

ENEL403 State-space design for an inverted pendulum and 3 cart controller

Lab Report

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15th May, 2017

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1 Abstract

2 Introduction

3 Method

Inverted Pendulum Controller

The inverted pendulum system was modeled in matlab using *ss()* function. To confirm that the system is currently unstable, the poles of matrix A are found by using the *eig(A)* function in MatLab. To stabilize the system, feedback was introduced. For this to be possible all four states must be controllable, which was found by using the *ctrb()* and *rank()* functions.

After the system has been verified unstable and fully controllable, the controller can now be designed. The first method used was linear quadratic regulation to determine the state feedback control gain matrix K . The matlab function *lqr* was used which parameters change the relative importance of the controller effort and error. The simplest Q and R are chosen to find the first set of gains :

$$Q = C' * C$$

$$R = 1$$

$$K = \text{lqr}(A, B1, C1, D1l)$$

4 Results

5 Discussion

6 Conclusion

7 References