Undetermined Coefficients, Part II

For problems 1 and 2 use undetermined coefficient to determine the solution to the given differential equation.

1. $y'' + 8y' + 20y = 5 + 4\cos(2t) - 8\sin(2t)$

2. $3y'' + 7y' = 9 - \mathbf{e}^{-t} - 14t$

3. Solve the following IVP using undetermined coefficients.

$$y'' + 2y' - 8y = 20\mathbf{e}^{t} - 90t\mathbf{e}^{2t} \qquad y(0) = 0, \;\; y'(0) = -2$$

For problems 4 & 5 determine the best guess for the particular solution for the differential equation. Do not attempt to find the actual particular solution.

4. $y'' - 12y' + 37y = \mathbf{e}^{6t} - (1 + 3t^4)\mathbf{e}^{6t} - 3\mathbf{e}^{6t}\sin(t)$

5. $y'' + 24y' + 144y = t\sin(4t) - \cos(4t) + t^2\mathbf{e}^{-12t}$

Variation of Parameters

6. Use variation of parameters to find the solution to the following differential equation.

$$4y'' + 4y' + 17y = 12\mathbf{e}^{-\frac{1}{2}t}$$

7. Solve the following IVP using variation of parameters.

$$2y'' + 7y' - 4y = 4 + 3\mathbf{e}^{2t}, \qquad y(0) = -2 \quad y'(0) = 1$$

Vibrations

For problems 8 – 11 if you use decimals in your answers use a minimum of four decimal places for all numbers. Also if the solution contains both a sine and a cosine it should be reduced to a single cosine.

8. A ¼ lb object will stretch a spring 6 inches by itself. If there is no damping in the system and the mass is initially displaced 1 inch upward from the equilibrium point and given an initial velocity of 5 in/sec upward determine the displacement, $u(t)$.

9. A 60 gram mass will stretch a spring 1 cm by itself and a damper is hooked up to the system and will exert a force of 0.75 N when the velocity is 6.25 cm/s. The mass is initially displaced 10 cm downward from the equilibrium point and released with initial velocity of 8 cm/sec upward. Determine the displacement, $u(t)$, at any time *t*.

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10. Take the system from #8 and hook up a forcing function of the form $F(t) = \mathbf{e}^{-4t} - \sin t$ to it. Determine the displacement, $u(t)$, at any time *t*. Does the system experience resonance?

11. Take the system from #9 and hook a forcing function of the form $F(t) = 7\cos(2t)$ to it. Determine the displacement, $u(t)$, at any time *t*.