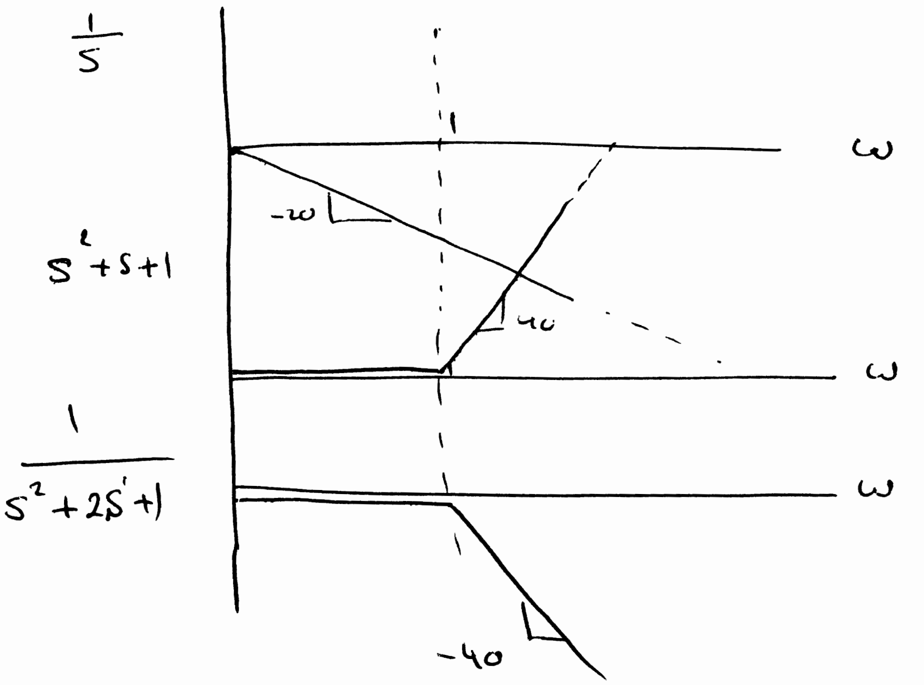
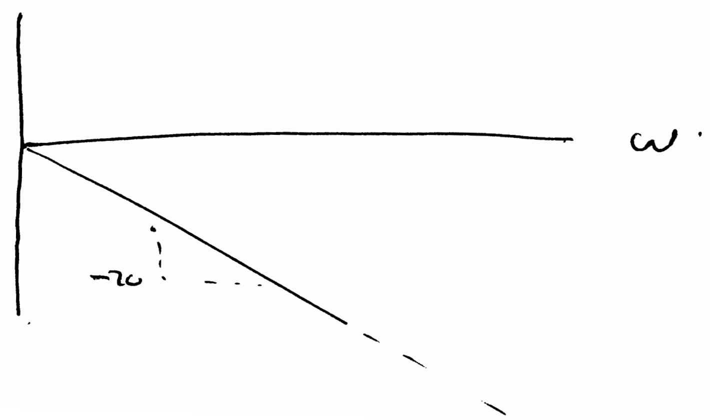
Quiz - EE 380 -

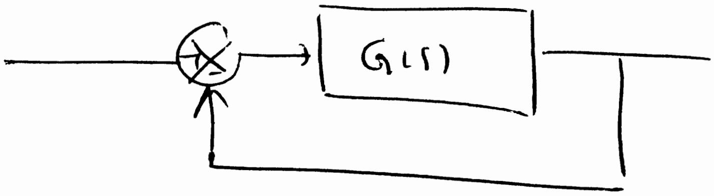
(1) $$\frac{s^2+s+1}{s(s^2+2s+1)} = \frac{1}{s}\,(s^2+s+1)\cdot\frac{1}{s^2+2s+1}$$




∴ total Bode magnitude plot is



2) $G(s) = \dfrac{k}{s(s^2+s+1)} = \dfrac{k}{s(s+0.5+j.866)(s+0.5-j.866)}$




Notice that G(s) is stable. so we can use the special case of Nyquist criterion to determine system's stability.

$$\therefore \frac{k}{j\omega((j\omega)^2+j\omega+1)} = \frac{k}{-j\omega^3+j\omega-\omega^2} = \frac{k}{-\omega^2+j\omega(1-\omega^2)}$$

$$= \frac{-k\omega^2}{A(\omega)} - j\,\frac{k\,\omega(1-\omega^2)}{A(\omega)}$$

$$A(\omega) = \sqrt{\omega^4+\omega^2(1-\omega^2)^2}$$

Intersection with real-axis (Imaginary = 0)

$1-\omega^2 = 0 \quad \therefore \quad \omega = 1.$

The real part $\quad -k\,\dfrac{1}{\sqrt{1+0}} = -K.$

$\therefore$ Stable value for system:

$$1 > K > 0$$