**Acceleration Due to Gravity**

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Introduction

Acceleration due to gravity is the acceleration on an object caused by the force of gravitation. Its value is 9.81 m/s².

Objective & Research Question

The objective is to verify by experimentation that the acceleration due to gravity on Earth is, as said, 9.81 m/s². This will be done by using the pendulum and Hal sensor to measure the time more precisely

Research question:

What is the value of acceleration due to gravity?

Is the value of the acceleration due to gravity 9.81 m/s²?

Theory

Acceleration due to gravity is defined as the acceleration of a body due to the influence of the pull of gravity alone. Acceleration is a vector quantity and thus must possess both magnitude and direction. It is usually denoted by the letter “g” and will be during this experiment. The magnitude of acceleration due to gravity on earth is 9.81 m/s². The value can differ from the usual value depending on how close an object would be to the Earth’s core. The equation for the acceleration due to gravity is as follows: where G is the gravitational constant, m is the mass and r is the distance. The acceleration due to gravity will be measured using pendulum and Hal sensor (with magnet attached to the pendulum arm for more precise time measurements) for this experiment.

Pendulum

A simple pendulum consists of a mass (m) that is suspended by a pendulum arm of length (l) in which it is allowed to swing back and forth in place. With the pendulum swinging back and forth, it creates a periodic motion. A period is the time taken for a pendulum to complete one oscillation. Other quantities that can be used to describe the motion is the frequency of oscillations. The frequency of oscillations (f) is the number of oscillations that occur over time. Its equation is where f is the frequency of oscillation and T is the time taken for one oscillation. The equation to find the acceleration due to gravity for a simple pendulum is

* T is the time taken to complete one oscillation
* l is the length of the Pendulum
* g is the acceleration due to gravity

Hypothesis

The value calculated from the experiment with pendulum (acceleration due to gravity) should be 9.81 m/s².

Materials Needed

* Pendulum arm
* Pendulum stand
* A flat surface perpendicular to the ground, commonly known as “wall”
* Hal sensor
* Arduino
* Jumper wires
* USB cable
* Ruler
* Scales
* Permanent magnet

Variables

Independent variable: The length of the pendulum

Dependent Variable: The time taken for the pendulum to complete a period

Controlled Variable: mass of the bob, number of complete oscillations

Procedure

1. Attach permanent magnet to the pendulum arm and attach the pendulum arm to the pendulum stand.
2. Measure the pendulum arm since that will be your value for l.
3. Attach your Hal sensors as shown in Fig. 1.
4. Upload script to your Arduino and connect all the jumper wires as shown in Fig. 2.
5. Connect Arduino to power so that it starts the script.
6. Displace the pendulum arm from an angle and let it swing back and forth.

Results and Analysis

Bibliography