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“THERMAL ANALYSIS ON CAR BRAKE ROTOR USING FEA METHOD”

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ABSTRACT

The vehicle plate brake rotor is a pivoting gadget. Slowing down is a cycle which changes over the dynamic energy of the vehicle into mechanical energy which must be scattered as warmth. This paper presents the examination of the temperature and warmth motion at the plate interfaces utilizing an itemized 3-dimensional limited component model of a genuine vehicle brake rotor. rotor disc are made utilizing CATIAV5R20 and recreated utilizing ANSYS R 20 Disc brake noise and vibration generation due to thermal stresses generation, during braking has been one of the most important issues and definitely worrying problem to automotive manufacturers. Despite brake noise is not a safety issue and has little impact on braking performance by hydraulic pressure applied on brake pads, it gives customers the impression of underlying quality problems of the vehicle. In addition, the customers view that the noise emitted from the brake system is indicator of malfunctioning condition and consequently lose confidence on the quality of the vehicles.

Key Words: Gray Cast Iron , Thermal Stresses, Deformation, Heat flux, Temperature, Pressure , Disc brake rotor

I. INTRODUCTION

The brakes proposed to race need high slowing down capability. The mileage of the pads or the cost isn't of marvelous concern to the producer of the hustling auto brakes. From the start the vehicles used drum brakes in the cars. The essential point of convergence of this proposition isn't for the voyager auto advancement yet it centers around the vehicle running industry, NASCAR, the Nation Association of Stock Car Racing. NASCAR is a dapper class like other hustling bunches like Formula 1. The words "Stock Car" are done explanation amassed race cars whose solitary similarity to the creation vehicles copy in outside side profile. Genuine vehicle structures are planned for their specific swank purposes . The underside used by the dapper auto is full cylinder plot while that used on business vehicles is made of single body layout. Another differentiation is the drive plan; race structures have eight chamber engines with raise wheel drive however business vehicles are four or six barrel engines with front wheel drive.

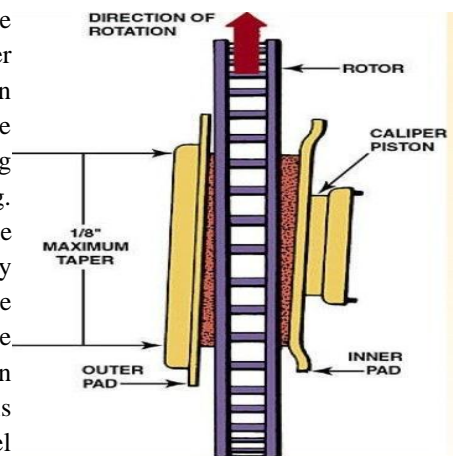


Fig 1: Floating caliper outline

Vast measure of warmth is delivered in braking activity as dynamic vitality is straight forwardly changed over into warm vitality. The substantial measure of warmth can be found in figure 1. This vast measure of warmth needs to disseminate or consumed effectively to maintain a strategic distance from over warming of the slowing mechanism.

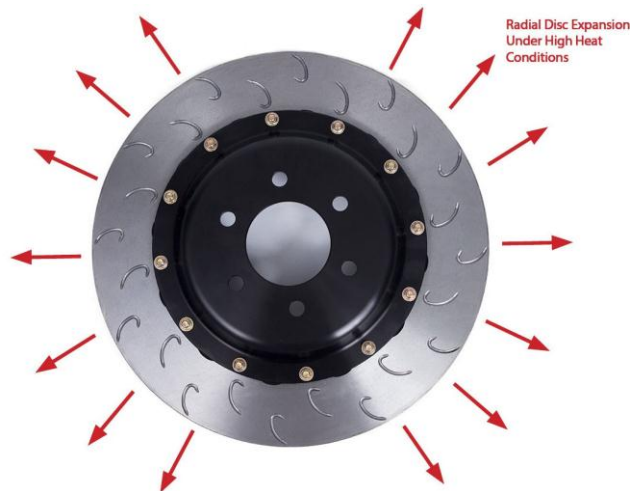


Fig 2: Heat created braking

Brake cushions are rubbed against the pivoting rotor creating vast measure of grinding bringing about ceasing of the vehicle. The rotor temperature can surpass 350°F for typical autos and 1500°F for race autos. Rotor assumes a critical part in cooling execution a stopping mechanism. For this reason brake rotors are vented to permit most extreme wind stream through the warmed rotor. The inner vanes enable air to course between two grinding surfaces of the rotors as appeared in figure 2



Fig 3 Internal vanes in the rotor

These vanes can be straight vanes or directional vanes. Plate brake rotor configuration is a basic piece of the slowing mechanism plan. This may incorporate elements like warmth protection, high cooling factor and less vibration. Aluminum metal framework composites brake rotors offers the light weight advantage over customary cast press rotors. These kinds of rotors can be utilized for traveler vehicles where the temperature is less as contrasted and race autos.



Fig 4 Vented disc rotors

II. METHODOLOGY OF RESEARCH

Some fundamental strategies that will be followed so as to satisfy the goals of the theory are expressed beneath:

- Identifying the material kinds thinking about cost, accessibility, and their weight.
- Calculation of stresses, and greatest weights utilizing Euler-Lagrange conditions.
- Developing 3D model on Solid edge programming.
- Exporting the model of rotor import to ANSYS02020 R1 work bench for FEA.
- Static and dynamic examination of on ANSYS software with various working condition.

III. MATERIALS

Grey Cast Iron

Mechanical properties-Table 5.1

Material Field Variable	Value	Units
Density	7200	Kg/m ³
Young's modulus	1.1E+5	MPa
Poisson Ratio	0.28	
Shear modulus	4.2969E+4	MPa
Bulk Modulus	8.33E+4	MPa
Tensile Yield Strength	97	MPa
Tensile ultimate Strength	2400	MPa
Compressive Ultimate Strength	8200	MPa

Thermal properties-

Melting point temperature: 1127-1204 °C,

Specific heat $C_p = 447 \text{ J/Kg } ^\circ\text{C}$,

Thermal conductivity (K) = 52 W/m °C

IV. MODELING & SIMULATION

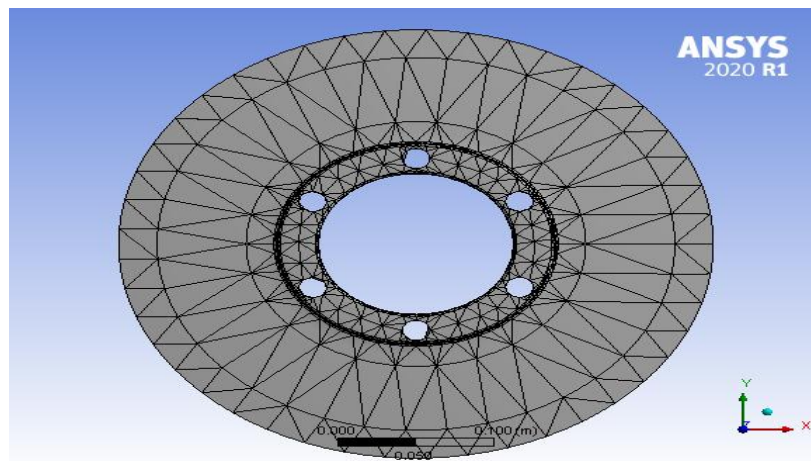


Fig.5 Meshing solid rotor Cast Iron material

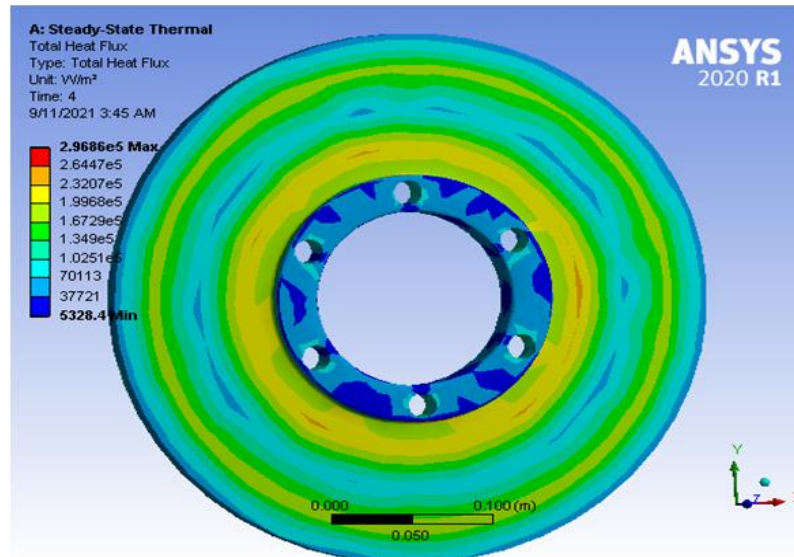


Fig. 6 Solid rotor Cast Iron material heat flux results

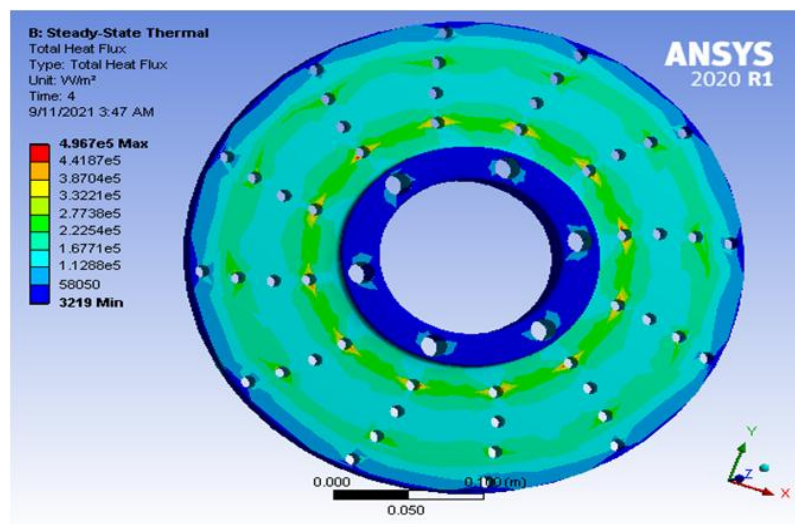


Fig. 7 Solid drilled rotor Cast Iron material heat flux results

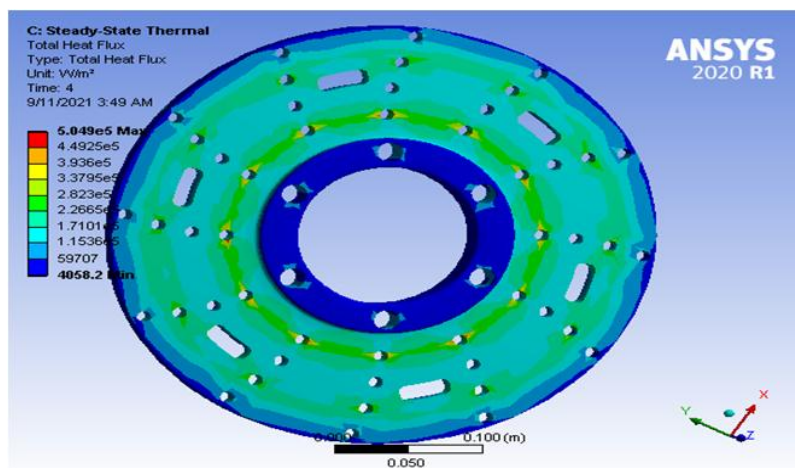


Fig.8 Solid drilled & slotted rotor Cast Iron material heat flux results

We take cast iron material and seen that Here we can clearly observed that drilled & slotted rotor geometry has very less value of temperature compare to other rotor geometries. So it is safe for future design. We take cast iron material and seen that the maximum heat flux value for All three geometries like Solid rotor, drilled rotor and drilled & slotted rotor respectively like are 2.9×10^5 w/mm², 4.96×10^5 and 5.04×10^5 w/mm². So we can suggest our new geometry drilled & slotted rotor for Low budget car's brake rotor in future.

V. CONCLUSION

Modeling and analysis of disc brake rotor is done to select the best material which is more durable. Space and assembly constraints are also an important factor while designing the rotor body. Find out the value of deformations and stresses due to cause of pressure. Here we can clearly observed that drilled & slotted rotor geometry has very

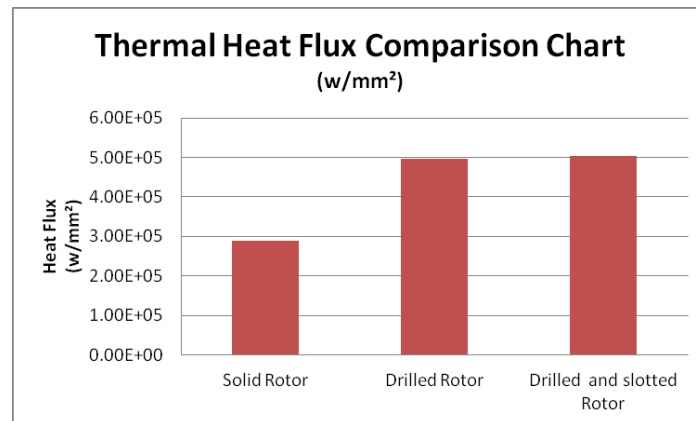


Fig.9 Heat flux comparison charts

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