



IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 Issue: VII Month of publication: July 2018

DOI: http://doi.org/10.22214/ijraset.2018.7123

www.ijraset.com

Call: 🛇 08813907089 🕴 E-mail ID: ijraset@gmail.com



Study of Various Stresses on a Crane Hook using FEA and Mathematical Data Analysis

Deeksha Sunaiya¹, Sandeep Jain²

¹Research Scholar, ²Associate Professor Department of Mechanical Engineering, Samrat Ashok Technological Institute, Vidsha, India

Abstract: Stress analusis is a must criterion for any stuructural component. Loading elements such as Crane Hook frequently comes under various Stress impacts and Bending Moment impacts. A numerical study with various stress analysis has been done on a Crane Hook to provide further modifications in the design of a crane hook. Keywords: Crane Hook, Stress, Principal Stress, Stress Intensity, Meshed structure, ANSYS R19.0.

I. INTRODUCTION

Crane hook is a mechanical component used in various engineering purposes for lifting loads and material handling by means of an hoist or crane. While performing the loading and unloading of load a Crane hook comes under various types of stresses. The analysis is made by designing the crane hook on Ansys Workbench with referral dimensions and creating a Mesh on the same software.

Stresses: Applying a load on any object generate stress in the object to resist the external effect of load. When applied axially it becomes an axial load which may be of Compressive or Tensile in nature whereas in the direction along the area generates Shear Stress.

An study of various stresses on a Crane Hook is as follows: Structre, load, geometry & fixed end other material details:



TABLE- II	TABLE-
Mass = 0.72726 kg	Directiona
Volume = 9.2644e-005m^3	X-axis dat
	Y-axis da
	Z-axis dat

BLE- III	
rectional Vectors	
axis data [1.0.0]	
axis data [0.1.0]	
axis data [0.0.1]	

TABLE-IV

Co-ordinate System:
X component = 0N
Y component $= 0N$
Z component = 100 N



International Journal for Research in Applied Science & Engineering Technology (IJRASET)

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 6 Issue VII, July 2018- Available at www.ijraset.com

II. MESHING

Meshingof the Hook refines the structure to to reduce errors in a finite element calculation. It is used to approximate a complex design into a geometric domain to simply the tests carried out on it for a precise result. A meshed structure of the crane hook design is shown in the diagram below.

MESHED DIAGRAM:



TABLE-V
Bounding Box Conditions:
Length $X = 7.8788e-002m$
Length Y =3e-002m
Length $Z = 9.627e - 002 m$

TABLE- VI	
INFLATION:	
TRANSITION RATIO=0.272	
MAXIMUM LAYERS=5	
GROWTH RAFE= 1.2	

Here we have 3 active body parts in the given crane hook which have: Total no. of Nodes = 6073 Total no. of Elements = 1112

TABLE- VII
The Bounding Box which carries the Meshed Design has following specification:
Bounding Box Diagonal =0.128240m
Average Srface Area = 6.7815e-004m^2
Minimum Edge Length = 2.2285e-003m



IV. SHEAR STRESS:





International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 6 Issue VII, July 2018- Available at www.ijraset.com

A. Normal Stress & Shear Stress

The force has been applied normally in Z-direction influencing it for 1 second. As we can see in diagram normal stress has a greater impact than the shear force in tension. Shear stress more tends to compress from a value of 15686 Pa to 1.4118e5 Pa, while the effect of normal stress pushes the hook to a higher tension value of 9.4241e5 Pa.



VII. MIDDLE PRINCIPAL STRESS:

VIII. MINIMUM PRINCIPAL STRESS:



IX. STRESS INTENSITY





International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887

Volume 6 Issue VII, July 2018- Available at www.ijraset.com

X. EQUIVALENT STRESS



III. **RESULTS & CONCLUSION**

- Α. TOLERANCE VALUE=3.059e-004m
- В. TRIM TOLERANCE= 3.205e-004m
- DEFORMATION TIME =1SEC FOR APPLICATION OF LOAD С.
- D. MINIMUM = 0
- *E.* MAXIMUM= 2.6437e-006m iii) AVERAGE 1.0822e-006m
- F. A LIST OF ALLT HE VALUES (from minimum to maximum) OF DIFFERENT STRESSES CALCULATED HAS BEEN TABULATED BELOW & IS DEPICTED IN THE GRAPH

	TABLE VIII						
SERIAL NO.	NORM A L STRE SS (X - axis)	SHEAR STRESS (XY- plane)	MAXIMUM SHEAR STRESS	MAXMUM PRINCIPAL STRESS	MIDDLE PRINCIPAL STRESS	MINIMUM PRINCIPAL STRESS	
Ĺ.	-4.3306e5	-1.4118e5	+0.443.24	-1.2376e5	-1.6641e5	-1.2112e6	
2.	-2.8023e5	-1.098e5	+1.4202e5	+1.6425e5	-1.1225e5	-1.055e6	
3.	-1.274e5	-78431	+2.8404e5	+4.5226e5	-58082	-8.9872e5	
4.	+25430	-47059	+4.2605e5	+7.4027e5	-3918.2	-7.4248e5	
5.	+1.7826e5	-15686	+5.6807e5	+1.0283e6	+50245	-5.8623e5	
б.	+3.3109e5	+15686	+7.1009e5	+1.3163e6	+1.0441e5	-4.2999e5	
7.	+4.8392e5	+47059	+8.5211e5	+1.6043e6	+1.5857e5	-2.7374e5	
8.	+6.3675e5	+78431	+9.9412e5	+1.8923e6	2.1274e5	-1.175e5	
9.	+7.8958e5	+1.098e5	+1.1361e6	+2.1803e6	2.2669e5	38750	
10.	+9.4241e5	+1.4118e5	+1.2782e6	+2.4683e6	3.2106e5	1.9499e5	
	All the values are i	n Pascal.					





GRAPH-I A comparative chart of all the stresses has been shown in figure below: Here

Stress1= Normal Stress (X-axis) Stress2= Shear Stress (XY-Plane) Stress3= Maximum Shear Stress Stress4= Maximum Principal Stress Stress5= Middle Principal Stress Stress6= Minimum Principal Stress Stress7=Stress Intensity Stress8= Equivalent Stress

IV. ACKNOWLEDGMENT

I am thankful to Mr. Sandeep Jain(Guide) for their support and guidance in completion of this project. I am also thankful to all the authors who worked on Crane Hook System.

REFERENCES

- [1] P. Seshu; Textbook of Finite Element Analysis.
- [2] O.C. Zienkiewicz, R.L. Taylor & J.Z. Zhu; A Textbook on The Finite Element Method: Its Basis & Fundamentals.
- [3] ASME Standard B30.10, "Hooks Safety Standard for bleways, Cranes, Derricks, Hoists, Hooks, Jacks and Slings," 2009.
- [4] Stress analysis of crane hook and validation by photo-elasticity", by Mr.Rashmi Uddanwadiker.
- [5] Deborah L Boklund Moran, "Hook Assembly and Kit," United States Patent, Patent No.: US 20060289714 A1.
- [6] Snow, S.D.; Morton, D.K.; Pleins, E.L.; Keating, R. 2010. Strain-based acceptance criteria for energy-limited events. ASME Pressure Vessels and Piping Conference, Operations, Applications and Components, Vol. 7: 91-96.











45.98



IMPACT FACTOR: 7.129







INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 🕓 (24*7 Support on Whatsapp)