COST REDUCTION OF SECTION CHANNEL BY VALUE ENGINEERING

[1]Mandar Joshi,[2]K A Rade,
[1]Research scholar, Mechanical Engineering Department Bharti Vidyapeeth Deemed University College of Engineering,Pune-43,
[2]Assistant professor at Vidyapeeth Deemed University College of Engineering,Pune-43,

ABSTRACT- *Cost reduction is a mechanism where companies bring down cost of the component to increase their profit by increasing their functionality and quality. The process of cost reduction start it self from new concept generation. Cost reduction is important factor as, competition in market is increasing day by day. In this research, we have done cost reduction on C section channel. The main functionality of this C section channel is to carry out wires, cables, and Pneumatic pipes. For cost reduction of C section channel, we had optimized weight of C section Channel. As a result of this experiment, we reduced the cost of C section channel by half (50%).*

KEYWORDS- Reverse Engineering, Vibrationional Frequency, Manufacturing Cost, 3-D software UGNX, Von Mise stress, C section channel, Fast Fourier Transformation,Factor of Safety

I-INTRODUCTION

Value engineering is a phenomenon where, we can optimize cost of component with respect to function and quality. It can be done by weight reduction, design change, alternative material, alternative supplier. "C" Section channel is made up of steel material having grade DC04-AM. The thickness of component is 3mm and weight lying on component is 11kg by considering FOS 1.4 The weight of cables, wires, and pneumatic pipes are 6.5kg. The weight is uniformly distributed over the components.

This part is got fixed in ring spinning machine. There are 60 parts in this machine. The main affecting factor on this part is vibration.As machine is running at the speed of 19,000 RPM.

II-ANALYSIS

The cost reduction of section channel is done by optimising its weight. In optimization of component we reduced the thickness of component form 3mm to 1.5mm

The first step of this research is to creating 3D model of component by using Unigraphics software.

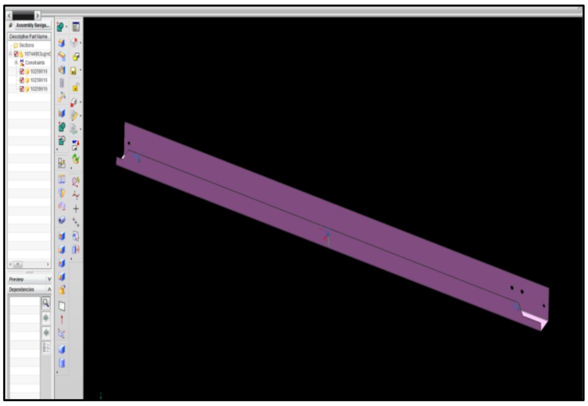

Fig 1: IGES Model for C section channel

- **Von Mises Stresses on old thick part – Resultant stress occurs is 52 MPa: -**

In existing design of 3mm thick channel part, we found max. induced Von Mises Stress is 53 MPa and the least Von Mises Stress is 0.03 MPa. In figure we can see that blue region is responsible for least induced Von Mises Stress

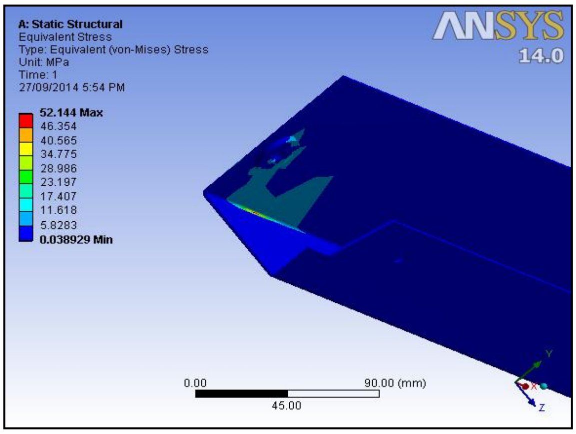

Fig. 2: Von Mises Stresses on old design part

➢ **Von Mises Stresses on new thick part – Resultant stress occurs is 65 MPa:**

In newly designed 1.5 mm thick channel part, we found max. induced Von Mises Stress is 64.45 MPa and the least Von Mises Stress is 0.02 MPa. In figure we can see that blue region is responsible for least induced Von Mises Stress and ed region is for Max. Induced Von Mises Stress.

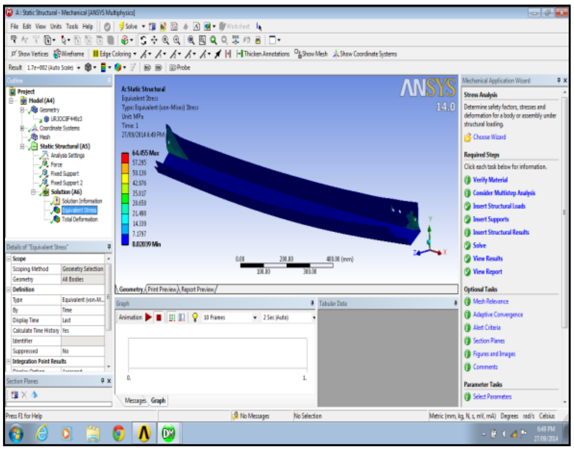

Fig. 3: Von Mises Stresses on old design part

➢ **Natural Frequency of component: -**

Natural Frequency of component is found out by using ANSYS R14 software. In order to get natural frequency, we create IGES model of newly designed part and same IGES model is used as input date for ANSYS software. Natural frequency of component is measured at different nodes and it is measured in Hz. Below figure shows natural frequency of component of newly designed part at different nodes.

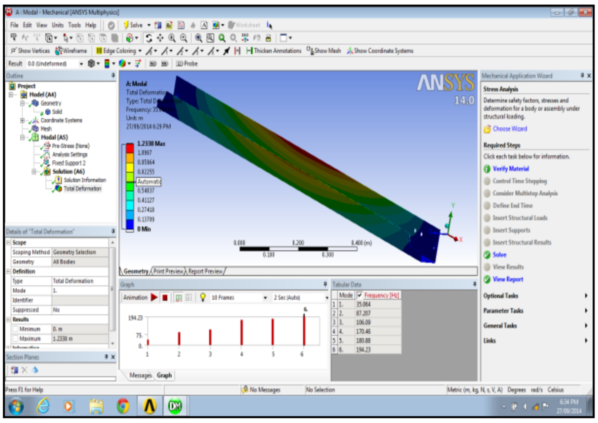

Fig. 4: Natural Frequency by ANSYS

➢ **FFT Analyzer**

Fig. 5: FFT Instrument

- FFT is also called as newer version of DFT (Discrete Fourier Transform) it helps to reduce complexity of computing the DFT form
- An FFT measure the DFT and produces conclusion as exploring the DFT definition directly; the basic variation is that an FFT is much faster
- FFT analyser is used to determine natural frequency and mode shape of component
- FFT basically computes the discreet Fourier Transform (DFT) of sequence. This instrument

converts signal received from sensor to representation in frequency domain and reverse

- A signal in time domain can be converted to frequency domain with the help of Fourier Transform the signal must be sampled at discrete time
- FFT is used for widely application such as Engineering, Science and in Physics

➢ Measuremen.t Process:

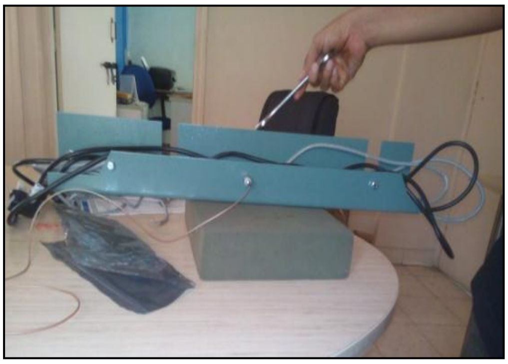

Fig. 6: FFT Instrument

1. **Step 1: -**
   We put all wires in Cable Duct channel in order to have simulation of real situation.
2. **Step 2: -**
   FFT Analyser PAK&GO is used for measurement of Vibrational frequency.
3. **Step 3: -**
   The connections of the FFT analyzer, laptop, transducers, steel hammer along with the power connections were made as per requirement.
4. **Step 4: -**
   Sensor are attached to Middle part of the component to have more reliable readings of vibration
5. **Step 5:-**
   Hammer is used to create vibration oscillation on part.
6. **Step 6: -**
   Once we hammer the part vibration creates in part.
7. **Step 7: -**
   This vibration then converted into electrical signal and then we can produced required graph

➢ Natural Frequency of 1.5mm Part:

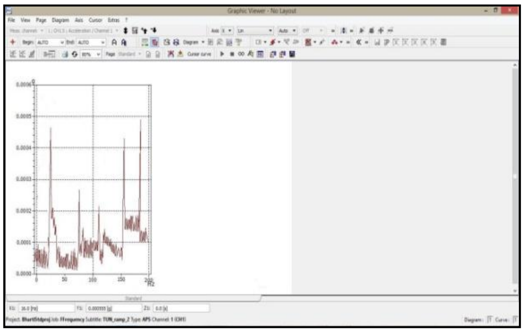

Fig 8: Natural Frequency of 1.5mm Part

- **Manufacturing Cost for bottom part before weight reduction: -**

Table No 1: Cost of old designed Bottom Part

Sr. No	Operation	Resource	Time required in hr	Value INR	Break up
1	sheet 3x1250x2500 = 9.18 kg	10127856		**470.35**	
2	Laser Cutting	45112	0.01	2.35	**Machining Setup Time**
			0.02	49.50	**Machining Time**
			0.05	4.85	**Labour Time**
	Operation 1		**0.08**	**56.7**	
3	Straightening	45114	0.002	1.11	**Machining Setup Time**
			0.004	2.87	**Machining Time**
			0.016	1.16	**Labour Time**
	Operation 2		**0.022**	**5.14**	
4	Tapping	45117	0.001	0.15	**Machining Setup Time**
			0.006	2.60	**Machining Time**
			0.005	1.25	**Labour Time**
	Operation 3		**0.012**	**4.0**	
6	Bending	45115	0.001	0.25	**Machining Setup Time**
			0.010	6.50	**Machining Time**
			0.012	1.35	**Labour Time**
	Operation 4		**0.023**	**8.1**	
7	Powder coating	45119	0	0	**Powder coating setup time**
			0.004	43.96	**Powder coating time**
			0.050	4.45	**Labour time**
	Operation 5		**0.054**	**48.41**	
8	Over heads	45021		13.15	**Administration**
			Total Manufacturing Cost	**605.85**	

- **Manufacturing Cost for bottom part after weight reduction: -**

Table No 2: Cost newly designed Bottom Part

Sr. No	Operation	Resource	Time required in hr	Value INR	Break up
1	sheet 1.5x1250x1750 = 4.70kg	10526396		**210.1**	
2	Laser Cutting	45112	0.009	**2.46**	**Machining Setup Time**
			0.025	**38.80**	**Machining Time**
			0.043	**4.50**	**Labour Time**
	Operation 1		**0.077**	**45.76**	
3	Straightening	45114	0.008	**1.16**	**Machining Setup Time**
			0.0045	**3.00**	**Machining Time**
			0.020	**1.30**	**Labour Time**
	Operation 2		**0.032**	**5.46**	
4	Nut welding	45116	0.001	**0.59**	**Machining Setup Time**
			0.024	**4.92**	**Machining Time**
			0.021	**2.32**	**Labour Time**
	Operation 3		**0.046**	**7.83**	
5	Hexagonal weld nut	10254567	-	**1.8**	**3pcs**
6	Bending	45115	0.001	**1.30**	**Machining Setup Time**
			0.012	**7.32**	**Machining Time**
			0.025	**1.42**	**Labour Time**
	Operation 4		**0.038**	**10.04**	
7	Powder coating	45119	0	**0**	**Powder coating setup time**
			0.005	**58.75**	**Powder coating time**
			0.048	**5.15**	**Labour time**
	Operation 5		**0.053**	**63.90**	
8	Material over heads	45021		**5.2**	**Administration**
			Total Manufacturing Cost	**350.09**	

III-RESULT AND DISCUSSION

Table No. 3: Yield Strength of Part

Name of Part	Von Mises Stress (MPa)	Yield strength of component material (MPa)
Old Section Channel-3mm thickness	52.14	140
New Section Channel-1.5mm thickness	64.45	140

Stress induced in newly designed is lower than yield strength of Cable Duct steel material

Yield Strength of Steel – 140 MPa > Stress Induced in Part 65 MPa

- **Difference between Software and Experimental Natural Frequencies**

Table No.4: Frequency Difference Result

Mode	ANSYS Frequency (Hz)	Experimental Frequency (Hz)	Percentage Deviation
1	35.064	33.310	0.05
2	87.207	78.486	0.1
3	106.00	104.5	1.5
4	170.40	169.04	0.8
5	180.88	179.55	0.1
6	194.23	190.93	1.7

In this paper we had presented the natural frequency of Cable Duct Part derived using ANSYS R14.0 and compared with experimental result i.e operating frequency. In FEA modal analysis for Cable Duct Part component is carried out using ANSYS Work bench R14.0 software. It is observed that the natural frequency of component by FEA and natural frequency in experimental FFT method validations are closed to similar, modes are within 2% of the measured mode.

By above all results we concluded that we can reduce the thickness of the part & because of reducing thickness of the part we got reduction in the cost as per below:

- Present cost of C section channel :- INR **605.85 /-**
- After weight reduction of C section channel:- INR **350.09/-**
- Appropriate cost saving per component :- INR **255.76/-**
- No. of components used in spinning m\c:- 60
- Approximate cost saving per machine:- INR **15,346/-**

CONCLUSION

This research was carried out with the aim of optimization of cost for spinning machine, By decresing the thickness of C section channel, we optimize the cost. We have save 4.5kg of raw material steel per part which saves natural resources also. By considerning all above data we conclude that we can optimize the cost of part by value engineering method.

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