Design and Analysis of Wheel Hub

Rohit B. Pawar, N. K Nath, S. B. Satpal

Abstract: ***In this project various methodologies adopted by present researcher for analysis of Mahindra TUV wheel hub and upright assembly with main objective of analysis and optimization of the vehicle. This analysis will assist researchers working in the field of development of the structural design and mass reduction of vehicle through optimization methods conducted by FEA software viz. Catia V5 R20 and Ansys (workbench 16). The review includes key areas of researches as shape optimization, static load analysis and fatigue load analysis using FEA. This literature gradually discusses about the research methodology, software and the outcomes of the discussed researches and is planned to give a brief variety of the researches carried out on the wheel hub and upright assembly.***

Keywords: Mahindra TUV, FEA software viz. Catia V5 R20 and Ansys (workbench 16).

I. INTRODUCTION

Wheel & upright assembly is the important part of vehicle suspension system. Upright is also called as knuckle. Hub & upright assembly are support to vertical weight of the vehicle. Hub is key part of wheel assembly system .It is used to transfer the motion vehicle into wheel. Maximum Speed for the sport car, Designer keeps as the key factor, Design the vehicle of the minimum weight and maximum stresses capability. Weight & Mass reduction can be reduced by such method of material selection, Optimum design analysis system. Hub are Transfer the whole weight of the vehicle into wheel. Hub are usually attached to motor by closely sliding over and locking into engagement with their shaft, transferring torque from the motor, through hub & wheel.

II. PRESENT WORK

The automotive suspension a steering upright is that part which contain the wheel hub or spindle & attaches to the suspension component, variously is known as steering knuckle, spindle, upright or hub. Wheels are normally attached to hubs via the wheels face or its centre. The wheel is attached through fastener to hub due to the good strength & can easily remove for servicing. Wheels are normally attached to the motor by closely sliding over and locking into engagement with their shaft transferring torque from the motor through the hub & to the wheel. Present TUV hub made from mild steel Material.

Revised Version Manuscript Received on March 24, 2018.

Mr. Rohit B. Pawar, Department of Mechanical Engineering, Savitribai Phule University Pune (Maharashtra), India. E-mail: pawarrohi1294@gmail.com

Dr. N. K Nath, Department of Mechanical Engineering, JSPM'S Rajarshi Shahu Collage of Engineering & Research, Tathawade (Pune), India. E-mail: niloykn@yahoo.com

Dr. S. B. Satpal, Department of Mechanical Engineering, JSPM'S Rajarshi Shahu School of Engineering & Research Narhe, (Pune), India. E-mail: satish.satpal@gmail.com

2.1. Previous Researches

Razak et al [1], carried out analysis for lightweight and optimized design of steering knuckle using aluminum 6061-t5 alloy (yield strength 276Mpa).that conclude alloy to be best material for the component due to better physical and mechanical properties.

Dyapa and shenoy [2], carried out model analysis using upsprung mass to improve dynamic of the vehicle. the conclude that the steel upright can definitely replace aluminum without affecting the performance.

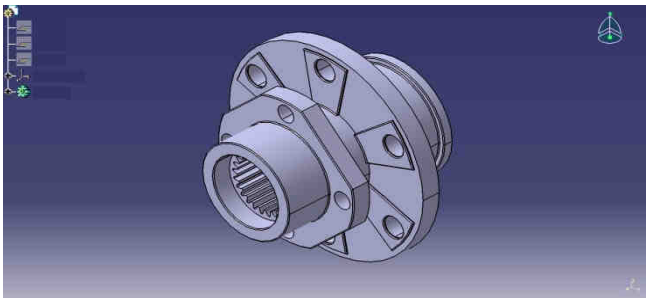

Fig 1. Catia Model of TUV Wheel Hub.

III. EXPERIMENTAL WORK

In this experiment the adding the composite material [carbon fiber (2%)+Kevlar(0.8)] in stainless steel material and make hub model. analysis the both present mild steel hub and stainless steel hub.

3.1. Experimental Process & Result.

1) Design the present wheel hub of TUV Mahindra.
2) Analysis the design wheel hub.
3) Changes the material & add composite material.
4) Analysis of changing material wheel hub.
5) Compare two analysis results and manufacture hub by best material result.

3.2. Result of Analysis

Table II A) Mild Steel Material (Analysis Test Result)

Sr No	Test Name	Result
1	Deformation	0.0068168 mm
2	Maximum Shear Stress	55.549 Mpa
3	Maximum Principal Stress	125.9 Mpa
4	Equivalent(von-Mises)Stress	104.61 Mpa

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication Pvt. Ltd.

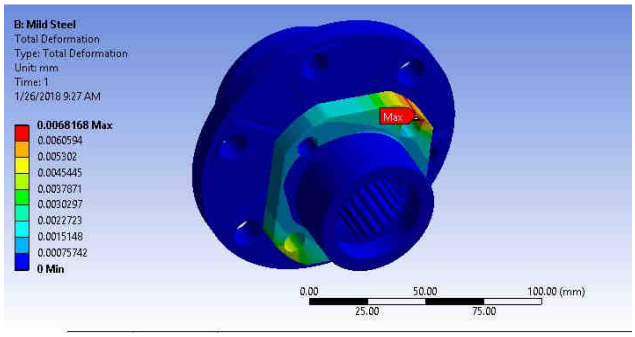

Fig. 2. Deformation Analysis Result

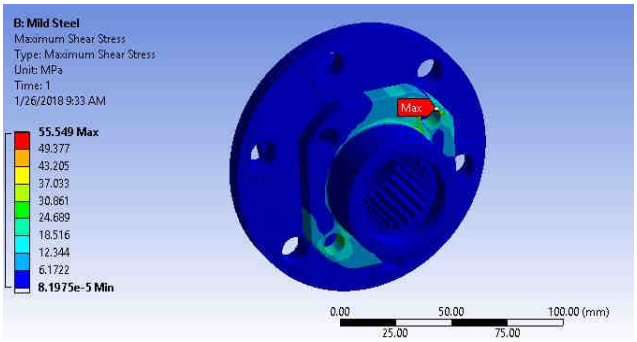

Fig.3.Maximum Shear stress Analysis Result

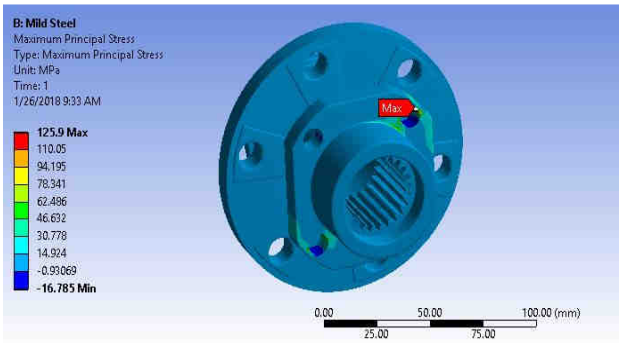

Fig.4.Maximum Principle Stress Analysis Result

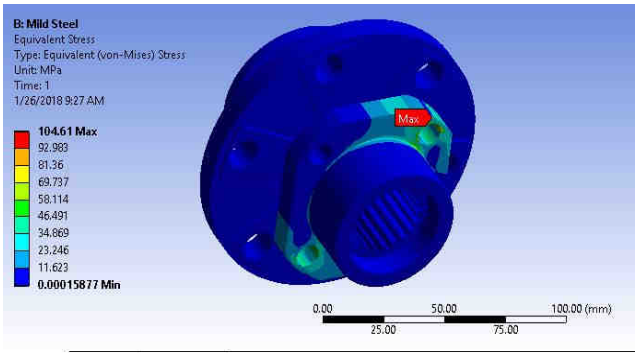

Fig.5.Equivalent (von-Mises) stress Analysis Result

TABLE II B) Stainless steel Material with Composite Material (Analysis Test Result)

Sr No	Test Name	Result
1	Deformation	0.0070774 mm
2	Maximum Shear Stress	55.735 Mpa
3	Maximum Principal Stress	126.44 Mpa
4	Equivalent (von-Mises)Stress	104.61 Mpa

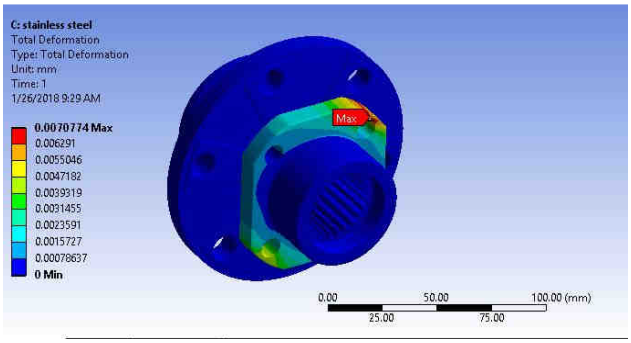

Fig.6.Deformation Analysis Result

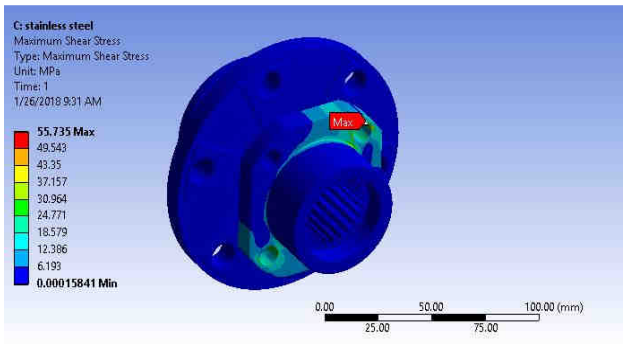

Fig.7.Maximum Shear stress Analysis Result

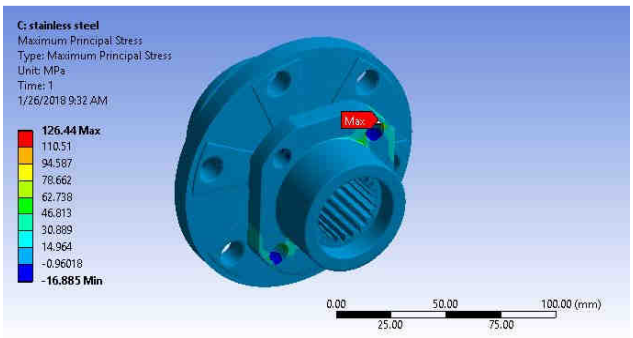

Fig.8.Maximum Principle Stress Analysis Result

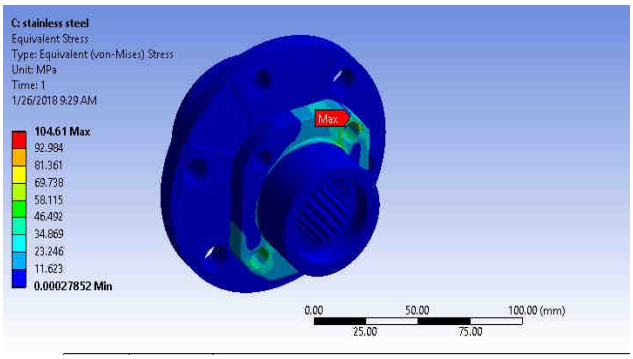

Fig.9.Equivalent (von-Mises) stress Analysis Result

IV. CONCLUSION

1) Adding composite material on the stainless steel (carbon Fibre+kevlar), results are increasing the stress capacity of Wheel hub model.
2) Also increase the von-Mises stress & shear stress of wheel hub model.
3) Reduce upspring mass by using or adding composite material for manufacturing the wheel hub.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication Pvt. Ltd.

V. ACKNOWLEDGEMENT

I give immense pleasure to present paper on “design and analysis of wheel hub” prepare this Present Work no of hand helped directly and indirectly therefore it become my duty to express my gratitude towards them.

I would to take this opportunity to express my sincere gratitude to my project guide Dr. N.K Nath &co-guide Dr.S.B Satpal for this guidance support and encouragement. He valuable encouraged me to take sincere effect for enhancing quality of Work.

I like to convey my gratitude to a Dr A.B Auti, Director JSPM, NTC and Dr J.S Gawande, HOD, Mechanical Engineering and entire staff of Mechanical Engineering Department Of their valuable guidance and co-operation.

REFERENCE

1. Suhaimi Khalis bin,”Design and Fabrication Of An upright With Brake Capilar Mounting For Formula Versality Race Car’’, April 2011.
2. Rangababu, Daavulura, Depti and K, Ramana B.,”Optimal Design and strength Analysis Of Wheel Hub Using Different Type Of Material”, Oct-Dec 2015.
3. Das, Abhijeet,”Virtual Prototype Of Upright Assembly Of Race Car For SUPRA SAEINDIA Competition”, Oct 2014.-March-2015.
4. Razak I.H.A.Yusopm,”Simulation And Optimization Analysis Of Steering Knuckle Component For Race Car”, Nov2014.
5. Dyapa,Anudeep Reddy,Vishal,”Design And Analysis Of Upright Of An FIA Releated Cruiser Class Solar Electrical Vehicle”,April 8,2018.