

ENME808B: APPLIED NONLINEAR CONTROLS

Homework #09

(Due November 12, 2018)

1. [Example 8.1] Consider the simple system

$$m\ddot{x} = u$$

where m is an unknown parameter. An adaptive control law for this system is given by:

$$u = \hat{m}(\ddot{x}_m - 2\lambda\dot{\tilde{x}} - \lambda^2\tilde{x}), \quad \dot{\hat{m}} = -\gamma v s$$

where $\gamma > 0$, $v = \ddot{x}_m - 2\lambda\dot{\tilde{x}} - \lambda^2\tilde{x}$, $s = \dot{\tilde{x}} + \lambda\tilde{x}$, and x_m is the ideal response as the output of the following reference model:

$$\ddot{x}_m + \lambda_1\dot{x}_m + \lambda_2x_m = \lambda_2r(t)$$

where $\lambda_1, \lambda_2 > 0$.

For the sake of simulation, let $m = 2$.

- (1) Simulate the adaptive control system when $r(t) = 0$ and $x(0) = 0.5$.
- (2) Simulate the adaptive control system when $r(t) = \sin 4t$ and $x(0) = 0$.