MAE 200 Final project

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Step 1

Step 2

Step 3

Step 4: State Estimation based on α-horizon

I began with constructing my model of my system based on the linearized model around equation 22.34 of Numerical Renaissance. This resulted in the following code:

```
E = [
    mc+m1+m2  -m1*l1        -m2*l1;
    -m1*l1    I1+m1*l1^2      0   ;
    -m2*l2     0            (I2 + m2*l2^2);
];

E = [
    eye(3) zeros(3)
    zeros(3) E
];

A_bar = [
    0    0       0
    0 m1*g*l2    0
    0    0       m2*g*l2
];

A_bar = [
    zeros(3)  eye(3)
    A_bar zeros(3)
];

B_bar = [
    0
    0
    0
    1
    0
    0
];
```

Since E is invertible around $\vec{q} = \vec{0}$, we can solve for the A and B matrices from the standard form,

$$\dot{q} = Aq + Bu,$$

by inverting the E matrix. Thus, we create the following code

1

```
A = inv(E)*A_bar;
B = inv(E)*B_bar;

C = eye(3, 6);
D = 0;

sys = ss(A,B,C,D);
```

Step 5