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DEVELOPING PART PROGRAMMING AND DESIGNING AND ANALYSIS OF COMPLEX DISC BRAKE ROTOR USING (UNIGRAPHICS)

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Abstract : The project work aims Modeling ,Analysis and Manufacturing of a complex disc brake rotor Modeling by using Unigraphics soft ware.Analysis by ANSYS Software and Manufacturing by CNC vertical machining centre by developing a part program the part program developed by using G- Codes and M-Codes .The machining model is carried out in CNC Vertical Machining Centre.

NX is one of the world's most advanced and tightly integrated CAD/CAM/CAE product development solution. Spanning the entire range of product development, NX delivers immense value to enterprises of all sizes. It simplifies complex product designs, thus speeding up the process of introducing products to the market.

The NX software integrates knowledge-based principles, industrial design, geometric modeling, advanced analysis, graphic simulation, and concurrent engineering. The software has powerful hybrid modeling capabilities by integrating constraint-based feature modeling and explicit geometric modeling. In addition to modeling standard geometry parts, it allows the user to design complex free-form shapes such as airfoils and manifolds. It also merges solid and surface modeling techniques into one powerful tool set.

Ansys develops and markets engineering simulation software for use across the product life cycle. Ansys Mechanical finite element analysis software is used to simulate computer models of structures, electronics, or machine components for analyzing strength, toughness, elasticity, temperature distribution, electromagnetism, fluid flow, and other attributes.we use ansys workbench 17.2 .

The disc brake is a device for slowing or stopping the rotation of wheel. Brake converts the friction into heat if brake to hot they will expose to large thermal stress during rotation of braking. Brake is a mechanical device is used to stop or slowing of vehicle during the motion.

1. INTRODUCTION OF DISC BRAKE

1.0 Introduction:

Brake is a device by means of artificial frictional resistance applied to moving machine member In order to stop the motion of vehicle .the energy obsorbed by brakes is dissipated in the form of heat . The heat is dissipated in the form of atmosphere.

1.1 Principles Of Braking System :

When brakes are applied, hydraulically actuated pistons move the friction pads into contact with the disc applying equal and opposite forces on the disc. Due to the friction in between disc and pad surfaces, the kinetic energy of the rotating wheel is converted into heat which vehicle is to stop after a certain distance.

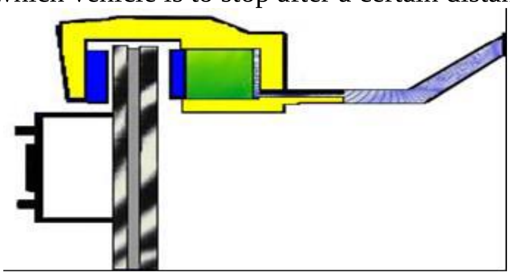

Fig 1 disc brake

1.2 Disk Brake

Ever since the invention of the wheel, if there has been "go" there has been a need for "whoa." As the level of technology of human transportation has increased, the mechanical devices used to slow down and stop vehicles has also become more complex. In this report I will discuss the history of vehicular braking technology and possible future developments. Before there was a "horse-less carriage," wagons, and other animal drawn vehicles relied on the

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animal's power to both accelerate and decelerate the vehicle. Eventually there was the development of supplemental braking systems consisting of a hand lever to push a wooden friction pad directly against the metal tread of the wheels. In wet conditions these crude brakes would lose any effectiveness.

1.2 How Brakes Work:

We all know that pushing down on the brake pedal slows a car to a stop. But how does this happen? How does your car transmit the force from your leg to its wheels? How does it multiply the force so that it is enough to stop something as big as a car?

1.4 Brake Basics

When you depress your brake pedal, your car transmits the force from your foot to its brakes through a fluid. Since the actual brakes require a much greater force than you could apply with your leg, your car must also multiply the force of your foot.

It does this in two ways:

- Mechanical advantage(leverage)
- Hydraulic force multiplication.

1.5 Leverage

The pedal is designed in such a way that it can multiply the force from your leg several times before Any force is even transmitted to the brake fluid

1.6 Hydraulic Systems

The basic idea behind any hydraulic system is very simple: Force applied at one point is transmitted to another point using an **Incompressible fluid**, almost always an oil of some sort. Most brake systems also multiply the force in the process

1.7 Friction

Friction is a measure of how hard it is to slide one object over another. Take a look at the figure below. Both of the blocks are made from the same material, but one is heavier. I think we all know which one will be harder for the bulldozer to push.

1.8 A Simple Brake System

The distance from the pedal to the pivot is four times the distance from the cylinder to the pivot, so the force at the pedal will be increased by a factor of four before it is transmitted to the cylinder. The diameter of the brake cylinder is three times the diameter of the pedal cylinder. This further multiplies the force by nine.

All together, this system increases the force of your foot by a factor of 36. If you put 10 pounds of force on the pedal, 360 pounds (162 kg) will be generated at the wheel squeezing the brake pads.

1.9 Types Of Brakes

1. DRUM BRAKES
2. DISC BRAKES (CALLIPER BRAKES)

1.10 Drum Brakes:

The drum brake has two brake shoes and a piston. When you hit the brake pedal, the piston pushes the brake shoes against the drum This is where it gets a little more complicated. As the brake shoes contact the drum, there is a kind of wedging action, which has the effect of pressing the shoes into the drum with more force. The extra braking force provided by the wedging action allows drum brakes to use a smaller Piston than disc brakes.

But, because of the wedging action, the shoes must be pulled away from the drum

when the brakes are released. This is the reason for some of the springs. Other springs help hold the brake shoes in place and return the adjuster arm after it actuates.

1.1 1 Disk Brake Basics:

The disk brake has a metal disk instead of a drum. It has a flat shoe, or pad, located on each side of the disk. To slow or stop the car, these two flat shoes are forced tightly against the rotating disk, or rotor. Fluid pressure from the master cylinder forces the pistons to move in. This action pushes the friction pads of the shoes tightly against the disk. The friction between the shoes and the disk slows and stops the disk.

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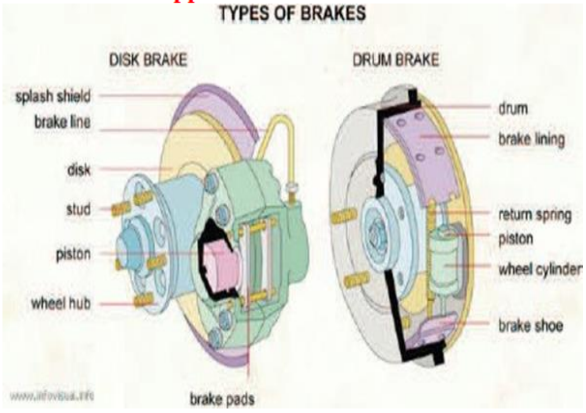

Fig 1.1 types of brakes.

1.12 Types Of Disk Brakes

The Three Types of Disk Brakes Are:

1. FLOATING CALIPER DISK BRAKES
2. FIXED CALIPER DISK BRAKES
3. SLIDING CALIPER DISK CALIPER

1.13 Main Parts:

The main components of a disc brake are:

- The brake pads
- The caliper, which contains a piston
- The rotor, which is mounted to the hub

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1.14 Brake Pad:

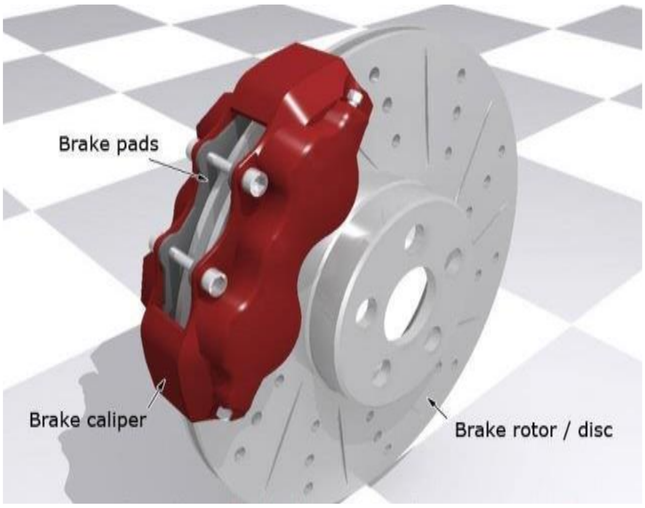

Fig 1.2 caliper and rotor

1.14 Working Of Disc Brakes

The caliper is the part that holds the brake shoes on each side of the disk. In the floating-caliper brake, two steel guide pins are threaded into the steering-knuckle adapter. The caliper floats on four rubber bushings which fit on the inner and outer ends of the two guide pins. The bushings allow the caliper to swing in or out slightly when the brakes are applied.

1.15 Fixed-Caliper Disk Brake

This brake usually has four pistons, two on each side of the disk. The reason for the name fixed-calipers that the caliper is bolted solidly to the steering knuckle. When the brakes are applied, the caliper cannot move. The four pistons are forced out of their caliper bores to push the inner and outer brake shoes in against the disk. Some brakes of this type have used only two pistons, one on each side of the disk.

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Fig1.3 fixed caliper disc brake.

1.16 Sliding-Caliper Disk Brake

The sliding-caliper disk brake is similar to the floating caliper disk brake. The difference is that sliding caliper is suspended from rubber bushings on bolts. This permits the caliper to slide on the bolts .when the brakes are applied.

Fig 1.4 sliding caliper disc brake.

1.17 Types of Drum Brake Systems:

- Twin Leading Shoe Drum Brake Systems
- Leading/Trailing Shoe Drum Brake Systems
- Duo-Servo Drum Brake Systems

1.18 Twin Leading Shoe Drum Brake Systems

The twin leading shoe drum brake system is the least common type in modern automotive use. This system was once popular on front wheels because it is very efficient at braking in the forward direction. Since the vehicle travels much faster forward than it does in reverse, this matched the braking needs well. The large forward stopping power the twin leading shoe drum brake system generated also allowed the system to operate without a power brake booster.

Twin leading shoe drum brake systems use two single-piston wheel cylinders (also called single-acting wheel cylinders)—one near the top of the backing plate and one near the bottom. Each wheel cylinder activates one of the brake shoes. The brake shoes are anchored at the closed end of the opposite wheel cylinder. It is called a twin leading shoe drum brake system because both shoes are arranged in a leading shoe (self-energizing) configuration in the forward direction. This arrangement gives very good stopping power in the forward direction. When applied in the reverse direction, the braking force is much less, only about 30% as efficient. This type of drum brake system was usually accompanied by one of the other types of brakes

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on the rear wheels to be used as a parking brake. The twin leading shoe drum brake system is very well suited for motorcycles since they are driven mostly in the forward direction and rarely reverse.

1.19 Leading/Trailing Shoe Drum Brake Systems:

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The leading/trailing shoe drum brake system is very common on the rear wheels of front-wheel drive vehicles due to their equal braking forces in both the forward and reverse direction. This system uses a single wheel cylinder with two pistons (also called a double-acting wheel cylinder), usually mounted near the top of the backing plate Each piston operates one of the brake shoes. Each shoe is anchored at the bottom of the backing plate. This arrangement makes one shoe a leading shoe and the other a trailing shoe. In the forward direction, the front piston forces the front brake shoe into the drum, and it acts like a leading shoe. The rear piston pushes the rear brake shoe into contact with the drum, but it acts as a trailing shoe, so it does not create as much braking power.

Fig 1.5 The leading/trailing shoe drum brake system.

When the brakes are applied when the car is reversing or facing uphill, the rear shoe becomes a leading shoe and the front shoe becomes a trailing shoe. The leading/trailing shoe drum brake system works equally well in both directions. It is also important to note that it does not provide maximum braking in either direction; it tends to produce a lesser but equal amount of force in both directions. This makes it ideal for the rear wheels of front-wheel drive vehicles since approximately 70–80% of the braking power needed under heavy braking occurs at the front wheels and only 20–30% at the rear wheels.

1.20 Duo-Servo Drum Brake Systems:

Duo-servo drum brake systems get their name from using the servo action in both the forward

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and reverse direction. Like the leading/trailing system, the system uses a single wheel cylinder with two pistons (also called a double-acting wheel cylinder), usually mounted near the top of the backing plate . The bottom of each brake shoe is not anchored to the backing plate but is connected by an adjustable, floating link. This configuration allows the bottom of the brake shoes to move in the direction of the drum. What keeps the shoes from just spinning around with the drum? There is an anchor pin at the top of the backing plate above the wheel cylinder that prevents each shoe from rotating past that point. The shoes can move away from the anchor pin, but they are stopped by it when they rotate toward it.

When the brakes are applied, the front piston overcomes the weaker front return spring tension to move the forward shoe into contact with the drum. When the shoe contacts the drum, the friction causes it to start to rotate with the drum. This puts a small force through the bottom connecting link and applies (servo action) the bottom of the rear shoe, pushing it into contact with the rotating drum. The top of that shoe is thus carried into the anchor pin at the top of the backing plate, causing both shoes to stop rotating. The brakes generate a small amount of force at this point.

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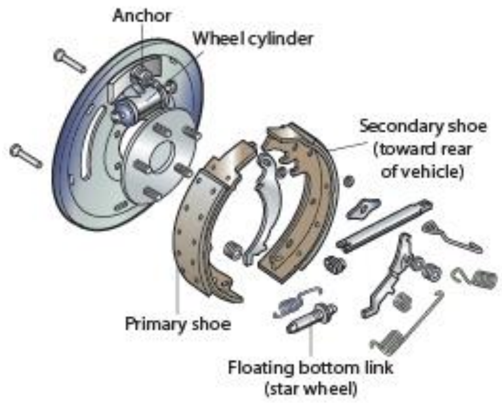

Fig 1.6 A duo-servo drum brake system.

As the driver applies more force to the brake pedal, the forward piston in the wheel cylinder pushes the front shoe harder into the rotating drum, which causes the front shoe to apply more force to the rear shoe. This forces the rear shoe harder into the drum as the anchor pin prevents it from rotating. Since hydraulic pressure is the same on both pistons in the wheel cylinder, the rear piston also tends to push the rear shoe outward into the drum, which helps apply it, although not in a completely complimentary direction. Since the front shoe multiplies the force
applying the rear shoe, the rear shoe does more of the braking work. If the linings were the
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same length front to rear, then the rear one would wear out much faster. This is why manufacturers put more lining on the rear shoe than on the front shoe. They might also use linings with different coefficients of friction for each of the shoes to get the desired braking load between the two shoes. It is important, therefore, to install the correct shoe in the correct position. Failure to do so will cause the brake linings to wear unevenly, as well as work improperly.

1.21 SELF ADJUSTMENT OF DISK BRAKES:

Disk brakes are self-adjusting. Each piston has a seal on it to prevent fluid leakage. When the brakes are applied, the piston moves toward the disk. This distorts the piston seal. When the brakes are released, the seal relaxes and returns to its original position. This pulls the piston away from the disk. As the brakes linings wear, the piston over travels and takes a new position in relation to the seal. This action provides self adjustment of disk brakes.

1.22 EMERGENCY BRAKES

In cars with disc brakes on all four wheels, an emergency brake has to be actuated by a separate mechanism than the primary brakes in case of a total primary brake failure. Most cars see a cable to actuate the emergency brake.

Some cars with four-wheel disc brakes have a separate drum brake integrated into the hub of the rear wheels. This drum brake is only for the emergency brake system, and it is actuated only by the cable; it has no hydraulics.

1.23 BRAKE FADE

Vehicle braking system fade, or brake fade, is the reduction in stopping power that can occur after repeated or sustained application of the brakes, especially in high load or high speed conditions. Brake fade can be a factor in any vehicle that utilizes a friction braking system including automobiles, trucks, motorcycles, airplanes, and even bicycles. Brake fade is caused by a buildup of heat in the braking surfaces and the subsequent changes
and reactions in the brake system components and can be experienced with both drum brakes and disc brakes. Loss of stopping power, or fade, can be caused by friction fade, mechanical fade, or fluid fade

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2. METHODOLOGY

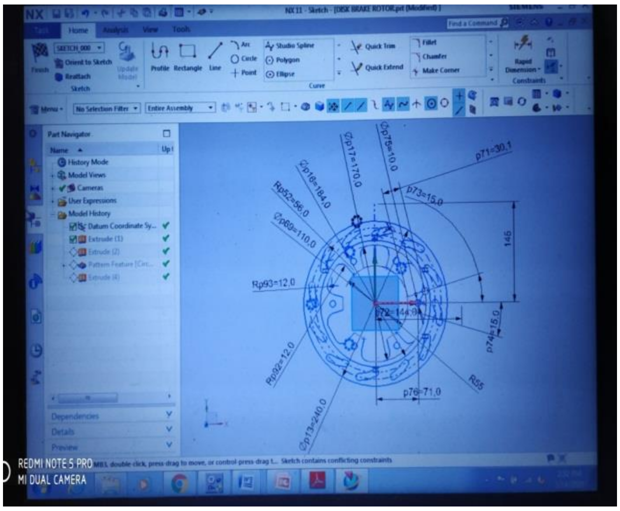

Fig 2.0 2D Disc brake rotor.

Commands used for this disc
Circle command ɸ240,ɸ220,ɸ200,ɸ184,ɸ170,ɸ10
Arc command 52 radius and56 radius
Fillet 24 radius

2.1 3d disc brake rotor

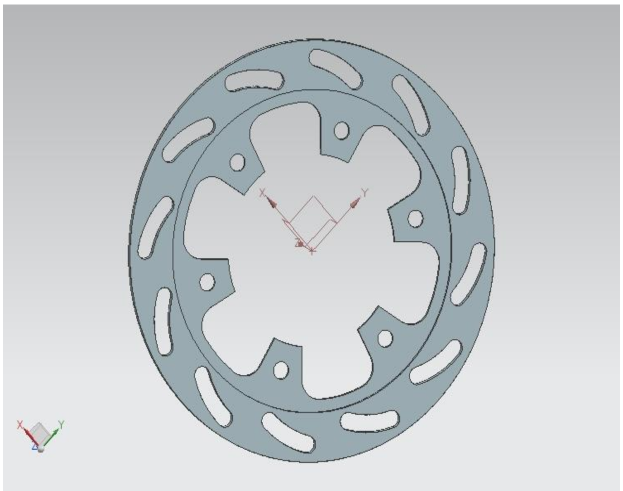

Fig 2.1 3d disc brake

Steps involved in modeling of disc

- Select the extrude command
- Select the scetch and next select circle command and draw as per dimensions .
- Select arc command and draw that and select the fillet command and select finish command and click extrude then it automatically 3d object formed.

3. ANSYS

Analysis of disc brake rotor is carried out in ANSYS 17.2 software. Static structural and steady state thermal analysis are carried out for existing and modified disc. In static structural analysis, deformation and equivalent stresses of disc are calculated and in steady state thermal analysis the heat flux and temperature is calculated. This analysis is done for the best combination of disc brake rotor.

3.1 Static Structural Analysis :

A static structural analysis determines the displacements, stresses, and strains in elements caused by masses that don't induce inertia and damping effects. The static structural loads are applied in Ansys. The types of loading that may be applied in a very static analysis include: 1 Forces and pressures 2 Fixed supports. 3 moment. Structural analysis procedural steps are given below Step 1: Importing Geometry
Step 1: Importing Geometry

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Fig 2 Imported geometry

Step 2: Meshing

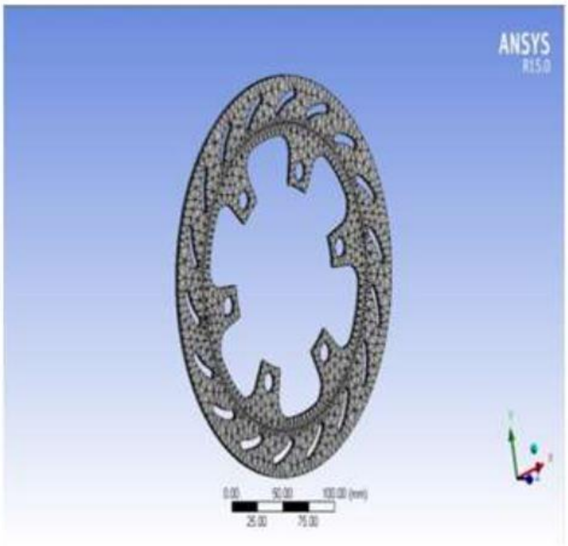

Fig 3 Mesh model

Fig 3.0 structural analysis for disc brake.

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Step 3: Applying Structural boundary conditions

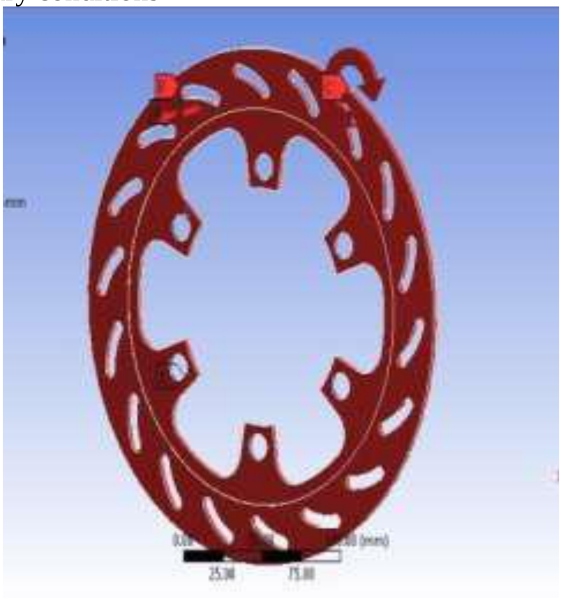

Fig 3.1 After Applied boundary conditions

3.2 Effect of deformation and equivalent stresses on modified disc

Effect of equivalent stress on modified disc of alluminium with 3mm thickness, the maximum stress of 11.363 MPa is at clamping holes and minimum stress of 0.033909 MPa is developed at brake pad contact area. Figure 3 shows the equivalent stresses of modified disc.

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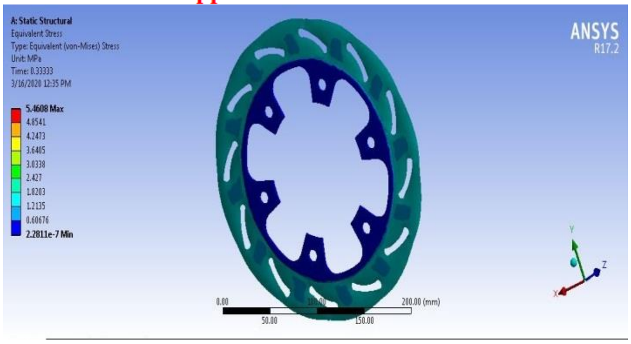

Fig 3.2 Equivalent stresses of modified disc with 5mm thickness

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Fix six bolted holes are constraints. Force applied on the rubbing area is 637.65N. Acceleration applied on the brake disc is -3.75m/s².Thermal loads are imported

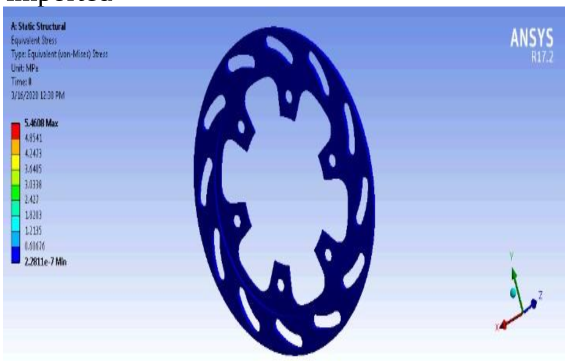

fig 3.3 Equivalent stress

3.3 Effect of deformation and equivalent strain on modified disc

Effect of equivalent stress on modified disc of alluminium with 3mm thickness, the maximum stress of 11.563 MPa is at clamping holes and minimum strain of 0.035909 MPa is developed at brake pad contact area. Figure 5 shows the equivalent stresses of modified disc

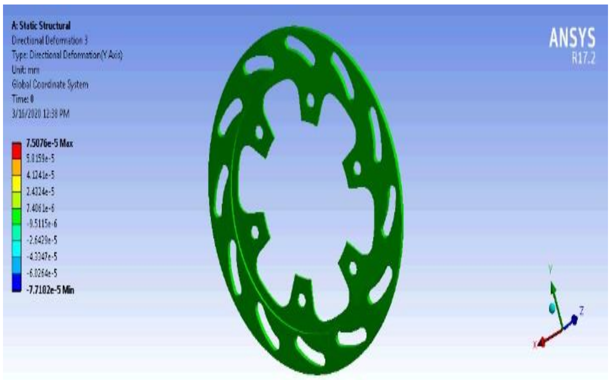

Fig 3.2 equivalent strain

3.4 Total deformation

Effect of deformation on modified disc of alluminum with 5mm thickness, the maximum deformation of 0.0032829 mm is at extreme end of the disc and minimum deformation of 0 mm is at clamping holes. The red and blue color indicates maximum and minimum deformation respectively. Figure 6 shows the deformation of modified disc.

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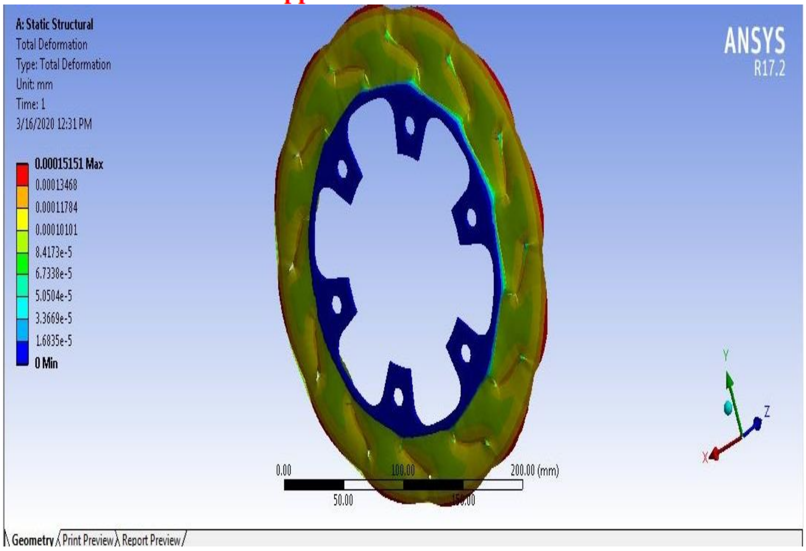

Fig 3.5Total Deformation

3.5 Static Structural Analysis Results

Table Static structural analysis results.

MATERIALS	ALUMINUM 6061 ALLOY	ALUMINUM 6063 ALLOY
Equivalent stress (MPa)	106.33	5.4608
Total deformation (m)	0.00028462	0.00015151

From comparing the above results ,stress distribution throughout the brake disc is low in aluminium 6063 alloy as 5.4608 MPa and high values in aluminium 6061 alloy as 106.33 MPa .Total deformation obtained low in aluminium 6063 and high in aluminium 6061.By the values of equivalent stresses, aluminium 6063 is the best material from comparing the results.

Manufacturing

Cnc vertical machining centre

4. Introduction to cnc :

Computer Numerical Controls is an NC system that utilizes a dedicated ,stored program computer to perform some or all of the basic numerical functions .Because of trend towards downsizing in computers ,most of the CNC systems sold today use a micro computer based controller units .Over the years , minicomputers have also been used in CNC controls .

Fig 4.0 CNC VMC.

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The external appearance of a CNC machine is very similar to that of conventional NC machine .part programs are initially entered in a similar manner .Punched tape readers are still the common device to input the part program into the system. However ,with conventional numerical control , the punched tape is cycled through the rear for every work piece in the batch .with CNC ,the program is entered once and then stored in computer memory .thus the tape reader is used only for original loading of the part program and data .compared to regular NC , the CNC offers additional flexibility and computational capability. New system options can be in corporated to regular NC, the CNC offers additional flexibility and computational capability .New system optrions can be incorporated into the CNC controller simply by re programming the unit .Because of this reprogramming capacity , both in terms of part programming and system control options.CNC is often reffered by the term “soft word” NC.

4.1 Cnc Controllers:

Fig 4.1 CNC controller.

The CNC machines can be classified on many basis some of them are given below:

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1.Open Loop System &Closed System

The basis of this classification is on the feedback operation.In open loop system there is no feedback mechanism , i.e. the information or data can’t be transmitted back to the machine control unit . On the other hand in closed loop system a feed device is connected in the circuit.This feed back device transfers the data processor by the sensors (speed sensors, displacement sensors etc.) back to the machine control unit . The MCU then compares the feed back values with the original values and gives the appropriate orders to that particular device so that required value is obtained

2. On The Basis Of The Tool Moment

a)POINT TO POINT CNC

Point to Point is also sometimes known as positioning system.In PPT,the Objective of the machine tool control system is to move the cutting tool to predetermined location.The speed or path by which this movement is accompolished is not important in point to point system.Once tool reaches the desired location ,the matching operation is performed at that location.

b)STRAIGHT CUT CNC

Straight cut control system are capable of moving the cutting tool parallel to one of the major axis at a controller rate suitable for machining.It is therefore appropriate for performing milling operation to fabricate rectangular piece.with this type of NC system it is not possible to combine movements in more than a single axis direction .Therefore angular cuts on work piece would not be possible , a CNC machine capable of straight cut movement is also capable of PTP movements.

c) COUNTERING CNC

countering is the most complex,and most flexibler,and the most expansive type of machine tool control.it is capable of performing both PTP and straight cut operation.in addition ,the distant features of countering CNC system are their capacity to control simultaneously morethan one axis movement of the machine tool .The path of the cutter is continuously controlled to generate desired geometry of the workpiece. For this reason countering system is also called continuous path CNC system.

3.On The Basis Of Number Of Axis

TWO AXIS(2) CNC :

In two axis CNC machine any two of the three axis (X Y Z) are present i.e.XY or YZ orZX are only present .That means the tool or machine base can move only in two directions.

TWO AND HALF AXIS(2 ½) CNC :

In 2 ½ axis CNC contrary machining through three axis (x y z) the machine tool or machine base can be moved only in two directions simultaneously. For example ,if it has to move in all directions then it is moved in X and Y direction first simultaneously and then in z dirtection.

THREE AXIS (3) CNC :

CONCLUSION

Solid modelling of complex disc brake rotor was made in **UNIGRAPHICS** according to production drawing specification and analysis under the effect of tensile and compressive load in terms of force/moment is done in ANSYS workbench.

This analysis help to identify high &low stress region from the input of the material properties, boundry condition and loads. The study shows the portionsd or areas where maximum stress and maximum deformation develop ,as it is more susceptible to the failure.. This areas where the stress concentration is more,in order to minimize the stress at that stressed portion material can be added .

For further optimization of material dynamicanalysis of disc brake is required. After considering dynamic load condition ,once again fea will have to be perform .it will givemore accurate results than existing results .

Manufacturing is done on CNC Vertical Machining centreby taking ALLUMINIUM ALLOY 6063 material and finally the desires componentis obtained.

REFERENCES

1. Cad /Cam Text book(Ishrat.M.Mirzana) is used for developing programme.
2. Production technology text book for vmc machine.
3. Simens Unigraphics software for modelling