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ANALYSIS FRAME OF HUSKER MACHINE TYPE LM-24 USING SOLIDWORKS SOFTWARE 2018

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ABSTRACT

Rice is a strategic commodity that directly affects the lives of the majority of the Indonesian population, therefore the program to increase rice production gets a top priority from the government to achieve food security and farmers' welfare. The work of farmers in order to increase domestic rice production, for example is the Rice Milling Unit (RMU). The technology that is usually used in producing grain into rice, one of which is a husker (husker) machine. grains of rice, in the rice mill there is a husker machine weighing 115 kg which is only based on the floor so the machine requires a support or foundation so as not to cause vibrations that can damage the structure of the building around it, therefore it is necessary to make a design the support frame is sturdy and also flexible. To determine the strength of the frame, it is necessary to analyze the calculation of the frame simulation which includes the simulation of Von misses, Displacement and Safety factor, the simulation is carried out at a load of 1127 N which produces a Von misses max value of 102,486 MPa, with the highest displacement value of 0.274 mm and the lowest value of 0. mm, and produces a safety factor value of 2,439. with the value of the safety factor, it can be said that the frame construction is safe.

Keywords : Rice husker machine, Support frame design, Von misses, Displacement, Safety factor.

INTRODUCTION

Rice is a strategic commodity that directly affects the lives of the majority of the Indonesian population, therefore the program to increase rice production is a top priority from the government to achieve food security and farmers' welfare. The quality produced by rice into rice will be very influential for farmers for the value of rice sales.

Lack of human resources and natural resources that are increasingly unsupportive as agricultural land and water catchment areas decrease, making the agricultural sector, especially rice cultivation in Indonesia, begin to experience a decline in production quality. helping farmers work in order to increase domestic rice production, for example is the Rice Milling Unit (RMU). RMU is an agricultural machine tool that is used to grind grain into rice. By using RMU, grain milling becomes faster than manual or pounded methods.

The technology that is usually used in producing grain into rice, one of which is a husker machine, the husker machine itself has a function as a separator between husks (hulls) and rice seeds. Where the result of this process is usually called broken skin rice.

Basically the machine really needs a foundation or support to create a safe and sturdy machine, so the support frame is one of the machine elements that really needs its presence. With the support frame is expected to make the engine performance for the better.

RESEARCH METHOD

The method used by the author in doing this writing is:

1. Literature Study

Data was obtained by looking for references through books or ebooks, journals and learning videos related to the research topic.

2. Field Study

Data collection was obtained by direct observation by looking at the working process of the machine.

The design of the frame that will be made includes the design of the support frame for the LM-24 rice husker machine. The purpose of making this frame is as a medium to support the machine so as not to cause vibrations that can cause damage around the machine. And also with the machine support frame, it can make it easier if the machine wants to be moved. Therefore the frame must be made strong and sturdy. To find out whether the frame structure is strong or not, a static load simulation will be carried out using the solidworks 2018 software.

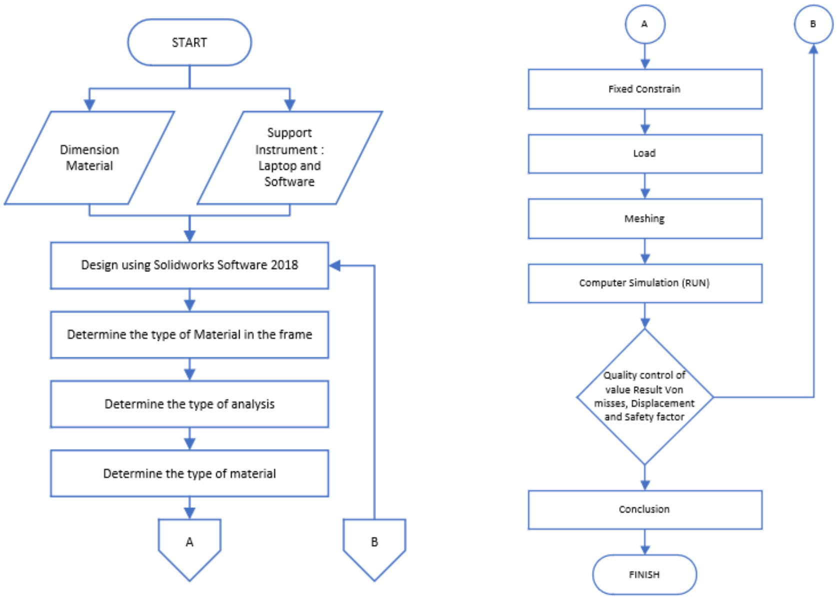

Figure 1. Flowchart of the frame design of the grain skin crusher machine

RESULT AND DISCUSSION

In this process, the specification data for the Rice husker machine type LM-24 is inputted. Measurements are made at a rice mill located in Parakan Village, Ciomas District, Bogor Regency. As can be seen in Figure 2.

Figure 2. Dimensions of the LM-24 . rice husker machine

Measurements were made using a meter on the dimensions of the machine and the following results were obtained:

Husker Machine LM-24 : Length = 725 mm
Widht = 685 mm
High = 870 mm

The material selection in the design of this frame design is ASTM A36 and is simulated with the help of a laptop and using solidworks 2018 software. For the specifications of the laptop used are:

Laptop Type : ASUS Vivobook A442U
Processsor : Intel Core i7-7500U
RAM : 4 Gb
GPU/VGA : NVIDIA GeForce 930 MX

Determining the Type of Iron in the Frame

The type of iron used is an angel iron with a size of 35 x 35 x 5 mm. The wireframe can be seen in Figure 3.

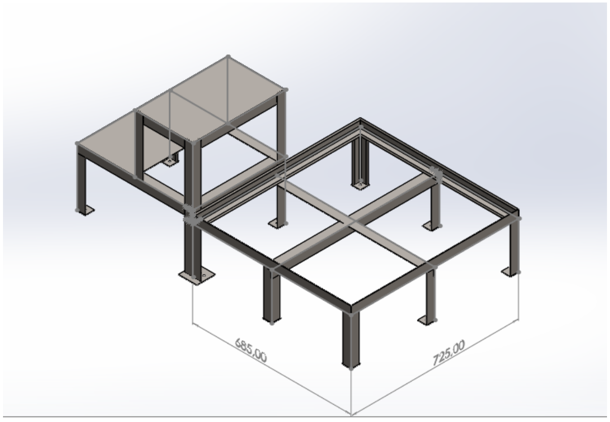

Figure 3. 3D drawing of the support frame for the grain crusher machine

Determining the Type of Material

The material used in the frame of the grain husk crusher is ASTM A36. Which has a yield strength value of 250 MPa.

Define fixed constraints

Fixture advisor which aims to select the part that will be the stressor on the frame.

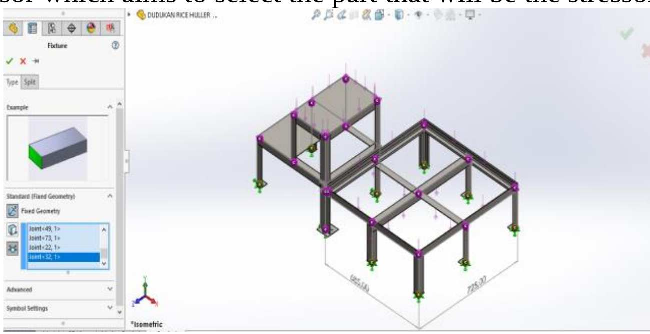

Figure 4. Determination of fixed geometry

Giving Load on the Frame

Given the load on the support frame of the grain husk crusher machine, the grain husk crusher machine has a total weight of 115 kg which will be carried out in distributed loading.

There are various components in the husker machine that have different masses, each mass in the component will greatly affect the loading. The loading value can be seen in table 1.

Table 1. Table of Component Mass

No	Component	Total	Mass (kg)
1	*Hopper*	1	10 kg
2	*Gear box*	1	16 kg
3	*Pulley (free and main pulley)*	2	2 kg + 6 kg = 8 kg
4	*Box*	1	50 kg
5	*Blade*	1	3 kg
6	*Pulley Blower*	1	6 kg
7	*Outlet*	2	10 kg
8	*Rubber Roll*	2	12 kg
	Total Number	**11**	**115 kg**

The location of the load that will be given to the truss can be seen in Figure 5.

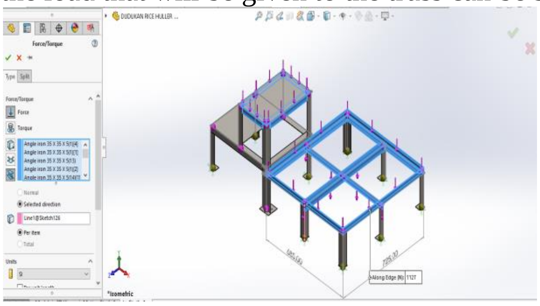

Figure 5. Loading on the frame

Frame Simulation of Grain Skin Breaker Machine With Solidworks

Running the program on solidworks (static simulation), to find out the results of the von misses, displacement and safety factor simulations.

Von Misses Stress

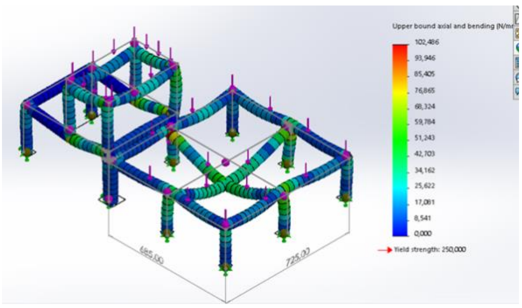

Figure 6. Results of Von misses stress on the frame of the grain husk crusher

The results of the von misses values obtained from simulations on the grain husk crusher machine produce a max stress value of 102,486 MPa.

Displacement

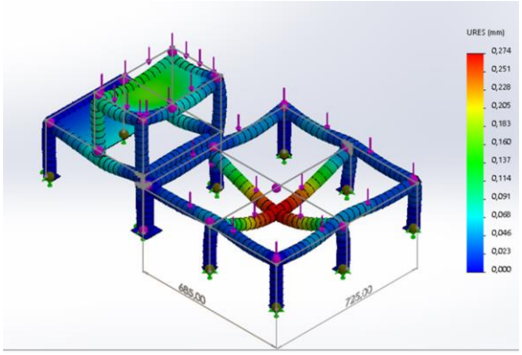

Figure 7. Displacement results on the frame of the grain skin crusher machine

The results of the Displacement value obtained from the simulation on the grain skin crusher machine produce a max value of 0.274 mm.

Safety Factor

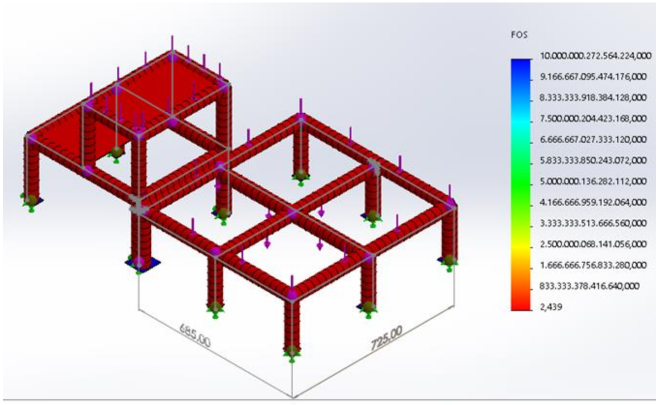

Figure 8. Safety Factory results on the frame of the grain husk breaker

The result of the safety factor value obtained from the simulation on the grain husk crusher machine produces a value of 2.439 ul, so with this it states that the frame is safe to withstand the load of the husker.

Actual Calculation of the Frame Strength of the Grain Skin Breaker
Force Load

Calculation of loading with a total machine weight of 115 Kg, can be done using the following formula

$$F = m \times g$$
$$F = 115 \text{ kg} \times 9.8 \text{ m/s}^2$$
$$F = 1127 \text{ N}$$

Calculation of Frame Surface Area

$$A = P \times L$$
$$A = 725 \text{ mm} \times 685 \text{ mm}$$
$$A = 496625 \text{ mm}^2$$

Shear Stress In Frame

$$M = F \times (1/2 \times \text{frame length})$$

= 1127 N x 362.5 mm
= 408.537.5 Nmm
A = 496,625 mm^2
T = 5 mm

τxy $= \frac{M}{2.A.t}$

τxy $= \frac{M409.537,5\ Nmm}{2\ .\ 496.625\ .5}$

τxy = 0.082 N/mm^2

Frame Center Weight Value

The length of the angle iron is 35 mm, so to see the center of gravity use the following formula.

y $= \frac{d}{2}$

y $= \frac{35}{2}$

y = 17,5 mm

Moment of inertia

I $= \frac{b\ x\ h^3}{36}$

I $= \frac{35\ mm\ x\ (35mm)^3}{36}$

I = 41684,02 mm^4

Normal Stress

σ_t $= \frac{M\ .\ y}{I}$

σ_t $= \frac{408.537,5\ Nmm\ .\ 17,5\ mm}{41684,02\ mm^4}$

σ_t = 171,51 N/mm^2 = σ_x

Von Misses Stress maximum

$$\sigma max = \frac{\sigma x + \sigma y}{2} + \sqrt{(\frac{\sigma x + \sigma y}{2})^2} + (\tau xy)^2$$

$$\sigma max = \frac{171,51}{2} + \sqrt{(\frac{171,51}{2})^2} + (0,082\ MPa)^2$$

σmax = 85,75 MPa + $\sqrt{7353,92}$ MPa + 0,0067 MPa

σmax = 85,75 MPa + 85,75 MPa

σmax = 171,51 MPa

***Displacement* of Frame**

δ $= \frac{P\ .\ L^3}{48\ .\ E\ .\ I}$

δ $= \frac{1127\ N\ .\ (685)^3}{48\ .\ 200.000\ N/mm^3\ .\ 41684,02\ mm^4}$

δ = 0,905221 mm

Safety Factor

$$Sf = \frac{\text{Actual Strength}}{Required\ Strength}$$

$$Safety\ factor = \frac{\text{250 Mpa}}{171{,}51\ Mpa}$$

$$Safety\ factor = 1{,}45\ \text{ul}$$

Error Percentage of *Von Misses*

$$\eta = \frac{Von\ misses\ \text{teori} - Von\ misses\ \text{simulasi}}{Von\ misses\ \text{teori}} \times 100\%$$

$$\eta = \frac{\text{171,51 Mpa} - \text{102.486 Mpa}}{171{,}51\ Mpa} \times 100\%$$

$$\eta = 4{,}02\%$$

Error Percentage of *Displacement*

$$\eta = \frac{Displacement\ \text{teori} - Displacement\ \text{simulasi}}{Displacement\ \text{teori}} \times 100\%$$

$$\eta = \frac{\text{0,905221 mm} - \text{0.274 mm}}{0{,}905221\ mm} \times 100\%$$

$$\eta = 6{,}97\%$$

Error Percentage of *Safety Factor*

$$\eta = \frac{Safety\ Factor\ \text{theory} - Safety\ Factor\ in\ \text{simulation}}{Safety\ Factor\ \text{theory}} \times 100\%$$

$$\eta = \frac{\text{1,45 ul} - \text{2,439 ul}}{1{,}45\ ul} \times 100\%$$

$$\eta = 6{,}82\%$$

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the purpose of writing and discussion, it will be concluded as follows:

1. The support frame for the grain crusher machine has a size of 725 mm x 685 mm x 870 mm, with the material used is ASTM A36 Steel and uses an angel iron measuring 35 mm x 35 mm x 5 mm. the truss design process using the solidworks 2018 software.
2. The strength of the support frame that has been obtained from the simulation results of the 2018 Solidworks software is as follows:
   a. Von misses
      Based on the simulation results, the max von misses stress is 102,486 MPa and the smallest value is 0.000 MPa, this happens because of the vibration generated by the operating machine.

b. Displacement
Displacement simulation on the support frame results in a max displacement of 0.274 mm and the smallest value of 0.000 mm.

c. Safety factor
The safety factor obtained from the simulation results in the software solidworks for the support frame is 2,439 ul with a loading value of 1127 N, so with these results the support frame is safe enough to withstand the load of the grain crusher machine.

Suggestion

From scientific research, there are several suggestions for further research to make it more perfect, so things that need to be considered are as follows:

1. The selection of the type of material on the support frame can be changed to get a better safety factor value
2. Using different software in the design to know the difference.

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