Design Development Analysis And Performance Evaluation Of Conventional Brakes In Two Wheeler:A Review

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Abstract-*In recent days speed of motor cycle is much more expected, so that why there is the more requirement of power. Instead of having air bag, good Suspension systems, good handling and safe cornering, there is one most critical system in the vehicle which is brake systems. with incapable of braking system, the vehicle will put a passenger in unsafe position. But, to achieve all that braking distance is an important factor, also vibration while brake is applied and brake power absorbs at various speed. An efficient braking system play an important role then vehicle has to run at high speed. The conventional disc brake are not so much capable to stop the vehicle in less braking distance. The design begins with study of basic parameters, calculations giving required values, followed by analysis of various conditions. Then a prototype is made to find out flaws and feasibility, proceeded by material selection, analysis, manufacturing, design validation, final assembly, and testing. The design is then validated by measuring performance in terms brake torque, brake distance, torque capacity.so it will help to avoid accident which going to happened in now day's.*

Keywords-Motorcycle brakes, disc brakes, peripheral brakes

I. INTRODUCTION

The disc brake is a wheel brake which slows rotation of the wheel by the friction caused by pushing brake pads against a brake disc with a set of calipers. Friction causes the disc and attached wheel to slow or stop. Brakes convert motion to heat, and if the brakes get too hot, they become less effective, a phenomenon known as brake fade. Disc-style brakes development and use began in England in the 1890s. The first caliper-type automobile disc brake was patented by Frederick William Lanchester in his Birmingham,UK factory in 1902 and used successfully on Lanchester cars. A disc brake is a type of brake that uses calipers to squeeze pairs of pads against a disc in order to create friction that retards the rotation of a shaft, such as a vehicle axle, either to reduce its rotational speed or to hold it stationary. Compared to drum brakes, disc brakes offer better stopping performance because the disc is more readily cooled. As a consequence disc are less prone to the brake fade caused when brake components gets overheat. Most drum brake designs have at least one leading shoe, which gives a servo-effect. By contrast, a disc brake has no self-servo effect and its braking force is always proportional to the pressure placed on the brake pad by the braking system of any brake servo, braking pedal, or lever. Even having more stopping feature Disc brake have some disadvantages; brake squeal, break judder, less breaking distance. To avoid this problem perimeter disc is one of the solution for it.

II. LITERATURE SURVEY

In this paper author told about the manufacturing and assembly of disk brake. He also compare with drum brake and state related problem occurred in disk brake. Mention that scarring, cracking, warping or excessive rusting are the reason of damaging of disc brake. In this he calculate tangential force between pad and rotor of inner face as well as outer face, brake torque with equal coefficient of friction and normal forces on inner and outer edges. Also calculate braking distance. Finally he did analysis of disc brake and conclude that this all factor are necessary to understand action force and friction force on the disc brake, because of which the disc brake works more efficiently [1]. Aim of the paper was to develop a braking system in the automobile and check for it's torque absorbing capacity and tors conclude that compare it with conventional braking system. In this paper author conclude points are braking efficiency is high as a result of both axial andradial force produce in the system .Braking efficiencyradial forces produced in the system. Braking efficiency is not affected in wet conditions as the system is enclosed completely in the drum. Further he compare torque absorbing capacity of conventional disc brake, drum brake and also with disc-o-drum brake and finally conclude that absorbing power of disc-o-drum is more as compare to conventional disc brake system [2]. The design of brakes involves evaluating the force, pressure, torque, heat-generated, heat dissipated and the coefficient of friction. When in use, the energy absorbed by brakes in the process of slowing down or stop moving part(s)) is dissipated as heat. In the area of brake design, a number of researchers have contributed towards the advancement of the process. One such contribution was from

Fazekas; who significantly reduced the difficulty associated with numerical integration in the analysis of circular (Bottom or Puck) pad caliper brake.in this paper with the use of software he show that applied force has adirect and linear relationship with the normal force also the radius of the drum of the brake increase, the torque increases proportionately [3]. Brake noise is due to brake vibration during braking. If change of friction force between friction plate and brake disc is too large and fast during the braking, it can cause the brake disc and the friction plate to vibrate. When the vibration frequency up to a certain value, they will produce different brake noise. In this paper, the author considers that Brake torque variation (BTV) is the main reason about brake vibration and brake noise. He also said that, it not only just replacing the friction plate but also should change the structure design and careful selection of brake friction parts in order to minimize brake noise. [4].

III. RELATED THEORY

1) PROBLEM IN CONVENTIONAL DISC BRAKES:

BRAKE SQUEAL:

Sometimes a loud noise or high pitched squeal occurs when the brakes are applied. Most brake squeal is produced by vibration (resonance instability) of the brake components, especially the pads and discs (known as force-coupled excitation). The metal to metal parts to move independently of each other and thereby eliminate the buildup of energy that can create a frequency that is heard as brake squeal, groan, or growl.

Dust on the brakes may also cause squeal and commercial brake cleaning products are designed to remove dirt and other contaminants.

BRAKE JUDDER:

Brake judder is usually perceived by the driver as minor to severe vibrations transferred through the chassis during braking.Hot judder is usually produced as a result of longer, more moderate braking from high speed where the vehicle does not come to a complete stop. It commonly occurs when a motorist decelerates from speeds of around 120 km/h (74.6 mph) to about 60 km/h (37.3 mph), which results in severe vibrations being transmitted to the driver. Cold judder, on the other hand, is the result of uneven disc wear patterns or disc thickness variation (DTV). These variations in the disc surface are usually the result of extensive vehicle road usage. DTV is usually attributed to the following causes: waviness and disc surface, misalignment of axis (run-out), elastic deflection wear and friction material transfersss.

Advantages and Disadvantages of Disc Brakes:

1) Advantages:

- Being external to the hub, they don't impose special lubrication requirements like a coaster brake, or risk contamination by lubricants like an integral drum brake, or overheat the hub on long, steep downhill runs.

- They also dissipate heat without overheating the tire of special importance when used as a downhill drag brake on a tandem or cargo bike.

2) Disadvantages:

- A front disc brake stresses one blade of the front fork very heavily, requiring a stronger, heavier fork, resulting in a bumpier ride with a non-suspension fork, and if a fork isn't quite rigid enough, producing 'brake steer''.

A front disc brake caliper behind the fork blade generates a powerful force tending to loosen a quick release and pull the wheel out of the fork. Special hub and fork designs are needed to surmount this problem.

IV. RULES FOR DESIGN

The design and capacity of brake depends upon the following factors:

- The unit pressure between the braking surface.
- The coefficient of friction between the braking surface
- The peripheral velocity of the brake drum.
- The projected area of the friction surface.
- The ability of brake to dissipate heat equivalent to - The energy being absorbs. There should be two pads on the either side of the disk in the form of annular section.
- The friction lining is attached to each pad. A caliper is attached to non-rotating member exert a force on each pad.
- When pad are press against the rotating disc, the friction force between the surface of friction lining and the disc retards the speed and finally stop the disc.
- In between each piston and the disc there is friction pad held in position by retaining pins, spring plate, passages

are drilled in the caliper for the fluid to enter of leave each housing.

V. DESIGN OF DISC BRAKE

a) Tangential Forces:

The force acting on the inner and outer rotor faces due to contact with brake pads.

b) Brake torque:

1) Brake Torque In Case Of Pad And Rotor Of Different Material:

Brake torque was develope as a function of two tangential forces and the effective radius of pad and rotors interface.

2) Brake Torque In Case Of Pad And Rotor Of Same Material:

With the assumption of equal coefficient of friction and normal forces on the inner and outer faces are consider.

c) Brake Distance:

It is the distance that vehicle travel from the point when it's brake are fully applied to when it comes to a complete stop.

d) Torque Capacity Of Disc Brake:

It can be calculate multiplying by two with coefficient of friction multiply by force on each pad multiply by mean radius(center of wheel to center of pad).

e) Area of Pad:

force on each pad (N) divided by pressure (Pa)

VI. FEA ANALYSIS OF CONVENTIONAL DISC BRAKE

In this paper, static structure analysis is done with conventional disc brake. The material used for disc brake are as below:

DESIGNATION	ULTIMATE TENSILE STRENGTH N/mm^2	YEILD STRENGTH N/mm^2
II. EN8	520	360

The ANSYS results are as follows:

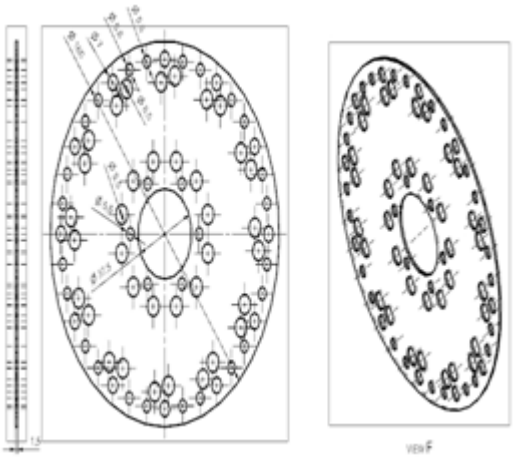


Figure 1: Geometry of the Disc

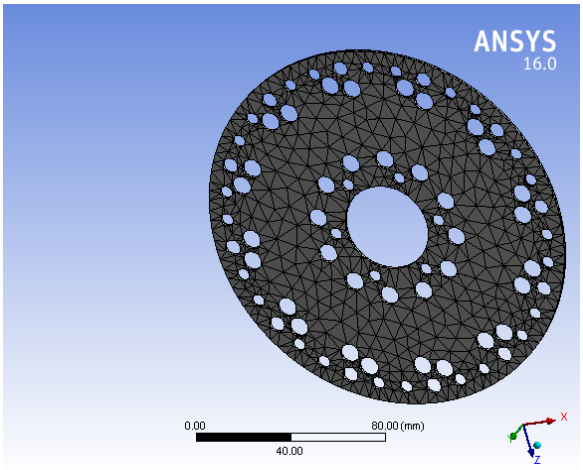
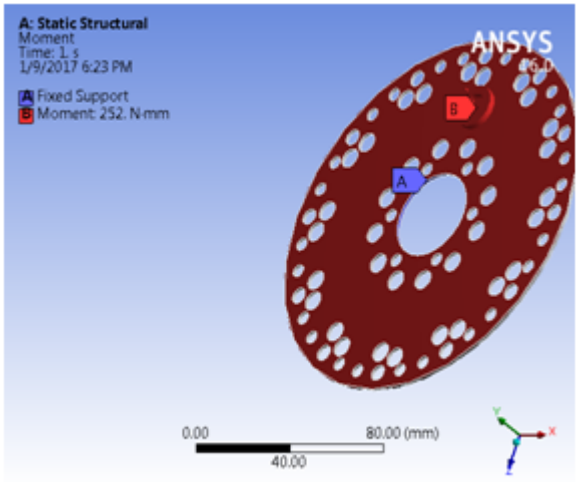
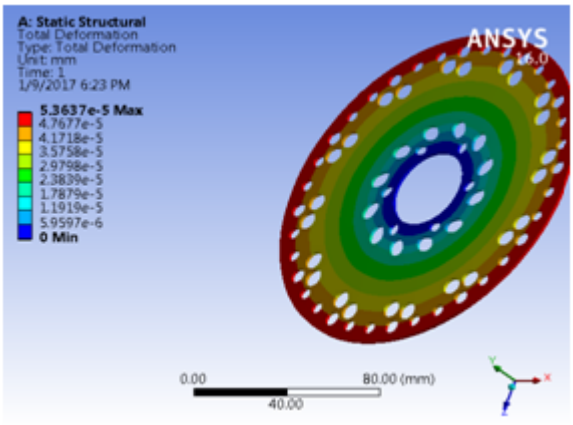


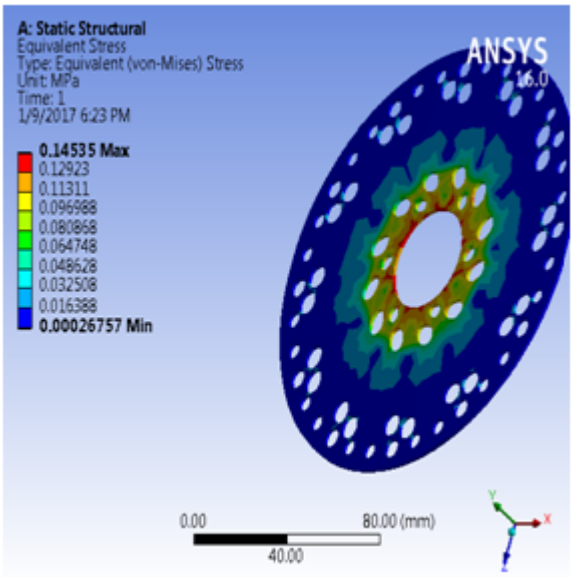
Figure 2: Mesh Model



Fixed support with applied moment 252.N-mm
Figure 3: Boundary Condition



Maximum total deformation :5.363e-5mm
Minimum total deformation :5.9597e-6mm
Figure 4: Total Deformation



Maximum Equivalent von-Mises Stress:0.1453MPa
Minimum Equivalent von-Mises Stress:0.0002MPa
Figure 5: Equivalent (von-Mises) Stress

VII. CONCLUSION

We have studied all dependents and independents parameters for design of conventional braking system which forms the base for further manufacturing and execution of complete design. This design not only allows in achieving a better directional stability but also proves beneficial for maneuverability.

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