1.0 Abstract

2.0 Introduction

3.0 Theory

3.1 Gyroscopic Theory

A rotating body has a perpendicular vector quantity of angular momentum **L**, formed from the inertial and velocity components of the rotation.

CHANGE THIS Gyroscopic torques can be come prevalent in rotating bodies when the angular velocity is greater than the precession rate. This can be expressed in equation 1.

(1)

Resolving the forces in a planar system a factor is introduced to fully describe useable torque in the roll direction. So, for a single tracked vehicle like system, we can use equation 2, to describe the output forces from a rotating flywheel.

(2)

Where θ is the angle of the rotating body in reference to its precession.

3.2 System Model

3.3 Microcontrollers and Code

3.4 Circuits

* Two Circuits, measurement and controller

4.0 Methodology

4.1 Test Frame Design

For this investigation, code testing and system analysis was completed on a bespoke frame designed and built by Dr Phil Lightfoot.

The rectangular frame consists of two flywheel housing units mounted on bearings, whose orientation is controlled by two continuous servos. Each of these housings were built with two motors on either side of the flywheel cage, used to balance each unit as well as power the flywheels’ rotation. These motors are powered through the frame and the bearings, eliminating cable snag. Each housing can move independently to one another, however they are powered in opposite bias rotating one flywheel clockwise and the other counter clockwise. This intentionally results in the housings respectively moving in opposite directions to produce corrective torques, as well as countering any yaw toques produced; additionally better maintaining a consistent centre of mass for the bike. In the servo to housing gearing mechanism, a potentiometer has been introduced to provide information about the orientation of the housings. A dual layer of Perspex provides an area for the controllers and the electrical circuits, including an area for a Lithium-polymer battery to be securely mounted to the frame. The entire frame then can be mounted on a test frame with bearings as shown in figure **X**, or onto two wheels to better simulate a motorbike like system.

The safety frame is constructed from a skeletal cube frame work, with different height mounting points for the frame to rest in. The system was mounted up a few centimetres to produce a small destabilisation torques to test the system in. Clamps were used to better control the system.

Additionally, in figure **X** the flywheels shown are the lightweight, low moment of inertia testing flywheels. These were the ones used for the majority of the development phase of the project.

Insert Figures here.

Picture of the bike in the frame

4.2 Flywheel Design

4.3 Flywheel Angle

4.4 RPM measurement

4.5 Controller and code standards

4.6 Safety Precautions

5.0 Results

5.1 Moment of Inertia of the Flywheels

5.2 Zero Moment Frame Position

5.3 Raised Frame Position

5.4 Mounted Frame