

ECE 551, Spring 2008
Homework 1
Due: April 4, 2008

- (1) Text, P2.3
- (2) For the armature-controlled DC motor in class find the transfer function from v_a to θ (that is, view v_a as an input and θ as the output). Assume zero initial conditions.
- (3) For the quarter-car example in class (with linear spring model and zero initial conditions at rest with $u=0$) let $m=1$, $k=2$, and $b=2$. Let u be a unit step force input.
 - (a) Use Matlab to simulate the quarter-car to determine how this force will influence the vertical position of the car (i.e., using Matlab simulate to find $x(t)$).
 - (b) Suppose that the mass of the car increases due to the addition of passengers and cargo so that $m=1.25$. Repeat (a). Explain the influence of mass increases on vertical vehicle dynamics. Use intuition and the simulations in your explanation.
 - (c) Suppose that the mass of the car changes (we take passengers and cargo out of the car) so that $m=0.75$. Repeat (a). Explain the influence of mass decreases on vertical vehicle dynamics. Use intuition and the simulations in your explanation.