

ME 4189 Spring 2016  
Homework assignment #3  
Due on Tuesday 02/23/2016

**Make sure to read all the instructions listed on this document! Do not forget to plot the responses in Pb. 4.8 and Pb. 4.36. Make sure to write the units of your results.**

Learning objectives

Please study your class notes and the corresponding sections of the textbook before completing the assignment. After completing this assignment, you should be able to:

- Use Fourier series to analyze the steady state response of periodic forcing
- Determine the unit impulse response of a viscously damped system
- Use the convolution integral to determine the response of a viscously damped system to an arbitrary force

Solve the following problems of the textbook:

- 4.8: For this problem
  1. Determine the complex Fourier coefficients  $Y_j$ ,  $j=-\infty, \dots, +\infty$ , for  $y(t)$
  2. Derive the equation of motion for the system
  3. Determine the complex Fourier coefficients,  $X_j$ ,  $j=-\infty, \dots, +\infty$ , for the steady-state response  $x(t)$
  4. For  $k=1$  N/m,  $c=0.1$  Ns/m,  $M=1$  kg,  $Y=0.001$  m and  $\tau=0.5$  s, plot the steady-state response  $x(t)$  as a function of time (by truncating to a finite sum the infinite Fourier series of  $x(t)$ )
- 4.36. Solve the problem. Plot the response for each case (choose numerical values for the parameters), highlighting the key parameters (as done in class for the underdamped case)
- 4.17

For each problem, you need to show your work and circle your final answer. Please staple your homework.