Second Order System Adjustment:

$G(s) = \frac{y}{u} = \frac{s+b}{s^2+a_1 s+a_0}$

$G_m(s) = \frac{y_m}{u_c} = \frac{s+b_m}{s^2+a_{1m} s+a_{0m}}$

Let the control law : $u(t) = t_0 u_c(t) - s_0 y(t)$

$y\ \frac{s^2+a_1 s+a_0}{s+b} = t_0 u_c - s_0 y \ \Rightarrow\ \frac{y}{u_c} = \frac{t_0 s+b t_0}{s^2+(a_1+s_0)s+a_0+b s_0}$

$e = y - y_m$

$\frac{\partial e}{\partial t_0} = \frac{s+b}{s^2+(a_1+s_0)s+a_0+b s_0}\ u_c \approx G_m(s) u_c$

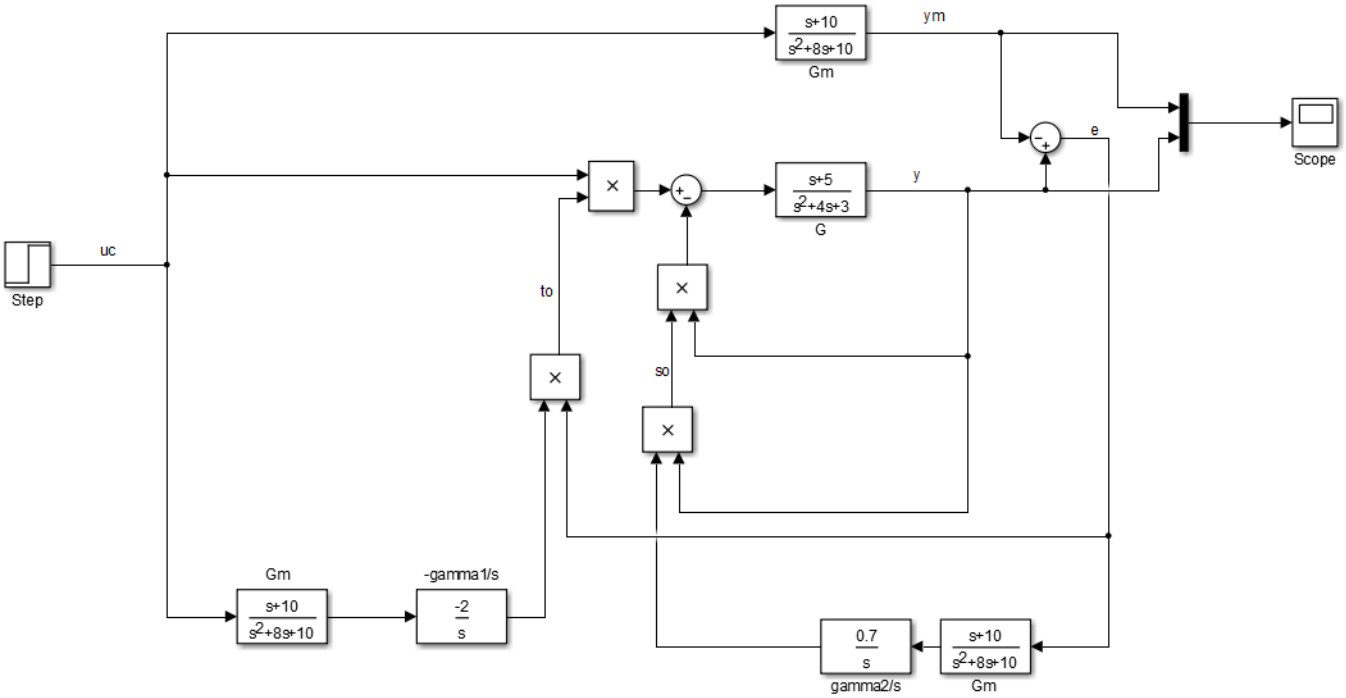
$\frac{\partial e}{\partial s_0} = \frac{-t_0(s+b)(s+b)}{[s^2+(a_1+s_0)s+a_0+b s_0]^2}\ u_c = \frac{-(s+b)}{s^2+(a_1+s_0)s+a_0+b s_0}\ y = \frac{-y^2}{t_0 u_c}$

$\frac{d\theta}{dt} = -\gamma \frac{\partial e}{\partial \theta} e$

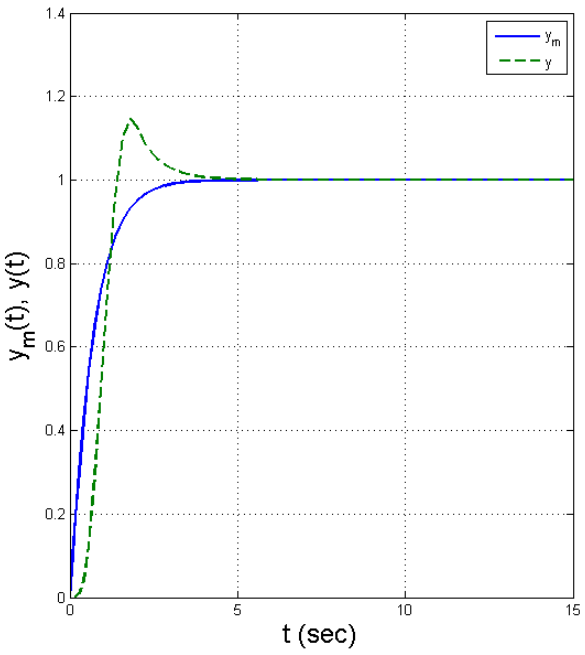
$\frac{dt_0}{dt} = -\gamma_1 G_m u_c e$

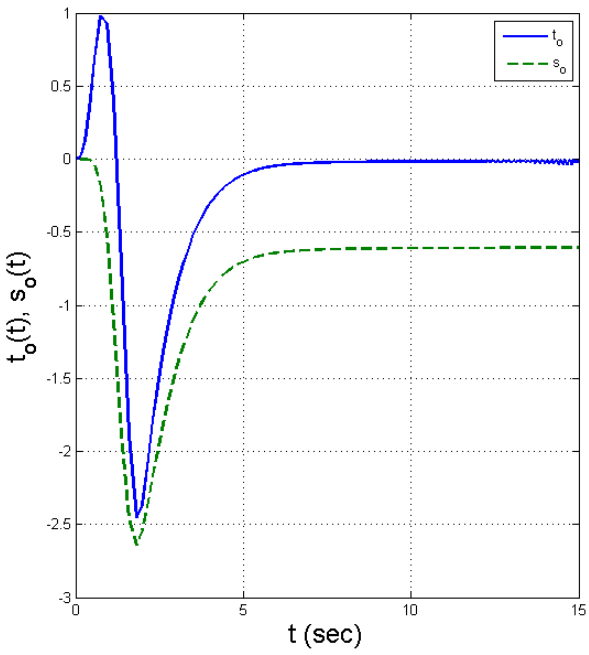
$\frac{ds_0}{dt} = \gamma_2 \frac{y^2}{t_0 u_c} e = \gamma G_m y e$

Let : $G(s) = \frac{s+5}{s^2+4s+3}$ $(stable)$, $G_m(s) = \frac{s+10}{s^2+8s+10}$

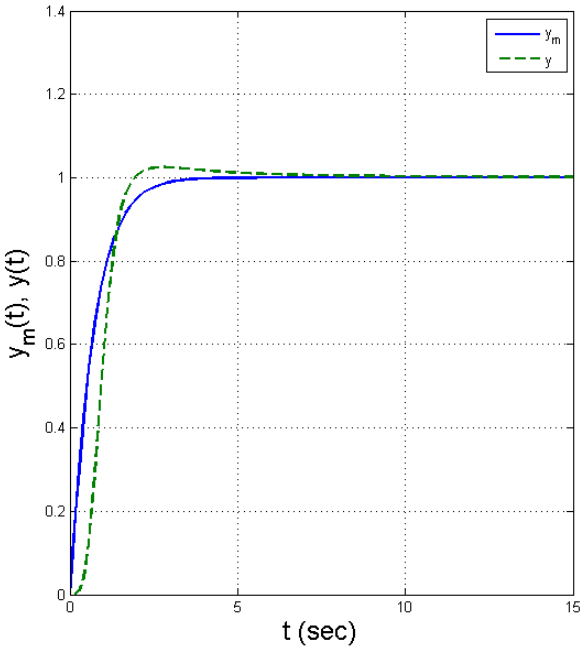


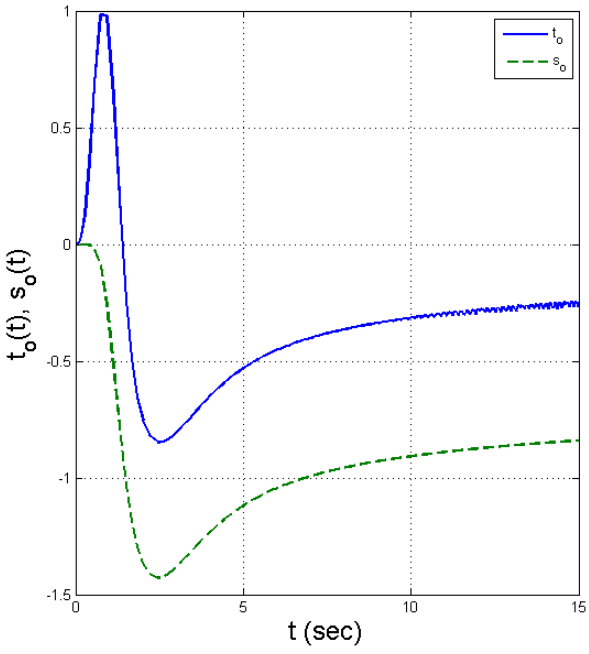
At $\gamma_1 = \gamma_2 = 10$



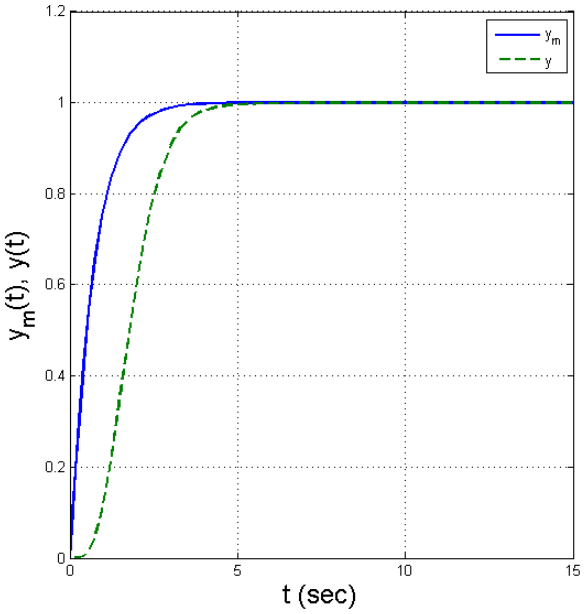


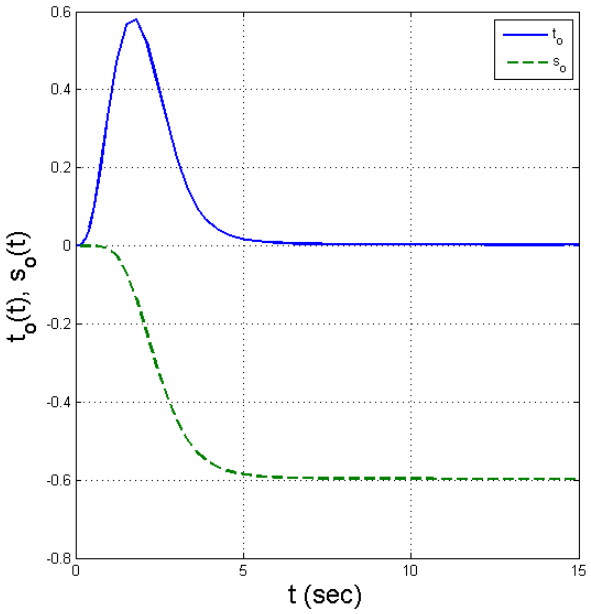
At $\gamma_1 = 10, \quad \gamma_2 = 5$



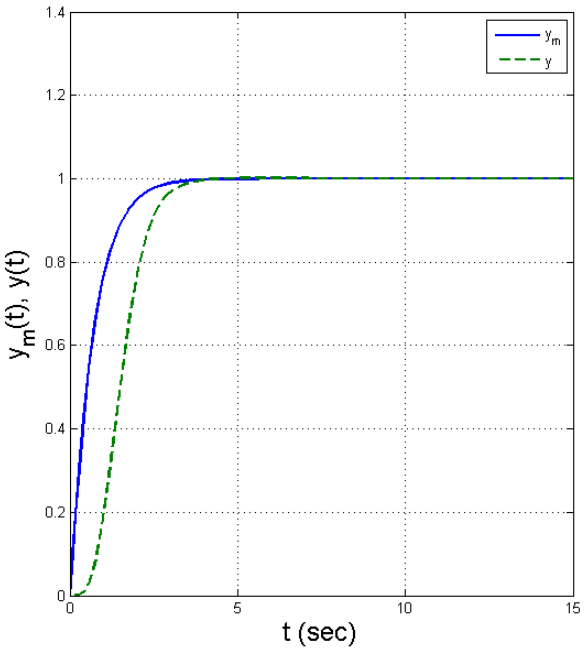


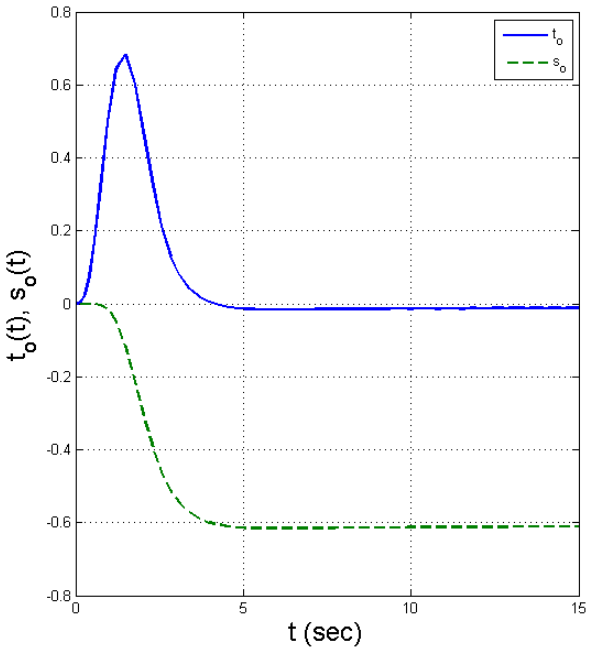
At $\gamma_1 = 1.2, \quad \gamma_2 = 0.5$



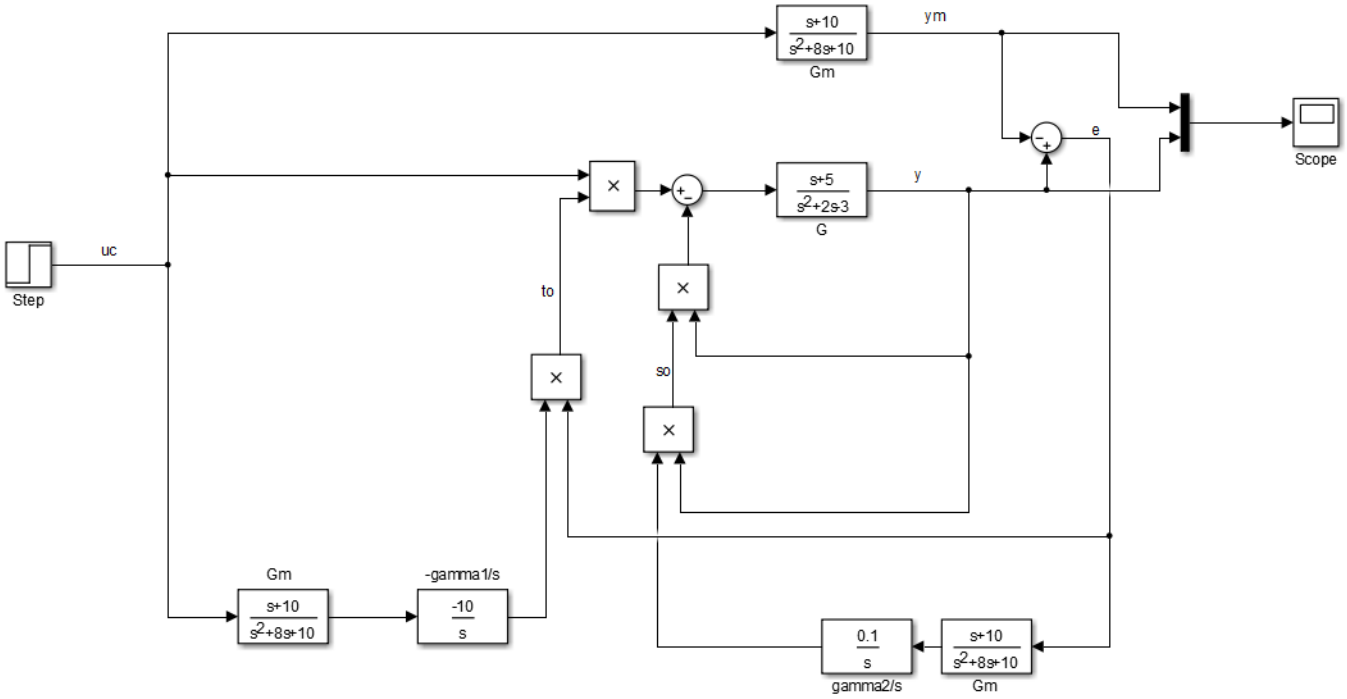


At $\gamma_1 = 1.2, \quad \gamma_2 = 0.5$

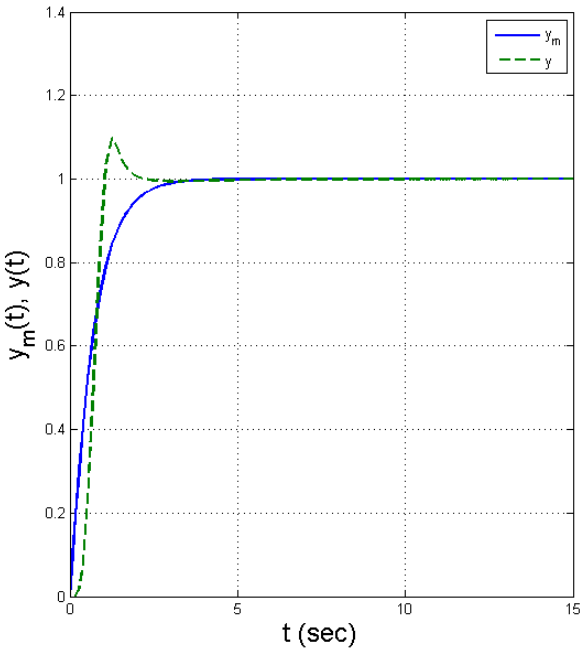


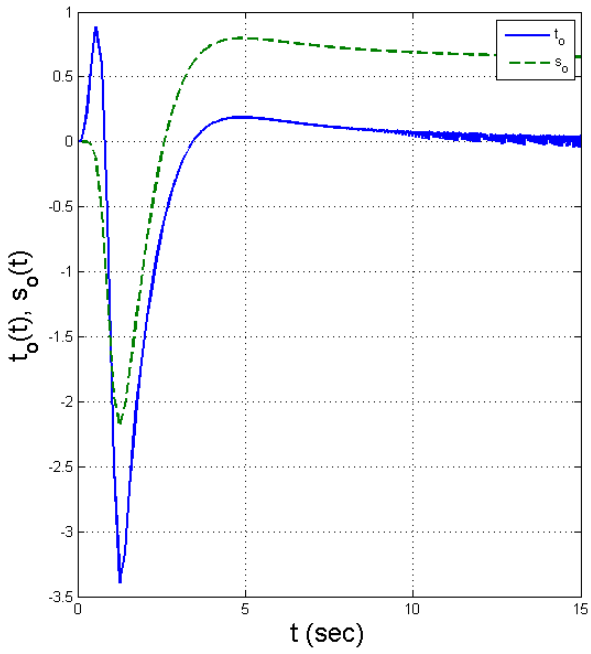


Let : $G(s) = \frac{s+5}{s^2+2s-3}$ $(unstable)$, $G_m(s) = \frac{s+10}{s^2+8s+10}$

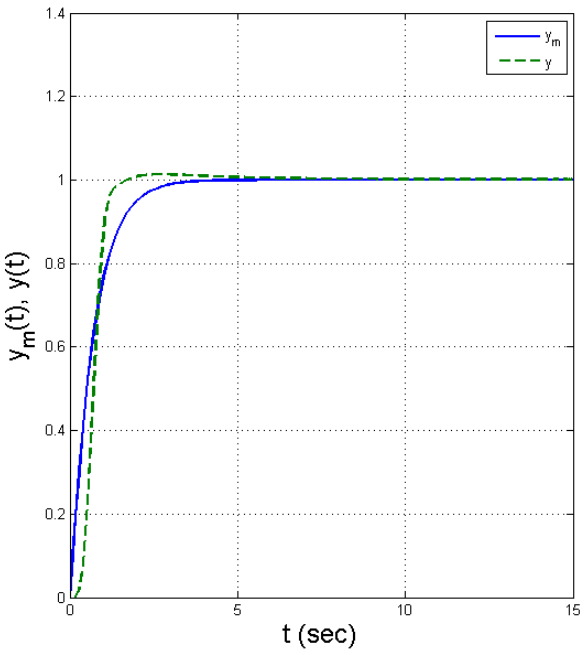


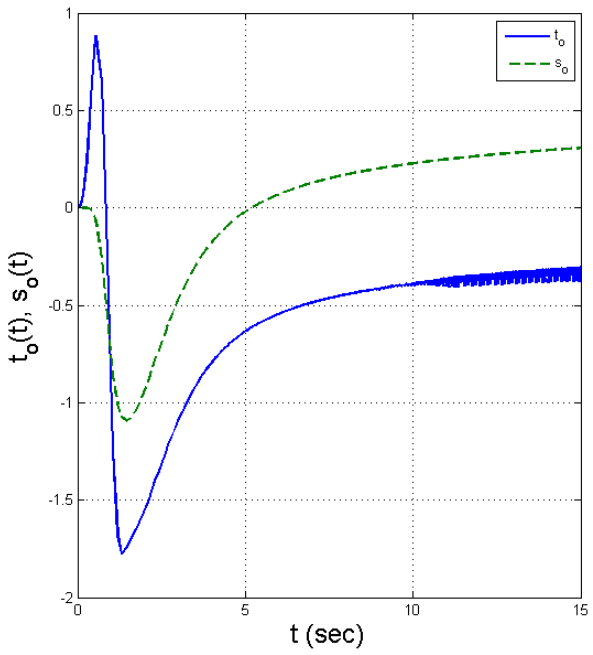
At $\gamma_1 = \gamma_2 = 20$



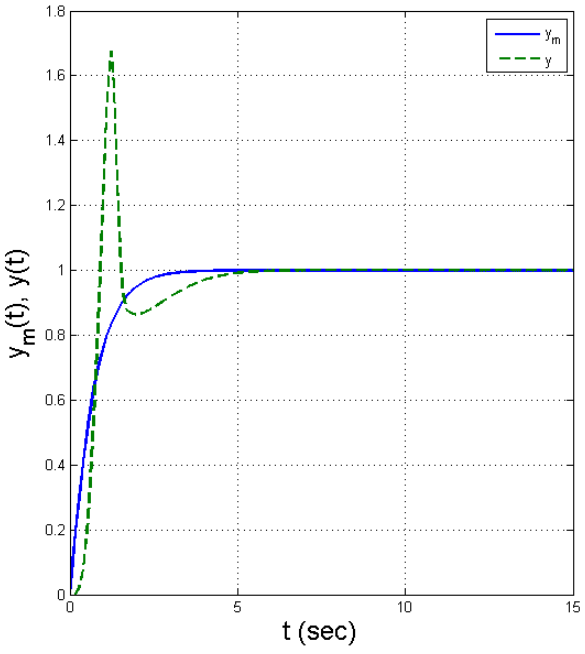


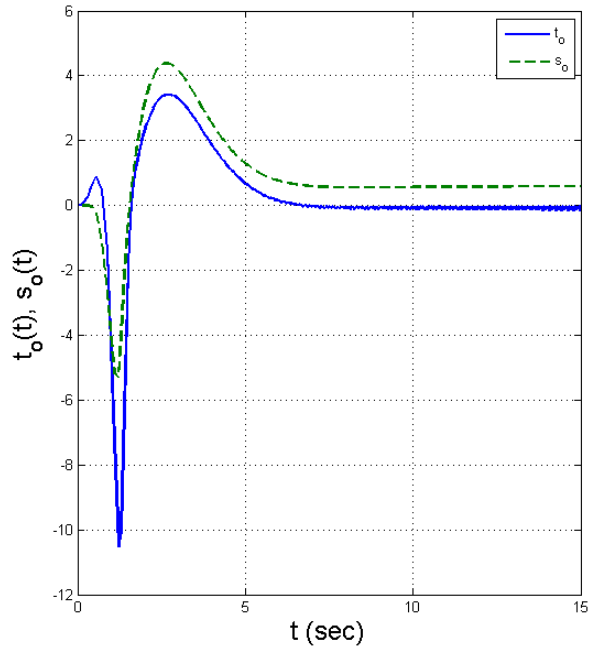
At $\gamma_1 = 20, \quad \gamma_2 = 10$





At $\gamma_1 = 20, \quad \gamma_2 = 40$





NOTE:

The simulink file will be sent to your mail.