UNIT-5

(Lecture-2)

Time-Domain Performance Criteria Specified In The Frequency Domain

Time-Domain Performance Criteria Specified In The Frequency Domain

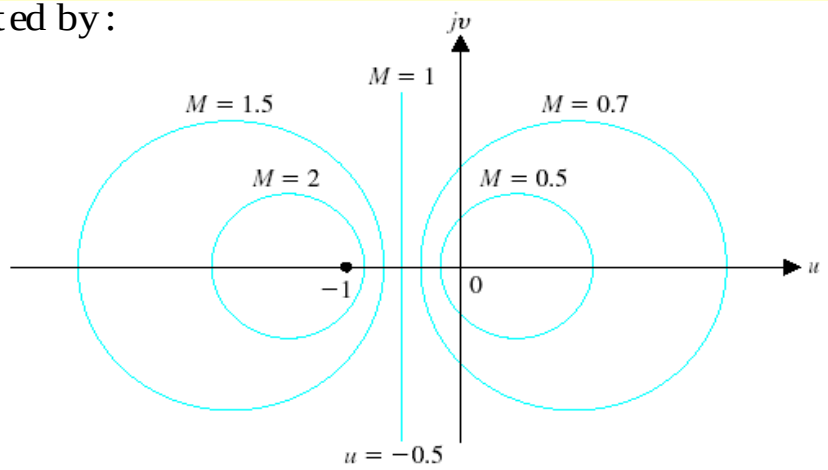
Constant M circles.

Open and closed-loop frequency responses are related by:

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

$$M_{pw} = \frac{1}{2\cdot\zeta\cdot\sqrt{1-\zeta^2}} \qquad \zeta < 0.707$$

$$G(\omega) = u + j\cdot v \qquad M = M(\omega)$$



$$M(\omega) = \left|\frac{G(j\omega)}{1 + G(j\omega)}\right| = \left|\frac{u + jv}{1 + u + jv}\right| = \frac{\sqrt{u^2 + v^2}}{\sqrt{(1+u)^2 + v^2}}$$

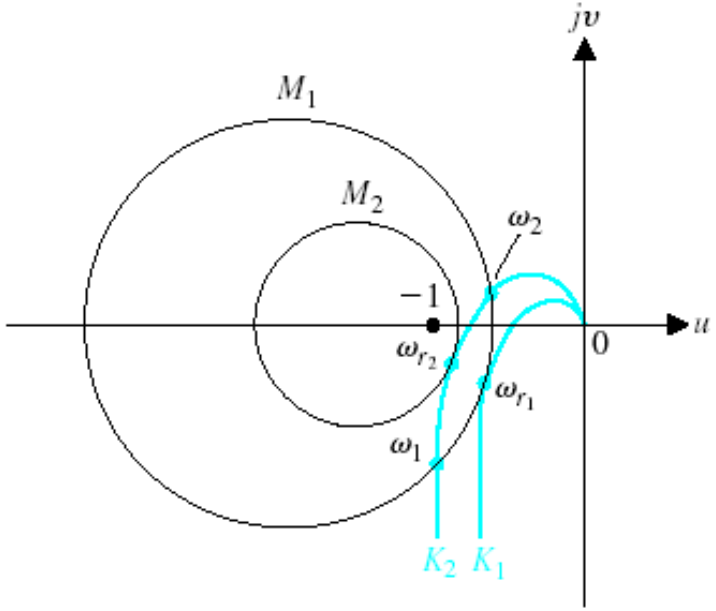
Squaring and rearrenging

$$\left(u - \frac{M^2}{1 - M^2}\right)^2 + v^2 = \left(\frac{M}{1 - M^2}\right)^2$$

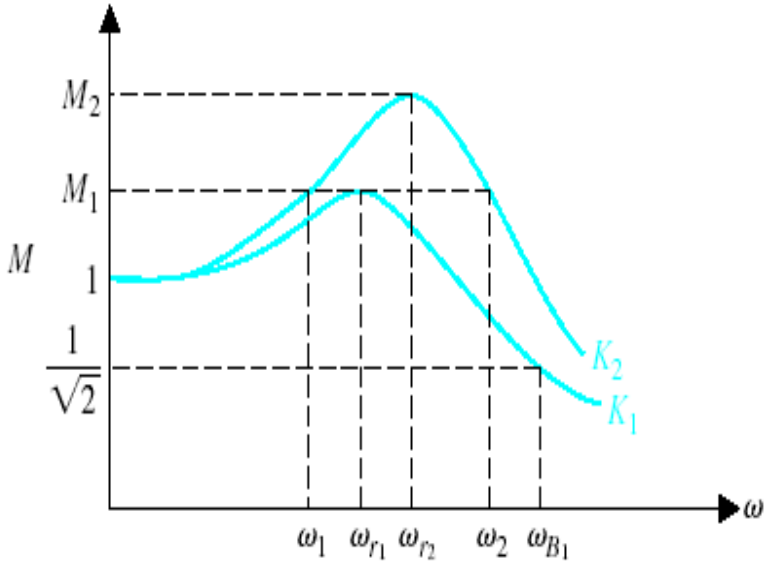
which is the equation of a circle on u-v planwe with a center at

$$u = \frac{M^2}{1 - M^2} \qquad v = 0$$

Time-Domain Performance Criteria Specified In The Frequency Domain

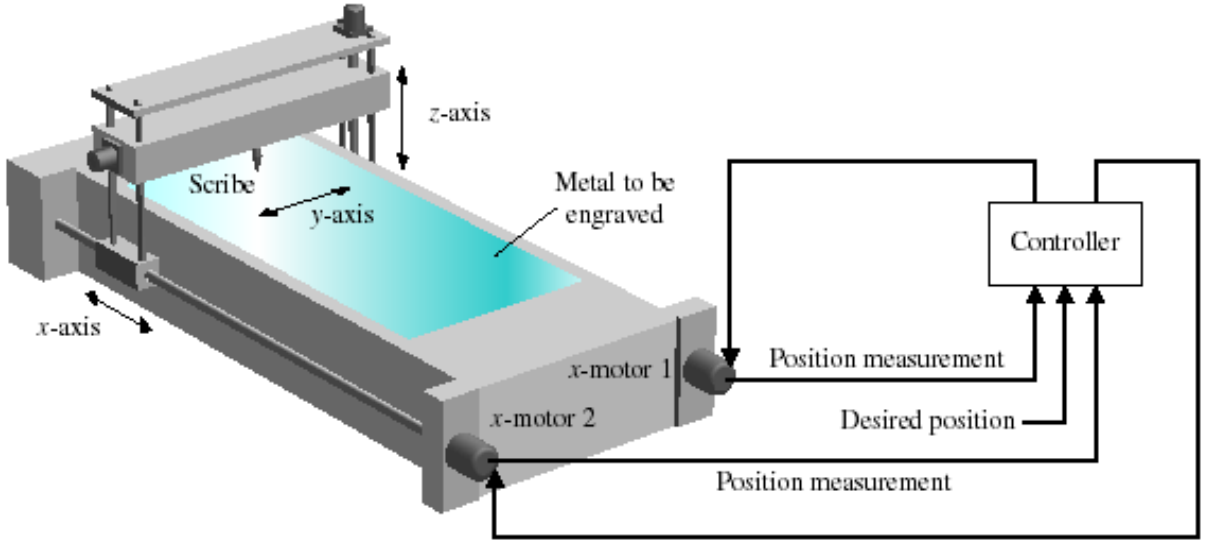


Polar plot of $G(j\omega)$ for two values of a gain ($K_2 > K_1$).

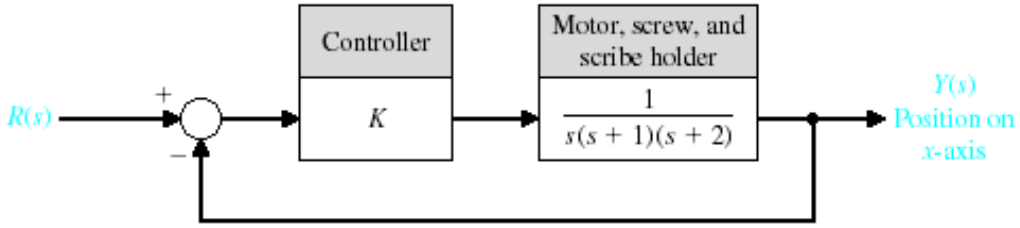


Closed-loop frequency response of $T(j\omega) = G(j\omega)/1 + G(j\omega)$. Note that $K_2 > K_1$.

Performance Specification In the Frequency Domain Example

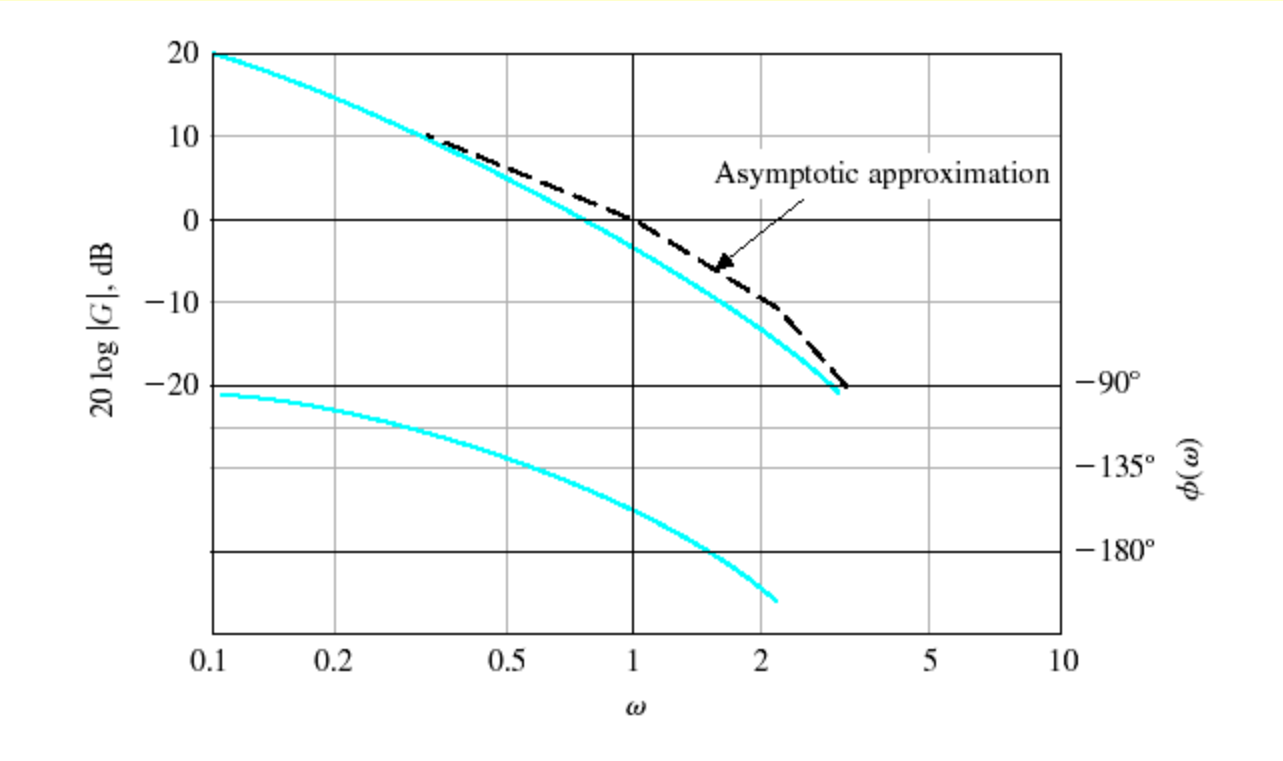


(a)



(b)

Performance Specification In the Frequency Domain Example



Performance Specification In the Frequency Domain Example