Math 246, Professor David Levermore
Group Work Questions for Discussion
Monday, 26 March 2018

First Set of Group Work Problems [4]

These problems are based upon Problem 4 of Exam 2. It considered a linear ordinary differential operator L with constant coefficients such that all of the roots of its characteristic polynomial (listed with their multiplicities) are $-3+i4$, $-3+i4$, $-3-i4$, $-3-i4$, -2, -2, -2, 0, 0. Assume that L is in normal form.

(1) Give its characteristic polynomial $p(z)$. (Leave it in factored form!)
(2) Give L. (Leave it in factored form!)
(3) Consider the nonhomogeneous equation $\mathrm{L}w = t^2e^{-2t}$. Give the form of the particular solution used by the method of Undetermined Coefficients. (Do not carry out the method!)
(4) Consider the nonhomogeneous equation $\mathrm{L}w = t^2e^{-2t}$. Which derivatives of the Key Identity need to be evaluated at the characteristic by the method of Key Identity Evaluations? (Do not carry out the method!)

Second Set of Group Work Problems [6]

These problems are based upon Problem 11 of Exam 2. It considered that the vertical displacement of a spring-mass system is governed by the equation

$$\ddot{h} + 14\dot{h} + 625h = a\cos(\omega t - \phi)\,,$$

where $a > 0$, $\omega > 0$, and $0 \leq \phi < 2\pi$. It assumed CGS units.

(1) Give the damping rate of the system.
(2) Give the steady-state solution in its amplitude-phase form starting from its phasor form.
(3) Give the phase shift of the steady-state solution.
(4) Give the transient solution associated with the initial conditions $h(0) = \dot{h}(0) = 0$.
(5) Give the Green function $g(t)$ associated with the equation.
(6) Use the Green formula to express the solution of this equation that satisfies the initial conditions $h(0) = \dot{h}(0) = 0$. (Do not evaluate the definite integrals that arise.)