Quanser Qube 2 – Report

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# Introduction

In the following chapters we’ll resume our work on the project of the Inverter Rotary Pendulum Quansar Cube 2 by explaining how did we approach to it, starting from the mechanical equations, to a state space model used in the simulations. An important aspect was the parameter estimation, including Frictions, Disturbances and others.

Once an good model was found we could go trough different control scheme, based on output feedback and state feedback.

# Model Identification

In this section we will compute the equations of motion of the system, starting from the mechanical part and then adding the DC motor effects.

## Dynamical Model

A simplified representation of the QUBE-Servo 2 is shown below, along with some necessary notation :

* Θ : Motor angle (Positive clockwise)
* Φ : Pendulum angle (Positive counterclockwise and null for the pendulum pointing
* Jr : Rod moment of inertia with respect to its rotation axis
* Lr : Rod Lenght
* Jp : Pendulum moment of inertia with respect to its centre of mass
* Lp : Pendulum lenght
* lp : Distance of the pendulum centre of mass from the rotating axis
* mp : Pendulum mass

IMAGE

With “rod” we indicate the element of the QUBE-Servo rigidly connected to the motor shaft that holds the pendulum. The Position of the origin of the fixed reference frame and its axes orientation are shown in the drawing above.

According to Lagrange method, the equations of motion of the system can be written as

## Inertia

## DC Motor

## Equations

This section gives some examples of writing mathematical equations in your thesis.

Maxwell’s equations read:

|  |  |  |
| --- | --- | --- |
|  |  | (1.1a) |
| (1.1b) |
| (1.1c) |
| (1.1d) |

The equations must be labeled and cited in the text, such as Equation (1.1a), Equation (1.1b), Equation (1.1c) and Equation (1.1d) need to be cited in the text. To automatically name the equations and to cite them use “*References, Insert Caption and Cross Reference*”.

The following Equations (1.2), (1.3), (1.4) and (1.5) show the same equation as before, with multiple global references rather than sub-references and without brace:

|  |  |  |
| --- | --- | --- |
|  |  | (1.2) |
|  | (1.3) |
|  | (1.4) |
|  | (1.5) |

Equation (1.6) is the same as before, but with just one label:

|  |  |  |
| --- | --- | --- |
|  |  | (1.6) |

# Parameters Estimation

# Controllers and state estimation

## Stabilization

## Swing-up

# Validation

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