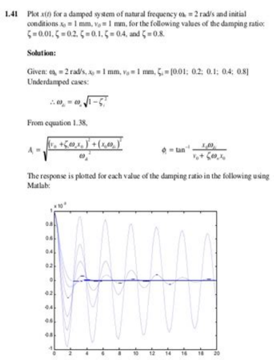

**1.41** Plot $x(t)$ for a damped system of natural frequency $\omega_n = 2$ rad/s and initial conditions $x_0 = 1$ mm, $v_0 = 1$ mm, for the following values of the damping ratio: $\zeta = 0.01, \zeta = 0.2, \zeta = 0.1, \zeta = 0.4$, and $\zeta = 0.8$.

**Solution:**

Given: $\omega_n = 2$ rad/s, $x_0 = 1$ mm, $v_0 = 1$ mm, $\zeta_i = [0.01;\ 0.2;\ 0.1;\ 0.4;\ 0.8]$
Underdamped cases:

$$\therefore \omega_{di} = \omega_n \sqrt{1-\zeta_i^2}$$

From equation 1.38,

$$A_i = \sqrt{\frac{(v_0 + \zeta_i \omega_n x_0)^2 + (x_0 \omega_{di})^2}{\omega_{di}^2}} \qquad \phi_i = \tan^{-1} \frac{x_0 \omega_{di}}{v_0 + \zeta_i \omega_n x_0}$$

The response is plotted for each value of the damping ratio in the following using Matlab: