International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 14
October 2016

Design and Thermal Analysis of Disc Brake for Sports Bikes

PATHA. SIVAIAH
DEPARTMENT OF MECHANICAL
NEWTONS INSTITUTE OF SCIENCE & TECHNOLOGY

MR.V.M LAKSHMAIAH
ASSISTANT PROFESSOR
DEPARTMENT OF MECHANICAL
NEWTONS INSTITUTE OF SCIENCE & TECHNOLOGY

ABSTRACT

At the IAA in Frankfurt in 1999, the carbon-ceramic brake disk had its world premiere. The use of the high-tech material had revolutionized the brake technology: In comparison to the conventional grey cast iron brake disk the carbon-ceramic brake disk weighed round 50 per cent less reducing the unsprang mass by almost 20 kilograms. Further significant advantages are: improved brake response and fading data, high thermal stableness, no hot judder, excellent pedal feel, improved steering behavior, high abrasion resistance and thus longer life time and the advantage of avoiding almost completely brake dust. At first Porsche AG built the carbon-ceramic brake disk in 2001 into the 911 GT2 as series equipment. Since that time also other premium brands use the advantages of this innovative brake technology for more security and comfort. These are for example sports cars and luxury class limousines from Audi, Bentley, Bugatti and Lamborghini.

In this paper we will design a disk break using carbon ceramic composite for high speed two wheelers. The main aim of this paper is to design a composite disk break with least possible production cost and long life, for achieving this goal we will compare different models of structural models of disk brakes with different materials finally we conclude the best model and material based on the thermal behavior and stress concentrations of each model, for designing disk brakes we use Catia V5 R21, and for analysis we use Ansys 14.5

INTRODUCTION

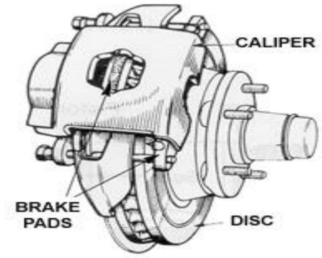
Brake is a Mechanical Device used to stop or slowing down the Vehicle or a body in motion. A disc brake is a type of brake that utilizes calipers to clutch pairs of pads alongside a disc in arrange to create friction that retards the rotary motion of a shaft, for instance a vehicle axle, moreover to retard its rotational speed or to seize it stationary. Hydraulic disc brakes are the a large amount universally used form of brake for motor vehicles but the ideology of a disc brake are appropriate to almost any rotating shaft. Brakes generally use friction amid two surfaces hard-pressed together to renovate the kinetic energy of the moving vehicle or body into heat.

Brakes may be described as using friction, pumping, or electromagnetic. One brake may use a number of principles: for instance, a pump may pass fluid through an orifice to create friction.

Mechanical brakes are most common and can be divided broadly into shoe or pad brakes, using an open have on surface, and hydrodynamic brakes, such as parachutes, which use friction in a working fluid and do not overtly wear. Classically the term "friction brake" is named to mean shoe brakes and excludes hydrodynamic brakes, still while hydrodynamic brakes use friction. Friction brakes are frequently revolving devices with a motionless pad and a rotating wear exterior. ordinary configurations comprise shoes that bond to rub on the outside of a rotating throb, such as a band brake; a rotating throb with shoes that expand to rub the inside of a drum, regularly called a "drum brake", even if other drum patterns are possible; and pads that touch a rotating disc, usually termed as “disc brake”. Other brake configurations are used, but less frequently.

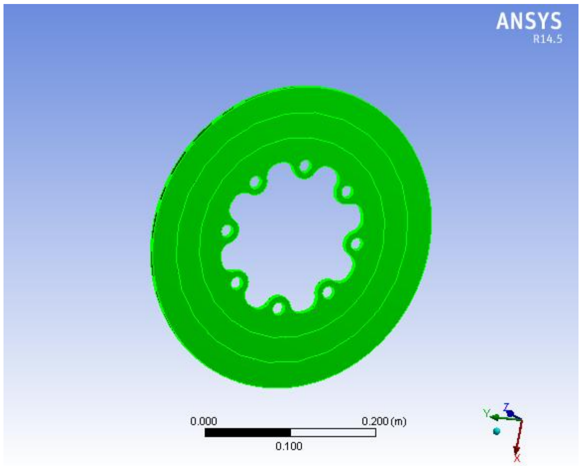
A drum brake is a vehicle brake in which the friction is sourced by a set of brake shoes that push against the inner surface of a rotating drum. The drum is associated to the rotating wheel center.

The disc brake is a machine or device for retarding or stopping the rotation of a Vehicle in motion. A rotor usually made of cast iron or ceramic, is connected to the wheel. To retard the wheel, friction substance in the form of brake pads associated in a device termed as brake caliper is enforced mechanically, hydraulically, pneumatically or electromagnetically against together sides of the disc. Friction sources the disc and attached wheel to retard or stop.

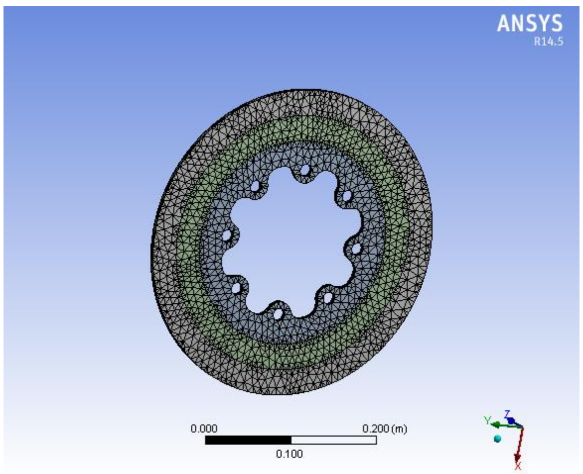


DISK BRAKE

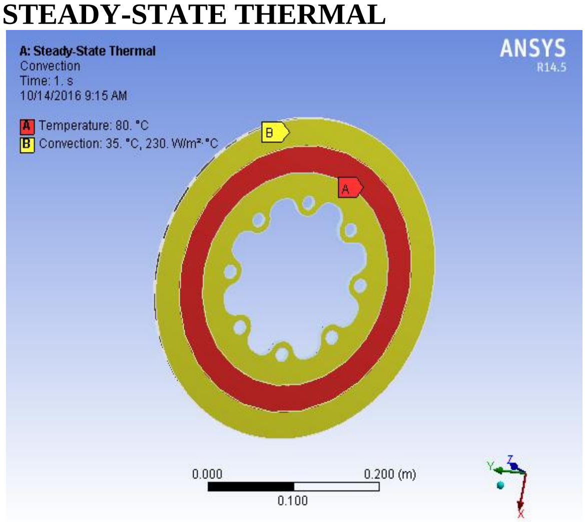
GEOMETRY



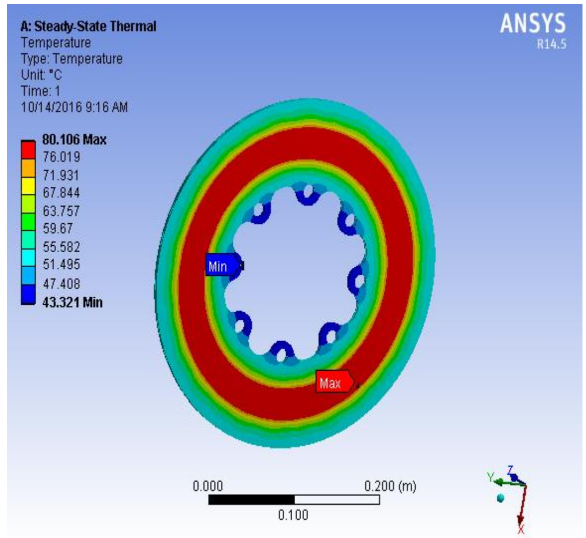
MESH



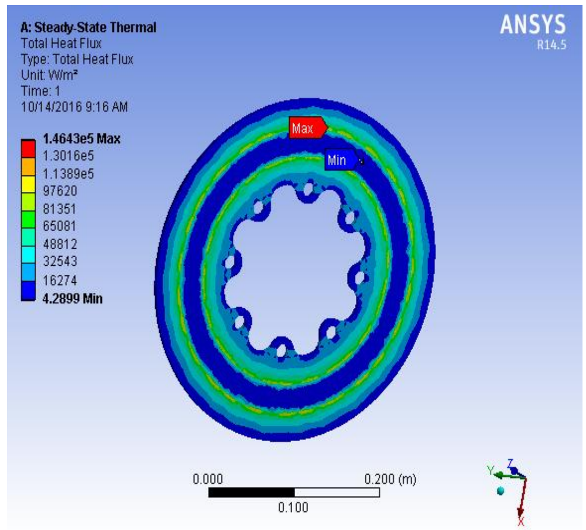
STEADY-STATE THERMAL



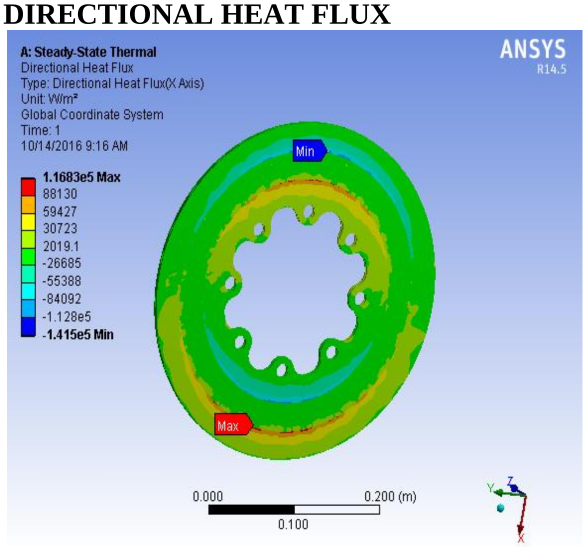
TEMPERATURE



TOTAL HEAT FLUX

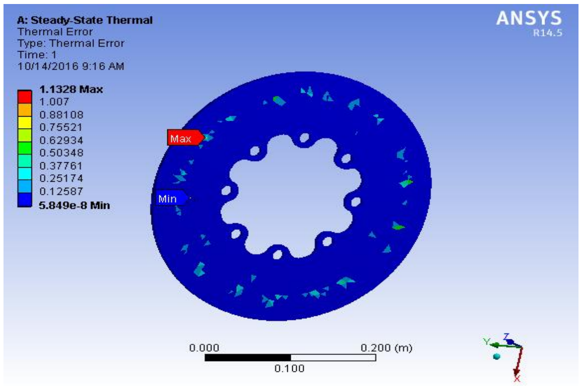


DIRECTIONAL HEAT FLUX

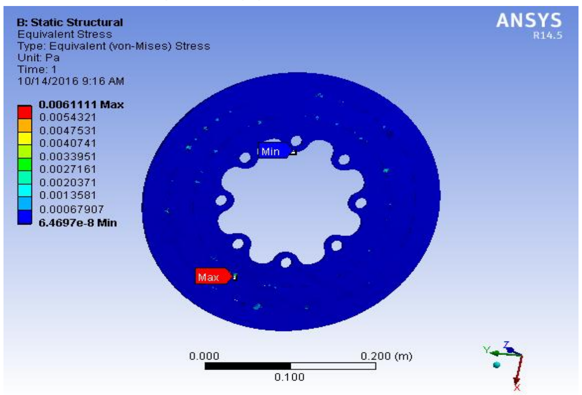


THERMAL ERROR

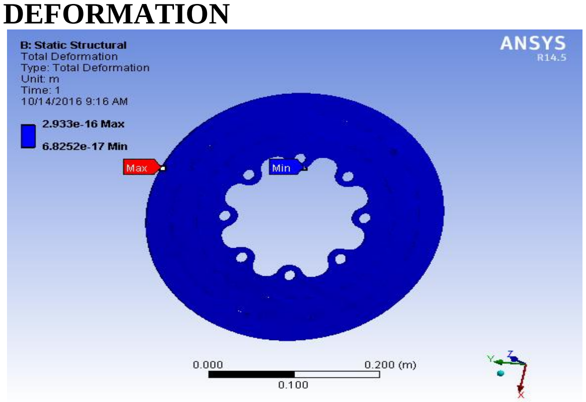
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 14
October 2016



THERMAL STRESS

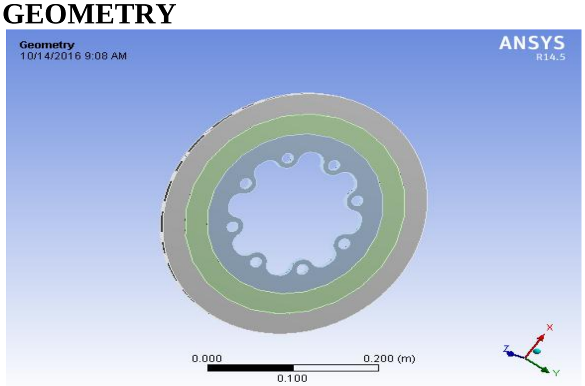


DEFORMATION

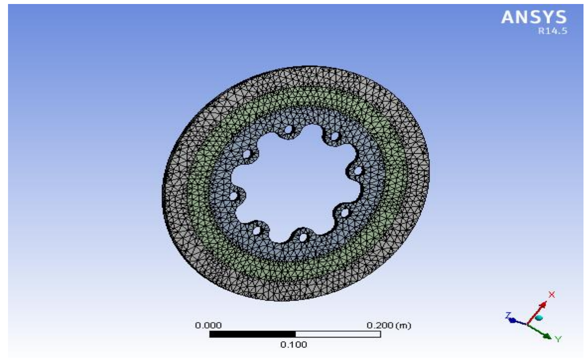


ANALYSIS OF A DISC BRAKE OF MODEL - 1 WITH HM-CFRP 10%

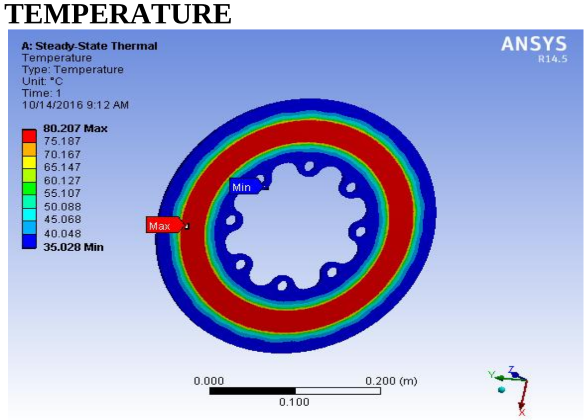
GEOMETRY



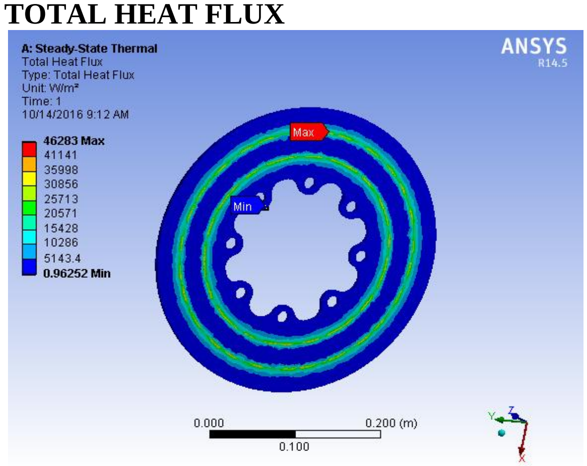
MESH



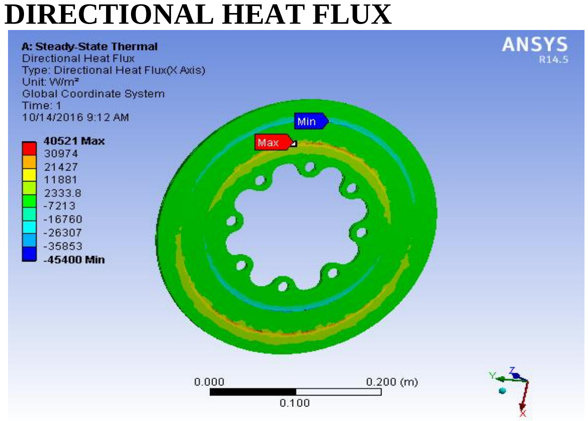
TEMPERATURE



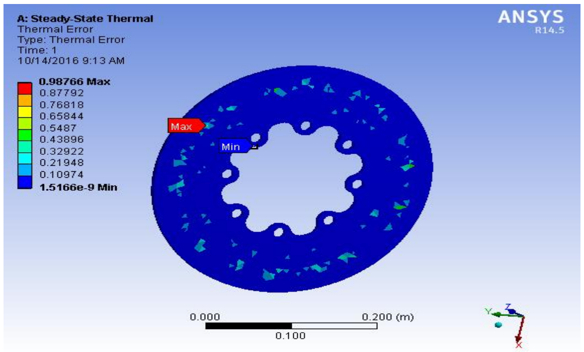
TOTAL HEAT FLUX



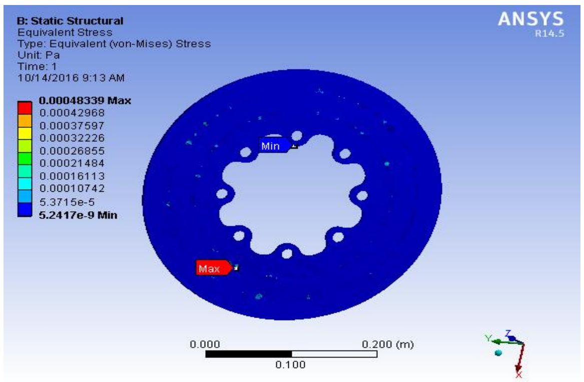
DIRECTIONAL HEAT FLUX



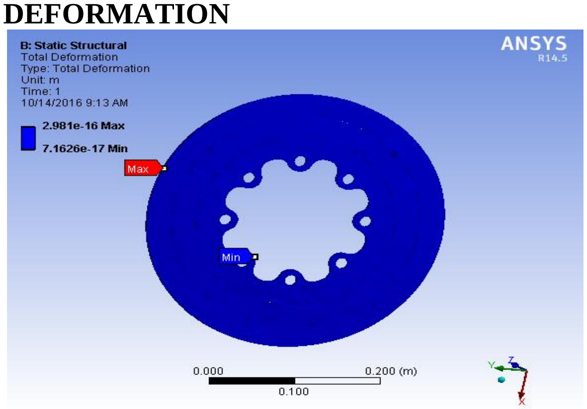
THERMAL ERROR



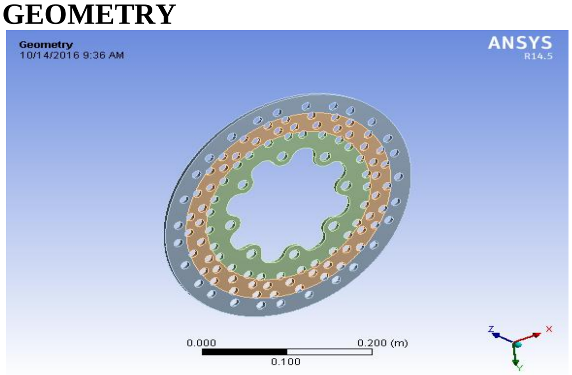
THERMAL STRESS



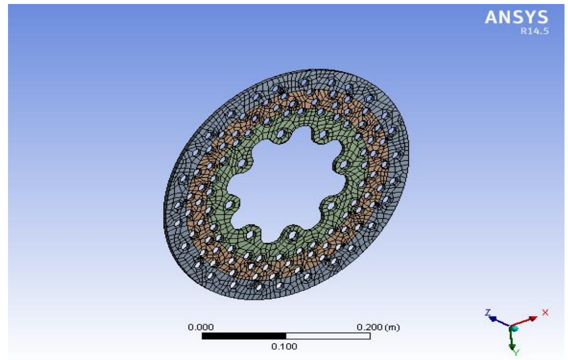
DEFORMATION



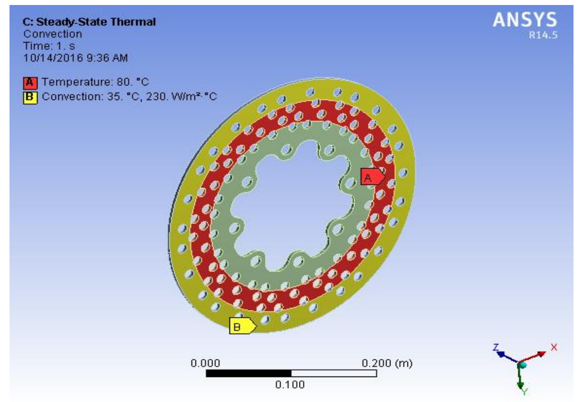
ANALYSIS OF A DISC BRAKE OF MODEL - 2 WITH C-C-C IMPORTED FILE IN TO ANSYS GEOMETRY

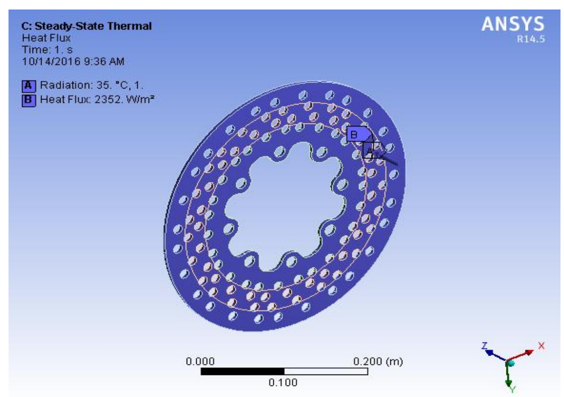


MESH

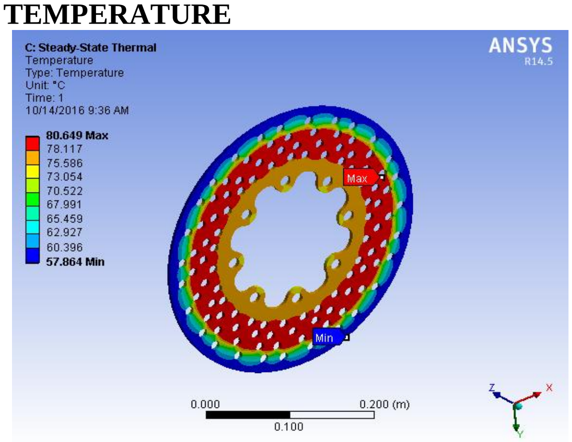


STEADY-STATE THERMAL



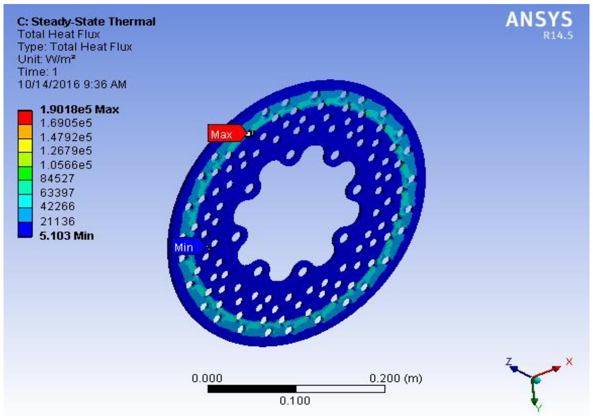


TEMPERATURE

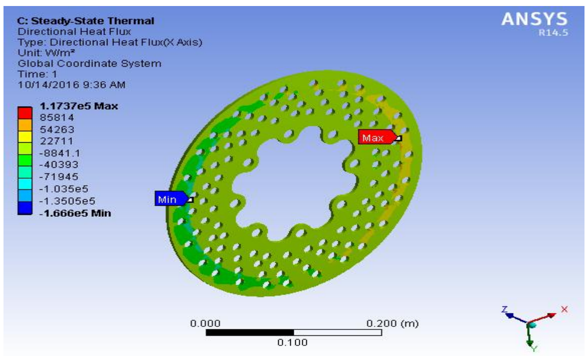


TOTAL HEAT FLUX

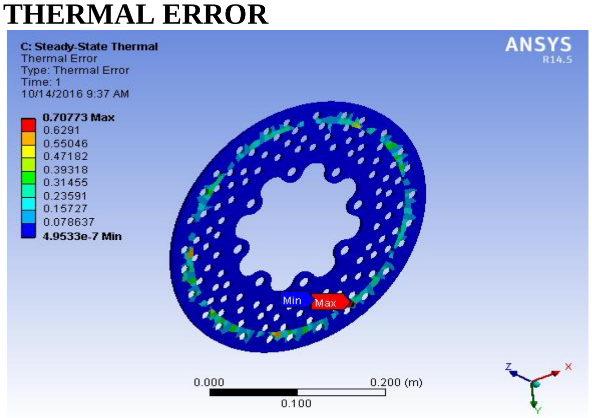
International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 14
October 2016



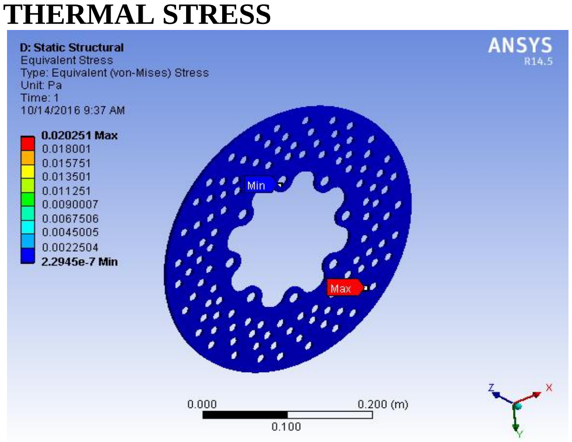
DIRECTIONAL HEAT FLUX



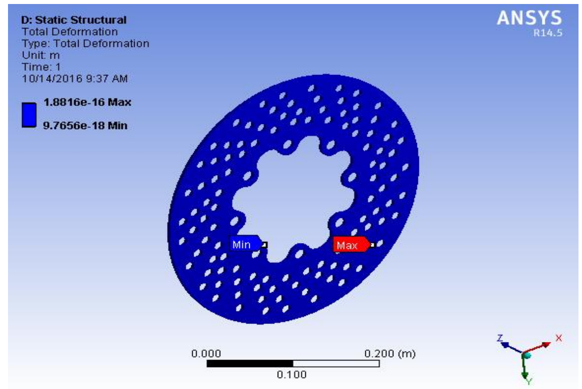
THERMAL ERROR



THERMAL STRESS

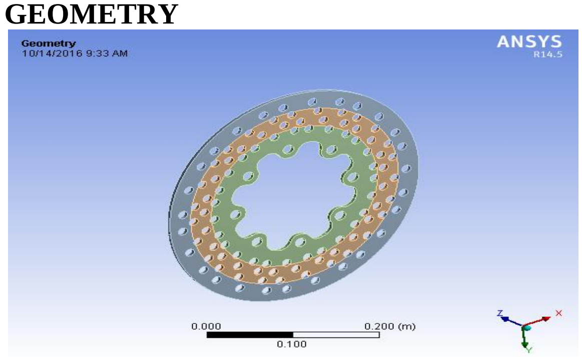


DEFORMATION

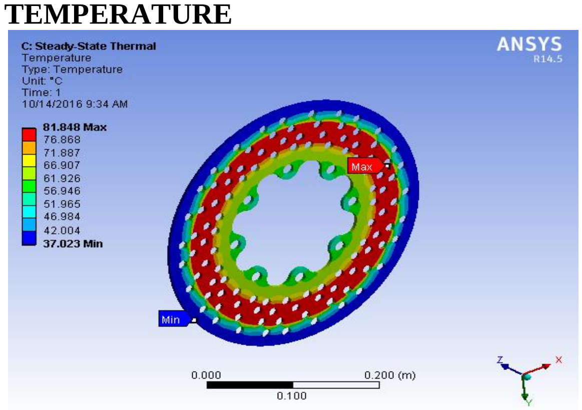


ANALYSIS OF A DISC BRAKE OF MODEL - 2 WITH HM-CFRP 10%

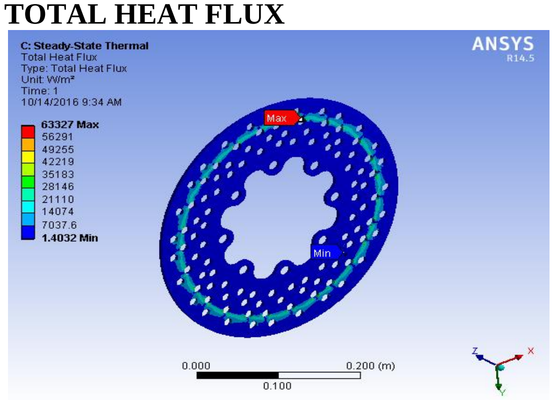
GEOMETRY



TEMPERATURE

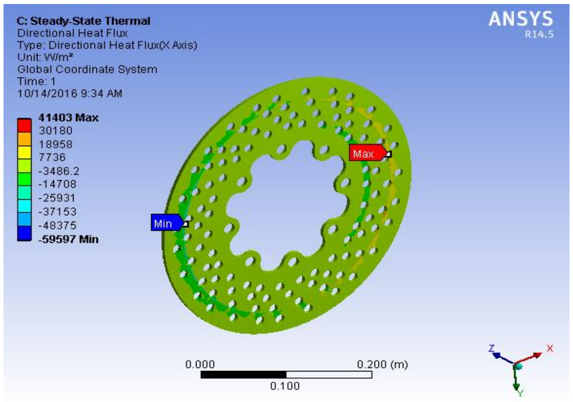


TOTAL HEAT FLUX

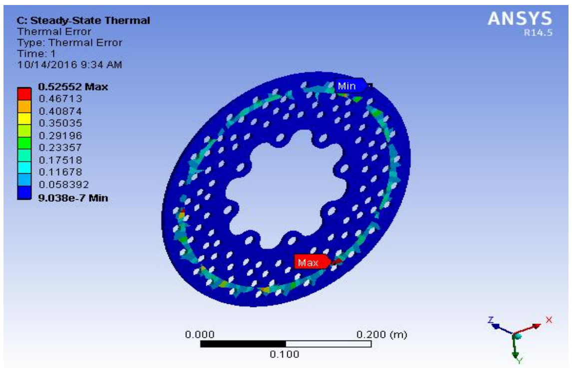


DIRECTIONAL HEAT FLUX

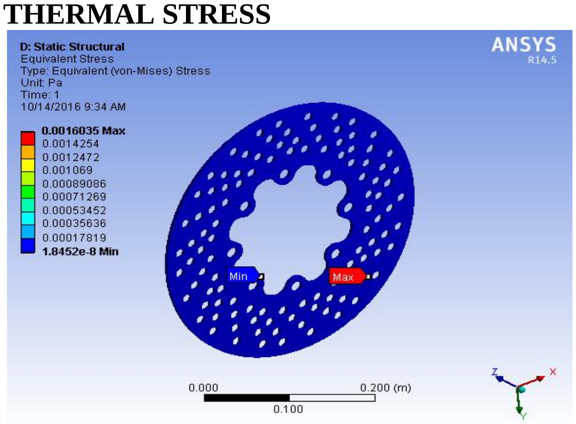
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 14
October 2016



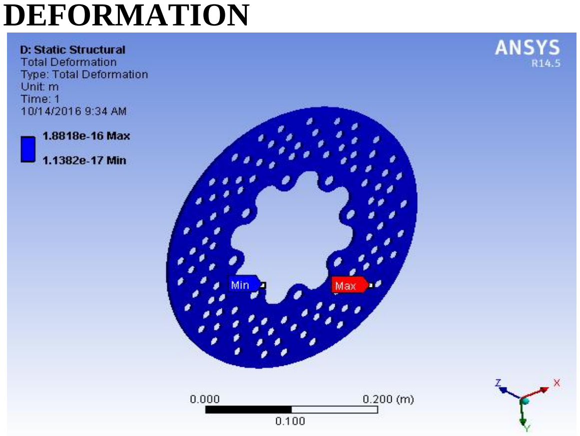
THERMAL ERROR



THERMAL STRESS



DEFORMATION



TABLES

MODEL 1

		C-C-C	HM-CFRP 10%
TEMPERATURE	MIN	43.321	35.028
	MAX	80.106	80.207
TOTAL HEAT FLUX	MIN	4.2899	0.96252
	MAX	1.4643e5	46283
DIRECTIONAL HEAT FLUX	MIN	-1.415e5	-45400
	MAX	1.1683e5	40521
THERMAL ERROR	MIN	5.849e-8	1.5166e-9
	MAX	1.1328	0.98766
THERMAL STRESS	MIN	6.4697e-8	5.2417e-9
	MAX	0.0061111	0.00048339
DEFORMATION	MIN	6.8252e-17	7.1626e-17
	MAX	2.933e-16	2.971e-16

MODEL 2

		C-C-C	HM-CFRP 10%
TEMPERATURE	MIN	57.864	37.023
	MAX	80.649	81.848
TOTAL HEAT FLUX	MIN	5.103	1.4032
	MAX	1.9018e5	63327
DIRECTIONAL HEAT FLUX	MIN	-1.666e5	-59597
	MAX	1.1737e5	41403
THERMAL ERROR	MIN	4.9533e-7	9.038e-7
	MAX	0.70773	0.52552
THERMAL STRESS	MIN	2.2945e-7	1.8452e-8
	MAX	0.020251	0.0016035
DEFORMATION	MIN	9.7656e-18	1.1382e-17
	MAX	1.8816e-16	1.8818e-16

CONCLUSION

In this paper we will design 2 different models of disk brake using carbon - carbon composite and high modulus – carbon fiber reinforced polymer 10%(carbon) for high speed two wheelers. The main aim of this paper is to design a composite disk brake with least possible production cost and long life, for achieving this goal we will compare different models of structural models of disk brakes with different materials.

Here we have designed the disc brake using Catia V5, and thermal analysis is done in Ansys to the different models and the results are verified in a graph and tables.

As we observe in the first model the analysis is done with 2 materials i.e. with CARBON CARBON COMPOSITES and HM-CFRP 10%. As we observe in the results the material with HM-CFRP 10% is the best product which increases the life as we compare the results in the heat flux, thermal error, temperatures and thermal stress. So we can conclude that the material HM-CFRP 10% is the best output for **Model 1**

As we observe in the first model the analysis is done with 2 materials i.e. with CARBON CARBON COMPOSITES and HM-CFRP 10%. As we observe in the results the material with HM-CFRP 10% is the best product which increases the life as we compare the results in the heat flux, thermal error, temperatures and thermal stress. So we can conclude that the material HM-CFRP 10% is the best output for **Model 2**

As we compare the 2 different models and their results for the best material outputs, here by comparing the obtained results we can conclude that the material HM-CFRP 10% with the model 1 is the better product for the better life.

AUTHORS

1. **STUDENT**

2. **GUIDE 1**