Nyquist diagram

$G(s), s = j\omega$

$G(j\omega) = R + JI$

$R = f(\omega), I = f(\omega)$

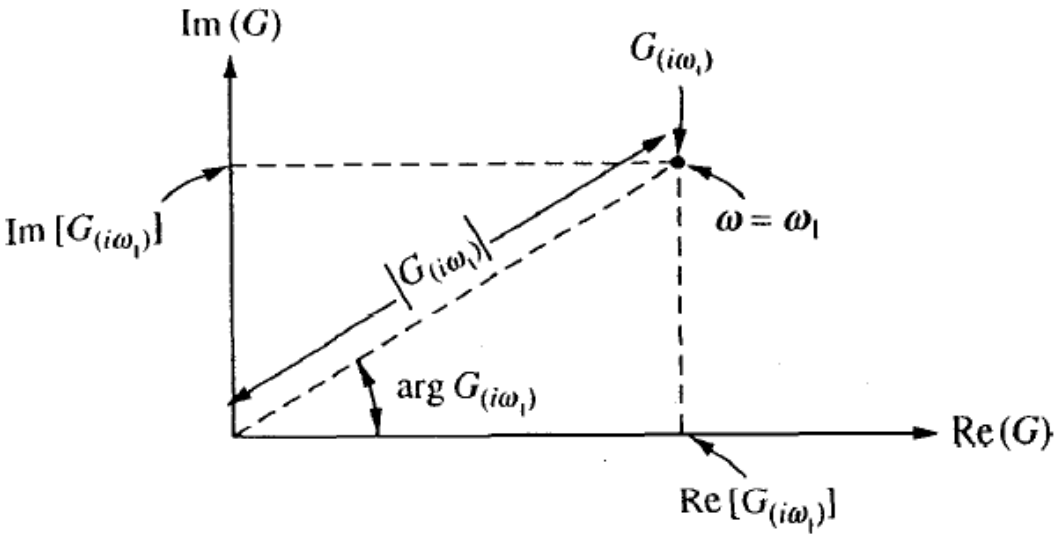

Fig.56 Nyquist diagram in G plane for single point G(jω$_1$)

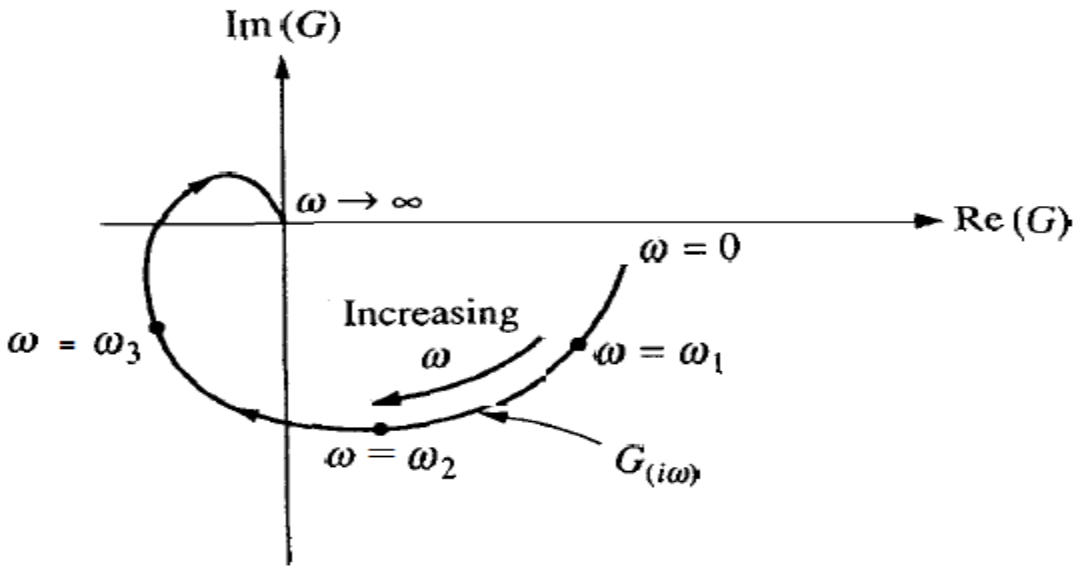

Fig.57 Nyquist diagram in G plane for complete curve G(jω)

1st order system

$$G(s) = \frac{k}{\tau s+1}$$

s =jω

$$G(j\omega) = \frac{k}{\tau j\omega +1}$$

$$G(j\omega) = \frac{k}{\tau j\omega +1} \times \frac{\tau j\omega -1}{\tau j\omega -1}$$

$$G(j\omega) = \frac{k}{\tau^2\omega^2+1} - j\frac{k\omega T}{\tau^2\omega^2+1}$$

$$|G| = \frac{k}{\sqrt{\tau^2\omega^2+1}}$$

$$< G = -\tan^{-1}\omega\tau$$

$$R = \frac{1}{\tau^2\omega^2+1}, I = \frac{-k\omega\tau}{\tau^2\omega^2+1}$$

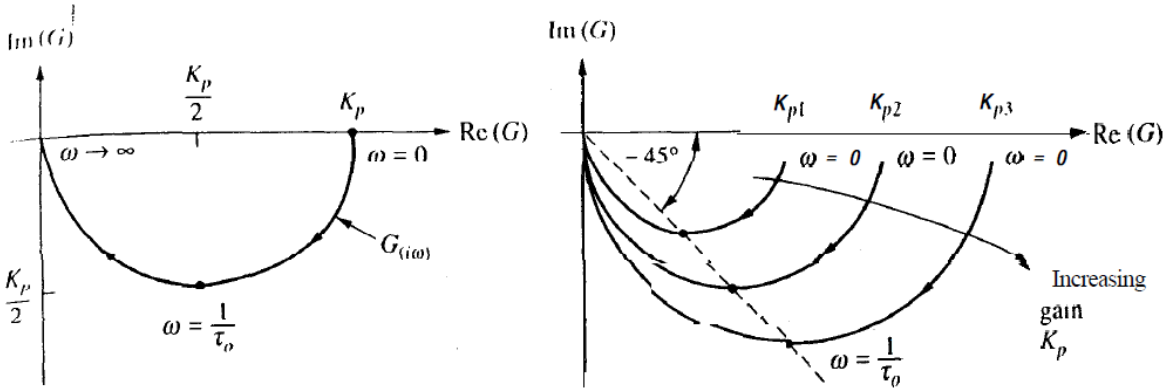

Fig.58

Nyquist diagram of first-order system

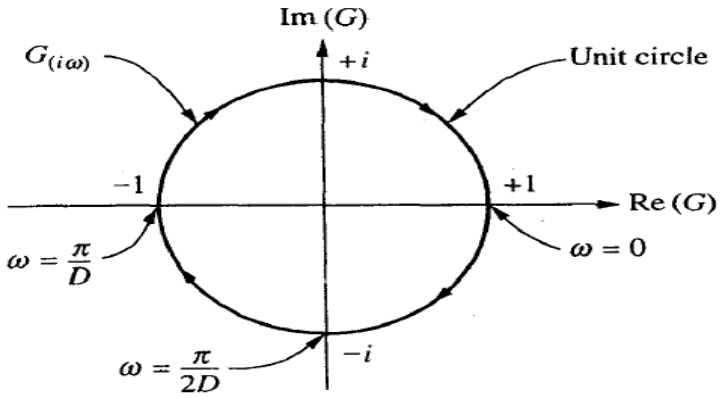

Fig.59 Nyquist diagram of dead time, (time delay)

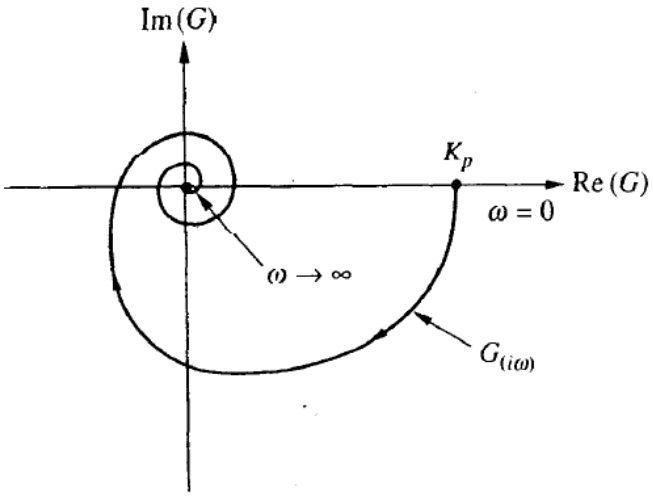

Fig.60 Nyquist diagram of first-order with time delay.

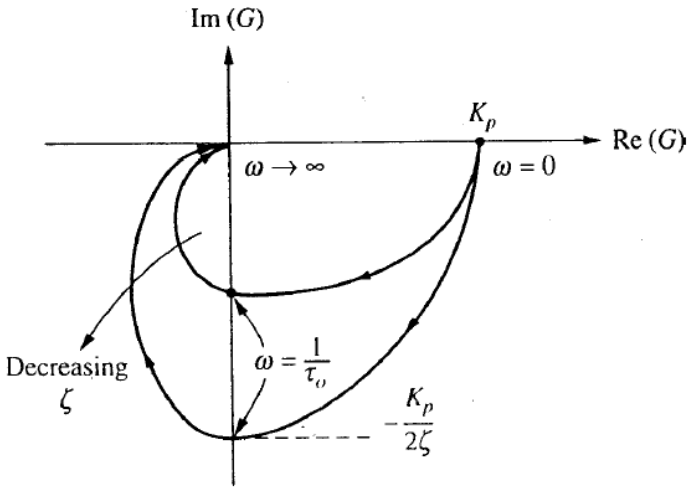

Fig.61 Nyquist diagram of second-order.