

Control Systems 2019 GATE Question

name-C.Sriram Saran
ROLLNO-EE18BTECH11007

February 18, 2020

QUESTION(2019 GATE EE Question no 14)

- The open loop transfer function of a unity feedback system is given by

$$G(s) = \frac{\pi e^{-0.25s}}{s}$$

in $G(s)$ plane, the Nyquist plot of $G(s)$ passes through the negative real axis at the point

(A)(-0.5,j0) (B)(-0.75,j0) (C)(-1.25,j0) (D)(-1.5,j0)

SOLUTION

$$G(s) = \frac{\pi e^{-0.25s}}{s}$$

Nyquist plot cuts the negative real Axis at $\omega =$ phase cross over frequency

$$G(j\omega) = \frac{\pi}{\omega}(-\sin 0.25\omega - j\cos 0.25\omega)$$

$$\angle G(j\omega) = -90^\circ - 0.25\omega \times 180^\circ / \pi$$

$$\angle G(j\omega)|_{\omega=\omega_{pc}} = -180^\circ$$

by solving for ω we get $\omega_{pc} = 2\pi$

magnitude at any point is $X = |G(j\omega)| = \frac{\pi}{\omega}$

substituting $\omega = 2\pi$ in magnitude we get $X = 0.5$

hence it intersects at $(-0.5, 0j)$ so answer is A

plot verification

we can verify with the following plot that it intersects at $(-0.5, 0j)$

