Homework #4

1 Problem Statement

For the dynamic system

$$m(x,\theta)\ddot{x} = f(x,\dot{x},t,\theta) + u \tag{1}$$

where $u \in \Re^1$ is the control input into the system, $m(x,\theta)$, $f(x,\dot{x},t,\theta) \in \Re^1$ denote auxiliary functions with $\theta \in \Re^n$ being unknown constant system parameters. Design the following required controllers for the system (1) and simulate for the obtained closed-loop systems to demonstrate the efficacy of the proposed controllers. Make whatever reasonable assumptions you need to fulfill your controllers.

- Design an adaptive controller to drive $x(t)$ to zero;
- Design a sliding mode controller to drive $x(t)$ to zero;
- Design robust controllers including both a high-gain feedback controller and a high-frequency feedback controller to drive $x(t)$ to zero.

Write your control design/analysis and simulation results into a report. For each controller, you need to include controller design, closed-loop system development, stability analysis, and simulation results in the report. Some concluding remarks are required to compare the performance of the aforementioned controllers.

2 Due Date

April 19, 2004.