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Analysis of Disc Brake Rotor of Two-Wheeler Using ANSYS 2022 R1 and Providing Optimized Design

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ABSTRACT: This work is presented with “Structural- Transient Thermal analysis of real disc brake rotor of HONDA CB SHINE 125 cc” which studies about on disc brake rotor by modeling & analysis of vehicle's disc brake rotor with outer diameter & inner mounting position of holes on wheel hub. Structural- Transient Thermal analysis gives stress, deformation & temperature and heat flux of disc brake rotor & also good heat dissipation. The purpose if this project is to study the chemical composition and the behavior of the sample on analyzing it in the software and propose it in more efficient design.

KEYWORDS: Disc Brake, Design, Modeling, Structural Analysis, Thermal Analysis

I. INTRODUCTION

The most important part of a vehicle is Brake system. Brakes are required to stop the vehicle within the possible distance and it is done by converting kinetic energy of the vehicle into heat energy by friction which is dissipated into atmosphere. The brakes are strong enough to stop the vehicle within the least possible distance. Brakes should also be consistent with safety. The driver should have a good control over the vehicle during panic braking. During the panic brake the vehicle should not skid. The brakes should have proper antifade characteristics and their effectiveness should not decrease with application. A disc brake assembly consists of Disc rotor that rotates with the wheel, Caliper assembly attached to the steering knuckle, disc pads that are mounted to the caliper assembly. This work shows a heat generation and dissipation of a disc brake of a vehicle during emergency braking and the following release period and an optimized design of the disc. Brakes which slows the vehicle and thus transforms kinetic energy into heat energy which results in heating of the brake disc. If the disc overheats the brake pads which fades and it can melt in rare cases. Zaid, et al. (2009) a presented paper on investigation of disc brake by Finite element analysis. In this paper, we have conducted a study on ventilated disc brake rotor of vehicle. This study is concern with heat and temperature distribution on disc brake rotor. In this paper, finite element analysis approached has been conducted in order to identify the temperature distributions of disc brake rotor. ANSYS has been used as finite elements software to perform the Thermal and Transient Thermal analysis of disc brake. This study provides us an understanding on the thermal characteristic of disc brake rotor and assist the automotive industry in developing optimum and effective disc brake rotor.

II. AIMS AND OBJECTIVES

- Providing a modified and optimized design for a existing disc brake rotor of a selected two-wheeler.
- Performing Transient-Thermal Analysis (Finite Element Method) using different materials and composites.
- Providing results for heat dissipation by considering a scenario of vehicle using emergency braking and comparing them with existing and the modified disc analysis.



III. PROBLEM STATEMENT

Discs are made up mainly grey cast iron, so discs are damaged in one of three ways: scarring, cracking, warping or excessive rusting. When brakes are applied then there is friction between brake pad and rotor surface due to this temperature of the brake disc increases and is subjected to thermal stresses. Due to this disc causes cracking scarring warping so a careful design and material selection is necessary to avoid the premature failure of the disc brake.

IV. DESIGN CONSIDERATIONS

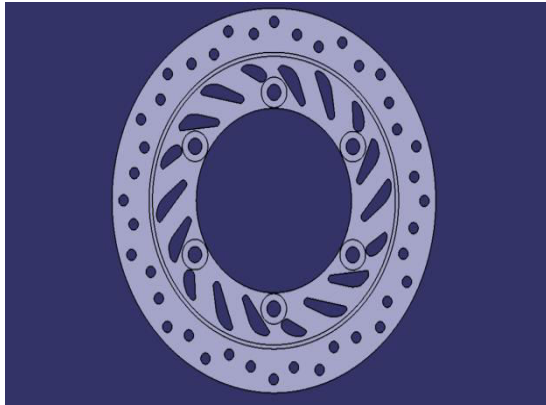
- └ Diameter of tire=432mm
- └ Outer diameter of rotor disc=240mm
- └ Pitch circular diameter of rotor disc=126mm
- └ Inner diameter of disc rotor=110mm
- └ Thickness of disc rotor=3mm
- └ Mass of vehicle =143kg
- └ Maximum speed of vehicle 115km/h=31.94m/s
- └ Rotational speed=147.87rad/sec
- └ Brake torque=120N.m
- └ Maximum pressure apply on disc break=1Mpa
- └ Coefficient of friction=0.4-0.5
- └ Pad brake area =2000mm²
- └ Distance travelled of vehicle before braking=126.81m
- └ Time taken to stop vehicle=8sec
- └ Disc brake material (original) =Grey cast iron

VOLUME OF THE DISC – 89645 mm³

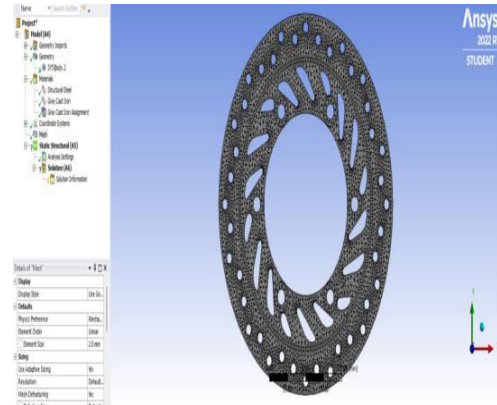
MASS OF THE DISC – 0.645 kg

V. ANALYSIS

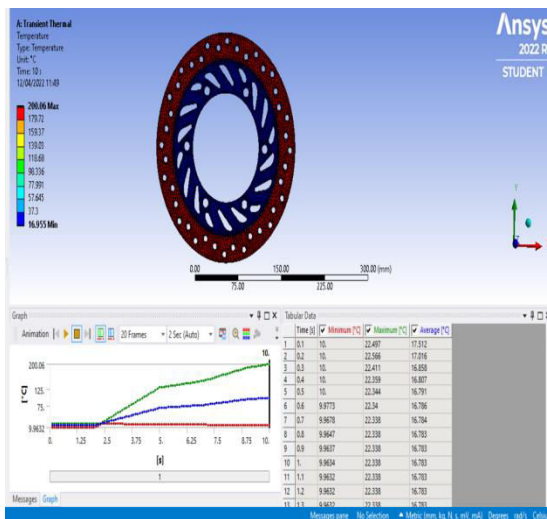
1. Transient Thermal Analysis linked to Static Structural Analysis of sample Disc (Vehicle- CB Shine 125 cc).



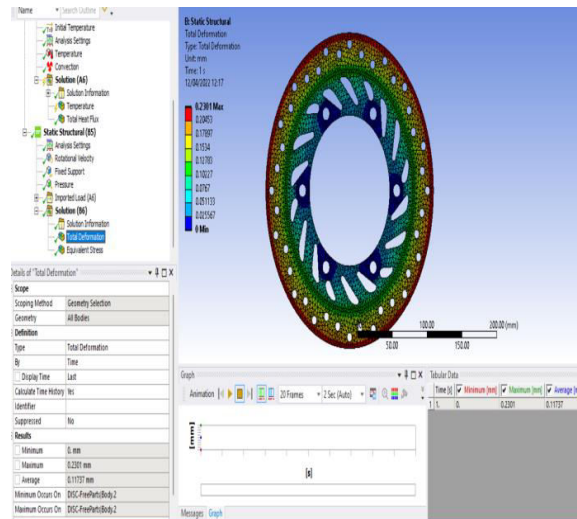
1. DISC



2. MESHING

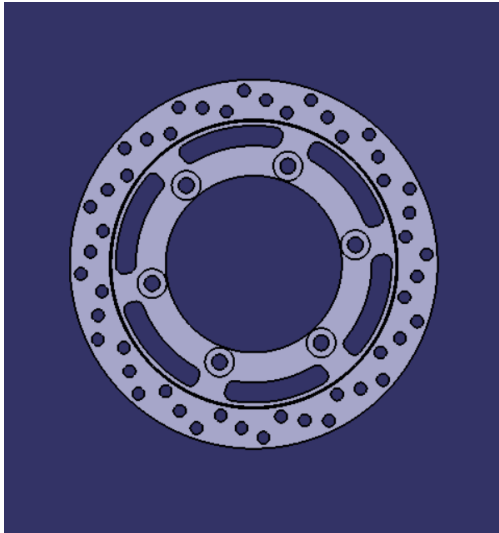


3. TRANSIENT THERMAL

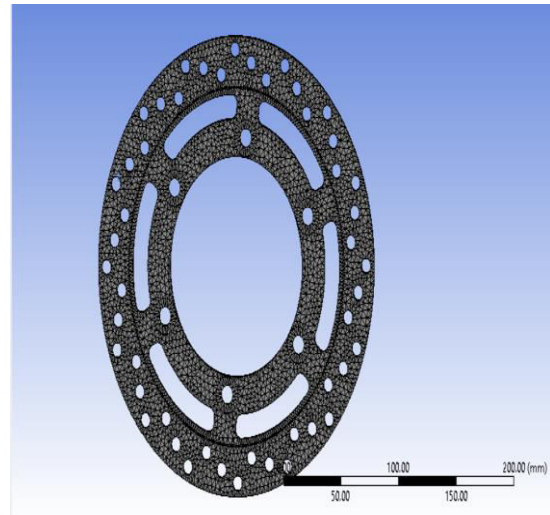


4. STATIC STRUCTURAL

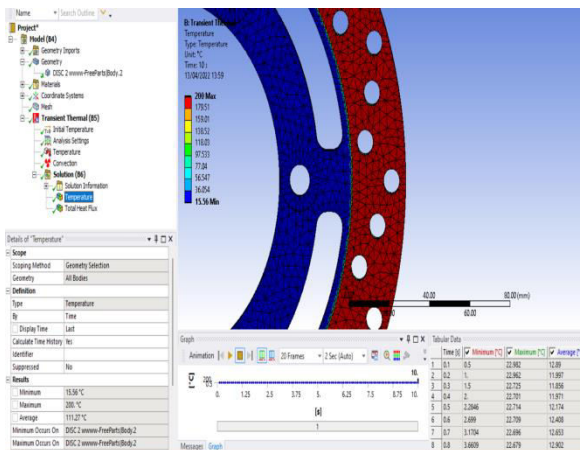
2. Transient Thermal Analysis linked to Static Structural Analysis of new proposed design of disc.



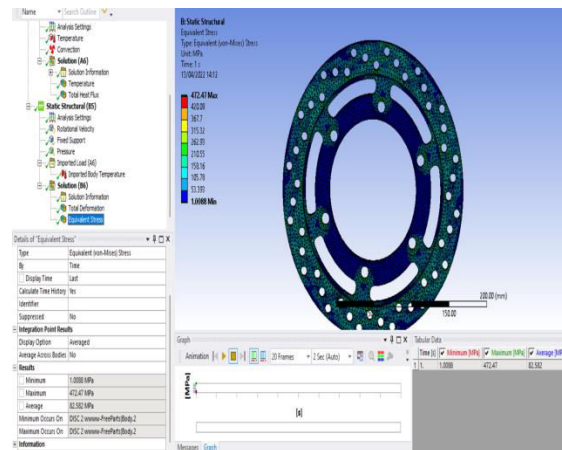
5. MODIFIED DISC



6.MESHING



7.TRANSIENT THERMAL



8. STATIC STRUCTURAL

VI. RESULTS

ORIGINAL DISC

1. **Volume-** 89645 mm³
2. **Mass** - 0.645 kg
3. **Temperature** - min. 16.95 deg. Cel.
4. **Heat Flux** - Max. 17.059 W/mm² (observed at very few locations)

Min. 7.15×10^{-14} W/mm² (observed almost everywhere)

except holes)

5. **Equivalent Stress**- Max. 463.61 MPa (observed at very less points on
Bolting locations)
Min. 0.341 MPa (observed almost everywhere)

6. **Total Deformation**- 0.2301 mm

MODIFIED DISC

1. **Volume**- 83075 mm³
2. **Mass** - 0.598 kg
3. **Temperature** - min. 15 deg. Cel.
4. **Heat Flux** - Max. 17.8 W/mm² (observed at very few locations)
Min. 1.2×10^{-13} W/mm² (observed almost everywhere except holes)
5. **Equivalent Stress**- Max. 472.4 MPa (observed at very less points on
Bolting locations)
Min. 1.008 MPa (observed almost everywhere)
6. **Total Deformation**- 0.220 mm

VII. CONCLUSION

On the analysis of the disc sample we found according to the metallurgical lab reports the carbon percentage in the disc is 0.069 which is very less. Generally in Grey Cast Iron this percentage is found 2.5 – 4.0 %. Silicon percentage is found 0.218 which is generally 1-3 %. Most percentage component found is Chromium which is 12.503% which is greater than normal range so, here this disc needs to be added a graphitised layer to avoid formation of hard edges. On performing hardness test results came as 34 to 35 HRC which is below normal. It can be hardened more by adding 0.15-0.5 % Vanadium. Another way is in the hardening of gray cast iron the casting is heated to a temperature high enough to promote the formation of Austenite held at that temp. until desired amount of carbon is dissolved and quenched at a suitable rate.

REFERENCES

1.Performance Analysis on Disc Brake of Super Bike

Author - A. Vennila (Mechanical Engineering SNS college of Technology, Coimbatore, India)

2.Design and analysis of Disc Brake Rotor.

Author - Kumaragurubaran Sb , Saravanan Boobalan (Bannari Amman IOT), Subramaniyan Sivakumar (Hallym University medical center.)

3.Design and Structural Analysis of Disc Brake Rotor for Different Material Using Finite Element Method (FEM)

Author - M. Mohamed Ajmal Mahasin, 2 M. S. Kavinkumar, 3 P. Prabu & 4 R. Praveen Kumar 1 Assistant Professor, 2,3,4UG Students, Department of Mechanical Engineering, Nandha Engineering College, Perundurai, Tamil Nadu, India.

4.Thermal Analysis of Disc Brake Rotor

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