A triangular pulse force as shown in Fig. 6.7 is usually employed to simulate a blast. The load F_0 is instantly applied to the structure and decreased linearly over the time duration t_1.

Phase I

$$m\ddot{x} + kx = F_0\left(1 - \frac{t}{t_1}\right) \tag{6.25a}$$

$$\ddot{x} + \omega_n^2 x = \frac{F_0}{m}\left(1 - \frac{t}{t_1}\right) \tag{6.25b}$$

$$x = x_c + x_p \tag{6.25c}$$

$$= A\sin(\omega_n t) + B\cos(\omega_n t) + \frac{F_0}{k}\left(1 - \frac{t}{t_1}\right) \quad 0 \le t \le t_1 \tag{6.25d}$$

$$\dot{x} = \omega_n A\cos(\omega_n t) - \omega_n B\sin(\omega_n t) - \frac{F_0}{k t_1} \tag{6.25e}$$

With zero initial conditions, Substituting $t = 0$ and solving we get

$$B = -\frac{F_0}{k}; \quad A = \frac{F_0}{k\,\omega_n\, t_1} \tag{6.26}$$

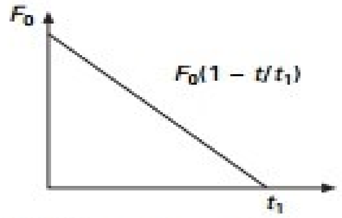
Substituting A and B in Eq. 6.25d we get

$$x = \frac{F_0}{k}\left[\frac{\sin(\omega_n t)}{\omega_n t_1} - \cos(\omega_n t) - \frac{t}{t_1} + 1\right] \quad 0 \le t \le t_1 \tag{6.27a}$$

$$\dot{x} = \frac{F_0}{k}\left[\frac{\omega_n \cos(\omega_n t)}{\omega_n t_1} + \omega_n \sin(\omega_n t) - \frac{1}{t_1}\right] \quad 0 \le t \le t_1 \tag{6.27b}$$

At the end of phase I

$$x = \frac{F_0}{k}\left[\frac{\sin(\omega_n t_1)}{\omega_n t_1} - \cos(\omega_n t_1)\right] \tag{6.28a}$$



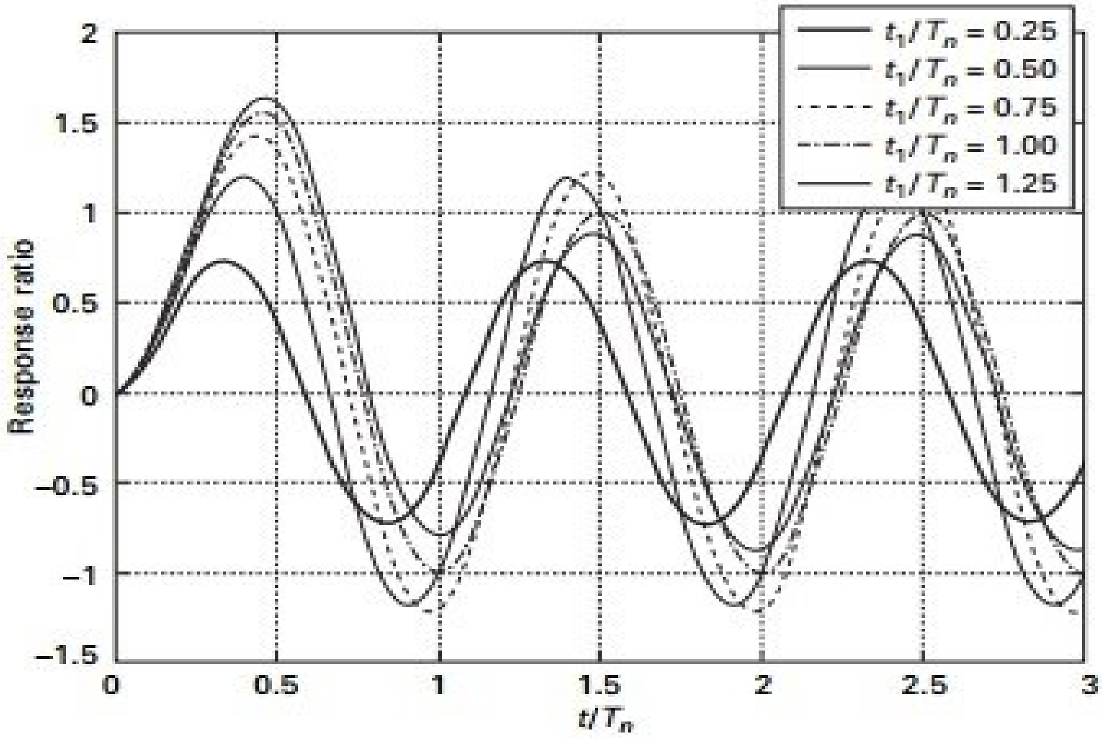
6.7 Triangular pulse.

$$\dot{x} = \frac{F_0}{k}\left[\frac{\cos(\omega_n t_1)}{t_1} + \omega_n \sin(\omega_n t_1) - \frac{1}{t_1}\right] \tag{6.28b}$$

Phase II

$$x = x(t_1)\cos[\omega_n (t - t_1)] + \frac{\dot{x}(t_1)}{\omega_n}\sin[\omega_n (t - t_1)] \quad t \ge t_1 \tag{6.29}$$

A plot of $R(t)$ versus t/T_n is presented in Fig. 6.8 for several values of t_1/T_n.



6.8 Reponse of undamped SDOF to triangular pulse.