Homework #2

1 Problem 1

Use Matlab/Simulink to simulate the following system

$$\dot{x} = -ax^3 - b\sin(t) + u$$

$$e = x_d - x$$

$$x_d = \sin(t)$$

a) EMK Controller:

$$u = \left[\dot{x}_d + ax^3 + b\sin(t)\right] + ke$$

adjust the control gain k to make the tracking error go to zero, and then plot the figure of tracking error e and control input u.

b) Adaptive Controller:

$$\begin{aligned} u &= \left[\dot{x}_d + \hat{a}x^3 + \hat{b}\sin(t)\right] + ke \\ \dot{\hat{a}} &= \Gamma_1 e x^3 \\ \dot{\hat{b}} &= \Gamma_2 e \sin(t) \end{aligned}$$

adjust the control gain k, parameter update gains Γ_1 and Γ_2 to make the tracking error go to zero, and then plot the figure of tracking error e, parameters estimation $\hat{a}$, $\hat{b}$ and control input u.

2 Due Date

March 15, 2004