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Multi-Mold Design For Fishing Boats Southern Coastal Region Of Java

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***Abstract*— In general, molding or FRP ship molds can only produce one hull shape. This is, of course, contrary to the production of ships, which are mostly of the customized type (based on consumer demand) and very rarely mass-produced to produce sister ships. The high cost of molding certainly makes economic sense in terms of shipbuilding costs. With the aim of a low price for fishing boats, of course, it can become a mainstay and ease the burden on the answer to the high demand for fishing boats in the coastal community or as a specialty for the South Coast of Java. Multi-mold is a ship molding solution for FRP ship material that can produce more than one hull shape. It will reduce the cost of producing a boat. To get the best mold design results, it is necessary to design the structural strength. The mold design is strong, but not overly strong. The method used in designing the mold structure uses the finite element method. To get the best mold design results, it is necessary to design the structural strength. The method used in designing the mold structure uses the finite element method. The analysis is carried out at the position of the forepart of the mold construction, in this case because the part has a large load with a more limited area. The result of post-processing on Von Misses stress with value 14.98 N/mm^2 in finite element analysis is still acceptable for the allowable stress. In the multi-mold system or components, there are the main shell structure, reinforcement frame, and support or mold holder. The shape of the multi-mold is carefully designed so that it can be knocked down to reveal each constituent component. To get good results in the assembly of multi-mold, an production drawing is needed in the order of the development process so that effective and efficient results are obtained.**

Keywords— multi-mold, fishing boat, low price, components, assembly.

I. INTRODUCTION

While the advantages of fiberglass ships include, among others, age resistance or ship life is much more durable, maintenance is much easier and cost-effective. Fiber ships are also much lighter, and have more leverage in fishing production [2]. Fiberglass shipbuilding begins with the availability of molds or molding. The first step of the fabrication process is to make ship molds which generally use wood and multiplex materials. The mold on the hull follows the shape of the ship's body adjusted to the line plan drawing of each station [1]. Ships are usually built in a customized manner so that unique specifications are needed or different specifications for one ship to another. The hull form that only produces 1 (one) hull form is less economical, because the cost of making the mold is also taken into account so that it is a component of shipbuilding costs. Expensive costs in the allocation of molding manufacturing certainly make economic considerations regarding the cost of shipbuilding. The high cost in the allocation of molding manufacturing certainly makes economic considerations regarding the cost of building the ship so that the price of the fishing boat becomes friendly, of course, it can ease the burden on the answer to the high demand for fishing boats in the coastal community or the South Coast of Java [5] [7].

The condition of the South Coast of Java is a coastal area directly adjacent to the Indian Ocean [8]. This boundary will directly affect the oceanographic characteristics of the South Coast of Java [3]. The southern sea of Java or known as the Indian Ocean has significant wave height and extreme weather. The Indian Ocean or Indian Ocean is the third largest body of water in the world, covering about 20% (twenty per cent) of the total amount of Earth's water surface and is a very influential ocean for ecosystems on planet Earth [6]. Several influences from the cross position are also one of the conditions that make the Indian Ocean an international shipping and trade route travelled by many countries in the world. Through this, research was conducted by making multi-mold. The constituent components of the multi-mold are the main structure of the shell, reinforcement frame and support or mold holder. The shape of the multi-mold is carefully designed which can be knocked down each constituent component. The multi-mold disassembly process is accompanied by operational instructions and 3D simulation of the multi-mold assembly. Further analysis of the lifting process on the structure that has been built is needed [9]. The structural strength of the multi-mold components is also analyzed for strength so that an effective and efficient multi-mold design is obtained. Several of research aim is to determine the value of stress in the support structure and the safety factor brought by tensile load transferred [10]. The multi-mold design also pays attention to the cost budget plan which is determined in detail through a survey of material prices and conducting a price determination

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study with an engineering estimate approach is a solution in deciding the main price of shipbuilding.

A. Type of fishing ship

Fishing boats in the Indonesian region have unique characteristics in each region. It can be in the form of differences in the shape of the hull, ornaments of ship equipment, types of fishing gear and so on. These differences do not escape the influence of culture and natural conditions of waters in the fishing process. Some types can be shown in the following types of fishing boats such as:

- Helical trawl vessels are one of the fishing boats that are often used to catch fish and sometimes directly process fish products both above and below the deck. It depends on how big the size of the ship's capacity is. Where some types of ships on this one such as rear and side hela. Another name for the designation of this hela trawler is trawler Ship. Part of this trawl ship is deliberately designed to be able to catch fish with trawls. The location of the cargo that can be placed in this type of trawl ship reaches several volumes. Another type of trawl ship is a trawl that is commonly used to take marine products such as clams, oysters, crabs, and so on.
- Gillnett vessel, these vessels are not designed to carry many people, and the capacity is usually only capable of carrying 7 to 12 crew members. Because of the small size of the vessel, the gill net fishing gear also cannot transport a lot of equipment, only focusing on certain fishing gear. Where there are 3 types of gill net fishing gear, which are distinguished by surface, mid and basic gill nets.
- The longline vessel is characterized by the type of fishing gear contained in this vessel such as hatches, rope pullers, throwers, and organizers.
- Pursein boats are equipped with fishing gear with a net The formation of the bag (bunt) can be at the end of the net or in the center of the net. Where the top of the net is installed buoys and the bottom is installed weights, as well as a number of clamping rings (Purse ring) made of brass or iron.
- This fishing boat is also equipped with wings on its right and left sides (outriggers). In addition, this fishing boat also has a fish storage box and the ship is equipped with wheels at the bottom to facilitate pushing to the seabed.

B. The habits of fishermen on the South Coast of East Java.

The location of the South Sea on the island of Java does have a high level of wave conditions and extreme weather that can cause ships that are anchored to experience severe shocks or even upside down. This makes it a habit for local fishermen to raise and lower the fishing boat or outrigger ship every time they operate or vice versa. This puts a significant effort on the need for human labor to manually raise or lower them. Many fishermen are injured because of this process, so this is a serious problem. The placement of wheels on the fishing boat will increase the resistance force of the ship so that it will give a decreased ship speed and increase the weight of the ship which in fact reduces the load capacity for ship design with acurate [12].

C. Ship Resistance

The resistance is identical to the component of fluid force that is able to work parallel to the direction of the ship's motion axis. On the total resistance of the ship is given the notation Rt, which can be decomposed into several different components caused by various causes and interact with each other in a really complicated way. The driving force required for a ship to move through the water is highly dependent on how efficient the propulsion system is against the resistance received by the ship. Ship resistance is a very complex function and depends on the variables of hull shape, displacement and ship speed.Some of the main ship resistance components are Frictional resistance, Pressure resistance (form resistance), Wave resistance, Added resistance in wave, Air resistance.

The total resistance (RT) is a number of resistance components that occur due to various causes and interact with each other on the ship. In the ship's propulsion system, the power from the main motor to the power needed to push the ship experiences a power reduction, because this propulsion system undergoes several power transmission processes. This is commonly referred to as the efficiency value. The division of power in the ship's propulsion system can be seen in the following chart, namely:

- EHP, Effective Horse Power is the power needed to move the ship in the water or to pull the ship at a speed of V (knots).
- THP, Thrust Horse Power is the power needed to produce thrust on the back of the ship's propeller.
- DHP, Delivered Horse Power as the power in the propeller shaft tube.
- SHP, Shaft Horse Power as power on the propeller shaft.
- BHP, Brake Horse Power is the power that comes out of the main motor. For the selection of the main motor, Brake Horse Power is required when the maximum continous rating state.

From the above calculations, to be able to find out how much engine to use, and how much fuel needs are needed and the results of the ship's speed to be planned. One of the results of calculations using Ship Resistance (ship resistance) obtained is to produce engine power requirements and estimated ship speed. This is the basis for the selection of the ship's main engine. Where the ship's main engine will affect the system and supporting equipment for driving a ship. Some forms of ship performance require accurate study and analysis in ship maneuvering [14].

D. Molding

The method used in making fiberglass boats or ships is using the molding method, because the method that allows it to be used is only the molding method. This is due to the fiberglass raw material in the form of hardened liquid (Resin, Catalyst, Mat and WR). The work of making molds is carried out by referring to the line plan and line plan drawings. The Line Plan is analyzed based on the ship's resistance pattern that occurs in the hull. So that the shape of the hull must be streamlined.

II. METHOD

A. Description

In the method used in analyzing the strength of multi-mold structures, the finite element method is used. This is because the finite element method is a numerical method for calculating the stress and behavior of structures.

B. Steps of research

This research is an analytical descriptive research using quantitative and qualitative methods. The stages of research that will be carried out in the research entitled "Multi-Mold Design for Fisher Vessels of the Southwest West Coast of Java" are in accordance with the flowchart in the figure 1.

C. Analysis design requirment

To make it easier to analyze and design this fishing boat, the technologies that will be needed are as follows:

- Software
  In a ship design that is used when calculating ship resistance requires a software to support the system, the software needed includes:
  – Maxsurf
  – AutoCad
  – MS Excell
- Hardware
  In hardware requirements to support running ship design modeling, a hardware is needed, namely: Laptop with a minimum dual core processor and 3 GB memory.
- Regulation too get the results of ordinary shipbuilding using the rules of regulation from BKI [11]. Issued a new regulation for fiberglass vessels, this regulation named Rules for Fiberglass Reinforced Plastics Ships of Special Ships.

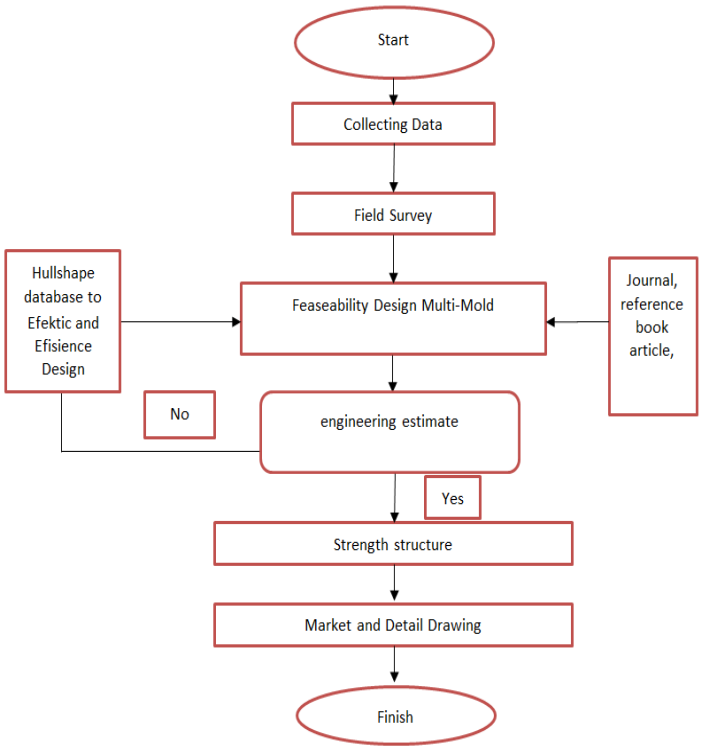

Figure 1 Flowchart research

III. RESULTS AND DISCUSSION

A. Design Multi-mold

Multi mold design is a mold design for fishing boats that is designed effectively and efficiently. Multi mold design is a mold design for fishing boats that is designed effectively and efficiently [13]. Where the boat mold uses the material applied is made of melamine with the concept of one mold to become many hull models.

Figure 2 Multi-mold design of single hull shape

B. Single Hull Form Mode

In the single hull multi-mold design shown in Figure 3, it will provide an overview of the shape of the molding or molding parts to be made. In this case, it is enough to be grouped into 6 (six) existing parts, among others:

– Left front part
– Right front section
– Left center section
– Right center section
– Back left section
– Right Back Section

C. Trimaran Hull Form Mode

For the development of the multi mold shown in Figure 3 above, it can be realized into a trimaran ship where for development enough into 6 main multi parts are used so that it can provide optimal function. As for the shape of the trimaran ship multi mold, it can function the front mold of the front of the left and right positions can be reused or can be duplicated as needed.

D. Part of Design Multi-mold

The after part can be shown by dividing into two parts, namely the left and right. The materials used are teak wood and melamine wood. The construction of the multi mold mold is a whole structural unit. The construction form can be shown in the Figure 4.

The midle section can be shown by dividing it into two parts, namely the left and right. The materials used are teak wood and melamine wood as well. The construction of the multi mold mold is a whole and solid structural unit. The construction form can be shown in the Figure 5.

At the front it can be shown by dividing into two parts, namely the left and right. The materials used are teak wood and standard melamine wood. The construction of the multi mold mold is a whole and strong structural unit. The construction form can be shown in the Figure 6.

E. Multi Mold Analysis results

For the multi-mold design analysis, 5 (five) kinds of analysis were conducted with non linier material woods as follows:

– Contrains and Load result

A constraint is a part of the alignment or boundary condition applied in the finite element method analysis. This results in optimal structural behavior. The placement of the constraint can be placed into the available nodal or element and even some conditions can be conditioned to be in surface or line geometry.

While loading is a pressure condition when given the load of the mold made. Contrains and loan result can be shown in the figure 7.

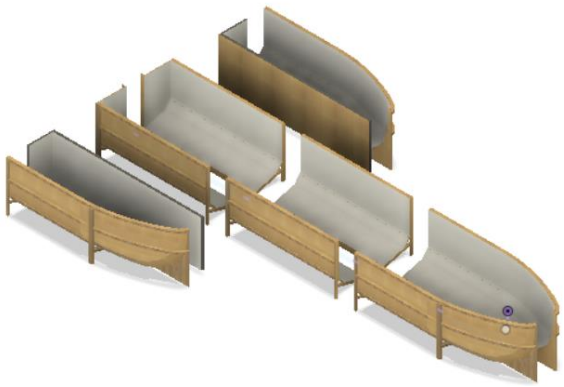

Figure 3 Multi-mold design of trimaran shape

Figure 4 After Part Mold

Figure 5 Middle Part Mold

Figure 6 Fore Part Mold

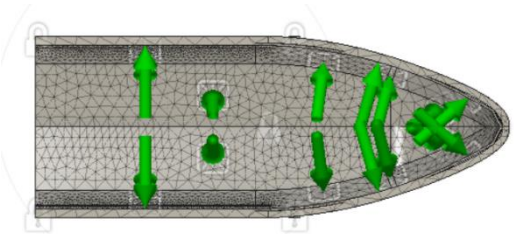

Figure 7 Contrains and Load

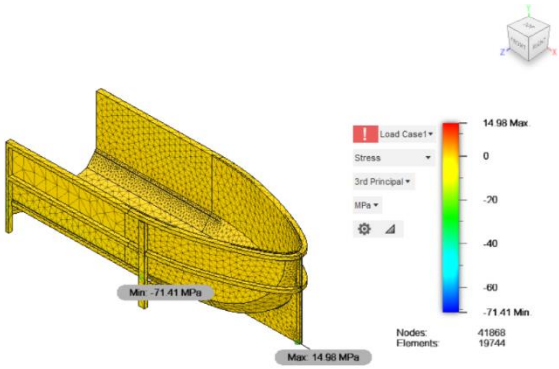

Figure 8 Von Misses Stress Result

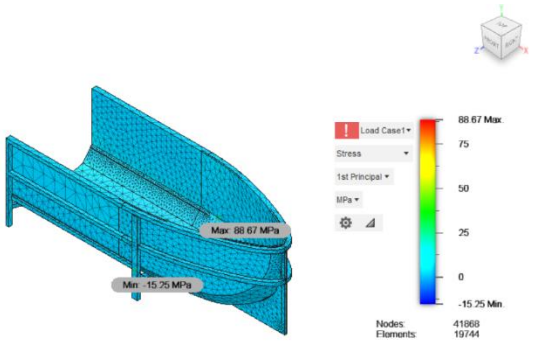

Figure 9 1st Principle Stress Result

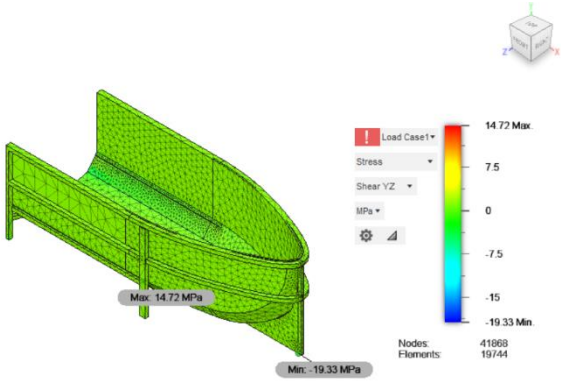

Figure 10 Shear Tress Result

VonMisses result

Vonmisses stresses are combined stresses that arise due to loads acting simultaneously on the imposed structure. Therefore, the results of vonmisses stress usually have greater results than the results of other stresses. The results of the vonmisses stress are shown in the calculation results of the finite element method as figure 8.

– 1st Principle stresses

The 1st principle stress result is one of the stress results due to the behavior of the existing structure due to loading in one optimum direction. This will give a magnitude of stress that is identical to the normal force. The 1st principle stress result can be shown in the figure 9.

- Sheer stress

Shear stress is the result of stresses that occur due to loading and imposed area. This can initial to cracking if the structure is unable to withstand or support the existing load [4].

– Deflection

Deflection is a form of structural change when passing the fatigue point condition of a material, but when the elastic period is still possible the structure can return to its original shape.

Deflection conditions reflect the behavior of the structure subjected to loading and constraints in the form of specified contraints. It changes shape if the structure has crossed the elastic limit which can be expressed by the amount of strain that occurs.

F. Production drawing

Production drawings are intended in the process of conducting multi mold fabrication activities. Some sizes are needed to facilitate the mold assembly process. In addition to this, production drawings can provide information on the size and dimensions of the mold object to be made. The production drawing is shown in Figure 12.

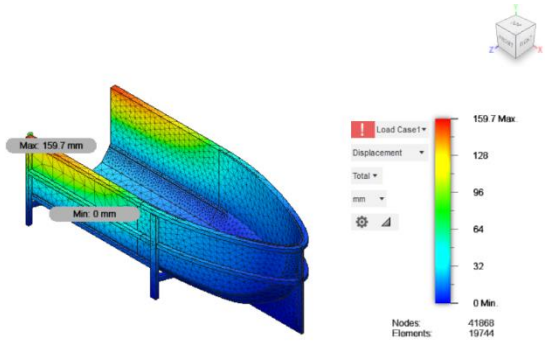

Figure 11 Deflection Result

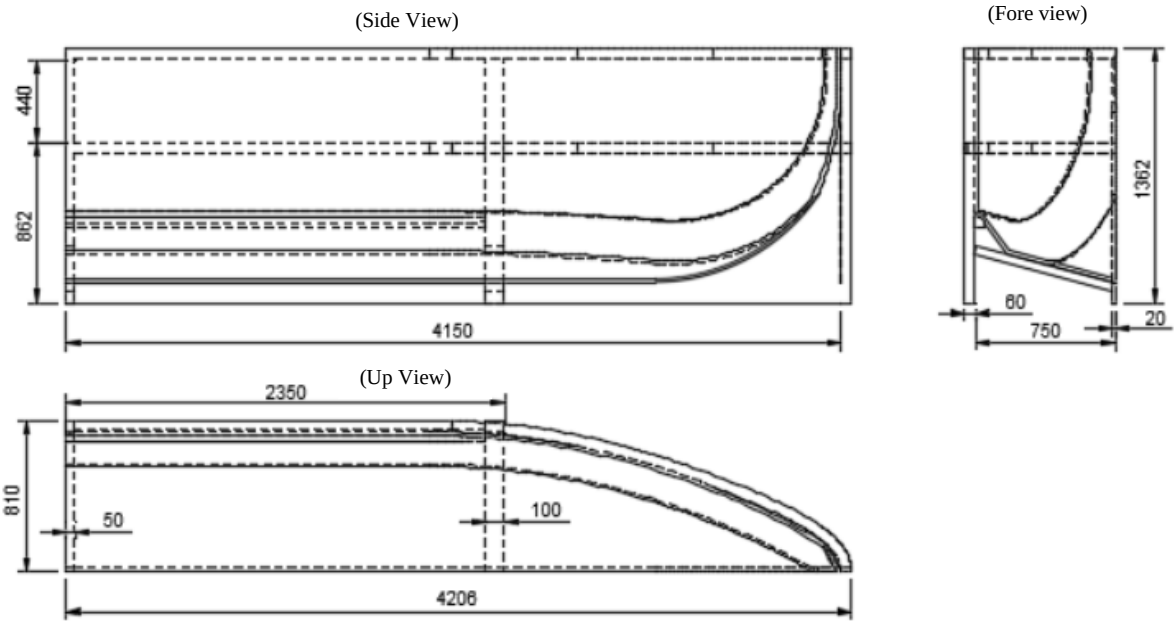

Figure 12 Production Drawing

IV. CONCLUSION

In the design of multi-mold Trimaran ships can meet the rules of strength in accordance with construction calculations. This is evident from the results of stress and strain on multi-mold Trimaran ships still accepted by the permissible limits. To calculate the stress distribution carried out by the Finite Element Method. To get the best mold design results, it is necessary to design the structural strength. The mold design is strong, but not overly strong. The method used in designing the mold structure uses the finite element method. To get the best mold design results, it is necessary to design the structural strength. The method used in designing the mold structure uses the finite element method. The analysis is carried out at the position of the forepart of the mold construction, in this case because the part has a large load with a more limited area. The result of post-processing on Von Misses stress with value 14.98 N/mm2 in finite element analysis is still acceptable for the allowable stress.

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