

Sheet 1

Solution of the vibration equation

1. Find and plot the solution of each of the following second-order differential equations
 - a. $\ddot{x} + 9x = 0$.
 - b. $5\ddot{x} + 16x = 0$.
 - c. $\ddot{x} - 9x = 0$.
 - d. $2\ddot{x} + 3\dot{x} + 7x = 0$.
 - e. $2\ddot{x} - 3\dot{x} + 7x = 0$.
 - f. $2\ddot{x} - 3\dot{x} - 7x = 0$.
 2. Find and plot the time response of each of the following second-order differential equations
 - a. $3\ddot{x} + 25x = 5 \sin 2t$, $x_o = 2, v_o = 0$.
 - b. $3\ddot{x} + 25x = 5$, $x_o = 2, v_o = 0$.
 3. Discuss the stability of the dynamic systems whose differential equation is given in problems 1 and 2.
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Matlab Problems

4. Plot the time response of each of the following second-order differential equations by using Matlab
 - a. $\ddot{x} + 9x = 6e^t$, $x_o = 1, v_o = 1$.
 - b. $\ddot{x} + 16x = 10 + 3e^t$, $x_o = 0, v_o = 1$.
 - c. $3\ddot{x} + 25x = t^2e^t + t$, $x_o = 1, v_o = 0$.
 - d. $2\ddot{x} + 3\dot{x} + 2x = 10t(1 + \sin 2t)$, $x_o = 1, v_o = 0$.
 - e. $\ddot{x} - 2\dot{x} + 5x = e^{3t}(1 - t \sin 3t)$, $x_o = 1, v_o = 2$.
 - f. $2\ddot{x} + 15\dot{x} + 6x = 3e^{-2t} + te^{3t}$, $x_o = 1, v_o = 4$.
5. Discuss the stability of the dynamic systems whose differential equation is given in problems 3.

Hint

1. Use Matlab "Sheet_1_general_final" Program to solve Problem 1.
2. Use Matlab "RK_1_mass_Final" Program to solve Problem 2,4.