

## ME 352: Dynamics of Physical Systems and Electric Circuits

## Problem Set No. 7

Due Monday, March 26, 2001

## Reading :

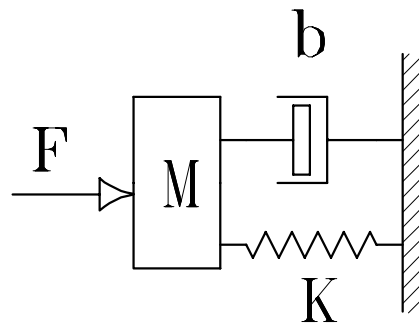
Rowell and Wormley, Appendix B, pp. 205-229, pp. 233-236, pp. 244-269.

A Review of How to Solve Linear Ordinary Differential Equations with Constant Coefficients

Reminder: The following material has been assigned previously: pp. 169-187 and Appendix A.

## Problems:

Problem 1: The translational mechanical system consisting of a spring, a mass, and a damper from Problem 1 of Problem Set No. 6 is shown in the schematic below.



The system is at rest and relaxed for  $t < 0$ . The input to the system is a step change in force of  $F = 10$  applied at time  $t = 0$ . Use Mathematica or Mathcad to solve the state equations and plot the velocity of the mass and the force in the spring for the following data, where  $t_{\text{end}}$  is the duration of the simulation:

$t_{\text{end}}$	$m$	$k$	$b$
10	1	1	1
20	2	1	1
10	1	10	1
10	1	1	2

Along with each plot, solve the characteristic equation of this system for each set of parameters. Is there a correlation between the roots of the characteristic equation and the nature of the response?

Rowell and Wormley: Problems 7.2, 7.7, 7.8, 7.11, 8.2, 8.19.