Final Year Project 2007-2008
Balance of Double Inverted Pendulum
over a Communication Channel
QL1-07
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Introduction

Inverted pendulum is a classic problem in dynamic system and control theorem research. It is widely used as benchmark for testing control algorithms. It is also called a cart and pole. There is an inverted metal rod and a cart in the pendulum system. The cart can move on the rail which is connected to a local computer. Both of the two rods are perpendicular to the cart surface when the system is balanced. When a force is applied to the rod, the cart will automatically move left and right to keep the rods and cart perpendicular, same as the initial balanced state. The whole system is controlled by a computer program called MATLAB.

Remote control systems are very popular and widely used nowadays and they are essential for many control systems. Controlling or tuning of machines can be very complicated and hazardous, so make these works online would be a safety solution. In this project, a remote control function was added in the double inverted pendulum system to balance to remotely.
Methodology

In our project, internet is adopted as our communication channel. Coding of the internet channel is essential. The remote control of inverted pendulum system is implemented according to the following block diagram.
The following graph shows simulation results of SIP by different controller design method.

Red line: simulation result of SIP using PID method (angle).
Cyan line: simulation result of SIP using PID method (position).
Pink line: simulation result of SIP using LQR algorithm (angle).
Yellow line: simulation result of SIP LQR algorithm (position).

The following graph shows simulation Result of Double Inverted Pendulum

Yellow line: $x(t)$
Pink line: $\theta_1(t)$
Cyan line: $\theta_2(t)$