MA 107 Modeling And Analysis of Dynamic Systems F19

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Test 2 (closed books/notes, no calculator)

1. Given the following LTI system: $\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}=u(t)$

Frequency response (frequency transfer function) = $\frac{1}{(jw)^2+jw}$

Sketch the Bode plot (you should know what level of detail to show)

Show your work below:

$s^2y + sy = u$

$y(s^2+s) = u$

$\therefore \frac{y}{u} = \frac{1}{s^2+s}$

$\therefore G(s) = \frac{1}{s^2+s}$

$G(jw) = \frac{1}{(jw)^2+jw}$ } frequency response.

$1 = \frac{1}{(jw)^2+jw}$

$-w^2+jw = 1$

$w^2 - jw + 1 = 0$

$jw = \frac{j \pm \sqrt{-w^2-4}}{2} = \frac{j \pm \sqrt{5}j}{2}$

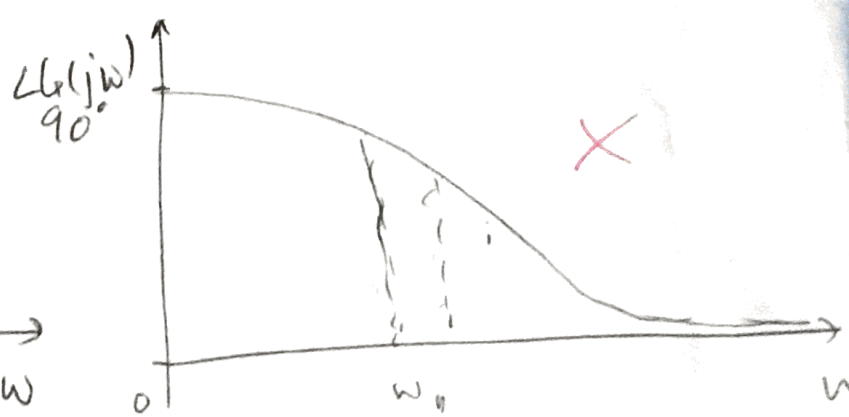
w_n

$G(w_n) = \frac{1}{\left(\frac{1+\sqrt{5}}{2}\right)^2 + \left(\frac{1+\sqrt{5}}{2}\right)}$

$= \frac{1}{\left(\frac{1+\sqrt{5}}{2}\right)\left[\frac{3}{2}+\frac{\sqrt{5}}{2}\right]}$

$w \to 0, \quad G(j0) = \infty \quad \angle G(j0) = 90^\circ$

$w \to \infty, \quad G(j\infty) = 0 \quad \angle G(j\infty) = 0^\circ$



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The Bode plot of an asymptotically stable linear time invariant system is shown below. Find the steady state output response for

$u(t) = \sin 4t$, → $y_{ss}(t)$= $0.4\sin(4t - 75^\circ)$

right idea +2