MODELLING AND ANALYSIS FOR INVERTED PENDULUM

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ABSTRACT

This project is intended to solve a complex nonlinear control problem. The problem is to come up with an automatic means of controlling the back and forth movement of a cart in order to balance the inverted pendulum and guide the cart to the center of a tooth track in a vertical pole attached at its base to the cart.

From the practical, two experimental results are attached refer to Linear servo motor experiment which involved two controllers, PD and PID and Linear motion experiment by using full state feedback with and without integrator controller considering the four observable parameter of the inverted pendulum system referred to the optimal gain of K.

From the observation found PID more efficient to improve the stability and the transient response of the system than PD controller and the state feedback with integrator more accurate and speed up the response.

The key, is to give readers plenty of examples, each in sufficient detail so that the student can assimilate the information and use the accumulated experience of others to create his/her own applications.

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CHAPTER 1

1.0 INTRODUCTION

The pendulum is in a stable condition if the pole is held vertically but it is unstable if it falls down. Balancing an inverted pendulum mounted on the motor-driven cart has become a classical controller design problem. The design and practical implementation of a controller has been of much interest in process control and has been the subject of research in the past decade.

1.1 OBJECTIVE

The objective of this classical problem is to maintain a rod in the upright position as the cart to which it is hinged horizontally. The cart pole is a special form of inverted pendulum. The most often used version of the cart pole balancing problem is the one described by Barto et al [1]. The lower end of a pole mounted on a cart in such a way that the pole can only swing in vertical plane parallel to the direction of motion of the cart. To balance the pole the cart is pushed back and forth on a track of limited length. Balancing fails when the inclination of the pole exceeds preset limits, or when the cart hits the stops at the end of the track.

The aim is to find a controller that prevents the cart pole from falling. A more demanding version of the cart pole experiment requires the controller to balance the pole and bring the cart back to the center of the track. Even on a track of limited length avoiding failure