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Synopsis on Experimental and Finite Element Analysis of Brake-Shoe

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Abstract: ***Design engineers always aim at improvement in each and every part of the automobile system. The automobile industry has continued improving for many years with the efforts conducted for the purpose of modification of the mechanical parts of vehicles in order to improve their performance and vibration response. These characteristics have a vital impact on the mechanical performance of the overall system balance. In addition, redesigning the mechanical models plays an important role in improving the sustainability of the system against the resultant stresses and strains; therefore, significant consideration should be taken for this when designed by engineers.***

A brake shoe is the part of a braking system that has brake lining used in automobiles. It is a device put on a track to slow down a bike; it is also called a brake shoe. When the brake is applied, the shoe moves and presses the lining against the inside of the drum. The friction between the lining and drum provides the braking effort. Energy is dissipated as heat.

Keywords: Experimental Analysis, Photo stress Analysis Etc.

I. INTRODUCTION

The brake shoe is designed to help stop the bike. In fact, brake shoes are an essential element of certain braking systems, and, contrary to popular belief, they are not the same thing as brake pads. If the brake shoes become excessively worn or overheated, their capacity to slow the vehicle may be reduced. This may result in a vehicle that takes longer to stop when the brakes are applied, especially during high-speed or heavy braking situations. There are a few other pieces of hardware that are found in the brake system that might need to be serviced as well, including calipers and rotors, but the most common service will be to replace brake pads. Figure-1 Dimensions of Brake Shoe (All dimensions in [mm], inch)

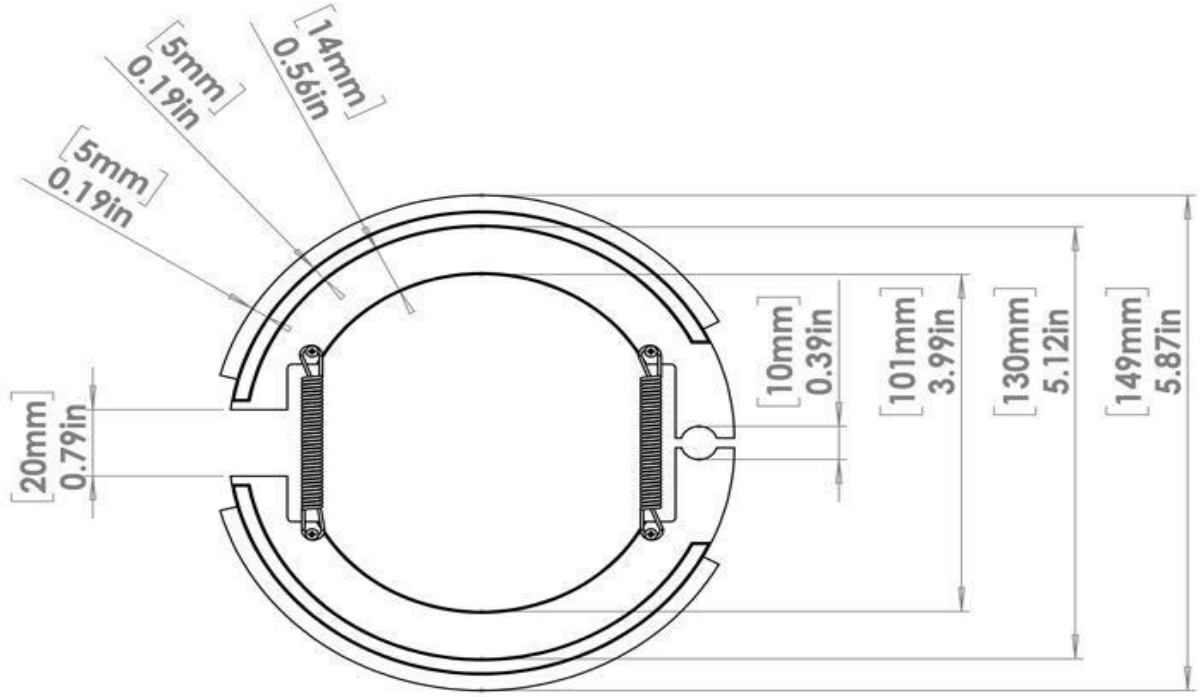


Figure-1 Dimensions of Brake Shoe (All dimensions in [mm], inch)

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II. LITERATURE REVIEW

A considerable research work in the area of contact stress analysis of Brake Shoe has been carried out. However, it is seen that a very little work has been carried out on Experimental and FEA of Brake Shoe. A brief Review of some selected references on this topic is presented here.

Bin Zheng et al [1] have worked on Brake system of the car is an important part of the safety of the car. At present, most of the cars are used drum brakes. The drum brakes have a large braking force due to the large contact surface, but the drum brakes are subject to problems such as stress concentration during use. This is the main problem that restricts the development of drum brakes.

V.S.Chavan et al [2] worked on brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction .Most brakes commonly use friction between two surfaces pressed together to convert the kinetic energy of the moving object into heat, though other methods of energy conversion may be employed.

Praveen Pachauri et al [3] have investigated that now a days, over 100 years after the first usage, drum brakes are still used on the rear wheels of most vehicles. The drum brake is used widely as the rear brake particularly for small car and motorcycle. The leading-trailing shoe design is used extensively as rear brake on passenger cars and light weight pickup trucks. Most of the front-wheel-drive vehicles use rear leading- trailing shoe brakes. Such design provided low sensitivity to lining friction changes and has stable torque production.

K. Radhakrishna et al [4] have used aluminum with copper and fly ash as reinforcements and concluded that up to 15% the reinforcements are successfully dispersed in the matrix and hardness, wear resistance increases up to 15 wt% addition of reinforcements.

K. Deepika et al [5] worked on brake lining materials such as asbestos, metals, non -asbestos organic such as palm kernel shell (PKS), and ceramics. Asbestos during application releases the hazardous gases, which causes damage to the health. The main element is used for brake lining from palm kernel shell (PKS) which is agro-waste. The average disk temperature and average stopping time for pass is increased and it has poor dimensional stability. Hence it has lost favour and several alternative materials are being replaced these days. lamellar graphite and nodular cast iron, which have a good thermal conductivity, good mechanical properties, good wear resistance. Cast iron brake block enjoys many advantages including hardness, impact strength and so on.

E. Surojo et al [7] worked on brake shoes or brake pads which were applied in brake system of vehicles which were manufactured using composite materials. Composite brake shoes consist of many ingredients in order to meet various requirements of brake performance. It is well known that properties of constituent materials contribute on composite characteristics. Thus, in manufacturing of composite brake shoe, the selection of ingredients, particle shape, and concentration is important for obtaining characteristics of brake shoe materials as required.

Uday Pratap Singh et al [8] studied that brake drum was invented by Louis Renault in 1902. It was found that woven asbestos lining for the brake drum lining as no alternative dissipated heat like the asbestos lining, though May has used a less sophisticated brake drum. In the first brake drums, levers and rods or cables operated the shoes mechanically. From the mid-1930's, oil pressure in a small wheel cylinder and pistons operated the brakes, though small vehicles continued with purely mechanical systems for decades.

M Ungureanu et al [9] investigated that friction is a complex process of molecular, mechanic and energetic nature. Dry friction is characterized by direct immediate contact of the surfaces in relative motion. No lubricant film is interfering between the brake-shoe friction areas, except the films absorbed from the ambient gaseous environment. The frictional properties of the brake shoe have very important influence on the braking reliability and safety of mine hoists.

Rinku B. Pradhan et al [10] studied that brake lining is a part of braking system, situated in between brake drum and shoe. A brake is a device which is used to bring to rest or slow down a moving body. Safe operation of vehicle demands dependable brakes is required to absorb the kinetic energy of the moving parts or the potential energy of the object being lowered by host when the rate of descent is controlled. The energy absorbed by brakes is dissipated in the form of heat. This heat is dissipated in the surrounding atmosphere to stop the vehicle.

III. PROBLEM STATEMENT

The aim of present investigation is to carry out the static analysis of brake shoe used in two wheeler. The brake shoe carries the brake lining, which is riveted or glued to the shoe. When the brake is applied, the shoe moves and presses the lining against the inside of the drum. The friction between lining and drum provides the braking effort. During operation of brake different types of forces such as frictional forces, tensile forces and compressive forces are act on brake shoe.

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There is lot of effort carried out for examination of brake shoe with the help of analysis software but very less work is available for experimental analysis particularly strain gauge analysis. Hence it becomes necessary to carry out experimental analysis of brake shoe.

In this dissertation work, the study of effect of frictional force on brake shoe by using analytical, experimental and theoretical technique in static condition will be carried out.

IV. SOLUTION

For exact evaluation of failure pattern it is necessary to carry out experimental and finite element analysis of Brake Shoe. In order to address the above problem and to determine the exact stresses developed in the all Brake Shoe, carry out experimental and FEA of Brake shoe.

V. OBJECTIVES

The main objectives of the dissertation are as follows-

1) To develop an experimental setup in order to simulate the conditions of a Brake.
2) To carry out experimental analysis of Brake Shoe for evaluation of stresses using strain gauges in working condition.
3) To investigate the stresses in Brake Shoe in finite element analysis in static condition using suitable analysis software.
4) To compare results of experimental and finite element analysis method.

VI. PROPOSED WORK

A. *Scope of Work*

In this detailed static analysis-displacement, maximum and minimum stresses analysis of Brake Shoe under static and radial loads will be done. The fixture will be designed to simulate actual working condition of Brake Shoe for experimental analysis. CAD models of the Brake Shoe will be designed using suitable modelling software and FEA will be carried out using suitable simulation software. The obtained results provided by experimental work and simulation software are compared to make the conclusion.

B. Methodology

In this dissertation work it is proposed to study the effect of stress, occurred due to load coming on the Brake Shoe from vehicle by using experimental technique and validate the results with finite element analysis

1) Phase I- Literature survey.

Literature survey will be carried out by referring journal like ASME journal, Springer link, European patents, US patents, etc. to study the recent developments in this field.

2) Phase II

a) Experimental Work

Carry out stress analysis by using strain gauge technique as follows:

1. To develop loading fixture for Brake Shoe.
2. To select proper strain gauge and test on UTM.
3. To evaluate stresses

b) Finite Element Analysis

1. To model brake shoe using suitable modelling software.
2. To import models in analysis software.
3. To carry out static structural analysis using suitable analysis software.

VII. EXPERIMENTAL SETUP

Experimental work require to apply force and measure the stress of the component. For this universal testing machine (UTM) and Strain gauge will be used.

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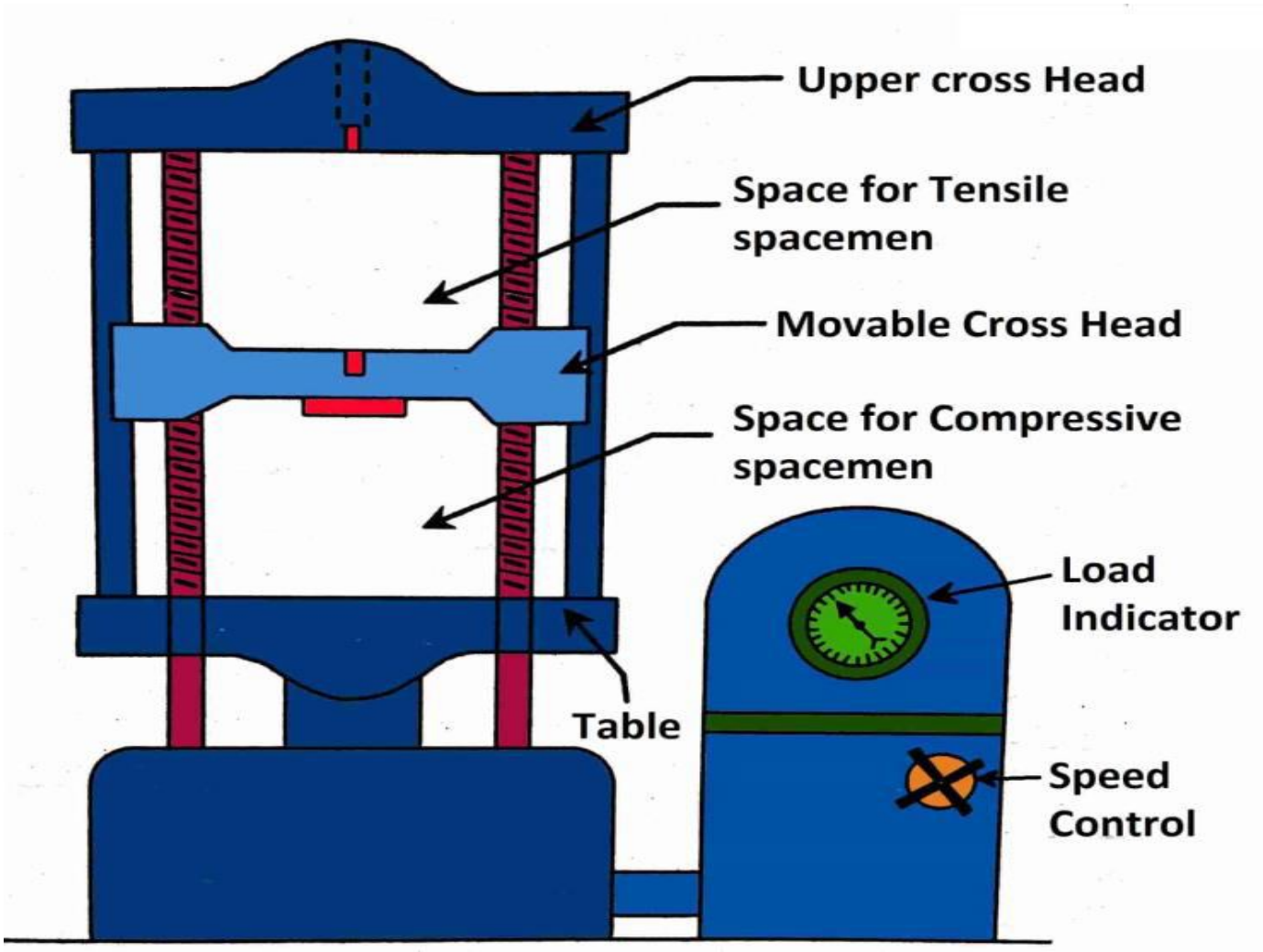


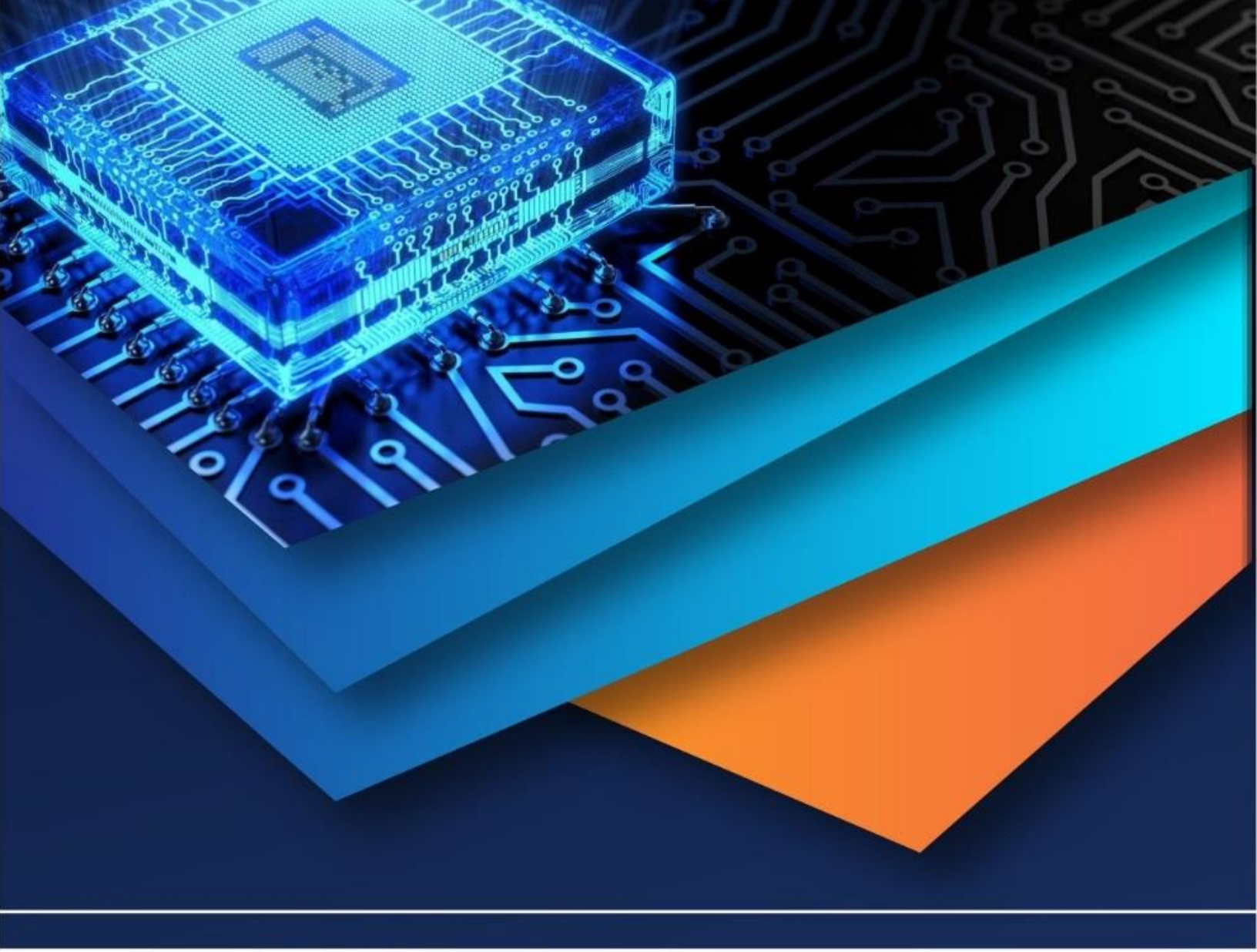
Figure- Universal Testing Machine (UTM)

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