Quiz 2 -- 2.087 Fall 2014

Quiz 2 will take place as individually scheduled oral exams throughout the week of 6 OCT.

You should budget 30 minutes to complete the quiz (even though I'm targeting 20 minutes for the duration). Quiz 2 will cover the material of Chapter 2 and 3 in Strang's Differential Equations and Linear Algebra, especially topic addressed in the lectures on 15, 17, 22, 24, and 29 SEP and especially concepts you practiced on Homework #2 and #3.

In Quiz 2 you are permitted to use a computer and you are allowed to implement and run MATLAB$^{®}$ code in the quiz to find solutions. You can run other applications as you see fit such as Mathematica. The quiz is intended to be completely "software neutral". You will NOT NEED to interpret MATLAB code or write code, but you can do so if it is helpful for solving a problem.

The quiz is open-book: you may refer to the textbook, to any class materials, to old solutions from past semesters, and to your own notes. In fact, you can refer to any material whatsoever, but you may not communicate with anyone except with the person administering the exam.

_____

The following topics are "fair game" as subject matter for quiz 2.

Finding solutions for second order equations – both null (homogeneous) and particular solutions including initial value problems and especially emphasizing the following source functions:
constant source,
polynomial source,
unit step function (Heaviside),
delta function (Dirac),
exponential function
sine and cosine

The impulse response and the convolution integral as a means to find the system response to other source functions.

Finding solutions for systems of first order equations – both null (homogeneous) and particular solutions including initial value problems. Eigenvalues and eigenvectors.

Formulating differential equations from descriptions of physical systems in general and especially for systems of masses, springs, and dampers, RLC circuits, predator-prey models, simple heat transfer, and simple fluid systems.

Understanding the behaviors of non-linear differential equations and systems of non-linear differential equations. Direction fields. Phase portraits. Euler's method. Finding critical points. Assessing stability of critical points. Sinks, circles, spirals, and saddles.

Material from quiz 1 is also fair game, especially:
Categorizing linear versus non-linear equations.
What does superposition enable you to infer about solutions to linear differential equations?
What is stability? The difference between equilibrium and stability.
Differentiation and integration of Heaviside step functions and Dirac delta functions.
Representing piecewise functions using Heaviside step functions and Dirac delta functions.

2.087 Engineering Math: Differential Equations and Linear Algebra
Fall 2014