Acrobot Partial Feedback Linearization

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0.0/10.0 points (graded)

If, on the previous problem, you did not try simulating your LQR controller from initial states far away from the upright, try it now. It doesn't work so well, does it?

As the next step to developing a swing-up controller, we will use partial feedback linearization to regulate the elbow joint, q_2. Recall the manipulator equations:

$$\ddot{q} = H^{-1}\left(Bu - C\right)$$

Note that C is a vector here. If this form of the manipulator equation looks unfamiliar, you can just pre-multiply both sides by H and rearrange the terms to get back to the form we saw in lecture.

For some desired value y, use partial feedback linearization to determine u such that $\ddot{q}_2 = y$.

For the acrobot, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. Writing $C = \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}$ and $H^{-1} = \begin{bmatrix} a_1 & a_2 \\ a_2 & a_3 \end{bmatrix}$, find u in terms of y, C_1, C_2, a_1, a_2 and a_3.

u=

Answer: y/a_3 + C_2 + a_2/a_3*C_1

Explanation

Substitute in $\ddot{q}_2 = y$ and examine the second row of the dynamics:

$$\ddot{q}_2 = y = a_3 u - a_2 C_1 - a_3 C_2$$
$$u = \frac{1}{a_3}(a_2 C_1 + a_3 C_2 + y)$$
$$u = \frac{1}{a_3}(a_2 C_1 + y) + C_2$$

Did you use collocated or non-collocated partial feedback linearization for this problem?

- collocated ✔
- non-collocated

Submit You have used 0 of 1 attempt

Answers are displayed within the problem