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Literature Review: Mapping Maxsurf Software Implementation on Marine Vehicle Simulation

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Abstract

The implementation of maxsurf software on small dimensional fishing boat type marine vehicles has not been optimized in the simulation and modeling. Research topics require methods to identify research gaps from previous research. The aim of the research is to carry out a bibliometric analysis of the results of mapping the use of maxsurf software to be implemented on small-dimensional fishing boat-type marine vehicles. The research method used is data collection using Publish or Perish with Google Scholar and Scopus databases in 2015 – 2025. The search results are input into Mendelay for article validation in the form of a RIS file. RIS data is used in VOSviewer to analyze the number of publications per year, research topics, and types of Maxsurf features used. The search results obtained 42 articles with a maximum number of publications of 7 articles (2022 and 2021) and at least 1 article (2019, 2016 and 2015). A research topic that often appears is design analysis with a combination of maxsurf modeller - resistance. The VOSviewer visualization of the bibliometric network shows that each keyword is interconnected with the maxsurf keyword. The relationship between these keywords forms 4 clusters with 14 frequently appearing keywords. The overlay visualization results show that there are 4 keywords that can be used as the latest research topics related to Maxsurf. Density visualization shows that resistance, hull, and stability have the greatest density compared to other keywords. Mapping can contribute to implementing Maxsurf for simulation and modeling on small dimensional fishing boats.

Keywords: Bibliometric; Fishing Boat; Maxsurf; Publish or Perish; VOSviewer.

1. INTRODUCTION

Marine vehicles are the primary mode of transportation for various activities operating at sea. The variety of marine vehicles varies based on their type, size, shape, function, and the needs of the community. For example, passenger ships are more suited to inter-island ferry services [1]. In addition to passenger ships, there are patrol boats and fishing vessels that operate according to their respective functions [2]. From the three examples of ship types, it can be seen that the existing ship types correspond to aspects of use, function and size.

Ship usage studies can be obtained by utilizing modeling and simulation. Modeling and simulation aims to obtain values as a reference in determining load, resistance and engine power [3]. Modeling can be done using maxsurf software [4]. Several studies utilizing maxsurf software as modeling and simulation software, categorized by object, including: passenger ship, fishing vessel (purse seine, traditional ship), patrol ship, hydrofoil ship, tanker, container/cargo.

Utilizing Maxsurf software on ships can produce parameter values that describe the condition of the ship in various aspects. The modeling results can be a visual representation of the ship model, and simulations can include visualizations of wave patterns and resistance experienced by the vessel during operation. The results obtained can help support vessel operations at sea [5]. Based on observations and literature studies, it was found that Maxsurf software has not been utilized on small boats commonly used by fishing communities.

Fishing communities living in coastal areas generally use boats or other small vessels as a mode of transportation for fishing or for distribution. The use of small-sized transportation modes is consistent with the function and utilization of these vessels/boats. However, the use of these vessels/boats has not been modeled

and simulated, which can lead to overloading, which impacts the vessel's operational level. This phenomenon aligns with research [6], which states that the stability of a boat is influenced by its ability to handle loads. Conditions experienced by small boats can be addressed by utilizing Maxsurf software, which features a modeler, resistance, and stability. Values obtained from simulation and modeling can be used as a reference in designing ships/boats for operational use [7]. Utilization needs to be accompanied by a level of knowledge of these features. Therefore, mapping is necessary to ensure the usage process aligns with design needs.
Based on existing phenomena, the objective of this research is to map the potential use of Maxsurf software as a simulation tool for small-sized marine vehicles for fishermen. Mapping was conducted by reviewing articles related to the use of Maxsurf software based on the modeler, resistance, and stability. The research method used was a Publish or Perish literature search and VOSviewer bibliometric analysis [8]. Articles on the use of Maxsurf software from 2015 to 2025 were obtained from international journals indexed by Google Scholar and Scopus, with the main keyword maxsurf. The bibliometric review facilitates mapping in determining the appropriate use of Maxsurf software for small boats.

2. METHODS

Research on the use of maxsurf software as a simulation and modeling medium, applying Publish or Perish literature search and VOSviewer bibliometric analysis. The search was conducted on articles in the 2015-2025 period obtained from international journals indexed by Google Scholar and Scopus. Mapping analysis framework of the research can be ilustrated in Figure 1.

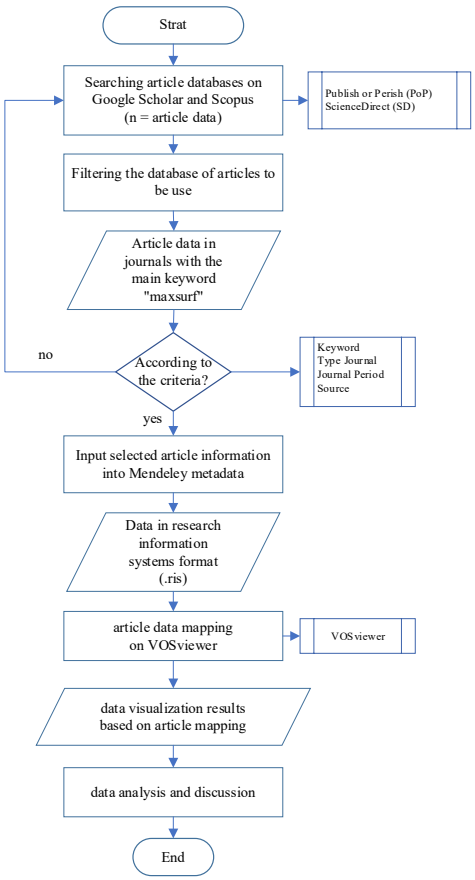

Figure 1. Mapping Analysis Framework

Based in Figure 1, the stages carried out in mapping the potential use of maxsurf software in modeling and simulating small-sized ships/boats can be explained. The articles selected as data were those containing the main keyword "maxsurf" in the title, abstract, and keywords. In addition, the selected articles must also contain maxsurf type; modeller, resistance, and stability. Then, the articles were tabulated to be entered into Mendeley Desktop which aims to filter articles that can be used as research data before being visualized. Valid data in the form of (.RIS) was then subjected to bibliometric visualization. Analysis in VOSviewer [9] serves to provide an overview of the use of maxsurf software. Bibliometric analysis is one method of literature review

that is widely applied in the fields of economics, business, and engineering to reveal the evolution of a research domain [10]. Bibliometric analysis in VOSviewer is systematic, transparent, and integrated in reading the keywords of an article. This can provide convenience in mapping the potential use of maxsurf as a simulation and modeling medium for small-sized ships/boats.

2.1. Publish or Perish

Publish or Perish (PoP) is software that functions as a tool for searching articles. The search system in PoP can be customized according to the available search pages. Some commonly used pages for searching articles include: Crossref, Google Scholar, Scopus, Web of Science [11]. The search system is carried out by typing keywords in the search. In addition, the PoP software can also be set to the year range of article publication [12]. In this research, the search process was carried out by typing the main keyword "maxsurf" in the range of 2015 to 2025. The search process was carried out on Google Scholar and Scopus pages. The results obtained are then presented in metadata according to their quality.

2.2. VOSviewer

VOSviewer is a software that functions to visualize data for network and cluster analysis in scientific publications. VOSviewer system allows researchers to visualize and analyze the relationships between keywords, topics, or authors in their scientific publication data sets [13]. The main advantage of VOS viewer is creating network maps that show the relationships between entities in the data set collected in (.RIS) format [14]. This phenomenon allows researchers to identify patterns, trends, and clusters that exist in the scientific literature on a particular topic. In this reseach, VOSviewer is used as a tool to visualize the connection between maxsurf topics on large-dimension ships. The use of VOSviewer in this study is using article metadata in the 2015-2025 period. The visual results of VOSviewer can be in the form of clusters and which can later be used as a reference for subsequent research topics.

3. RESULTS AND DISCUSSION

3.1. Publish or Perish Findings

The process of searching for article publications regarding the main keyword "maxsurf" was carried out using Publish and Perish (PoP) software. Based on article publication data from search results, it is known that there are various types of writing captured in PoP. The data is then tabulated and then checked. After sorting, the number of article publications used in this research was 42 publications. The results of this selection show that the published articles found include scientific articles. This is based on the clarity of the title, suitability of the abstract to the research, detailed research rules, the presence of scientific substance, and appropriate conclusions in accordance with the research objectives. Most of the articles obtained came from national seminar proceedings, national journals, accredited national journals, international journals and reputable international journals. The distribution of article publications is shown in Figure 2.

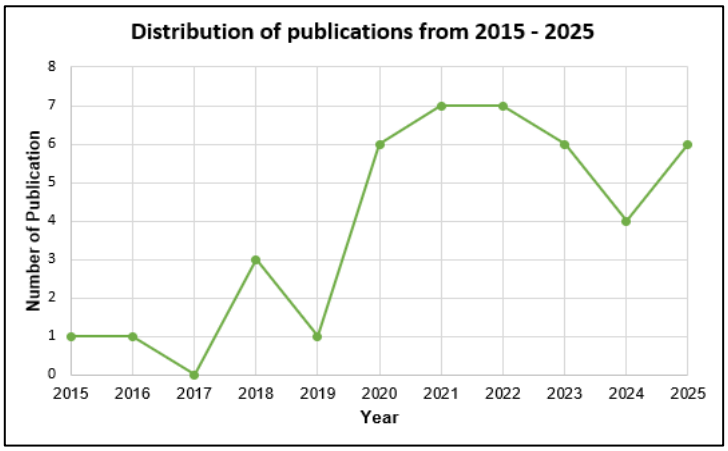

Figure 2. Distribution of Publications in Period 2015 - 2025

Based on the distribution of articles in Figure 2, it can be seen that there are fluctuations in the number of article publications each year. In 2015 to 2016, the number of related publications was 1 article. Then in 2017, no related article publications were found. The topic of writing articles "maxsurf" experienced an increase in the number of publications in 2018 before decreasing in 2019. In the following three years, there was a significant increase in scientific articles regarding maxsurf by 6 - 7 articles. In the intervening years, the number of articles by writers has decreased in interest in the main topic until 2024 and will begin to increase in 2025.

Different publications each year have shown the interest of researchers and academics in studying this topic. Especially in 2017, it is known that there were no publications of related articles. This is due to the type of software used to model the shape and size of fishing boats. This phenomenon is supported by the results of research conducted by [15] who explains that differences in writing keywords and writing commands produce differences in publication search results.

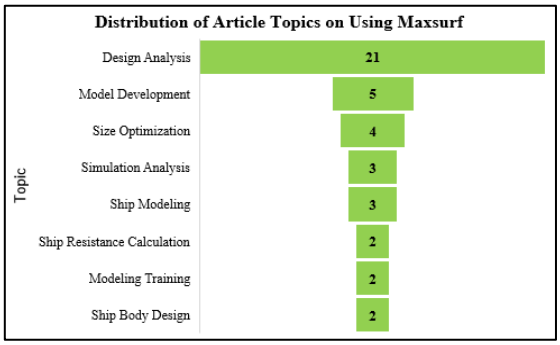

Figure 3. Relationship Topic and Amount of Articles

Based on the findings shown in Figure 2, the topic of the article and the use of Maxsurf as modeling and simulation software can be determined. It can be analyzed based on Figure 3 that the topic that is often studied in articles is design analysis in 21 articles. The topic of design analysis research is the most frequently studied topic. This is because the design of a boat plays a major role in determining hydrostatic values, resistance and stability. For example, the research topic of design analysis was carried out by [16], [17], and [18] explained that the shape of the boat and the hull can influence the level of technical and economic requirements for fuel use in the engine, hydrodynamic performance and stability, as well as measurement accuracy while the boat is in operation.

The research topics of ship resistance calculation, model training, and ship body design are still limited to 2 articles. The three topics are categories of research topics that require alignment and basic skills in using Maxsurf modeler and resistance. For example, the research topic ship resistance calculation carried out by [19] and [20] shows the use of maxsurf resistance in determining wave resistance which affects engine resistance and power. On the topic of model training by [4] and [21], it shows that modeling training still tends to be used as a topic in implementing scientific service to students. Meanwhile, on the topic of ship body design by [22] and [2], it shows that ship body design is a research topic that requires line design in making ship drawings. Several conditions that need to be considered in these three topics are one of the gaps for the introduction of other types of Maxsurf and supporting software in simulation and modeling.

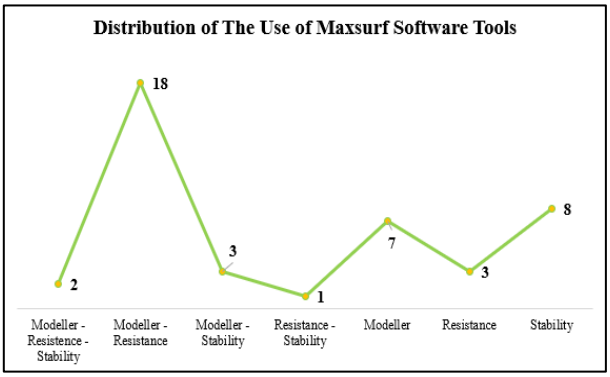

Figure 4. Relationship Tools Maxsurf and Amount of Articles

The high number of articles with design analysis topics corresponds to the use of the maxsurf tool which has the highest number of uses also in the combination of maxsurf modeller and resistance. Ship design requires modeling and simulation of resistance during operation. When creating an article on the topic of design analysis, a basic model is required which is created in Maxsurf Modeller shown in Figure 4. Then, to obtain resistance value parameters and design analysis when large-dimensional ships are in operation, this can be done with resistance maxsurf [23]. The existence of fluctuations in the utilization of maxsurf tools is based on the use of maxsurf according to the topic. The research conducted is in accordance with [7] which explains that the main principle in modeling and simulation is influenced by the ratio of ship size. This suggests that the use of the maxsurf tool can be used to determine the modeling and simulation results on ships/boats that have smaller dimensions.

3.2. VOSviewer Mapping Visualization

Article data that has been obtained through Publish and Perish searches is then input into delay. This aims to filter articles that have complete information such as; title, author's name, journal identity, and the year of publication of the journal. The articles that have been collected are then saved in (.RIS) format so that they can be read by VOSviewer software. A visualization of the distribution of Maxsurf utilization on large vessels is shown in Figure 5. Based on the mapping, it can be seen that Maxsurf software has a network of utilization clusters on several research article topics. The differences in the topics of these four topics are based on the relationship between Maxsurf software as a modeling and simulation tool and the topics that will be discussed in the article.

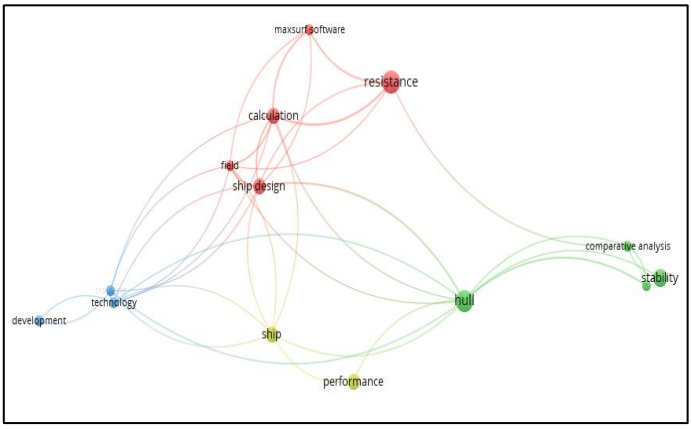

Figure 5. Visualization of Mapping the Use of Maxsurf Software

Table 2. Cluster Comparison Based on Main Keywords in The Period 2015 - 2025

Main Keyword	Keywords Networks			
	Large Scale	Medium Scale	Small Scale	Very Small Scale
Maxsurf	resistance	hull and stability	performance, calculation, ship design, and ship,	comperative analysis, high, training, development, technology, field, and maxsurf software

There are several large and small circle shapes that show the level of appearance of keywords in the title and abstract of the article. This is in accordance with a research study by [24] which explains that the larger the size of the circle, the more frequently the keywords appear in titles and tables. Referring to previous research, the tabulation in Table 2 shows topics that have a "large scale" cluster network, namely resistance; "medium scale" network, namely hull and stability; "small scale" network, namely performance, calculation, ship design, and ship; and the "very small scale" network, namely comparative analysis, high, training, development, technology, field, and maxsurf software.

The size of the circle indicates the level of keyword occurrence, network visualization results can also show the level of clustering that occurs. Based on the visualization results in Figure 5, there are 4 clusters consisting of Cluster 1 (calculation, field, maxsurf software, resistance, ship design); cluster 2 (comparative analysis, height, hull, stability); cluster 3 (development, technology, training); cluster 4 (performance, ship). The relationship between these clusters can provide information about the relationship between the research topic and other research topics. This makes it easier for researchers to examine research on research topics from the

results of modifying the relationships between keywords and different clusters. For example, the keyword topic ship design is related to cluster 2 (hull), cluster 3 (technology and training), and cluster 4 (ship). It can be explained that in research on the topic of ship design, there is scientific substance that discusses ships, technology and training, as well as hulls on boats.

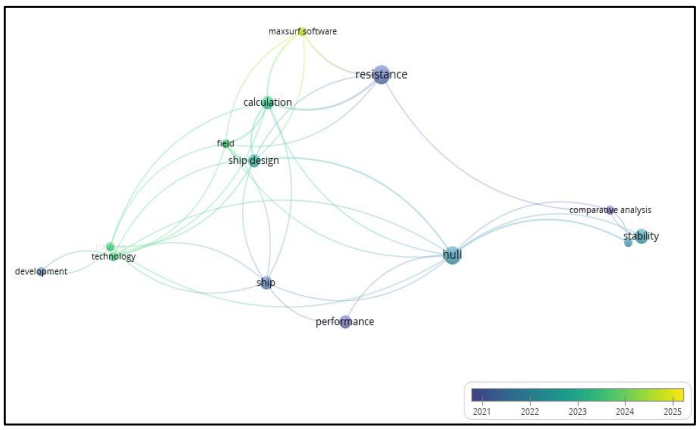

Figure 6. Overlay visualization of research topics based on keywords.

Identification of the latest research topics based on the overlay visualization results with VOSViewer software is shown in Figure 6. Yellow keywords indicate that the research topic being carried out is still new to publication. Dark blue keywords indicate that the research topic has been published for a long time. Research on the topic of Maxsurf software is the latest single research topic shown in the overlay visualization. This research topic can be related to several recent topics in the last two years, such as technology, training, fields, calculations, and ship design. The connection between these topics is a great opportunity to research how to use Maxsurf software as a tool in designing boats, determining resistance, and determining the level of stability of the boat when operating.

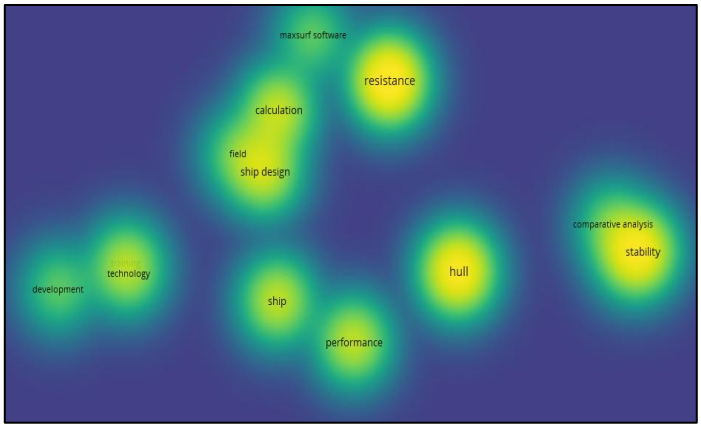

Figure 7. Visualization of research topic density based on keywords

Visualization of the density of research topics based on keywords using VOSViewer software is shown in Figure 7. The results of the density visualization show that most of the research topics have been studied by Maxsurf from several aspects. This can be seen by the brighter the yellow color and the larger the circle size, the more articles on this topic have been published. Based on the visualization results, it can be analyzed that the use of Maxsurf software as a whole for the three items (modeller, resistance, and stability) has not yet carried out much further research. The relationship and level of density of research topics means that it can be seen that there are still research topics that need to be studied further so that they can provide benefits for the development of science in the future.

3.3. Potential of Maxsurf Software for Small Fishing Boats

The existence of Maxsurf software as a tool shows the usefulness of the software in size modeling, operation simulation, determining resistance values, and boat stability. Maxsurf software consists of several types of

tools that can be used, including: (1) maxsurf modeler, (2) maxsurf resistance, and (3) maxsurf stability. These three tools are useful in designing models, calculating resistance, and simulating resistance and stability during operation. When this potential can be mapped, linkage information will be obtained that is in accordance with the required needs. The mapping is carried out in accordance with the provisions, namely paying attention to the comparison of value ratios between the main dimensions of the marine vehicles [25].
Fishing boats type can be categorized as boats that function as searchers and catchers of fish. This type of fishing boat generally operates with a high distance and sailing capability. To fulfill this function, fishing boats are designed to have different shapes. Several types of boats in various shapes, including; (1) Pakura boats are currently made in a slim shape, the hull is sharper at the front, can be ridden by 1 – 2 person, and operate to hunt fish; (2) ayuda boats are currently made wide from fiberglass, have a wider hull, can be ridden by 2-3 person, operate to find fishing locations; (3) Pelang boats are currently made bigger and longer, the hull is wider, can be ridden by 3-4 person, operate to find and catch fish.
The ideal conditions of the three types of boats can be known through modeling and simulation. This aims to provide initial information before fishing boats operate. Maxsurf software can play a practical role in knowing various technical aspects including dimensions, shape, wave profile, resistance value, stability and required engine power. Blibliometry analysis was carried out to try to examine developments in the use of Maxsurf software at the fishing boat level. The development of Maxsurf usage is shown by the distribution of keywords, showing which topics are often researched and which topics have not been researched. The existence of research gaps can be utilized as a superior topic in writing articles on the use of fishing boats.

4. CONCLUSION

Research on mapping the use of Maxsurf software on various types of marine vehicles has been successfully carried out by searching for related articles via Publish or Perish and visualization on VOSviewer. Based on the data and results of the discussion, it can be concluded that the use of Maxsurf software is currently used to determine dimensions, shape, wave profile, resistance value, stability and engine power. The current distribution of Maxsurf software topics is still limited to the use of one tool and there is still low correlation between keywords. Blibliometric research found that fishing boat type marine vehicles can be used as research objects in terms of determining technical aspects during operation. Determining technical aspects can be done using Maxsurf software and correlating tools with other topics that support these aspects. Apart from that, the existence of a cluster network helps analyze designs using a combination of Maxsurf modeller, resistance and stability.

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