Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -16A-D,
ISSN 2582-6026

TWO WHEELER DISC BRAKE SHAPE OPTIMIZATION BY USING THERMAL ANALYSIS OF DISC

[1]Abhijeet Kolawale, [2]Kishan Bandgar, [3]Amit More, [4]Pawar S.A

[1]UG Scholar, Mechanical Engineering Dept., Fabtech College of Engineering, Sangola.
[2]UG Scholar, Mechanical Engineering Dept., Fabtech College of Engineering, Sangola.
[3]UG Scholar, Mechanical Engineering Dept., Fabtech College of Engineering, Sangola.
[4]Assistance Professor, Mechanical Engineering Dept., Fabtech College of Engineering, Sangola.
abhijeetkolawale35@gmail.com

ABSTRACT: -A brake is a device by means of which artificial frictional resistance is applied to moving machine member in order to stop the motion of a machine. In the process of performing this function the brakes absorb kinetic energy of the moving member and dissipate the absorbed energy in the form of heat. Brakes might be a drum type or a circle type and are worked every now and again as and when required bringing about temperature ascent of the brake plate just as brake cushions prompting wear and disappointment of the framework. One of the ideal gadgets is a circle brake testing machine to test the normal ascent in temperature of brake plate surface while slowing down is applied often with a chose slowing down/un-slowing down cycle.
In the present study, a disc brake test rig has been selected for design; development and testing a brake disc for temperature rise and optimize brake disc design for of a two wheeler (PULSER).

I. INTRODUCTION

Braking system is one of the important safety components of a vehicle. Braking system is mainly used to decelerate vehicles from an initial speed to a given speed. Friction based braking systems are the common devices to convert kinetic energy into thermal energy through friction between the brake pads and the disc faces. The traveler requires rapid stopping mechanism to utilize the vehicle for low speed/fast which can't be met with drum slowing mechanisms. Unnecessary warm stacking can bring about surface breaking, judder and high wear of the scouring surfaces. High temperatures can likewise lead to overheating of brake fluid, seals and other components. The stopping capability of brake increases by the rate at which heat is dissipated due to forced convection and the thermal capacity of the system. Hence it is necessary to develop a suitable test setup to measure disc temperature distribution under repeated braking and unbraking cycle, usually applied in practice.

II. LITERATURE REVIEW

Daniel Das. et al. [1] have investigated the temperature fields and also structural fields of the solid disc brake during short and emergency braking with four different materials. The

distribution of the temperature depends on the various factors such as friction, surface roughness and speed including effect of the angular velocity and the contact pressure induces the temperature rise of disc brake. The finite element simulation for two-dimensional model is also presented using Aluminum Alloy and Carbon Reinforced Polymer is safe for Disc Brake. It has been concluded that by observing analysis results, Carbon Reinforced Polymer is best material for Disc Brake.

Nouby M. Ghazaly et al. [2] analyzed forces and torque on the rotor disc. The main parameters are tangential force, brake torque, and the motorcycle's stopping distance. The result of force value on rotor disc by tangential force and the motorcycle's stop distance are similar. Case studies on changing the dimensions of disc did not have an effect on normal and tangential forces, but have an effect on break force.

Thundil karuppa et al. [3] simulated the three dimensional temperature distribution through the brake rotor vanes by solving the appropriate governing equations viz. conservation of mass, momentum and energy using the commercial CFD tool, ANSYS CFX 12. The predicted results have been validated with the results available in the literature.. The effect of number and diameter of vanes in the circular pillared rotor is studied and the geometry is optimized for better mass flow and heat dissipation characteristics.

Guru Murthy Nathi et al. [4] evaluated the performance under severe braking conditions and there by assist in disc rotor design and analysis. An attempt has been made to investigate the effect of stiffness, strength and variations in disc brake rotor design on the predicted stress and temperature distributions. By identifying the true design features, the extended service life and long term stability is assured. A transient thermal analysis has been
carried out to investigate the temperature variation across the disc using axisymmetric elements.

2.1 SCOPE OF WORK

In recent decades the improvement of the braking performances are required as the two wheelers run at high speeds. The generated frictional heat, during braking operation causes several negative effects on the stopping mechanism, for example, brake blur, untimely wear, warm breaks and circle thickness variety. It is then imperative to decide the temperature field of the brake plate which will be in the protected reach. The brake circle producing enterprises are needing an appropriate test arrangement to test the brake plate temperature with selected braking cycle and a selected braking force including related instrumentation. It is proposed to fulfill this need.

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -16A-D,
ISSN 2582-6026

III. MODELING OF DISC BRAKE

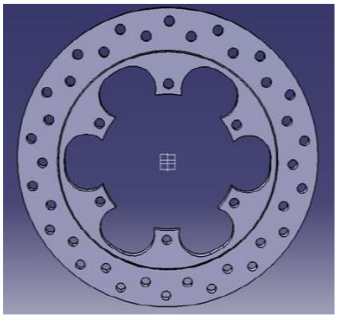


Fig.1 Original Disc 3D model

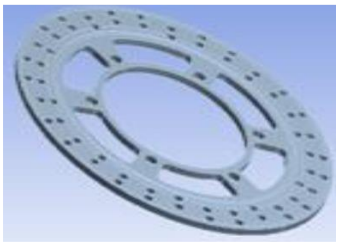


Fig.2 New Disc brake 3D Model

3.1 Sample Disc 1: Nonlinear Transient Thermal Analysis Result

ANALYSIS OF DISC BRAKE

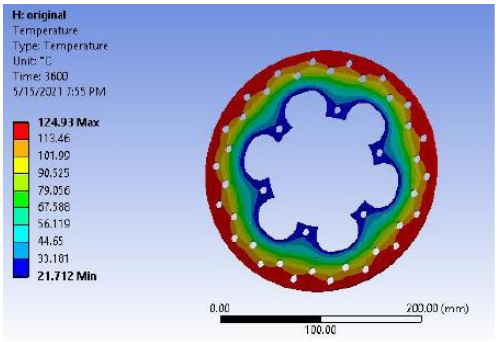


Fig. 3 Transient Thermal Analysis Result- Selected Disc (sample disc 1)

Nonlinear Transient Thermal Analysis Result of new disc

Innovative Journal for Opportunities and Development in Science & Technology,
Volume 1,Issue 9, May 2021
Paper Id: – IJ2021V1I9 -16A-D,
ISSN 2582-6026

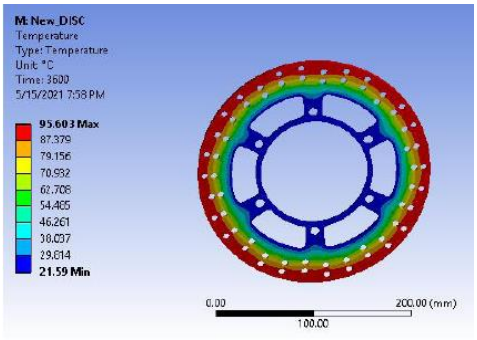


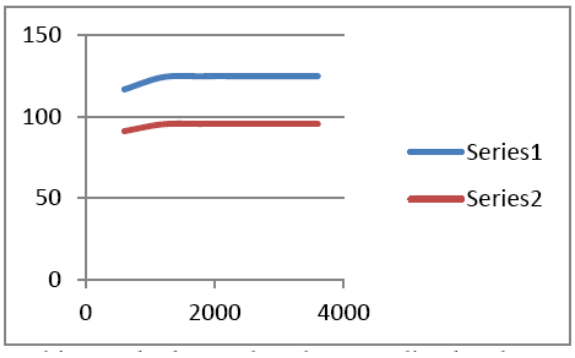
Fig. 4 Transient Thermal Analysis Result (ANSYS) of New Disc

IV. RESULT

From Transient analysis of both discs in ANSYS workbench we got following results shown in table.

Table 1 Thermal analysis results of both discs

Sr. No.	Time (S)	Original	New
1	600	116.8	91.111
2	1200	124.3	95.351
3	1800	124.88	95.589
4	2400	124.93	95.602
5	3000	124.93	95.603
6	3600	124.93	95.603



In this graph shows that the new disc has better results than sample original.

Table 2- Thermal analysis result

Result of Discs	Mass(Kg)	Remark
Sample Disc	0.986	Good
New disc	0.952	Very Good

3.2 COMPARISON OF ANSYS AND EXPERIMENTAL RESULTS

The ANSYS simulated analysis should be evidences or supported by empirical results. This is achieved by comparing ANSYS results with experimental results as shown in following graph.

V. CONCLUSION

The present study can provide a useful design and improved the brake performance of disk brake system. From the above outcomes, obviously execution of new planned circle in transient warm examination is better and streamlined as per slowing down temperature and warm circulation over the plate territory in correlation with given arrangement of circles.

REFERENCES

1. Daniel Das. A, Christo Reegan Raj.V, Preethy.S, Ramya Bharani.G., 2013, *Structural and Thermal Analysis of Disc Brake in Automobiles*, International Journal of Latest Trends in Engineering and Technology (IJLTET), Vol. 2 Issue 3, pp. 18–25.
2. Nouby M. Ghazaly1, Sufyan Mohammed, Ali M. Abd-El-Tawwab., 2012, *Understanding Mode-Coupling Mechanism of Brake Squeal Using Finite Element Analysis*, International Journal of Engineering Research and Applications (IJERA), Vol. 2, Issue 1, pp.241-250.
3. Thundil karuppa raj, R, Ramsai. R, Mathew. J, Soniya. G., 2001, *Numerical investigation of fluid flow and heat transfer characteristics on the aerodynamics of ventilated disc brake rotor using CFD*, Journal of SAE, pp. 3-5.
4. Guru Murthy Nathi, T N Charyulu, K.Gowtham, P Satish Reddy., 2012, *coupled structual / thermal analysis of disc brake,* International Journal of Engineering and Research and Technology (IJERT), Volume: 1 Issue: 4, pp. 539 – 553.
5. Ameer Fareed Basha Shaik1, Ch.Lakshmi Srinivas, 2012, "*Structural and Thermal Analysis of Disc Brake with and without Cross drilled Rotor of Race Car*", International Journal of Advanced Engineering Research and Studies IJAERS, Vol. I, Issue. IV, pp. 39-43.
-6. Belhocine Ali, Bouchetara Mostefa , 2013, "*Thermo mechanical Modelling of Disc Brake Contact Phenomena",*FME Transactions, Vol. 41, pp. 59-65.
7. Swapnil R. Abhang, D.P. Bhaskar, 2014, "*Design and Analysis of Disc Brake*",International Journal of Engineering Trends and Technology (IJETT), Vol. 8, Issue. 4.
8. Manjunath T V, Dr Suresh P. M.,2013, "Structural *and Thermal Analysis of Rotor Disc of Disc Brake*", International Journal of Innovative Research in Science Engineering and Technology, Vol. 2, Issue. 12.
9. Viraj Parab, Kunal Naik, PA. D. Dhale., "*Structural and Thermal Analysis of Brake Disc*"
10. P. K. Zaware, R. J. Patil, P. R. Sonawane., 2014, "*Design Modification & Optimisation Of*

Disc Brake Rotor" International Journal of Research in Engineering & Advanced Technology, Vol. 2, Issue. 3.