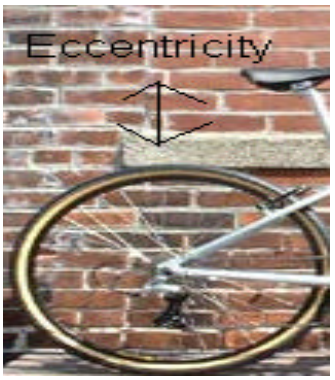
ABSTRACT

The primary aim of this project was to design a device that can be used as a bicycle wheel truer. The project system will allow a wheel's current state to be measured and analysed using strain gauges to detect the degree of wobble and eccentricity. The strain gauges will produce a small voltage as its means of detection, so an amplifier needs to be designed to boost the signal level for increased measurement resolution. The system also requires some means of holding the bicycle wheel securely while it is being tested. The test results from the system will provide information about the extent of the wobble and eccentricity that occur in the wheel.

INTRODUCTION

The wheel stability of a bicycle is very important for safety and comfort while riding it. For that reason, the project aim is to design a system that can test the stability of a bicycle wheel and assess how 'true' it is. This involves the measurement of the degree of eccentricity and wobble that characterize the wheel.



The directions to be sensed

For the purposes of testing the wheel, the project requires that a number of elements be designed. These are set out below.

1. Sensors to detect the degree of wobble and eccentricity of the wheel.

The wobble or eccentricity produced by the wheel usually originate over very small lengths of its circumference. Thus, the sensors required have to be able detect those small changes. Strain gauges were chosen because they have the capacity to measure very small changes in the length of a piece material, usually for the purpose of detecting stress in structures.

Figure 1 Strain gauge

The strain gauge consists of very fine wire or metallic foil arranged in a grid pattern. The grid pattern maximizes the amount of metallic wire or foil subject to strain in the parallel direction. In the application, strain gauges are glued to the side of a piece of metal or strain bar. When the strain bar is placed under stress, its resistance changes.

Figure2. Strain gauges use for eccentricity Strain gauges use for side wobbles

Attaching strain gauges to the strain bar can be applied in the case of the wheel to detect eccentricity and side wobble. For this purpose, they should be placed on the side and on the top of the wheel.

2. Device for the securing the bicycle wheel

A device will need to be built to secure and hold the wheel properly when conducting a test by placing the strain gauges in position. Bicycles have variable wheel sizes. The required device must be able to be placed on the bicycle frame and used on different sizes of wheels. Its design will involve advanced calculations and a particular machine will be needed to construct it. However, students do not have the facilities or skills to construct such a machine. The chosen design for the device must be simpler, but still able to accept different wheel sizes.

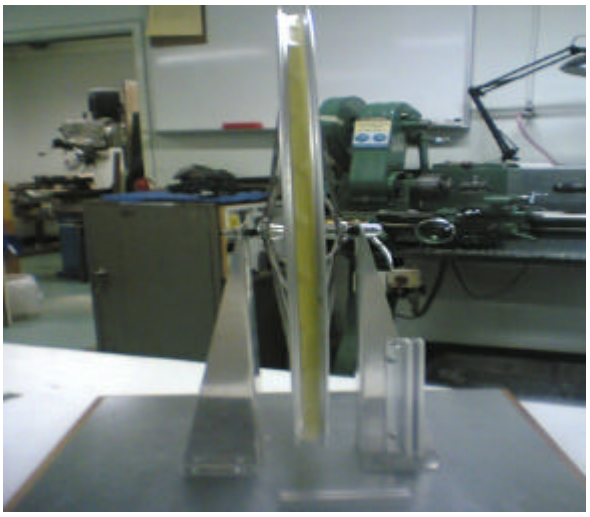


Figure 4. Device for holding the bicycle wheel

The picture in Figure 4 shows a bicycle wheel placed on towers made from aluminum. The device enables any size of wheel to be tested with strain gauges, which are placed on the towers and on the table.

THE DESIGN

2.1 Strain Gauge

2.1.1 Theory

'The constant demand for improvement in the design of machine and structural parts has led to the development of various experimental techniques for determining stress distributions. However, since stress cannot be measure directly, there is approach through some type of strain measurement' (Murray and Miller, 1992). A strain gauge is a sensor that can be installed so as to respond to this situation. It is used to sense bending, torque, force, pressure, or some other quantity related to strain (Murray and Miller, 1992).

In 1883, Lord Kelvin reported his observation that metallic conductors subjected to strain are characterized by a change in their electrical resistance. The use of strain gauges is based on this fact that the resistance of a conductor changes when the conductor is subjected to strain.