

ME 449 Robotic Manipulation  
Spring 2014  
Problem Set 4  
Due Wednesday May 21 at beginning of class

1. Chapter 9 exercise 1.
2. Chapter 9 exercise 2.
3. Chapter 9 exercise 21.
4. Chapter 9 exercise 22.
5. Chapter 9 exercise 23.
6. Chapter 9 exercise 25. Plot the motion cones at grid points spaced every 0.2 in the  $s$  direction (from 0 to 1) and every 0.2 (s parameter units)/s in the  $\dot{s}$  direction (from 0 to 1). The maximum torque at joint 1 is 2 Nm and at joint 2 is 1 Nm. The damping coefficient  $b$  at each joint is zero. Gravity is zero (horizontal plane). The length of link 1  $L_1$  is 1 m and link 2  $L_2$  is 0.5 m, and the point masses  $m_1$  and  $m_2$  at the end of each link are 1 kg and 0.5 kg, respectively. Turn in your analysis, your plot, and your commented, clearly structured code. (Ease of understanding your code will be part of the evaluation!)

**Preview: These exercises will be part of the next assignment: Chapter 10 exercises 1, 2, 3, 4, 7, 8, 9, 10, 11.**