# MECHATRONICS BOOK SERIES SYSTEM DESIGN AND SIGNAL PROCESSING

## VOLUME 1

Editors
Asan G. A. Muthalif
Amir Akramin Shafie
Siti Fauziah Toha
Iskandar Al-Thani Mahmood

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# CHAPTER 12

## Design and Prototyping of Inertia Wheel

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### 12.1 Introduction

In dynamics and control theory, inverted pendulum is classic problem and is widely used as a benchmark to test control algorithm such as PID, fuzzy logic, neural network etc. Inverted pendulum is a pendulum which is upside down. A regular pendulum has it pivot above the mass, whereas inverted pendulum has its pivot below its mass. Inverted pendulum is inherently unstable. To make it constantly upright, outside force must be applied accordingly [6]. There are several ways of applying this force. The most common is using a cart-wheel to exert force as in Fig. 12.1:

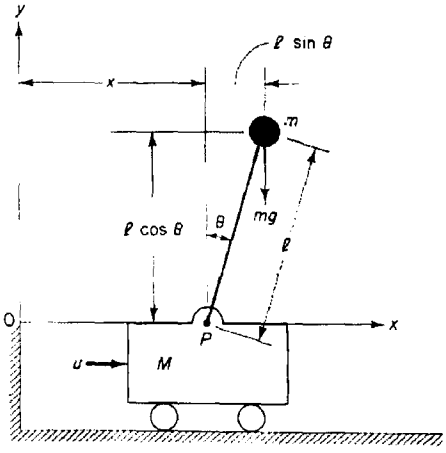


**Figure 12.1**. Cart Wheel Pendulum

The other method is that this project is all about is using reaction/inertia wheel. An inertia wheel is a type of flywheel to change the angular momentum of the body without using any other external force. The use of inertia wheel is common for a spacecraft and telescope to change direction.

Fig. 12.2 shows the free body diagram of an inverted pendulum [3,9] balanced by inertia wheel. The inertia is able to balance the inverted pendulum by using its inertia to exert force onto the pendulum.