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"A Study on Disc Brake Design & Analysis Using Topology Optimization Technique"

Nishant Singh
M.Tech (Machine Design, Millennium Institute of Technology, Bhopal)
Asst. Prof. Amit Kaimkuriya
(Department of Mechanical Engineering, Millennium Institute of Technology, Bhopal)

Abstract— In automobile the new models are proposed every day, the motive of today automobile industry is to produce vehicle with better performance and which is light in weight. In this, studies shows that disk brake are mostly used in automobile because the stopping power of disk brake is better than other commonly used brakes, but conventional disc brake are very bulky and heavy in weight. The present study focuses on the optimization of disc brake using topology optimization without affecting the basic performance of the disc brake. The ANSYS software is used for topology optimization. This topology optimization gives information of the part of material to be removed without affecting of disc brake performance. In this study, it was observed that 29% overall weight of disc brake is reduced without effecting disc brake performance.as the weight is reduced the overall cost is also gets reduced.

In this paper a different topology design is implemented to reduce the weight of disc rotor and for good wearing conductivity. Hopefully this paper will help everyone to understand analysis of disc brake rotor and how disc brake work more efficiently, which can help to reduce the accident that may happen. Modeling was done using CATIA V5R20 software and Static Analysis and Topology optimization was done using ANSYS 19 software.

Keywords- Disc brake; Finite element analysis; Finite element method.

I. INTRODUCTION

Brakes are very important mechanical mechanism on vehicle such that the safety and the life of the human being is mainly depend on the present barking system on the vehicle which get applied during the emergency condition. Estimation made by someone that for an average one person apply at least 50000 time brakes on vehicle in one year. As per the definition, the brakes are the mechanical mechanism which absorbs the energy in the form of heat during the stopping of the vehicle. The main purpose of the brakes is to resist the motion of the vehicle using frictional force.

A. TYPES OF BRAKE SYSTEM

1) Hydraulic braking system

The hydraulic brakes are mainly work on the basis of hydraulic pressure which works on the principle of Pascal's law.

Pascal's law: The pressure exerted anywhere in a mass of confined liquid is transmitted undiminished in all directions throughout the liquid. Applied in hydraulic lifts, hydraulic brakes etc.

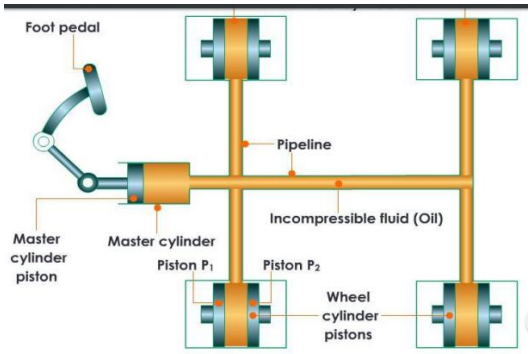

Figure: 1 hydraulic brake system

2) Air braking system

Air brakes use compressed air to make the brakes work. Air brakes are a good and safe way of stopping large and heavy vehicles, but the brakes must be well maintained and used properly. Air brakes are really three different braking systems: service brake, parking brake, and emergency brake.

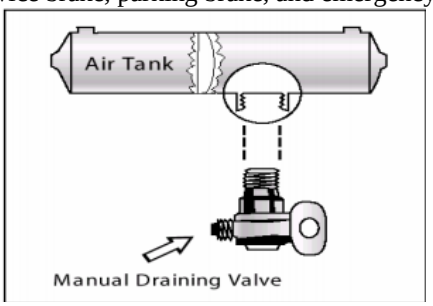

Figure: 2 Drain system

3) Based on type of rotor discs

(a) Disc Brake Rotors.

(1) Based on mounting