Control Systems 2019 GATE Question

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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 ω = phase cross over frequency

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

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

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

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)