DESIGN AND THERMAL ANALYSIS OF DISC BRAKE SYSTEM

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Abstract

In our project "Each single system has been studied and developed in order to meet safety requirement. 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. Without brake system in the vehicle will put a passenger in unsafe position. Therefore, it is must for all vehicles to have proper brake system. In this project Al Alloy, Ti Alloy and Gray cast iron, disc brake material use for calculating normal force, shear force and piston force. And also calculating the brake distance of disc brake. The standard disc brake two wheelers model using in Ansys and done the Thermal analysis and Modal analysis also calculate the deflection and Heat flux, Temperature of disc brake model. This is important to understand action force and friction force on the disc brake new material, how disc brake works more efficiently, which can help to reduce the accident that may happen in each day.

Key Word – *Analysis, Disc Brake, Brake Pads,*

INTRODUCTION

The sliding contact of the members of disc brake results in kinetic energy conversion into heat at the pad/disc interface. The increase of friction moment is a limited quantity and depends on the coefficient of friction, radius of rubbing path, and forces that act on the pads. The process of slipping leads the increase of temperature, whereas its peak value is one of the most crucial factor in the course of action to occur. The temperature on the contact surfaces of the turbo system during emergency braking intensified by significant thermal load due to frictional forces as well as the high velocity of the process is, in particular, important to predict in hazardous environments such as coal mines. Complexity of the friction and wear processes state major difficulty of formulating universal physical model to determine critical operation conditions for specified case of braking action. Exact analytical solutions of temperature of friction pair may be obtained with restriction to semi-spaces, plane parallel strip or semi-planes. Typically the heat flux condition is applied at the region of contact. The three-dimensional temperature distributions of a moving heat source problem with a rectangular and elliptic source on a rectangular prism and circular source on a rotating cylinder was proposed in article . The temperature and the thermal constriction resistance as a function of geometric characters and velocity were determined. The temperature and the thermal stresses of the pad (the strip) sliding with the constant retardation on a surface of the disc (the semi-space) both during heating and after the moment of standstill were studied . However these geometric configurations may correlate with actual engineering applications, absence of the exact solutions, primarily application of finite areas of frictional heating systems should be noticed.

1.SOFTWARE USED FOR DESIGN

SOLIDWORKS:

Solid Works can be used to create the model of parts with proper dimensions.

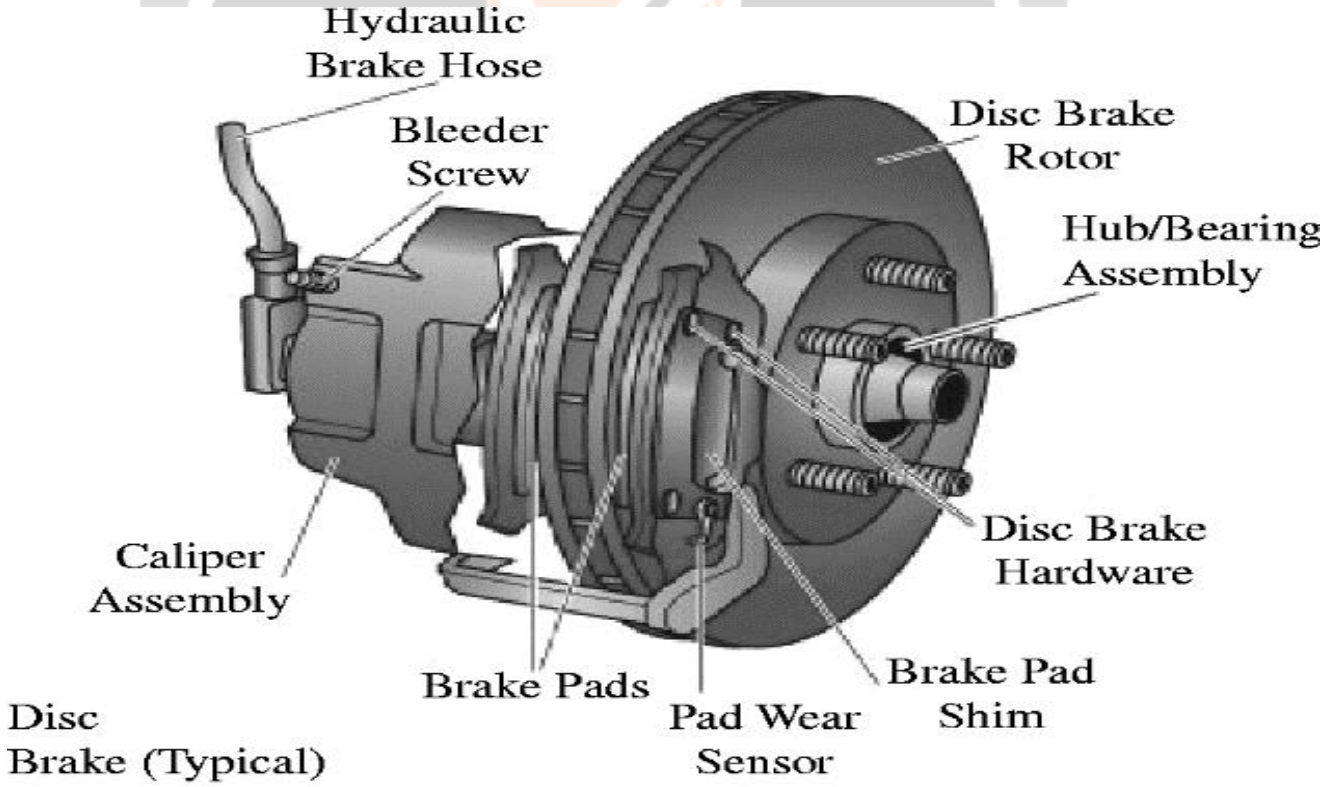
- Construction of basic sketch.
- Construction of 3D model by using Commands like Extrude, sweep, etc.,
- Assembly of various blocks.

ANSYS WORKBENCH:

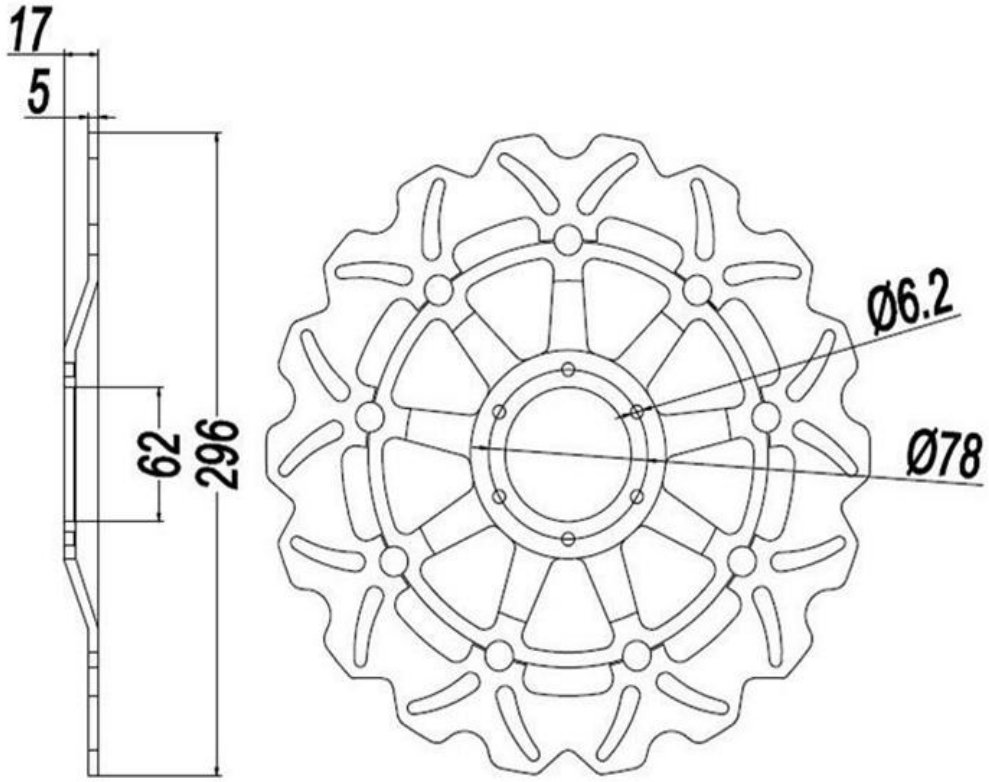
The ANSYS Workbench platform is deepest suite of advanced engineering simulation technology.

- Importing of 3D Model in to Ansys Workbench graphic user interface.
- Meshing the model by using Fine mesh with small element size.
- Fixing the boundary conditions and loading conditions.
- And finally analyze the assembly using Ansys solver.

2.LAYOUT OF DISC BRAKE SYSTEM:



2D MODELING



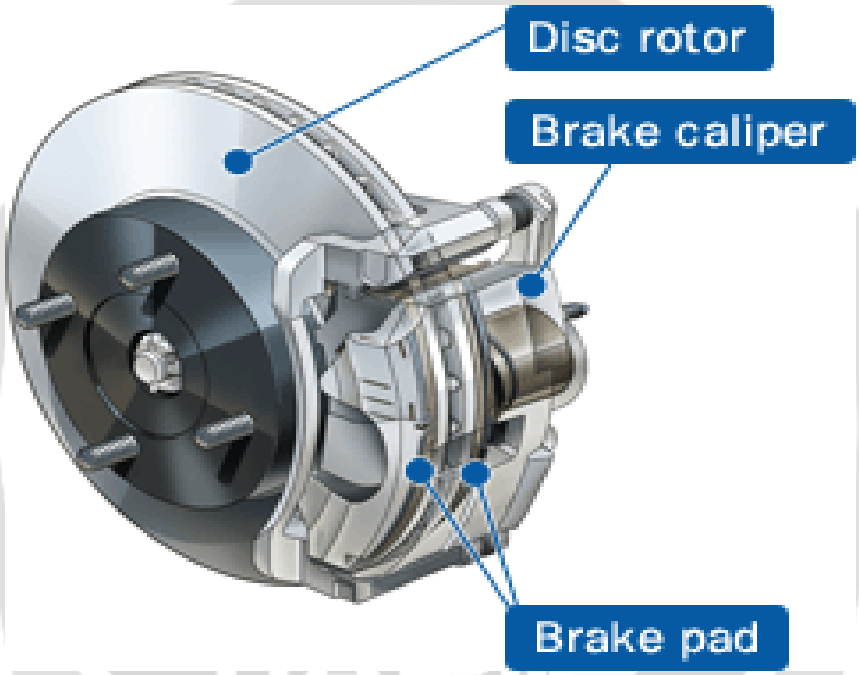
SAMPLE MODEL OF DISC BRAKE SYSTEM

3. HISTORY OF DISC BRAKE SYSTEM:

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. Before there was a "horse-less carriage," wagons, and other animal drawn vehicles relied on the animal’s power to both accelerate and decelerate the vehicle.

4.DISC BRAKE TYPES:

This type of brake consists of a disc rotor that is rotating together with the wheel and a stationary brake caliper assembly equipped with brake pads. When pads are forced against the rotor from both sides, friction that is generated converts kinetic energy into heat, which causes the rotor and attached wheel to slow or stop.



OPPOSED PISTON TYPE DISC BRAKE:

This type of disc brake has pistons on both sides of the brake rotor, and there are no moving parts in the caliper assembly other than the pistons themselves.1This type of caliper provides very even pressure distribution between pads and rotor providing better braking performance, especially under severe braking conditions.

FLOATING CALIPER TYPE DISC BRAKE

For Passenger Cars

Floating caliper type disc brakes have a piston (or pistons) only on the inner side of the rotor. When the brake is engaged, a piston pushes the inner brake pad against the rotor. This generates a reaction force that moves the

caliper itself along the slide pin, pushing the outer pad against the rotor to clamp it from both sides

Why disk brakes in a truck or bus that travels in excess of 65 mph?

- Improved road handling, higher engine ratings and torque, reduced drag and rolling resistance resulting in faster acceleration and higher average speeds
- Higher vehicle speeds with full loads
- Higher traffic density, greater chances of emergency braking
- Extremely high kinetic energy needed to brake on wet roads, high front axle loads effecting vehicle directional stability

Why are disc brakes system efficient?

- The design and analysis of DISC ROTOR is designed by using SOLIDWORKS modeling software and the analysis is carried out using ANSYS WORKBENCH.
- After completing the design part that could be saved by the parosolid_xt format and directly imported to the Ansys Workbench.
- Here we have analysis the, temperature and heat flux of the Choosed material.
- Plot the results and Flat brake disk (axial brake) under high pressure versus round brake drum (radial brake) during braking
- Full friction surface of the brake pad on the plane brake disk
- No loss of brake power due to overheating or partial contact from brake drum parts expansion
- Disk brakes can withstand higher loads and its efficiency is maintained considerably longer even under the highest stresses
- compare the results of various materials.

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