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Fabrication and Finite Element Analysis Of Wheel Hub

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***Abstract**: In this project various methodologies adopted by present researcher for analys is wheel hub and with main objective of analysis and optimization of the vehicle. This review will assist researchers working in the field of development of the structural design and mass reduction of Wheel Hub through optimization methods conducted by FEA software viz. Katia V5 R19 and Any's (workbench 16). The review includes key areas of researches as Weight optimization, static load analysis and fatigue load analysis using FEA. This literature progressively discusses about the research methodology, software's and the outcomes of the discussed researches and is intended to give a brief variety of the researches carried out on the wheel hub and upright assembly.*

Keywords: *Weight Optimization*

I. Introduction

Wheel hub is a very critical part of the vehicle suspension system which allows the steering arm to turn the front wheels and support the vertical weight of the vehicle. Upright is also known as the knuckle. It assembles with the front tire and a spindle that rotates in a stable plane of motion by a suspension assembly . The force exerted on hub and upright assembly are of the cyclic nature as the steering arm turned. To have the maximum speed for the car the weight has to be minimized, therefore while designing the any terrain vehicle car the designers keep this as key factor and design the vehicle for minimum weight and maximum stress and force sustaining ability. The design of wheel hub are one of the important parameters in optimizing the weight of the vehicle. The mass reduction without compensating the strength of the wheel hub *Fabrication and Finite Element Analysis Of Wheel Hub* is done by the researchers to optimize the weight of the vehicle. Weight or mass of the vehicle can be reduced by improving technology such as material selections, design and analysis method and optimization method. Wheel hub subjected to time varying load during service life, leading to fatigue loads. The hub and upright assembly also transfers the whole weight of the vehicle into wheels, which lead to stress on mountings.

Wheel hub can be analyzed without due consideration to bearing design. In automotive suspension, a steering upright is that part which contains t he wheel hub or spindle, and attaches to the suspension components, variously it is known as steering knuckle, spindle, upright or hub. The wheel and tire assembly attach to the hub or spindle of the knuckle where the tire/wheel rotates while being held in a stable plane of motion by the knuckle/suspension assembly of double- wishbone suspension, the knuckle is attached to the upper control arm at the top and the lower control arm at the bottom. The wheel assembly is attached to the knuckle at its centre point. Suspension systems in any vehicles uses different types of links, arms, and joint to let the wheels move freely , front suspensions also have to allow the front wheel to turn.

Steering knuckle/spindle assembly, which have two separate or one complete parts attached together in one of these links. Hub is the part attached to upright, the purpose of a wheel hub is to attach a wheel to a motor shaft.

Hubs are also used to attach lifting arms, release doors and pulleys to motor shafts. Wheels are typically attached to hubs via the wheels face or its centre. The wheel is attached through fasteners to hub due to a good strength and can be easily removed for storage or servicing. Hubs are typically attached to the motors by closely sliding over and locking into engagement with their shafts transferring torque from the motor, through the hub and to the wheel. Hub must be capable of rigidly supporting its share of the total weight of a vehicle without failure during its expected life span. If the hub geometry and material selection are inadequate, it will break assembly which cannot be repaired.

In order to delve into the real subject of study of this project is necessary to introduce brief information about the operation and behavior of the wheel hub. The hubs or axes support machine elements at rest or rotating, as in our case the wheels. Also the hubs or axes withstand axial forces, cutting forces, bending's and torsional moments. The alternative bending of the rotary axes brings the danger of fatigue failure in every transition section, every change of section, every groove, holes, etc. The stress spikes can be eliminated by taking various precautions during design. Finally, it is possible to prevent axial displacement centers or axes with lateral stop on the bearing, snap or circlips.

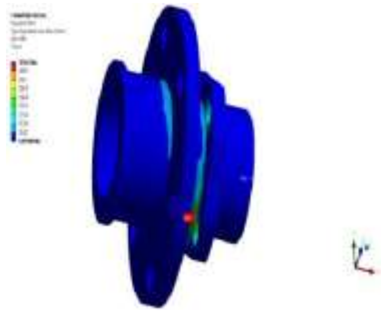
The wheel hub assembly make is possible for you to have a smooth and hassle-free driving experience. The hub is directly connected to the wheel, and is connected to the upright. The upright is to remain stationary relative to the chassis while the hub is to rotate with the wheel. This is done by placing a bearing between the hub and upright. Typically a spindle is pressed into the upright and does not rotate and a bearing is pressed into the hub, and the spindle is pressed into the bearings allowing the hub to rotate about the spindle. Unsprung mass is the mass of the wheel, hub, rotor, caliper, uprights, spindle, and brake pads. It is important to reduce unsprung mass in order to increase acceleration. The greater the unsprung mass, the slower the acceleration.

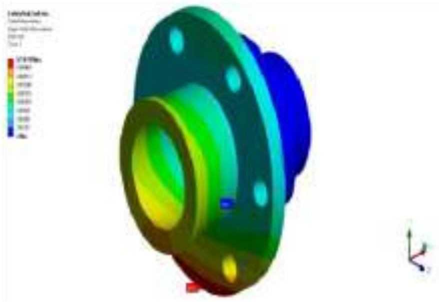
II. Objectives

1) To prevent the failure of wheel hub due to crack initiated in the hub which leads to fatigue failure.
2) To find behavior of hub with materials of stainless steel, Aluminium alloy, Mild Steel.
3) To improve number of cycles for hub.
4) Comparative study of FEA of four different materials and fabricate the best result providing material.

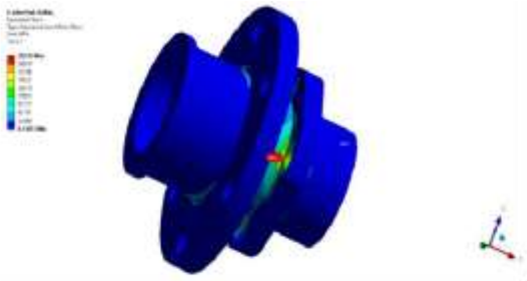
III. Results

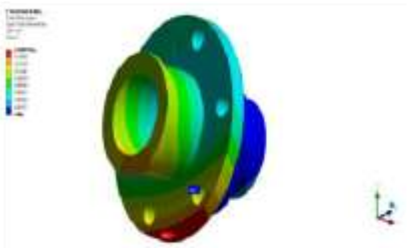
1) Cast iron



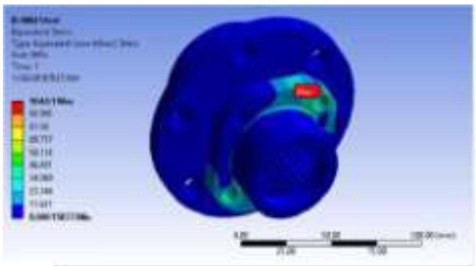


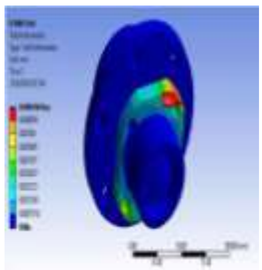
2) Aluminium Alloy



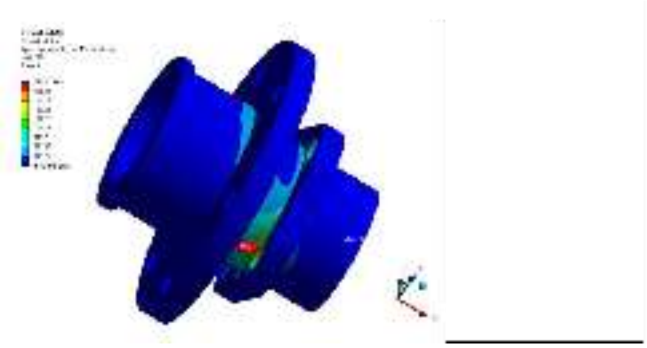


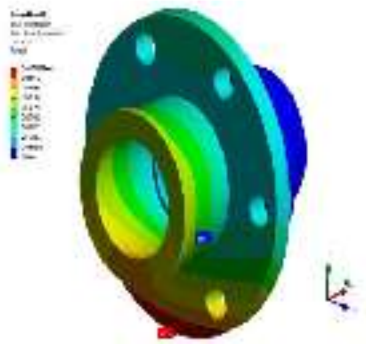
3) Mild steel





4) Stainless steel





Sr. No	Material	Weight [kg]	Von Mises Stress [Mpa]	Deflection [mm]	No of Cycle life [N]	FOS
1	Al Alloy	0.64511	292.93	0.1689	1 × E6 Cycle	0.955
2	Cast iron	1.6768	303.65	0.11079	Less than 1000 cycle	0.9089
3	Mild Steel	0.8192	104.61	0.006816	Less than 2 lakh cycle	0.4510
4	Stainless Steel	1.8049	297.31	0.06256	1 × E^5 Cycle	0.7231

IV. Conclusion

From finite element analysis And Actual Testing Result it is observed that aluminium alloy is a better option for wheel hub giving a good life cycle than hub and in turn reducing the weight of hub. FOS is better than other material. We will be proceeding for fabrication of hub for aluminium hub.

References

[1]. Kaixian Yue, , "Statistical Analysis of the Accelerated Life Testing for Fighter-Bomber Wheel Hubs" 1-4244-2509-9/09/$20.00 ©2009 IEEE

[2]. M. Amura , L. Allegrucci, F. De Paolis, M. Bernabei, "Fatigue fracture of an AMX aircraft main wheel" , Science Direct Engineering Failure Analysis 27 (2013) 194–202

[3]. Kazem Reza Kashyzadeh, Mohammad Jafar Ostad-Ahmad-Ghorabi , Alireza Arghavan, "Fatigue life prediction of package of suspension automotive under random vibration based on road roughness" , Mediterranean Journal of Modeling and Simulation Med. J. Model. Simul. 04 (2015) 037- 050

[4]. J. Janardhan, V. Ravi Kumar, R. Lalitha Narayana , "Radial Fatigue Analysis of An Alloy Wheel" , Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 4, Issue 12(Part 6), December 2014, pp.253-258

[5]. Malapati.M, K V S Karthik , "Fatigue based Design and Validation of Automobile Wheel Hub" , International Journal of Engineering Technology Science and Research IJETSR www.ijetsr.com ISSN 2394 – 3386 Volume 4, Issue 11 November 2017

[6]. Mehmet Firat , Recep Kozan, Murat Ozsoy, O. Hamdi Mete , "Numerical modeling and simulation of wheel radial fatigue tests" , Science Direct Engineering Failure Analysis 16 (2009) 1533– 1541

[7]. Fabio M. Santiciolli , Riccardo Möller , Ivo Krause , Franco G. Dedini, "Simulation of the scenario of the biaxial wheel fatigue test" , Advances in Engineering Software (2017) 1–11

[8]. Gowtham, A S Ranganathan, S Satish, S John Alexis, S Siva kumar , "Fatigue based design and analysis of wheel hub for Student formula car by Simulation Approach" , IOP Conf. Series: Materials Science and Engineering 149 (2016) 012128 doi:10.1088/1757-899X/149/1/012128

[9]. Shi-Jian Luo, Ye-Tao Fu, Yu-Xiao Zhou, "Perceptual matching of shape design style between wheel hub and car type" , Science Direct International Journal of Industrial