ECE 489 Robotics Dynamics and Control

Homework # 4

Due Date: 02/29/2007

The first two problems are from the textbook. If you have the preliminary paperback version, please check to make sure you are doing the correct problems.

1. Problem 8-3
2. Problem 8-12
3. Using the two-link robot model from Lab # 2, suppose the inertia parameters are known only within the following ranges

$$\begin{aligned} 1 \leq m_1 \leq 3 \qquad & 1 \leq m_2 \leq 10 \\ 0.4 \leq I_1 \leq 0.8 \qquad & 0.2 \leq I_2 \leq 0.8 \end{aligned}$$

The larger uncertainty on m_2 and I_2 may represent, for example, an unknown load carried by the robot, which could be modeled as part of link 2.

(a) Choose a nominal passivity based control of the form

$$\tau = \hat{M}a + \hat{C}v - Kr = Y(\Theta_0 + u)$$

and estimate a bound ρ on the uncertainty, i.e. find Θ_0 and ρ satisfying

$$||\Theta_0 - \Theta|| \leq \rho$$

You need not design the gains K, and Λ in the controller.
Note: You might find it useful to look up reference [123] from the text.