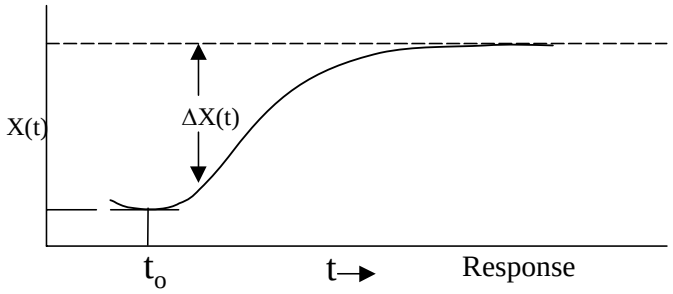
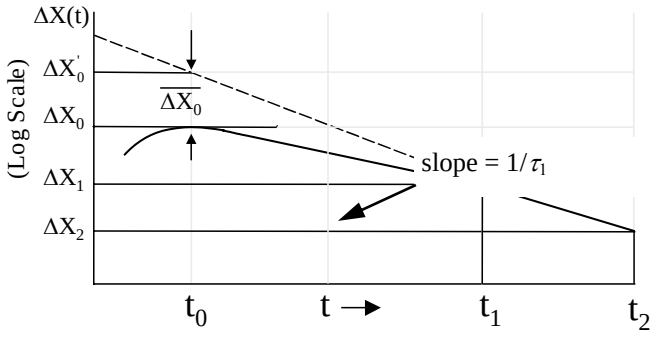
Method #6 Separated Real Root Analysis (when $\zeta>1$)

1) Determine several steady state $\Delta X(t)$ values from time history



2) Plot ΔX vs t on semi-log scale



3) After the faster root has decayed, the semi-log plot will be a straight line whose slope determines the slower root ($1/\tau_1$)

$$\tau_1 = \frac{t_1 - t_2}{\ln\left(\frac{\Delta\chi_1}{\Delta\chi_2}\right)}$$

4) Determine by extrapolating the straight line portion of the response to establish the values

$\left(\frac{1}{\tau_2}\right)$ $\overline{\Delta\chi_0}$ & $\Delta\chi_0'$

$$\tau_2 = \tau_1\left(\frac{\overline{\Delta\chi_0}}{\Delta\chi_0'}\right) \qquad \omega_n = \sqrt{\frac{1}{\tau_1}\frac{1}{\tau_2}} \text{ and } \zeta = \frac{-\left(\frac{1}{\tau_1}+\frac{1}{\tau_2}\right)}{2\omega_n} = \frac{-\left(\frac{1}{\tau_1}+\frac{1}{\tau_2}\right)}{2\sqrt{\frac{1}{\tau_1}\frac{1}{\tau_2}}}$$