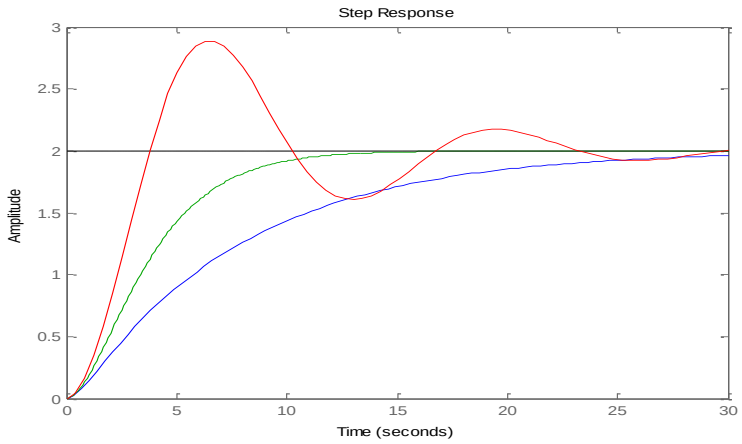
Second Order Systems

$$\tau^2 \frac{d^2y}{dt^2} + 2\zeta\tau\frac{dy}{dt} + y = Kf(t) \qquad G(s) = \frac{K}{\tau^2 s^2 + 2\zeta\tau s + 1}$$



Overdamped ($\zeta > 1$): Eqn. 5-48 / 5-49

Critically damped ($\zeta = 1$): Eqn. 5-50

Underdamped ($\zeta < 1$): Eqn. 5-51

(5-52)	$t_p = \frac{\pi\tau}{\sqrt{1-\zeta^2}}$		
(5-53	$OS = \exp\left(-\frac{\pi\zeta}{\sqrt{1-\zeta^2}}\right)$	$\zeta = \sqrt{\frac{\left[\ln(OS)^2\right]}{\pi^2 + \left[\ln(OS)^2\right]}}$	Above (5-56)
(5-54)	$DR = (OS)^2 = \exp\left(-\frac{2\pi\zeta}{\sqrt{1-\zeta^2}}\right)$		
(5-55)	$P = \frac{2\pi\tau}{\sqrt{1-\zeta^2}}$	$\tau = \frac{\sqrt{1-\zeta^2}}{2\pi}P$	Above (5-57)
(5-60)	$t_r = \frac{\tau}{\sqrt{1-\zeta^2}}\left(\pi - \cos^{-1}\zeta\right)$		