© July 2019 | IJIRT | Volume 6 Issue 2 | ISSN: 2349-6002

Structural Strength Improvement of universal Joint with Beryllium Copper Using Fem Solver Ansys Structural

Sandhya[1], Prof. K.K. Jain[2]
[1]*M.Tech Student, Department of Mechanical Engineering Shri Ram Institute of Technology Jabalpur MP*
[2]*Department of Mechanical Engineering Shri Ram Institute of Technology Jabalpur MP*

***Abstract*- In this dissertation research article we aimed to get the knowledge of mechanical behavior of copper alloy material beryllium copper using a 3D model of universal joint. For this purpose we have studied so many authors to get the parameters which affect the performance of universal joint. We found that factors and parameters such as material of universal joint, Construction and size of the universal joint, Mechanical properties of universal joint, Optimization methods for universal joint system, Innovative design of universal joint are the parameters which can be optimized for getting better results of structural performance enhancement of universal joint. Following the review process we modeled a 3d geometry of universal joint in CATIA V5 and performed structural analysis on ANSYS 14.0. we found out by solution of the analysis that beryllium copper is more suitable for manufacturing of universal joint since we got less total deformation for beryllium copper when compared with the conventional material of universal joint i.e. structural steel. The values of stresses and strains were found to be optimum as well. These all contributed to increase the structural performance of universal joint by using alloy material beryllium copper.**

Index terms- Mechanical haracterization, Alloy materials, Structural Analysis, Universal joint, ANSYS structural

I. INTRODUCTION

A universal joint is a positive, mechanical connection between rotating shafts, which are usually not parallel, but intersecting. They are used to transmit motion, power, or both. The simplest and most common type is called the Cardan joint or Hooke joint. It is shown in Figure 1. It consists of two yokes, one on each shaft, connected by a cross-shaped intermediate member called the spider. The angle between the two shafts is called the operating angle. It is generally, but in01 necessarily, constant during operation. Good design practice calls for low operating angles, often less than 25°, depending on the application. Independent of this guideline, mechanical interference in the construction of Cardan joints limits the operating angle to a maximum (often about i37½°), depending on its proportions.

The two fork ends are assembled co-axially with respect to the center block. The pins are assembled into the holes provided in the fork end. they are held in position by means of a collar and a collar ipin.

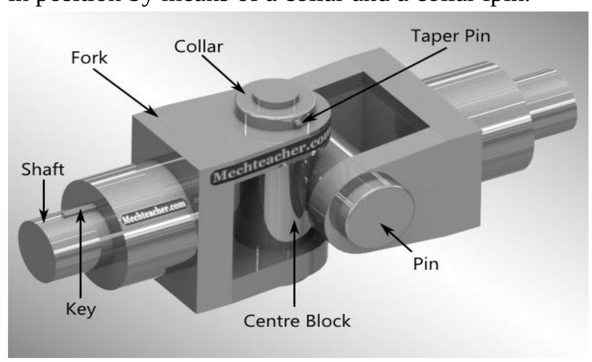

Fig 1.1) universal joint

II. GEOMETRY

The figure shown below is a 3d model of universal joint made with -

- Case1) Spring Steel
- Case2) Beryllium copper

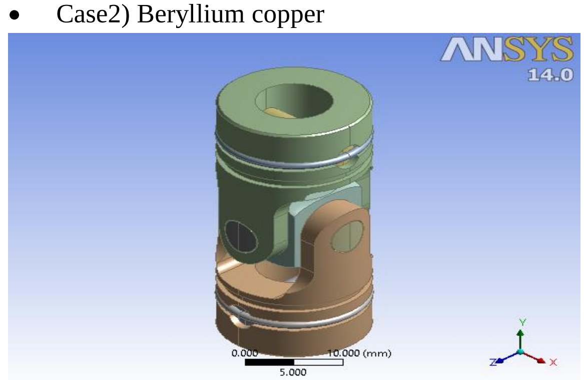

Fig.2.1) 3D Geometry of universal joint

III. MESHING

The figure shown below shows the meshing of universal joint geometry made with

- Case1) Spring Steel
- Case2) Beryllium copper

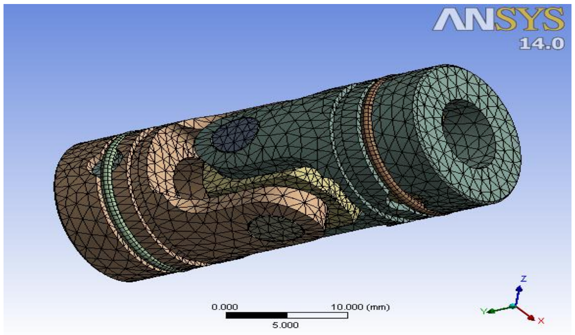

Fig.3.1) Meshing of Universal joint

IV. SOLVER SETUP

The following figures show the setup for solution in the Ansys 14.0.

- Case1) Spring Steel
- Case2) Beryllium copper

The figure shown below shows the fixed support applied at bottom end.

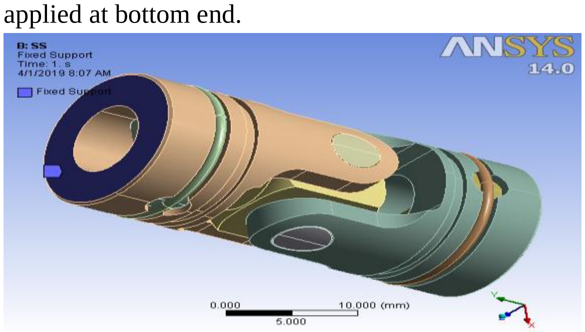

Fig.4.1) Fixed support at one end

The figure shown below shows the application of 1200N tensile force at the top end

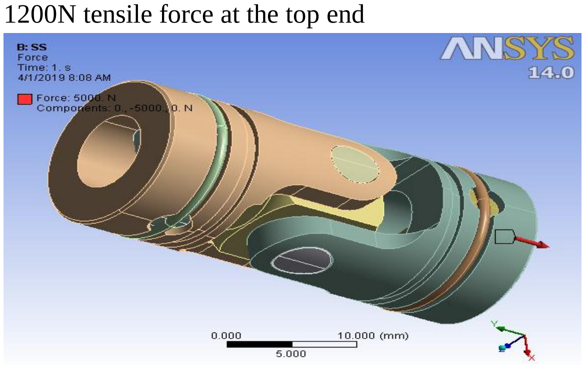

Fig.4.2) Tensile force at other end

Table 4.1) Details of Material Properties

Properties material name	Density (g/cm^3)	Modulus of Elasticity (GPa)	Poisson ratio	Tensile Strength(MPa)
Spring Steel	7.85	200	0.3	460
Beryllium copper	1.8	303	0.18	370

Table 4.2) details of loads and supports

Object Name	Fixed Support	Force
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	
Definition		
Type	Fixed Support	Force
Suppressed	No	
Define By		Components
Coordinate System		Global Coordinate System
X Component		0. N (ramped)
Y Component		5000 (ramped)
Z Component		0. N i(ramped)

V. RESULTS

The figures shown below are the contour graph of results of analysis for equivalent stress (Von -Mises) and total deformation i

- Case1) spring steel

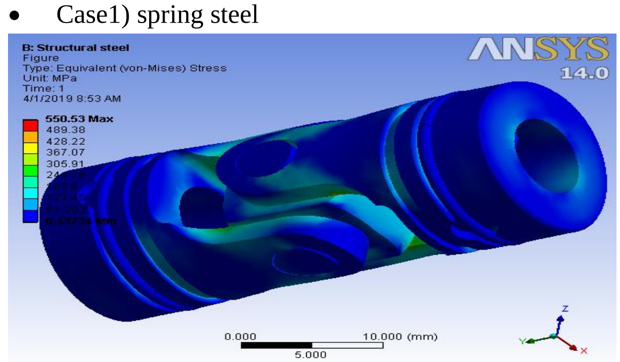

Fig.5.1) equivalent stress for spring steel

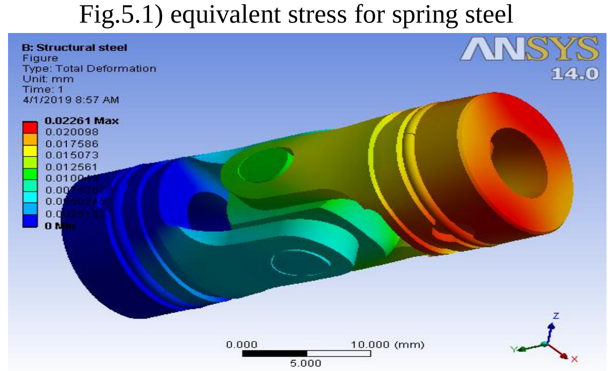

Fig.5.2) total deformation for spring steel

- Case3) beryllium copper

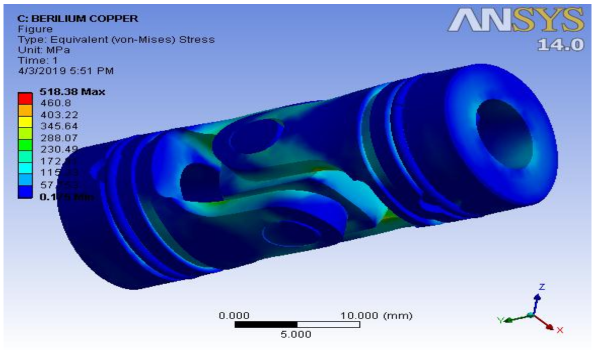

Fig.5.5) equivalent stress for beryllium copper

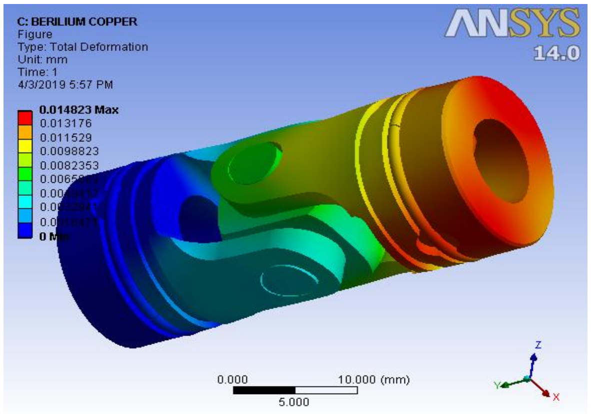

Fig.5.6) total deformation for beryllium copper

Table 5.1) solution results of all the materials for equivalent stress von mises and total deformation

Name of immaterial solution	Structural steel	Beryllium copper
Equivalent stress (MPa)	550.53	518.38
Total deformation(mm)	0.02261	0.014823

VI. CONCLUSION

The mechanical characteristics of alloy immaterial beryllium copper was analyzed by a comparative study using conventional immaterial of universal joint i.e. structural steel and beryllium copper by FEM testing on Ansys 14.0. The structural analysis was done using Ansys static structural i14.0. It is concluded that alloy material beryllium copper has lower value of total deformation when compared to conventional material of universal joint which leads to high structural strength of universal joint. It is also concluded that the values of equivalent stresses and equivalent is trains are also optimum for beryllium copper. so the enhancement of structural strength of shock absorber is achieved using beryllium copper alloy immaterial.

REFERENCES

[1] Ms. Nilesha Patil, Mrs. Sayli M.Sable and Mr. Kashinath Munde, "Static Structural Analysis of Universal joint", international journal of advanced technology in engineering and science, vol 4, issue 12, December 2016.

[2] Prof. Swati Datey, Amit A. Rangari, Adarsh A. Dongre, Kunal A. Paraskar & Sanket V. Lidbe, "Analysis of universal joint used in Mahindra 575 DL", IJARIIE-ISSN(O)-2395-4396, iVol-3 iIssue-2 i2017.

[3] Nipun Kumar, Dr. Gian Bhushan and Dr. Pankaj Chandna, "Analysis of Universal joint of Various materials using CAE tools", international journal of engineering technology, management and applied sciences, volume 5, Issue 1, January i2017.

[4] Kodali. Vikas and Kandula. Deepthi, "Analysis of serial pinned joints in composite materials", international journal of computational engineering research, Vol, 04, issue, 10, October– 2014.

[5] Shaik. John Bhasha and Hari Sankar Vanka, "Modeling and analysis of universal joint", international journal & Magazine of engineering, technology, management and research, volume no: 2 (2015), Issue No: 11 (November).

[6] Geun-Yeon Kim, Seung-Ho Han and Kwon-Hee Lee, "Structural Optimization of a universal joint with consideration of stiffness and durability requirements", the scientific world journal, 2014.

[7] Ms. Nilesha U. Patil, Mrs. Rupali S. Sewane and Mr. Kashinath H. Munde, "Optimization of universal joint by using FEA", international conference on Ideas, impact and Innovation in mechanical engineering), volume: 5 Issue: 6, 2017.

[8] Mahesh P. Sharma, Denish S. Mevawala, Harsh Joshi and Devendra A. Patel, "Static Analysis of Steering universal joint and its shape optimization", IOSR journal of mechanical and civil engineering, PP 34-38, 2014.

[9] Ms.Nilesha U. Patil, Prof. P. L. Deotale, Prof. S. P.Chaphalkar, A.M.Kamble & Ms.K.M.Dalvi5, " Application of Taguchi method for optimization of universal joint" international journal of recent

trends in engineering & research (IJRTER) ,Volume 03, Issue 11; November - 2017.

[10] Pankaj Dulani and S. A. K. Jilani, "Diameter and spiral thickness optimization of universal joint using neural network", international journal of science and research, volume 5 Issue 2, February i2016.

[11] Miss. Yogini .V. Deore ,Prof. J.R.Mahajan K, Mr. Vinay Patil & Mr. Balasaheb Ugale, " A static structural analysis of universal joint", international journal of advanced research in engineering & management (Ijarem) ,Pp. 10-22, Vol. 03, Issue 04, 2017.

[12] Dinesh Shinde and Kanak Kalita, "FE Analysis of universal joint pin used in tractor trailer", ARPN journal of engineering and applied sciences, Vol. 10, No. 5, March 2015.

[13] Abhishek Mandal & Utkarsh Sharma, "Static Structural Analysis of Universal joint to study the various stresses and strains developed in power transmission systems", international journal of engineering research & technology, Vol. 5 Issue 03, March-2016.

[14] Suraj Yadav, Sanket Benade, Sushil iAngchekar, Vaibhav Dhokle and Prof. Rakesh Kolhapure, "Design And Analysis of Universal joint by using FEA", Technical research organization India,Volume-4, issue-6, 2017.

[15] Shankar Majhi & Shaheen Beg Mughal, "Modeling and analysis of universal joint used in tractor", international research journal of engineering and technology, volume: 04 issue: 07, July -2017.

[16] Ravindra S. Dharpure and Prof D. M. Mate, "Study and Analysis of pin of universal joint in train", journal of emerging technologies and innovative research, Volume 1 Issue 3.

[17] Sourav Das, Vishvendra Bartaria & Prashant Pandey, "Analysis of universal joint of 30C8 steel for automobile application", international Journal of engineering research i& technology, Vol. i3 issue 1, January – 2014.

[18] Sangamesh B. Herakal, Ranganath Avadhani, Dr.S.Chakradhar Goud, "Structural Static Analysis of Universal joint", international journal of engineering research and general science, volume 4, issue 2, March-April, 2016.

[19] Dhananjay S Kolekar, abhay M. Kalje, swapnil S Kulkarni, "Design, Development and Structural Analysis of universal joint", international journal of advanced engineering research and studies, Vol 4, issue 4, July-September, 2015/09-12.

[20] Pilla. Anitha and V. Hari Shankar, "Design and Topology Optimization of A Steering Universal joint using FEA", International Journal of Scientific and Research Publications, Volume 6, Issue 11, November 2016.

[21] Nishant Vibhav Saxena and Dr. Rohit Rajvaidya, "Study & Analysis of universal joint with the replacement of immaterial by using Teflon", Int. journal of engineering research and applications, Vol. 5, issue 3, (Part -4) March 2015.

[22] Vivek Shaw, Tanuj Srivastava, Rohit Ghosh and Dr. Rabindra Nath Barman," Numerical simulation of I Universal joint using finite element method: A New Approach Based On composite", international E-Journal for Technology and Research, Volume 1, Issue 5, May 2017.

[23] Frederick T. Wallenberger; Paul A. Bingham (October 2009). Fiberglass and Glass Technology: Energy-Friendly Compositions and Applications. Springer. pp. 211–. ISBN 978-1-4419-0735-6. Retrieved 29 April 2011.

[24] Ashokrao Shinde, Omkar Chandrakant Vibhute, "Modeling and Analysis of Universal joint", International Journal of Engineering Research & Technology, Vol. 6 Issue 07, July – 2017.