

ANALYSIS OF DISC BRAKE SYSTEM

Hemraj Nimhal¹, Dr. Chitranjan Agarwal²

¹M.TECH (CAD/CAM), ²Assistant Professor

College of Technology and Engineering, Udaipur (Raj)
Maharana Pratap University of Agriculture and Technology

Abstract: *Disk drive Braking mechanism is actually aimed towards evaluating this efficiency of Disc foot brake rotor of a auto underneath significant braking ailments and also presently there by help in rotor design and style and also examination. An investigation in using fresh supplies is essential which often boost braking productivity and supply greater steadiness to be able to auto. This study can be carried out applying ANSYS software package. ANSYS 12.0 is a committed limited factor offer used by deciding this temp syndication, variant from the tensions and also deformation throughout the foot brake user profile. In today's operate, a trial may be created to take a look at the perfect a mix of both grp composite materials which is brighter in comparison with throw metal and it has beneficial Young's modulus, Deliver toughness and also occurrence components. Aluminum foundation precious metal matrix group composite and also Large Energy Cup Fibers composites have a very ensuring chaffing and also use conduct as being a Hard disk drive foot brake rotor. The examination of brakes throughout repeated foot brake purposes may be performed and also the results were being in contrast. The proper materials for the braking function is actually glass linens and also every one of the prices extracted from this examination are under their particular allowable prices. That's why this foot brake design and style is actually safe while using toughness and also solidity standards. By means of discovering the actual design and style functions, this extensive support lifetime and also long-term steadiness is actually guaranteed.*

Index Terms: Rotor Disc, Disk Brake

I. INTRODUCTION

Disc brake pedal is made up of cast straightened bolted for the controls switch and a immobile real estate named caliper. The particular calliper is usually linked to a number of immobile perhaps the vehicle such as axle covering or even the actual stub axle because is usually cast inside a pair of elements each and every component made up of a piston. Between each and every piston and you will find there's scrubbing station held in place simply by holding onto pins, spg plates. The particular airways tend to be therefore connected to another one particular pertaining to blood loss. Each storage container has rubber-sealing wedding ring involving the storage container and piston. A schematic diagram is usually demonstrated in the number. Because of the application connected with brakes around the car disc brake pedal rotor, temperature generation occurs caused by scrubbing and also this temperatures therefore earned really needs to be conducted and distributed throughout the rotor

combination part. A study into entry to completely new materials is needed that improve braking efficiency and gives increased security in order to vehicle.

II. ROTOR DISC OF DISC BRAKE

Your Disc braking system disks are generally made from dull forged in terms of iron. This keeps some sort of standards for your production regarding dull in terms of iron for a variety of apps. For standard automobile along with gentle pickup apps, this specification will be J431 G3000 (superseded to G10). That standards dictates the best selection of hardness, chemical composition, tensile strength, and also other houses needed for this planned use. A number of sporting autos along with aeroplanes use brakes together with as well as linens disks along with as well as linens protections to reduce pounds. Put on rates tend to be high, along with braking could be bad or maybe grabby before the braking system will be warm. Your materials employed for rotor disc usually are explained in detail. It really is investigated this heat range supply, this cold weather deformation, and the cold weather tension regarding car braking system drives include really in close proximity contact together with automobile security; therefore, considerably study within this field have been performed.

A. Cast Iron:

Cast iron usually refers to grey cast iron, but identifies a large group of ferrous alloys, which solidify with a eutectic. Iron accounts for more than 95%, while the main alloying elements are carbon and silicon. The amount of carbon in cast iron is the range 2.1-4%, as ferrous alloys with less are denoted carbon steel by definition. Cast irons contain appreciable amounts of silicon, normally 1-3%, and consequently these alloys should be considered ternary Fe-C-Si alloys. Here graphite is present in the form of flakes. Disc brake discs are commonly manufactured out of a material called grey cast iron.

B. Aluminium Metal Matrix Composites:

Aluminium can be the most famous matrix with the steel matrix composites (MMCs). The 's other metals may be appealing this can small density, their chance to always be heightened by simply precipitation, their very good deterioration resistance, large cold weather along with electric powered conductivity, along with their large damping ability. Aluminium matrix composites (AMCs) make reference to the actual class connected with light weight large performance lightweight aluminium centric

stuff programs. The reinforcement within AMC's could possibly be by means of steady as well as discontinuous fibers, whisker as well as particulates, within level fractions ranging from some percentage for you to 70%. Within the last number of years, AMC's are already employed in high-tech structural along with functional apps which includes aerospace, protection, automotive, along with cold weather administration regions, as well as within athletics along with adventure. There has been interest in using aluminium based metal matrix composites for brake disc and drum materials in recent years. While much lighter than cast iron they are not as resistant to high temperatures and are sometimes only used on rear axles of automobiles be-cause the energy dissipation requirements are not high as compared to front axle. While the friction is of high speeds and loads the behaviour could be greatly improved beyond that of iron discs, given the correct match of pad and disc material.

C. E Glass Fiber:

Using E-Glass for the reason that reinforcement stuff in polymer matrix composites is extremely common. Optimal strength properties usually are accumulated while right, continuous fibres usually are arranged parallel within a way. To promote strength in some other recommendations, laminate buildings may be produced, together with continuous fibres arranged in other recommendations. Dietary fiber sizing along with somewhat proper-ties may be manipulated from the procedure specifics for example melt heat (hence viscosity) along with drawing/spinning rate. This heat windows that can be used to generate a melt regarding acceptable viscosity is very large, creating this formula suitable for dietary fiber forming.

D. S2 Glass Fiber

High-strength glass fibers are used in applications requiring greater strength and lower weight. High-strength glass is generally known as S-type glass in the United States, R-glass in Europe and T-glass in Japan. S-glass was originally developed for military applications in the 1960s, and a lower cost version, S-2 glass, was later developed for commercial applications. The higher strength fibers fall into the S-2 category. Glass fibers in general are considered to be the "heavier" fibers within the reinforcement market although Boron also weighs in at about the same density. However, it is important to remember that the density of aluminum is about 2.8 gm/cm³ and steel about 7.8 gm/cm³. The cost difference between the E-glass fiber set and S2-glass fiber materials are about 8:1 with S2 being the higher price. However, many advanced composites use the S2-glass version because of the higher strength performance while E-glass is the traditional commercial and industrial product that dominates the world consumption in the FRP market.

III. MODELING OF THE ROTOR DISC

Based on the specifications the element type chosen is PLANE 77. The following Figure shows the schematic diagram of the 8-noded thermal solid element. The element has one degree of freedom, temperature at each node. The 8-

node elements have compatible temperature shapes and are well suited to model curved boundaries. The 8-node thermal element is applicable to a two dimensional, steady state or transient thermal analysis. The type of mesh generation considered here is a free mesh since the 2D figure is not a regular shape. Axis-symmetric element 77 is used to model in ANSYS by considering axis-symmetric geometry. Table 1.1 Rotor Disc

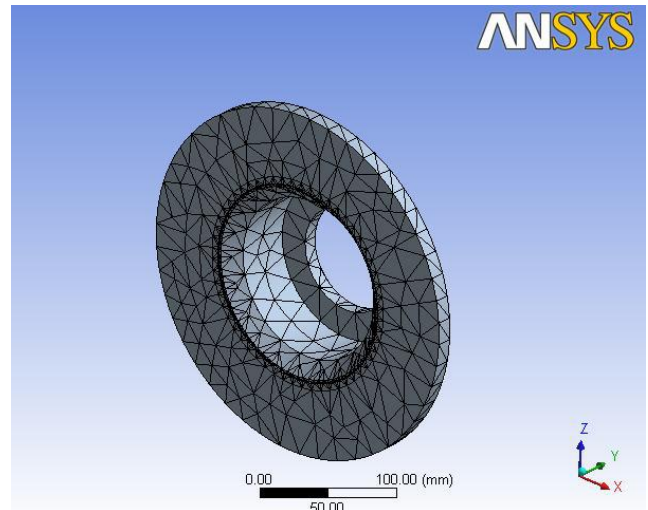


Fig.1 Isometric View of Rotor Disc

IV. RESULTS AND DISCUSSIONS

The investigation based on usage of new materials is required which helps to improves the disc braking efficiency and stability to vehicle. The suitable hybrid composite material which is lighter than cast iron and has good Young's modulus, Yield strength and density properties. The low weight, the actual firmness, the actual dependable characteristics likewise in case of ruthless and heat range the actual resistance for you to winter distress and also the ductility produce longevity time of the brake pedal drive and prevent many problems ending of filling, which might be typical for the basic greyish solid in terms of iron brake pedal devices.

V. CONCLUSION

The actual transient thermo supple research connected with Disk brakes with recurring foot brake purposes has been performed. ANSYS software program is given to the actual thermo supple make contact with problem with frictional high temperature . To search for the simulation connected with thermo supple conduct appearing with Disk brakes, the actual combined high temperature conduction as well as supple equations are usually solved with make contact with problems. The results with the scrubbing substance houses within the make contact with ratio connected with scrubbing surfaces are usually looked at as well as the greater influential properties are only to get the actual cold weather enlargement coefficient as well as the supple modulus. It's observed which the orthotropic Disk brakes can provide much better foot brake overall performance compared to the isotropic ones because of consistent as well as mild stress

distributions. The present review can provide a good design instrument as well as improve foot brake overall performance connected with Disk foot brake program. Through Stand 6. 1 we are able to declare in which S2 cup soluble fiber will be the ideal substance for the braking operation as well as all of the values obtained from the actual research are usually less his or her permitted values. Consequently the actual foot brake Disk design and style is risk-free while using power as well as stiffness considerations.

A. Future Scope of the Project

In our function, the best a mix of both composite material that's brighter compared to toss in terms of iron and possesses good Young's modulus, Provide energy along with density properties is usually been recently looked into. A transient thermal research will likely be carried out to analyze the actual heat alternative over the utilizing asymmetric aspects. Additionally structural research also are carried out by simply coupling thermal research.

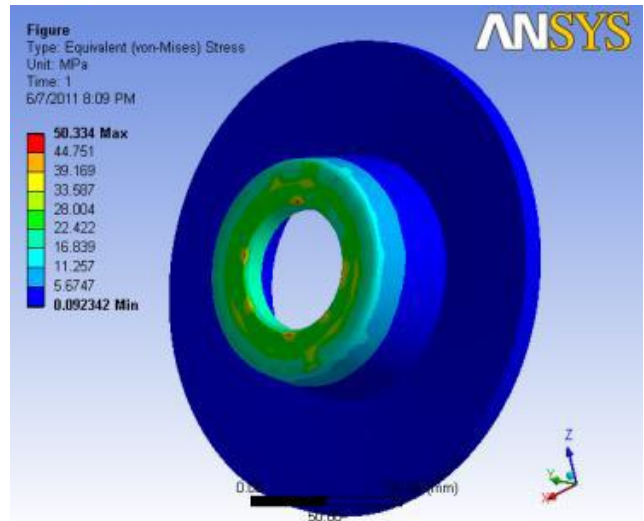


Fig.4 Equivalent Stress

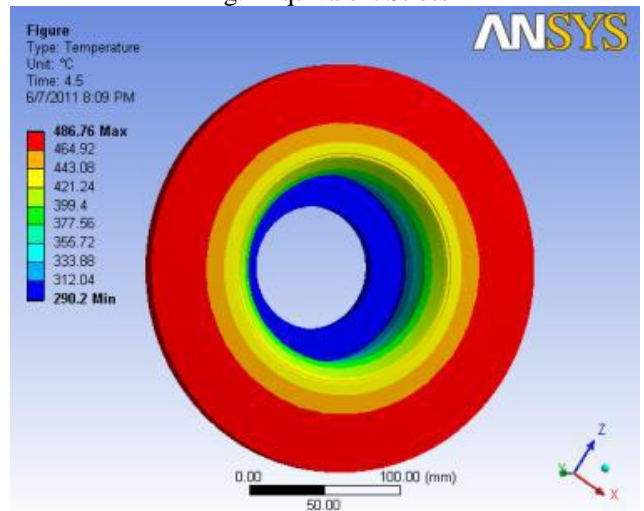


Fig.5 Temperature distribution

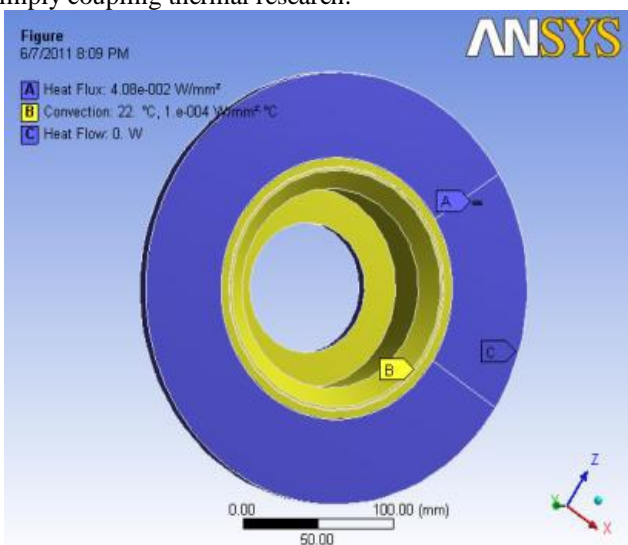


Fig.2 Thermal Loading

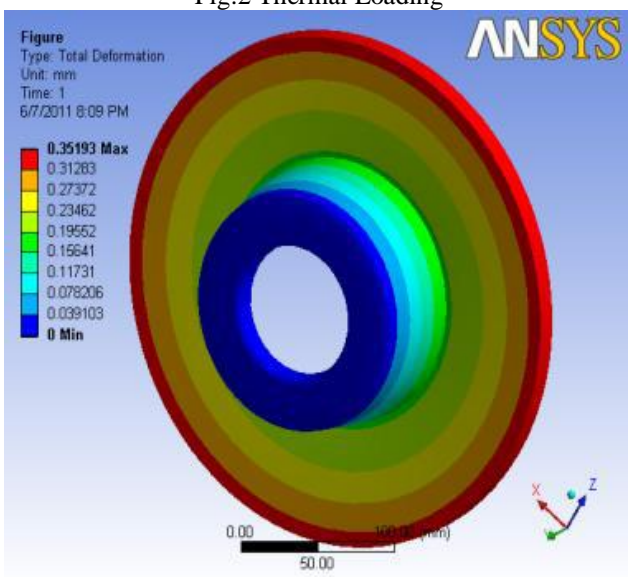


Fig.3 Total Deformation

Material	Deformation	Von-misses Stresses (MPa)		Temperature (°C)	
	mm	max	min	max	min
Cast Iron	0.35191	50.334	0.92342	486.76	290.2
AIMMC	0.35229	211.98	2.7269	29.232	21.9
E-Glass	1.036	274.14	0.44893	1219.8	22.019
S2 Glass	0.16097	50.197	0.079753	66.137	11.867

Table 1: Comparison of results

REFERENCES

- [1] Artus.S, Cocquempot, Staroswiecki.M, Hayat. S, Covo.C , (2004) , “Temperature Estimation of CHV Brake Discs using an Energy Balance Approach”, IEEE Intelligent Transportation Systems Conference, Washington, D.C., USA,pp-390-395.
- [2] Artus.S, Cocquempot, Staroswiecki.M, Hayat. S, Covo.C,(2005), “CHV's brake discs temperature estimation: results in open road Tests”, Proceedings of the 8th International IEEE Conference on Intelligent Transportation Systems Vienna, Austria.
- [3] Daniel Hochlenert, Thira Jearsiripongkul,(2006),

- “Disk Brake Squeal: Modeling and Active Control”, IEEE transactions on RAM.
- [4] Fei Gao¹, Gang Xiao, Yuanming Zhang, (2009), “Semi-similarity design of motorcycle-hydraulic-disk brake: strategy and Application”, pp-576-579.
- [5] Guangqiang Wu, Lin He ,Xianjie Meng, (2009), “Numerical Study on the Vibration Characteristics of Automobile Brake Disk and Pad”, IEEE transactions, pp-1798-1802.
- [6] HyunCheol Kim, Jungwon Hwang, Whoi-Yul Kim , Yeul-Min Baek,(2009), “Image Analysis System for Measuring the Thickness of Train Brakes” ,First IEEE Eastern European Conference on the Engineering of Computer Based Systems.pp-83-87.
- [7] Kyoung Kwan AHN, Tran Hai NAM, (2009), “A New Structure of MR Brake with the Waveform Boundary of Rotary Disk”, ICROS-SICE International Joint Conference, pp -2997-3002.
- [8] Li Yuren , Liu Weiguo, Tian Guanglai, Wei Hanbing , Xue Jing, (2009), “The Finite Element Model of Transient Temperature Field of Airplane Brake Disks with Rough Surface Profile”, Proceedings of the IEEE International Conference on Automation and Logistics.pp-41-44.
- [9] Liuchen Fan , Yaxu Chu , Xuemei Sun , Xun Yang ,(2010), “Thermal-structure coupling analysis of disc brake”, International Conference on Computer, Mechatronics, Control and Electronic Engineering (CMCE).pp-406-409. International Journal of Scientific & Engineering Research Volume 2, Issue 8, August-2011 4 ISSN 2229-5518 IJSER © 2011 <http://www.ijser.org>
- [10] Pramod Kumar.K, Ravikiran Kadoli, Anil Kumar. M.V. (2010)“Mechanical and Magnetic Analysis of Magnetostrictive Disc Brake System”, 5th International Conference on Industrial and Information Systems, ICIIS 2010.
- [11] Michael Goldfarb, Ryan J. Farris, (2010), “Design of a Multidisc Electromechanical Brake”, IEEE/ASME transactions on mechatronics, pp-1-9.
- [12] Mugeo Dong, Sok Won Kim, Nam-Ku, “Thermophysical Properties of Automotive Brake Disk Materials”, Department of Physics, University of Ulsan pp-680 – 749.