Indian Institute of Technology Delhi - Abu Dhabi

AMTL101

Tutorial Sheet 9: Applications to Second Order ODEs and Higher Order ODEs

(1) Model the RC-circuit and LC-circuit. Also, find the current $I(t)$ in each of the circuits for constant voltage supply.

(2) Consider the mass-spring system with $m = 1$ kg, $c = 4$ kg/sec, $k = 24$ kg/sec^2 and $F(t) = 10\cos(\omega t)$ Newton. Determine ω such that you get the steady-state vibration of maximum possible amplitude. Determine this amplitude. Then find the general solution with this ω and check whether the results are in agreement.

(3) Solve the following ODEs:
   (a) $y''' + 25y' = 0$
   (b) $y^{(4)} + 2y'' + y = 0$
   (c) $y^{(4)} + 10y'' + 9y = 0$

(4) Solve the following initial value problems:
   (a) $y^{(4)} + 4y = 0,\ y(0) = 1/2,\ y'(0) = -3/2,\ y''(0) = 5/2,\ y'''(0) = -7/2$
   (b) $y^{(4)} - 9y'' - 400y = 0,\ y(0) = 0,\ y'(0) = 0,\ y''(0) = 41,\ y'''(0) = 0$

(5) Solve the following ODEs:
   (a) $y''' + 3y'' + 3y' + y = e^x - x - 1$
   (b) $y''' + 2y'' - y' - 2y = 1 - 4x^3$
   (c) $y''' + 4y' = \sin x$
   (d) $y''' + 4y' = \sin 2x$

(6) Use the variation of parameters method to solve the following equations:

$$x^3y''' + x^2y'' - 2xy' + 2y = x^3 \ln x$$