overset Mesh System dari star ccm [11]

This research referred to ITTC regulations to ensure accuracy in numerical calculations performed by Star CCM+ code. The International Towing Tank Conference (ITTC) is an organization that is responsible for predictions about ship hydrodynamics based on the results of physical and numerical experiments. The recommendations used in calculating the ship resistance were as follows: (1) grid on the ship wall (y+); (2) time-step; (3) mesh-type; (4) the size of the fluid domain; and (5) grid density ITTC [13].

In determining the time-step, this research relied on Courant-Friedrichs-Lewy numbers. The CFL number represented the number of points traversed by a fluid particle in a time interval. The faster the ship, the smaller the time-step that was used [13]. Therefore, this research calculated the time-step, which referred to the calculations recommended by ITTC (The International Towing Tank Conference) as equation (2). In this study, the time-step used was 0.005.

$$\Delta t\ ITTC = 0.005 \sim 0.01 L/U \qquad (2)$$

The sizes used in the overset mesh are described in Table 3, the overset mesh Interface is used to couple the overset regions with the background region. As a background, the stern of the vessel is placed at the longitudinal position of zero. The water depth has been set to be 1.9L. However, for overset region set to be 0.75H. Two Figure 5 shows the dimensions of the fluid domain following the ITTC recommendations [14]. The length of the ship L, the height of the ship H, and the width of the ship B.

Figure 5. Fluid domain

Table 3. Towing Tank Size

Parameter	Background	Overset
Length (m)	7.75L from FP	0.25L of FP
	2.75L from AP	0.25 of AP
Height (m)	0.9L from top	0.75H of top
	1.9L from bottom	0.75H of bottom
Width (m)	3L of symmetry	0.5B of symmetry

The highest concentration of mesh was located on the hull and water surface. It aimed to reduce the simulation time. CFD simulation was carried out using a half-body ship. It also aimed to reduce the simulation time. To both obtain the desired results and ensure the accuracy of simulation, the computational mesh that is generated must be assessed in terms of independence from the solution. For this purpose, the compu- tational model, which was simulated by 1,900,000 cells, was re- stimulated by 3,000,000 and 7,000,000 cells.

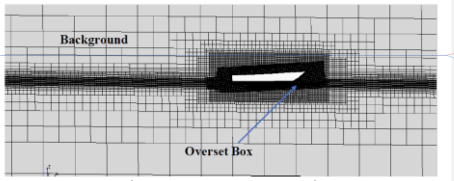


Figure 6. Overset Mesh

RESULTS AND DISCUSSION

Numerical analysis tests were carried out at five speeds to predict the ship's drag characteristics. The two-phase flow consisting of air and water was solved using the Volume of Fluid (VOF) method, which follows the free surface boundary. The dynamic fluid-body interaction (DFBI) model was implemented to provide two degrees of freedom (DOF) for the hull. The planing vessel was allowed to heave and trim.

Commented [HE22]: Please check the grammatical error.

Commented [Ma23R22]: OK. We generated a new sentences.

Commented [HE30]: Here, is this fluid domain or tank size? The height of fluid domain is from tank bottom to the water level (ship's draft), is not it?

Commented [Ma31R30]: It is a fluid domain or virtual tank size. The height of fluid is from bottom overset region to bottom background region.

Commented [HE24]: Please check the grammatical error.

Commented [Ma25R24]: OK. We Create new sentences.

Commented [HE32]: Please check it. It should be form deck to tank domain top.

Commented [Ma33R32]: OK. Thank you for the correction.

Commented [HE34]: What is the mesh number of ship model and fluid domain.
I sugest author(s) to do a mesh independence study. If not, the CFD results are not correct and cannot be used or trusted. The criteria of mesh independence should be show in this section. Also, author(s) should explain the convergence criteria for this simulation case.

Commented [HE26]: It should be fluid.

Commented [Ma27R26]: OK. Thank for the correction.

Commented [HE28]: Please state the type of mesh for both overset and background.

Commented [Ma29R28]: OK. We make a new sentence.

Commented [HE35]: Author(s) should state the physical paramaters of ship's response in 2-DoF.

Commented [Ma36R35]: OK. We create new sentences.

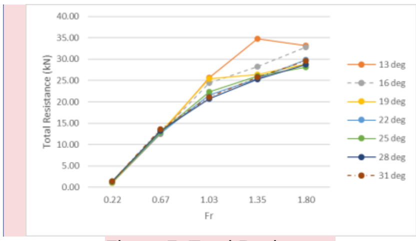


Figure 7. Total Resistance

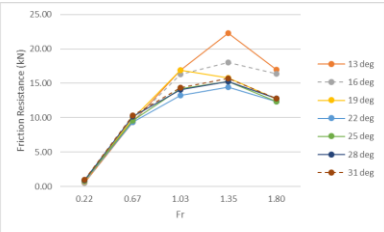


Figure 8. Friction Resistance

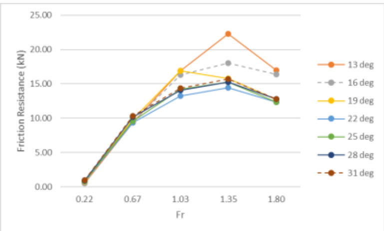


Figure 9. Residual Resistance

Figure 7 presents the analysis of the total resistance of the ship. The components of the total ship resistance consisted of two, namely residual resistance and frictional resistance. Figure 8 shows the result of the ship's frictional resistance analysis. Figure 9 shows the result of the analysis of residual resistance on the ship. Frictional resistance is more dominant than residual resistance. It happened because it was related to the ship's WSA, as a consequence the frictional stress on the hull generally will increase along the ship. There are two types of pressure that the vessel is subjected to: hydrostatic and hydrodynamic pressure. The buoyancy force is proportional to the ship's submerged volume (displacement) and is determined by hydrostatic pressure. The hydrodynamic pressure is proportional to the square of the ship speed and is determined by the flow around the hull. A form resistance component exists because of the interaction between the ship's shape and the viscosity. The form resistance effect showed the three parameters: frictional resistance, viscous resistance and flow separation.

The analysis results carried out in Figure 7 showed an increasing trend in ship resistance. The greater the ship's Froude number, so the more excellent the total ship resistance is. It applied to residual resistance and frictional resistance, which were components of the total drag of the ship.

Figure 7 at Fr < 1 was called the displacement mode condition. The analysis results showed that the bow entrance angle of 13^0 had the smallest total resistance value in these conditions. While at Fr > 1 or planing mode conditions, the angle of 31^0 indicated a smaller total resistance value. The frictional resistance influenced the trend in the total resistance graph in Figure 8 and the residual resistance in Figure 9. The total resistance was the sum of the residual resistance and frictional resistance. It happened because of the influence of frictional resistance, which was higher than the residual resistance. Another reason was that the planing hull-type ship had a high speed so the trim by stern that occurred affected the total resistance value.

In the Savitsky approach, several factors can affect the value of ship resistance, namely ship speed, WSA (Wetted Surface Area), and ship trim value [15]. Ship speed and WSA had a value that was directly proportional to the value of the ship's resistance, while the trim value of the ship was inversely proportional to the total resistance value of the ship.

At Fr < 1, reducing the bow entrance angle could reduce the total drag. Meanwhile, at Fr > 1, increasing the ship's hull entrance angle could reduce the total ship's resistance is due to the planing condition.

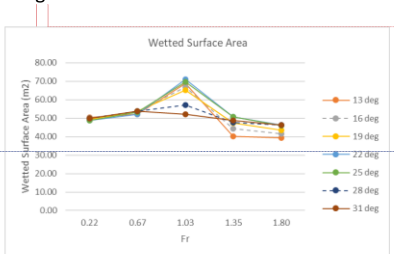


Figure 10. Wetted Surface Area (WSA)

Commented [HE41]: Are this correct sentences using the past tense? Author(s) asked reader(s) to see the figure. Also, the figure was explained by using the past tense. Please check all grammatical errors in this manuscript.

Commented [Ma42R41]: OK. Thank you for correction.

Commented [HE43]: Is this 130 degrees?
Is this bow or hull?

Commented [Ma44R43]: It is 13 degree.
Yes, It is hull entrance.

Commented [HE45]: Is this 310 degrees?

Commented [Ma46R45]: It is 31 degree.

Commented [HE47]: What does it mean that frictional resistance influence the total resistance "graph"?

Commented [Ma48R47]: Total resistance is the component of frictional resistance and residual resistance.

Commented [HE49]: This is not a cause and effect relationship. Please revise it.

Commented [Ma50R49]: OK. Thank you for your correction.

Commented [HE51]: Here, does it mean trim by stern?

Commented [Ma52R51]: Yes, it is.

Commented [HE53]: What does it mean? As known, the occurence of the trim by stern due planing condition can reduce WSA and then it does not relate inversely to ship's resitance.

Commented [Ma54R53]: Planing mode is defined as the operating speed at which hydrodynamic pressure is the dominant contributor in supporting the weight force
In a high-speed planing vessel, trim is a key component because it affects the total resistance and determines the stagnation line's location on the hull. Trim is produced by a combination of moments of propulsion, water pressure, drag, and lift.

Commented [HE37]: The number in the vertical and horisontal axis mustt be a decimal point, it is not a decimal comma.
Also, in the vertical axis, the description should be Total Resistance, Friction Resistance, and Residual Resistance, respectively.

Commented [Ma38R37]: OK. We revise it.

Commented [HE55]: Based on this Figure, the intrepretation that at Fr > 1, the increase of the ship's bow entrance angle could reduce the total resistance at Fr > 1 because the total resistance due to the reduction of WSA is smallest in the bow entrance angle of 13 degrees at Fr. 1.03 and 1.80.
Yes, I agree.

The number in the vertical and horisontal axis msut be a decimal point, it is not a decimal comma.
OK. Thank you for your correction.

Could Author(s) make a graph of the tendency between WSA and the angle of trim by stern?
As can be seen in Figure 10 and Figure 12.

...

Commented [HE39]: The friction resistance is not onlly influenced by WSA, but also the ship's form. Author(s) should show the pressure distribution acting on the ship's hull.

Commented [Ma40R39]: Yes. I agree. We create new sentences.

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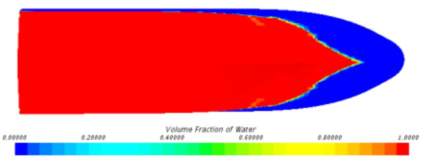

Figure 11. Volume Fraction of Water on Fr 1.35

Figure 11 showed the volume fraction of water as the definition of water and air. The properties of the meshing were shown in red and blue. The value 0 was the air fraction, and the value 1 was the water fraction.

Figure 10 was the result of the wetted surface area (WSA) analysis which showed the area of the hull submerged in water. Displacement and WSA values were directly proportional to the total resistance of the ship. WSA was very influential on the frictional resistance of the ship. The greater the WSA, the greater the value of the frictional resistance of the ship.

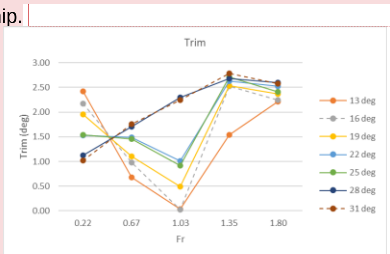

Figure 12. Trim Angle

The bow angle engineering of the ship could improve the trim condition of the ship at a certain speed. At Fr 0.22, there was a decrease in the trim angle of the ship along with the change in the angle of the bow (hull entrance), while at Fr 0.67, there was an increase in the trim angle of the ship along with the change in the angle of the bow of the ship. There was a change in the trim value of the ship due to the difference in the center of gravity of each ship model with a different bow angle.

From the analysis carried out on the planing hull, the trim condition can be improved by engineering the hull entrance according to the speed shown in Figure 12. At Fr 0.22, the smallest trim angle was 31^0. The trim value can be improved by increasing the bow entry angle. While at Fr ≥ 0.67, the smallest trim angle was at an angle of 13^0, meaning that the trim value could be improved by reducing the bow angle of the ship. The angle of trim by stern tended to decrease significantly at FR 1.03. It can thus be suggested that the trim by stern under porpoising oscillate largely, as shown in Figure 12. To prevent the porpoising phenomenon, it is effective to add appendages at the stern for generating a lot of bow-down moments, as we know interceptor and trim tab. The trim condition of the ship had a significant effect on the total resistance value of the ship. The more increase the trim angle value of the ship or the smaller the wet area or WSA (Wetted Surface Area), the smaller the value of the total resistance of the ship.

CONCLUSION

From the analysis, it was found that the change in the hull entrance of the ship by 3^0 can have a significant effect on the total ship resistance. The modification of the ship's bow had a total drag effect of 5%. Significant results occurred at Fr < 1, where the smaller the bow angle of the ship, the smaller the value of the ship's resistance. Meanwhile, for Fr > 1, the greater the bow angle of the ship, the smaller the ship's resistance. It happened because the factors that had a significant effect on the value of the ship's resistance were speed, WSA (Wetted Surface Area), and ship trim angle. Following the approach taken by Savitsky, the value of speed and WSA was directly proportional to the value of the total resistance of the ship. The value of the trim angle of the ship was inversely proportional to the value of the total resistance of the ship. These changes improved the trim condition of the ship according to the speed of the Ship.

ACKNOWLEDGMENT

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Commented [HE56]: Please check it, friction or fraction? Both of the terms are different.

Commented [Ma57R56]: Thank for the correction.

Commented [HE58]: Author(s) should move and place this paragraph before the previous paragraph due to the explanation of figure.
For this statement of “The modified ship displacement value showed a similar value”, if the bow entrance angle is changed, the displacement of ship is also changed. How can have the similar ship’s displacement?
OK. We create a new sentence to explain the displacement difference and move to “Ship geometry” section.
“By changing the angle of the entrance bow, the ship's volume displacement will change less than 6x10^4 %”

By using the SAC (Sectional Area Curve), if the area of hull of the ship in the bow part is changed (add or reduce), the consequence is that the area in the stern part is added or reduced in order to considere the similar displacement.
Yes. I agree for this issue, however the displacement was change less more 6x10^4 %.

Commented [HE59]: The number in the vertical and horisontal axis must be a decimal point, it is not a decimal comma.
These results are wondering and confusing, in low Fr around 0.22, the angle of trim by stern were occoured, and then in increasing the Fr until 1.03, the angle of trim by stern tended to decrease significantly, and for the bow entrance angles of 13 degrees and 16 degrees, the trim by stern reached almost zero (0). As known, the increase of Fr increases the trim by stern for planing hull.
Also, Author(s) considered 2DoF responses, in the initial condition, is the ship fixed condition with trim condition?
Perhaps the change of bow entrance angle affected the trim by stern in the initial condition before incoperating with Fr. Could author(s) check firstly the hydrostatic paramaters of the ship in the computational domain.

Commented [Ma60R59]: OK. Thank for the correction.

We were surprised to find the trim angle. In my suggestion, the trim under porpoising oscillate largely, as shown in Fig. 12. To prevent the porpoising phenomenon, it is effective to add appendages at the stern for generating a lot of bow-down moments, as we know interceptor and tim tab.

The initial condition is free heave and trim, as we mention in Computational Fluid dynamics section, “The dynamic fluid-body interaction (DFBI) model was implemented to provide two degrees of freedom (DOF) for the hull. The planing vessel was allowed to heave and trim.”

Commented [HE61]: Perhaps author(s) recommend their research in future experimental work for validation.

Commented [Ma63R62]: No funding was provided for this research, we will leave it blank in this section.

Commented [HE62]: Perhaps author(s) mention the kind of the support for their research given by university.

Archit. Ocean Eng., vol. 5, no. 1, pp. 161–177, 2013, doi: 10.3744/JNAOE.2013.5.1.161.

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Congratulation! We are pleased to inform you that your article entitled:

"An analysis of the effect of the bow entrance angle on ship resistance"

was reviewed by the reviewer and got a positive opinion. The paper has been ACCEPTED for publication at *SINERGI* and to be published on June 30, 2022 (Vol. 26 No. 2). Attached herewith the final version of the article (*if there is a mistake, please give us any comments, with different color*) and *the Copyright Transfer Agreement*. Please send ***the final revision*** and ***the Copyright Transfer Agreement*** as soon as possible via this email.

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COVER LETTER

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Dear Sinergi Journal,
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In this paper, I/we report on / show that:

Topic	:	Ship Design
Brief Background	:	Modification of the hull shape is one of the challenges in designing a ship. The angle of the ship's entrance is a significant determinant of the total resistance of the ship. This research aimed to analyze the total resistance of the ship due to changes in the shape of the ship's bow.
Research Problem	:	Analysis of The Bow Entrance Angle on Ship Resistance
Overview of Method	:	Computational Fluid Dynamics
Significant finding	:	Significant results occurred at Fr < 1, the smaller the bow angle of the ship, the smaller the value of the ship's resistance. Meanwhile, for Fr > 1, the greater the bow angle of the ship, the more modest the ship's resistance.

We have no conflicts of interest to disclose.

Thank you for your consideration of this manuscript.

Sincerely,
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I/We wish to submit an original research article entitled “An Analysis Of The Effect Of The Bow Entrance Angle On Ship Resistance” for consideration by SINERGI.

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