A Study on Design and Vibration Analysis of Automatic Bar Feeding Mechanism of Hacksaw Machine

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Abstract: In general, conventional hacksaw machine has been used for cutting plates and circular bars. This process is very time consuming as well as expensive and for this reason we are looking for new approach which is very easy and time saving in compare to conventional machine. This research paper proposes the model of Automatic Bar Feeding Mechanism in Hacksaw machine which is able to cut circular bar automatic without human efforts. The present work reflects the Vibration Analysis of Feeding Mechanism. The Main objective of this paper is to reduce a time and man workload in cutting operation in order to achieve higher productivity.

Keyword: Power Hacksaw Machine, Bar Feeding Mechanism, Electric Motor, Vibration Analysis

1. Introduction

In This Rapid Emerging Industrial Era, there are many industrial applications where round or square bar is required to make parts of many machines. This creates a need for making a large amount of bar which is very costly and time consuming process through a conventional hacksaw machine [1,2]. For industries to achieve mass production it arises the need for making automatic cutting or feeding in hacksaw machine operation [3]. This paper suggests a model of Automatic bar feeding mechanism in hacksaw machine. As this model overcomes all the limitations and drawbacks of conventional hacksaw machine, it is also useful in small as well as medium scale industries [4, 6].

1.1 Objectives [7]

- Worker has to do less effort.
- The main objective of product is increase the productivity of industry as well as worker , increase the quality of product.
- Reduce production time.
- Less wastages of material due to semi-automation
- Easy to implement in current technology
- Use of electronic components increases the accuracy.

1.2 Advantages [5, 8, 9]

- It is safe for cutting operation.
- It operates automatically so it Increase efficiency.
- It is accurate compare to human works.
- It is compact and less costly and it saves time also.
- It saves human effort.
- It can be used for solid as well as for hollow materials.

1.3 Disadvantages [5]

- Due to less human effort required for performing operation unemployment rate is increasing.

1.4 Applications [8, 9]

- Use in small scale fabrication and manufacturing companies.
- In professional workshops and in laboratories.

- Pipe cutting
- Metal cutting industries

2. Literature Review

The vast review of literature we understood the concepts, theorems and different factors affecting the performance of machine. R.S.Khurmi, J.K.Gupta [10] in their book "Theory of machines" (Velocities in mechanisms) helps to find Velocity diagrams of slider crank mechanism. Also, other literature we studied includes various papers on Automatic Feeding Mechanism for Power Hacksaw Machine by Mr.N.A.Jadhav , Shubham Shinde , Pradip Thorwat , and Automatic Feeding Mechanism for Pipe Cutting Machine Shital K.Sharma1 , Ashish V.Waghmare , Pranit S.Wakhare to name a few.

From the other Literature we understood the total components used in Hack saw machine and how forces will act on the cutting material and feeding mechanism and how machine is exclusively intended for the mass production and they represent faster and more efficient way to feed the metal and also we note that the clamping arrangement can be varied according to need of operations suitable. The overall system is compact in size, light weight, modular and flexible to be used in small works jobs who need batch production. The setup overall configuration can be adopted by a semi- skilled worker easily and can vary the operations by making certain small changes. The system even has the potential to add up a PLC system to control its overall working with ease and with less effort provided. This system has the potential to adopt higher level of automation if desired in future. This Literature is written by Shital K.Sharma, Ashish V.Waghmare and Pranit S.Wakhare.

3. Vibration Analysis

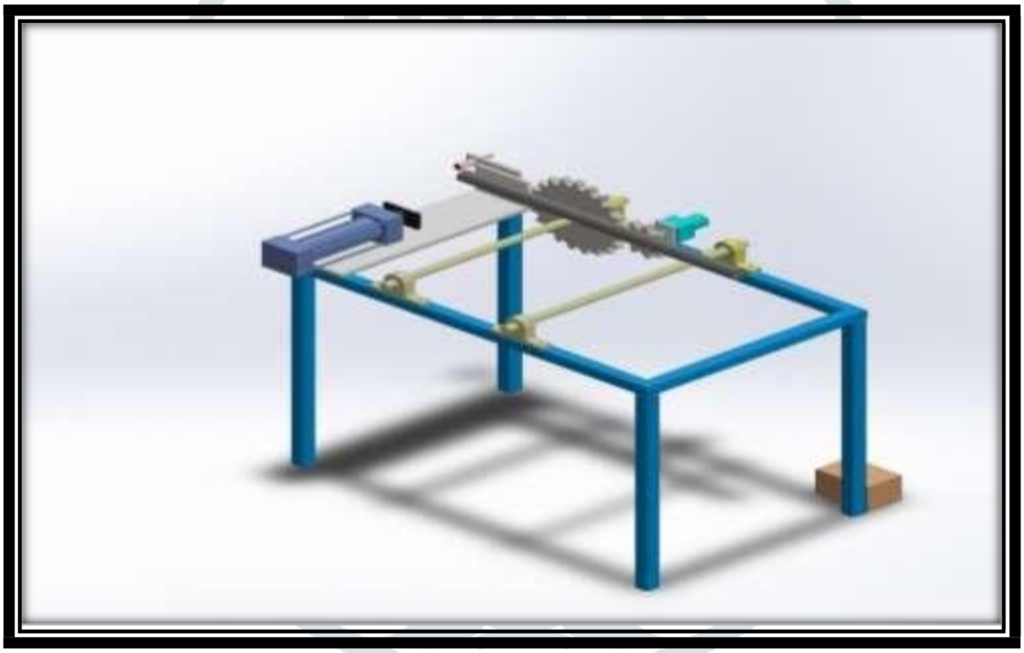
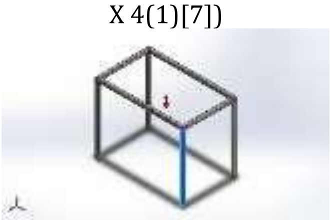
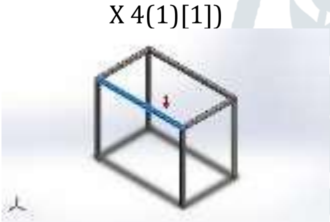
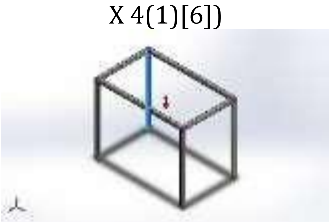
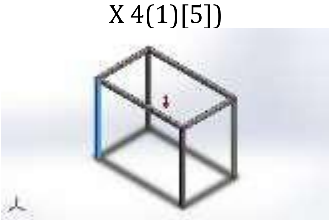


Fig. 1 CAD model of Automatic feeding mechanism for Hacksaw machine

Table no. 1 Beam Bodies

Document Name and Reference	Formulation	Properties	Document Path/Date Modified
Beam-1(Square tube 40 X 40 X 4(1)[7]) 	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:780mm Volume:0.000417141m^3 Mass Density:7800kg/m^3 Mass:3.2537kg Weight:31.8863N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019

Beam-2(Square tube 40 X 40 X 4(1)[2])	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:600mm Volume:0.000320884m^3 Mass Density:7800kg/m^3 Mass:2.50289kg Weight:24.5283N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019
Beam-3(Square tube 40 X 40 X 4(1)[8])	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:780mm Volume:0.000417141m^3 Mass Density:7800kg/m^3 Mass:3.2537kg Weight:31.8863N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019
Beam-4(Square tube 40 X 40 X 4(1)[3])	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:1000mm Volume:0.000534806m^3 Mass Density:7800kg/m^3 Mass:4.17149kg Weight:40.8806N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019
Beam-5(Square tube 40 X 40 X 4(1)[1]) 	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:1000mm Volume:0.000534806m^3 Mass Density:7800kg/m^3 Mass:4.17149kg Weight:40.8806N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019
Beam-6(Square tube 40 X 40 X 4(1)[6]) 	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:780mm Volume:0.000417141m^3 Mass Density:7800kg/m^3 Mass:3.2537kg Weight:31.8863N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019
Beam-7(Square tube 40 X 40 X 4(1)[5]) 	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:780mm Volume:0.000417141m^3 Mass Density:7800kg/m^3 Mass:3.2537kg Weight:31.8863N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019

Beam-8(Square tube 40 X 40 X 4(1)[4]) 	Beam – Uniform C/S	Section Standard-iso/square tube/40 x 40 x 4 Section Area: 0.000534796m^2 Length:600mm Volume:0.000320884m^3 Mass Density:7800kg/m^3 Mass:2.50289kg Weight:24.5283N	D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model\Base Structure.SLDPRT Mar 22 09:11:20 2019

We are trying to find how much amount of vibration our structure sustains and how its impact on raw material. To find out how its impact we done some work in solid works and done vibrational analysis and get some result as shown in above figures.

4. Model information

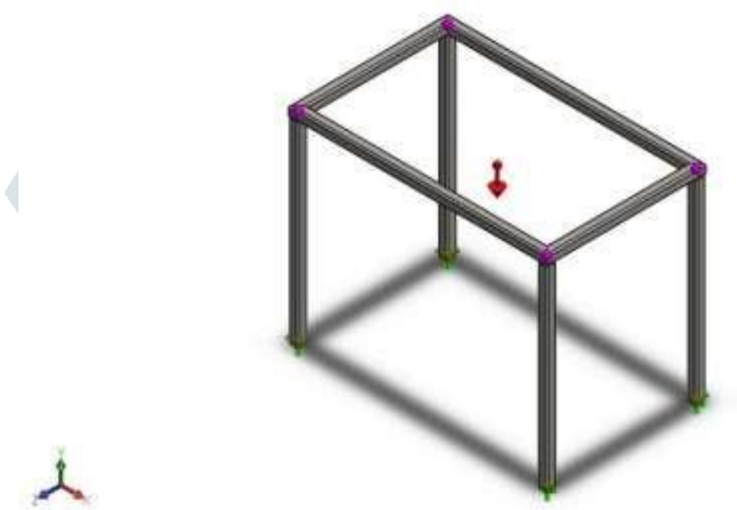


Fig. 2 Model name: Base Structure
Current Configuration: Default<As Machined>

Table no. 2 Study properties

Study name	Frequency 1
Analysis type	Frequency
Mesh type	Beam Mesh
Number of frequencies	5
Solver type	Direct sparse solver
Soft Spring:	Off
Incompatible bonding options	Automatic
Thermal option	Include temperature loads
Zero strain temperature	298 Kelvin
Include fluid pressure effects from SOLIDWORKS Flow Simulation	Off
Result folder	SOLIDWORKS document (D:\Laptop Backup_Oct 2017\DPP\BE Project_2018\22. Manthan\CAD Model)

Name	Type	Min	Max
Amplitude1	AMPRES: Resultant Amplitude Plot for Mode Shape: 1(Value = 45.5413 Hz)	0 Node: 1	0.241084 Node: 44

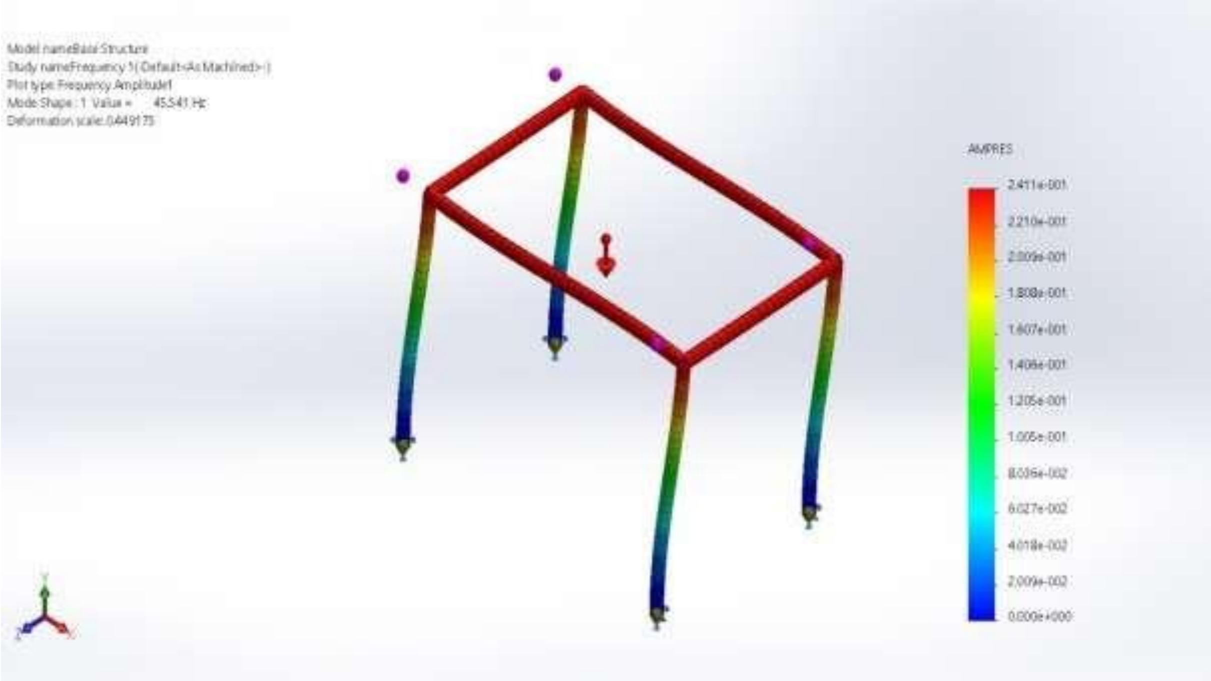


Fig. 3 Base Structure-Frequency 1-Amplitude-Amplitude1

Name	Type	Min	Max
Amplitude2	AMPRES: Resultant Amplitude Plot for Mode Shape: 2(Value = 47.8104 Hz)	0 Node: 1	0.249629 Node: 106

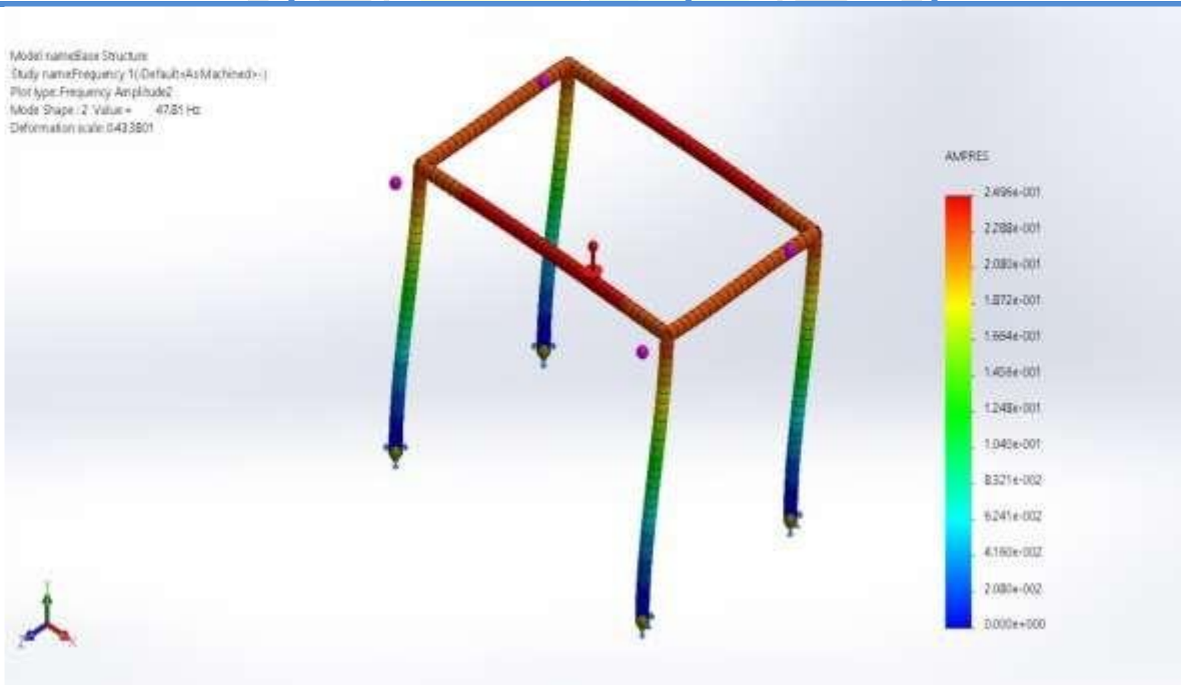


Fig. 4 Base Structure-Frequency 1-Amplitude-Amplitude2

Name	Type	Min	Max
Amplitude3	AMPRES: Resultant Amplitude Plot for Mode Shape: 3(Value = 60.514 Hz)	0 Node: 1	0.278068 Node: 32

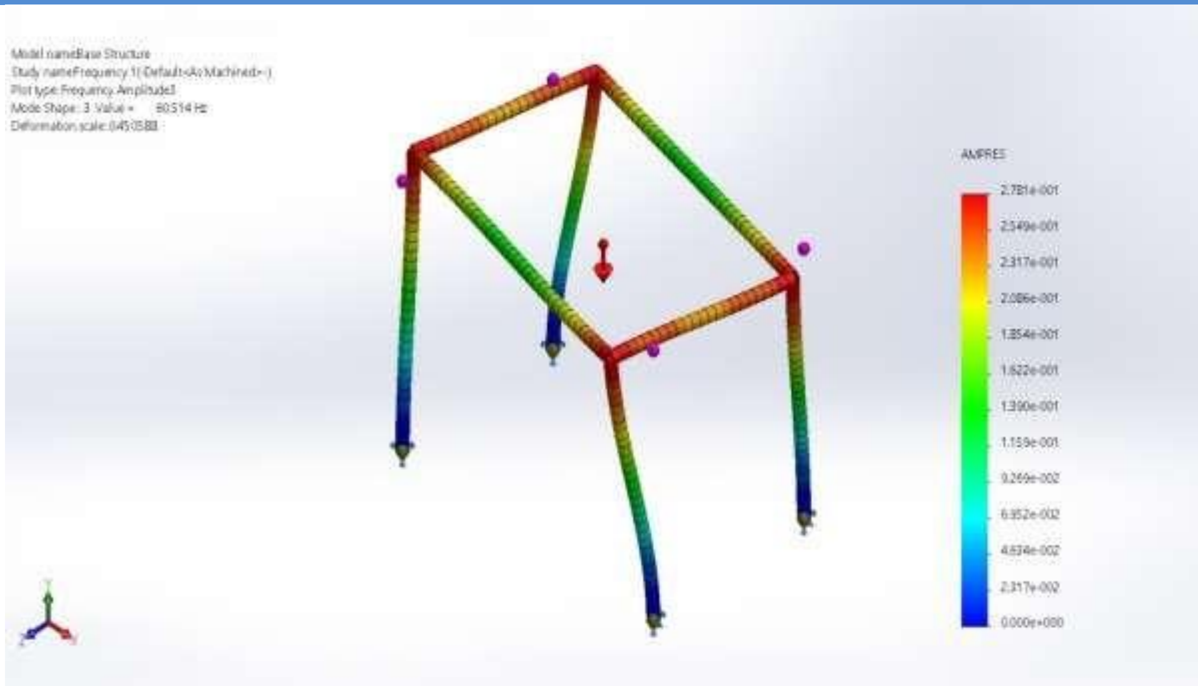


Fig. 5 Base Structure-Frequency 1-Amplitude-Amplitude3

Name	Type	Min	Max
Amplitude4	AMPRES: Resultant Amplitude Plot for Mode Shape: 4(Value = 108.135 Hz)	0 Node: 1	0.264764 Node: 91

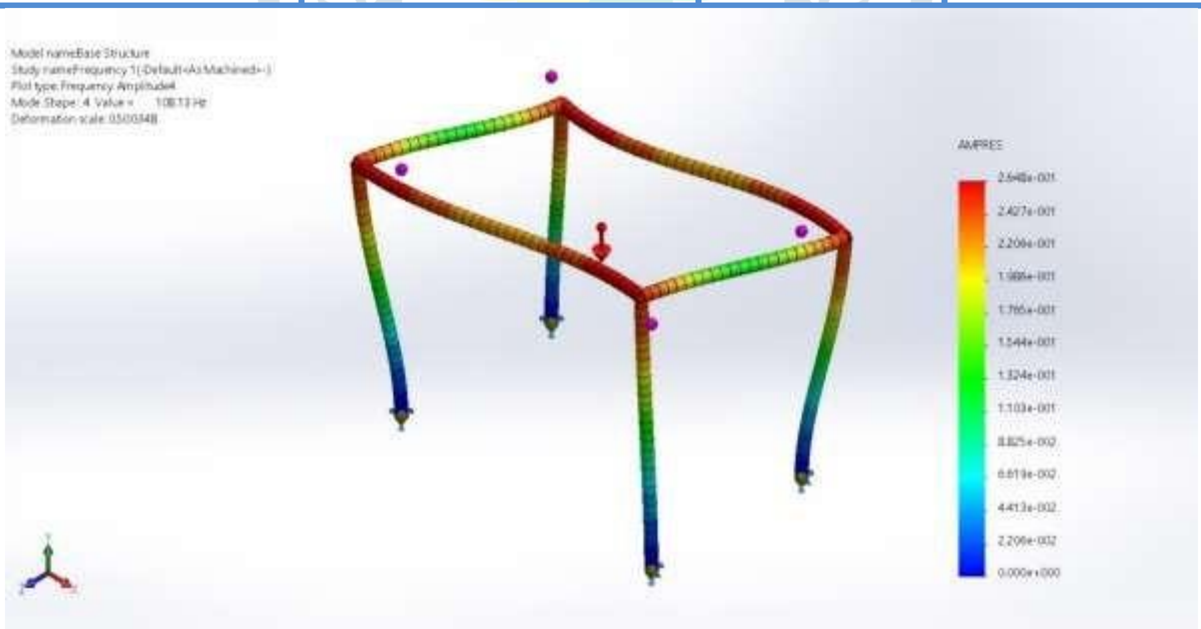


Fig. 6 Base Structure-Frequency 1-Amplitude-Amplitude4

Name	Type	Min	Max

Amplitude5	AMPRES: Resultant Amplitude Plot for Mode Shape: 5(Value = 166.529 Hz)	0 Node: 1	0.48194 Node: 106

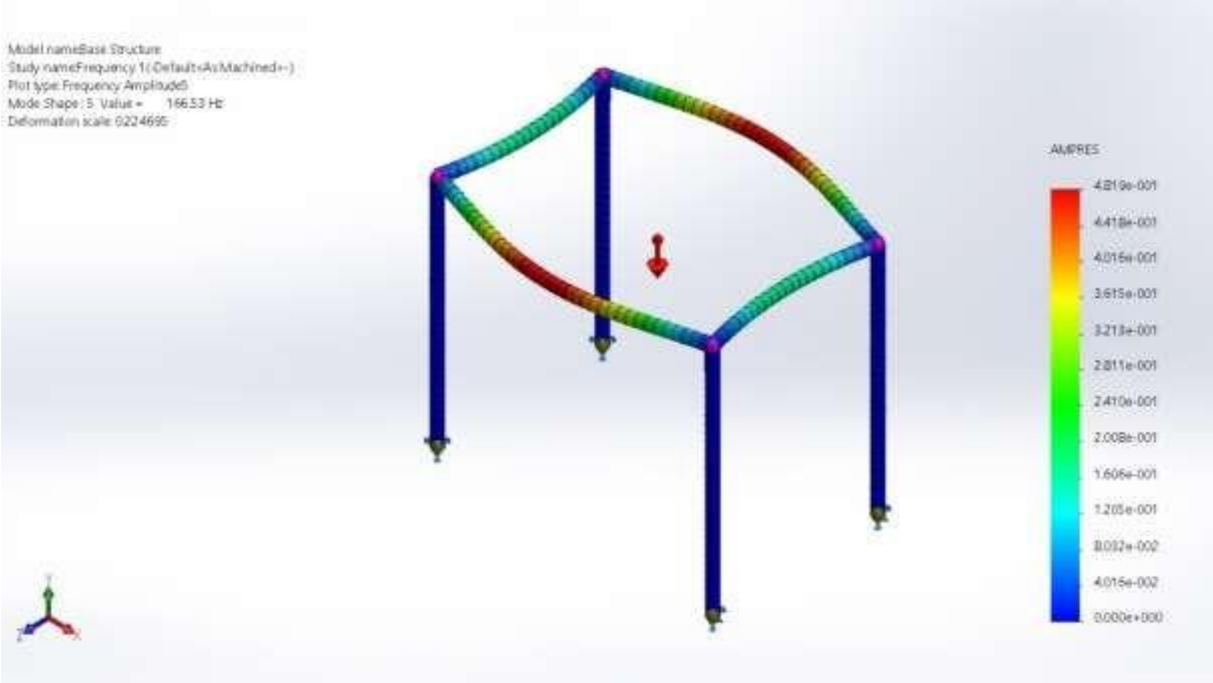


Fig. 7 Base Structure-Frequency 1-Amplitude-Amplitude5

Table no. 3 Model list

Frequency Number	Rad/sec	Hertz	Seconds
1	**286.14**	**45.541**	**0.021958**
2	**300.4**	**47.81**	**0.020916**
3	**380.22**	**60.514**	**0.016525**
4	**679.43**	**108.13**	**0.0092477**
5	**1046.3**	**166.53**	**0.006005**

Table no. 4 Mass participation (Normalized)

Mode Number	Frequency(Hertz)	X direction	Y direction	Z direction
1	**45.541**	**0.7993**	**3.7196e-017**	**5.0598e-015**
2	**47.81**	**5.1117e-015**	**1.2506e-017**	**0.80347**
3	**60.514**	**1.5645e-015**	**5.633e-018**	**1.3329e-015**
4	**108.13**	**8.6788e-017**	**8.0231e-019**	**3.1808e-017**
5	**166.53**	**7.6646e-019**	**2.0257e-006**	**2.2977e-017**
		Sum X = 0.7993	**Sum Y = 2.0257e-006**	**Sum Z = 0.80347**

4. Conclusion and Future Scope

We concluded that to overcome the problems in conventional hacksaw machine the proposed model of Automatic feed in hacksaw machine is helpful it reduces the cost and time with improving efficiency. The main advantage is it reduces the human intervention while performing the operation. So, according to vibration analysis our base structure design is safe under various stress and strain and in buckling loads. Future scope of this proposed research work is that PLC circuit can be used in hacksaw machine to make it more advance and efficient and find how much vibration effect the raw material.

5. Acknowledgement

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