THERMAL DEFORMATION OF 150 cc PULSAR DISC BRAKE

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Abstract We are studding the velocity reduce in every 0.3 sec time interval and calculating heat flux in every 0.3 sec of time interval. Calculating of that heat flux inputs of Ansys and abacus software and calculating of thermal stress, maximum temperature increases and maximum deflection in disc of disc brake and comparing their result and calculating minimum distance required between two shoo of disc brake of 150 cc pulsars during Un braking condition for avoiding jamming of brake.

Keywords: Brake disc, Thermal analysis, distance of two shoes.

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1 INTRODUCTION

Disc brake consists of disc material of cast iron or stainless steel. Brake shoo having frictional material. Each cylinder contains rubber-sealing ring between the cylinder and piston.
At the end of piston brake shoo is connected. When brake applied hydraulic liquid inter in cylinder due to it piston move outward. Shoo connected to piston grip the rotating disc. Rotating disc stop and also wheel of the vehicle which is connected to disc also stop.

2 LITERATURE REVIEW

R. A. Burton et al [2] showed the thermal deformation in frictionally heated contact wheel-mounted on disc brakes were exposed to severe non-symmetrical mechanical and thermal loads. The paper described the design process for two high-performance, hub mounted discs of different size and duty. The development was resulted in two very successful but fundamentally different hub designs and manufacturing methods. Initially, finite element analyses used in the design optimization were mainly concentrated on bulk thermal effects. Recently, in order further to improve the design process, analyses had included macro thermal effects, providing valuable results, particularly related to the prediction of disc permanent coning, one of the most critical design requirements. Whenever friction occurs in dry sliding of mechanical components, mechanical energy is transformed into heat through surface and volumetric processes in and around the real area of contact. This frictional heating, and the thermal and thermo mechanical phenomena associated with it, can have a very important influence on the tribologicalbehavior of the sliding components, especially at high sliding velocities. Significant developments in the study of these phenomena were reviewed. Among the topics reviewed were mechanisms of frictional heating and the distribution of heat during sliding friction, the measurement and analysis of surface and near surface temperatures resulting from frictional heating, thermal deformation around sliding contacts and the changes in contact geometry caused by thermal deformation and thermo elastic instability, and the thermo mechanical stress distribution around the frictionally heated and thermally deformed contact spots. The paper concludes with a discussion of the influence of the thermal and thermo mechanical contact phenomena.
T. A. Dowat et al [3] proposed to contribute to dynamic and thermal analysis of the braking phenomenon. A dynamic model was established. Using this model the equation of motion of a car was derived for straight line braking. In this context, firstly the pressure variations in the brake hydraulic circuit versus pedal force were determined. Afterwards, the expression for friction torques and associated braking force induced by hydraulic pressure was taken into account, and substituted into the equation of motion of vehicle. In its last form, this equation was numerically solved by means of the New mark integration scheme; so, the distance traveled by car until stopping, along with its speed and deceleration, was computed. Finally, a thermal analysis in the brake discs and drum was carried out. An excellent agreement between numerical and test results was observed. In addition, optimal pressure values for which the rear tyre do not go to lockup was obtained.

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K.Lee et al [4 , 5] thermo elastic instability in an automotive disk brake system was investigated experimentally under drag braking conditions. The onset of instability was clearly identifiable through the observation of non uniformities in temperature measured using embedded thermocouples. A stability boundary was established in temperature/speed space, the critical temperature being attributable to temperature dependence of the brake pad material properties. It was also found that the form of the resulting unstable perturbations or Eigen functions changes depending upon the sliding speed and temperature. A finite-element method was developed for determining the critical sliding speed for thermo elastic instability of an axis symmetric clutch or brake. Linear perturbations on the constant-speed solution were sought that vary sinusoid ally in the circumferential direction and grow exponentially in time. These factors cancel in the governing thermo elastic and heat-conduction equations, leading to a linear Eigen value problem on the two-dimensional cross-sectional domain for the exponential growth rate for each Fourier wave number. The imaginary part of this growth migration of the perturbation in the circumferential direction. The algorithm was tested against an analytical solution for a layer sliding between two half-plane and gave excellent agreement, for both the critical speed and the migration speed. Criteria were developed to determine the mesh refinement required to give an adequate discrete description of the thermal boundary layer adjacent to the sliding interface. The method was then used to determine the unstable mode and critical speed in geometries approximating current multi-disc clutch practice.

3 RESEARCH GAP:

There is not defining the exact deflection of disc in the disc brake. Not researching on the solution of jamming of disc brake due to continues applied of brake.

4 PROBLEMS IN DISC BRAKE

By applying brake, shoo pad is grip the disc of disc brake due to that stopping of their rotation and converting kinetic energy in to heat energy due to rapidly apply brake there is thermal expansion of disc . Due to thermal Expiation of disc brake jamming of disc in brake shoo.

5 CALCULATION OF HEAT FLUX

Heat flux formula

$$q_0 = \frac{1-ø}{2}\,\frac{m\,g\,v\,z}{2\,A_d\varepsilon_p}$$

Time	A	Ø	M	G	V	Z	Ad	εp	(1ø)	(mgvz)	(2Adεp)	**Heat Flux in W/mm2**
0	8	0.2	143	9.81	28	0.815494	0.030445	0.5	0.8	32032	0.03	**0.4208468**
0.3	8	0.2	143	9.81	27	0.815494	0.030445	0.5	0.8	30888	0.03	**0.4058166**
0.6	8	0.2	143	9.81	26	0.815494	0.030445	0.5	0.8	29744	0.03	**0.3907864**
0.9	8	0.2	143	9.81	25	0.815494	0.030445	0.5	0.8	28600	0.03	**0.3757561**
1.2	8	0.2	143	9.81	24	0.815494	0.030445	0.5	0.8	27456	0.03	**0.3607259**
1.5	8	0.2	143	9.81	23	0.815494	0.030445	0.5	0.8	26312	0.03	**0.3456956**
1.8	8	0.2	143	9.81	22	0.815494	0.030445	0.5	0.8	25168	0.03	**0.3306654**
2.1	8	0.2	143	9.81	21	0.815494	0.030445	0.5	0.8	24024	0.03	**0.3156351**
2.4	8	0.2	143	9.81	20	0.815494	0.030445	0.5	0.8	22880	0.03	**0.3006049**
2.7	8	0.2	143	9.81	19	0.815494	0.030445	0.5	0.8	21736	0.03	**0.2855746**
3	8	0.2	143	9.81	18	0.815494	0.030445	0.5	0.8	20592	0.03	**0.2705444**
3.3	8	0.2	143	9.81	17	0.815494	0.030445	0.5	0.8	19448	0.03	**0.2555142**
3.6	8	0.2	143	9.81	16	0.815494	0.030445	0.5	0.8	18304	0.03	**0.2404839**
3.9	8	0.2	143	9.81	15	0.815494	0.030445	0.5	0.8	17160	0.03	**0.2254537**
4.2	8	0.2	143	9.81	14	0.815494	0.030445	0.5	0.8	16016	0.03	**0.2104234**
4.5	8	0.2	143	9.81	13	0.815494	0.030445	0.5	0.8	14872	0.03	**0.1953932**
4.8	8	0.2	143	9.81	12	0.815494	0.030445	0.5	0.8	13728	0.03	**0.1803629**

5.1	8	0.2	143	9.81	11	0.815494	0.030445	0.5	0.8	12584	0.03	**0.1653327**
5.4	8	0.2	143	9.81	10	0.815494	0.030445	0.5	0.8	11440	0.03	**0.1503024**
5.7	8	0.2	143	9.81	9	0.815494	0.030445	0.5	0.8	10296	0.03	**0.1352722**
6	8	0.2	143	9.81	8	0.815494	0.030445	0.5	0.8	9152	0.03	**0.120242**
6.3	8	0.2	143	9.81	7	0.815494	0.030445	0.5	0.8	8008	0.03	**0.1052117**
6.6	8	0.2	143	9.81	6	0.815494	0.030445	0.5	0.8	6864	0.03	**0.0901815**
6.9	8	0.2	143	9.81	5	0.815494	0.030445	0.5	0.8	5720	0.03	**0.0751512**
7.2	8	0.2	143	9.81	4	0.815494	0.030445	0.5	0.8	4576	0.03	**0.060121**
7.5	8	0.2	143	9.81	3	0.815494	0.030445	0.5	0.8	3432	0.03	**0.0450907**
7.8	8	0.2	143	9.81	2	0.815494	0.030445	0.5	0.8	2288	0.03	**0.0300605**
8.1	8	0.2	143	9.81	1	0.815494	0.030445	0.5	0.8	1144	0.03	**0.0150302**
8.4	8	0.2	143	9.81	0	0.815494	0.030445	0.5	0.8	0	0.03	**0**
8.7	8	0.2	143	9.81	0	0.815494	0.030445	0.5	0.8	0	0.03	**0**
9	8	0.2	143	9.81	0	0.815494	0.030445	0.5	0.8	0	0.03	**0**
9.3	8	0.2	143	9.81	0	0.815494	0.030445	0.5	0.8	0	0.03	**0**

Tabel 1

Calculation of heat flux

Dimension For Pulsar 150 cc

M (mass of vehicle) =143 kg

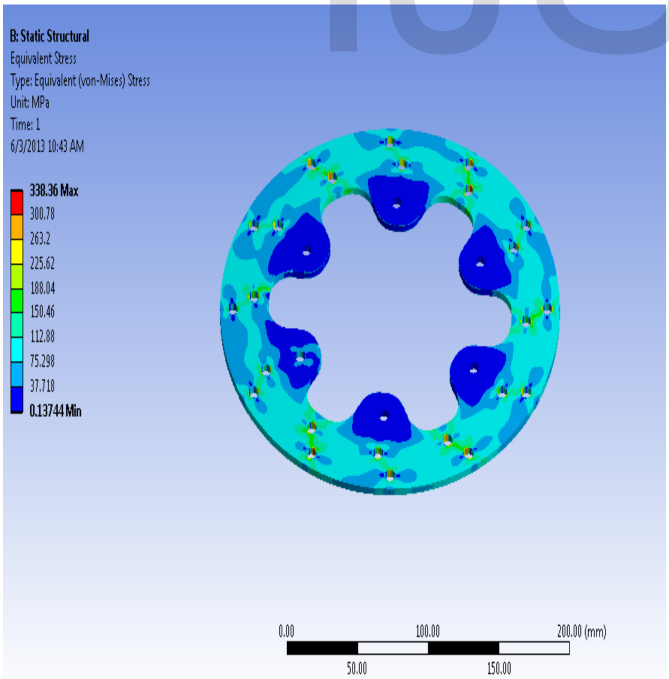
V (Initial speed of vehicle) = 28 m/s

A (Deceleration of vehicle)= 8 m/s

5 VALIDITION OF RESULT

Result by using Ansys

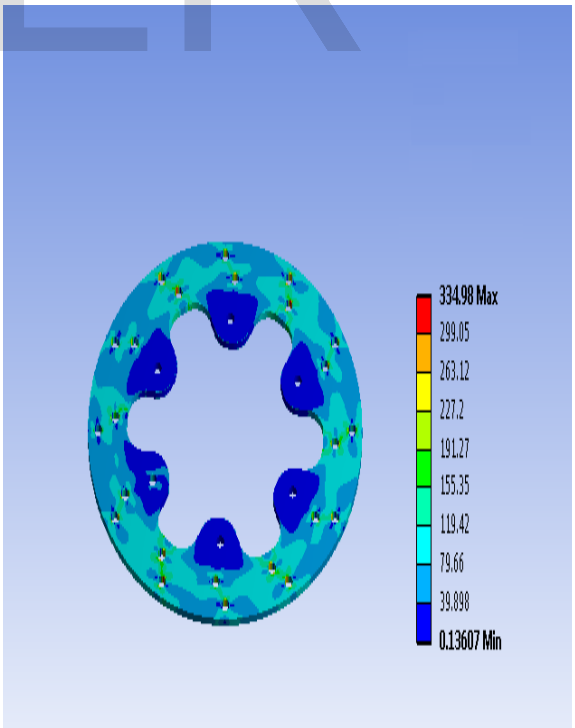
Stress



Maximum stress 338.36 Mpa

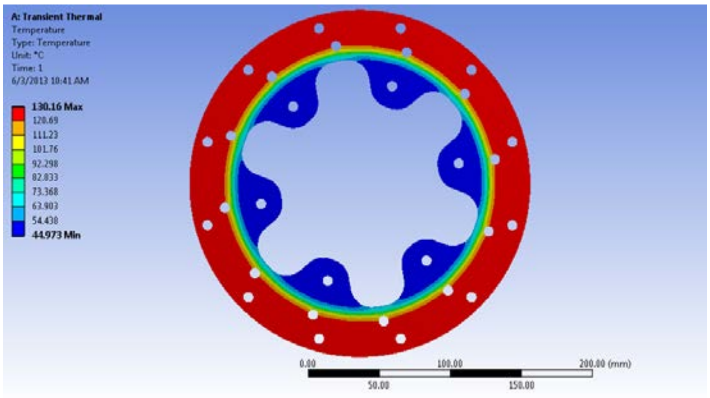
Result by using ABAQUS

Stress



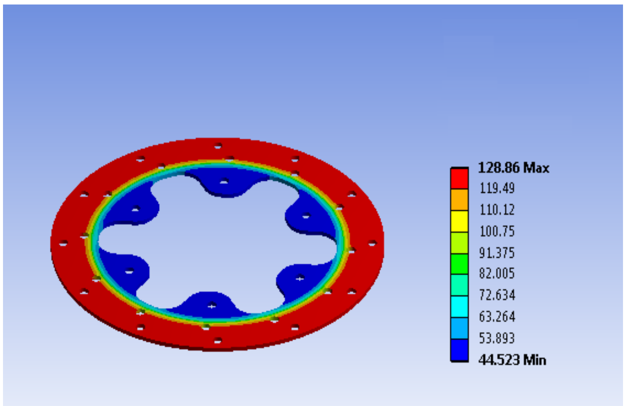
Maximum stress 334.98 Mpa

Temperature



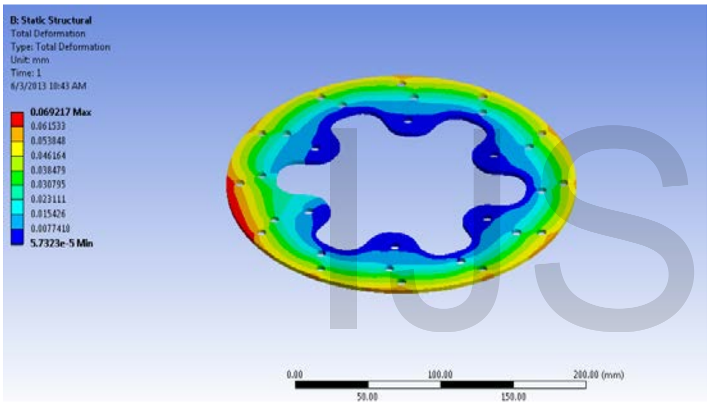
Maximum Temperature creates is 130.36 C

Temperature



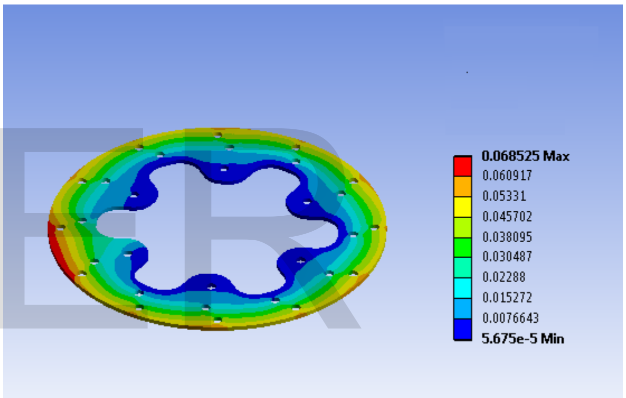
Maximum Temperature creates is 128.86 C

Deformation



Maximum Deformation is 0.069217 mm

Deformation



Maximum Deformation is 0.068525mm

6 RESULTS

Maximum deformation of the disc of disc brake is 0.069217 mm. Thickness of disc is 10 mm.
Maximum Thickness of disc when disc under thermal deformation = Thickness + Maximum Deformation of
=10+0.69217=10.69217mm

7 CONCLUSIONS

For avoiding the jamming of disc brake of 150 cc pulsar we provide minimum distance between two shoe of caliper is =10.69217 mm +factor of safety

=10.69217mm+0.1 mm

=**10 .79217 mm**

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