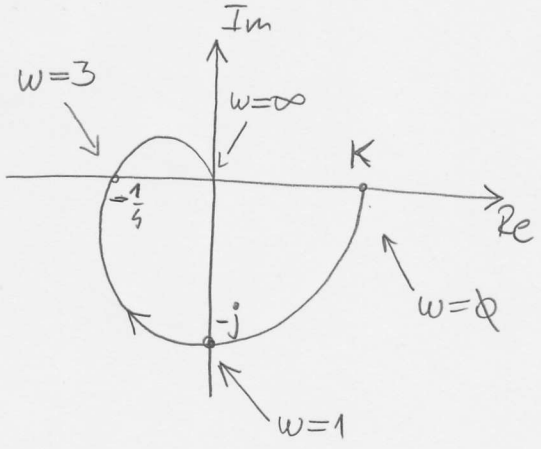
DODATNI ROK: 11.02.2011



ω	0	1	3	∞
$G(j\omega)$	$K>0$	$-j$	$-\frac{1}{4}$	0

A) NAĐI PRIJENOSNU F-JU

B) NAĐI ODZIV NA POBUDU:

$-2+3\sin t-4\cos(3t)$

(A) nyquist prolazi kroz 3 kvadranta

pa je prijenosna 3-reda sa oblikom:

$$G(s)=\frac{K}{a_3s^3+a_2s^2+a_1s^1+1}$$

$$G(j\omega)=\frac{K}{-ja_3\omega^3-a_2\omega^2+ja_1\omega+1}=\frac{K}{(1-a_2\omega^2)+j(a_1\omega-a_3\omega^3)}\cdot\frac{(1-a_2\omega^2)-j(a_1\omega-a_3\omega^3)}{(1-a_2\omega^2)-j(a_1\omega-a_3\omega^3)}$$

$$G(j\omega)=\underbrace{K\frac{1-a_2\omega^2}{(1-a_2\omega^2)^2+(a_1\omega-a_3\omega^3)^2}}_{Re(\omega)}\underbrace{-j\cdot K\frac{a_1\omega-a_3\omega^3}{(1-a_2\omega^2)^2+(a_1\omega-a_3\omega^3)^2}}_{Im(\omega)}$$

ZA $\omega=1$

$Re(\omega)=0$

$1-a_2\omega^2=0$

$a_2=1$ *

$Im(\omega)=-1$

$$\frac{-K(a_1-a_3)}{\underbrace{(1-a_2)^2}_{0}+(a_1-a_3)^2}=-1$$

$K(a_1-a_3)=(a_1-a_3)^2$

$K=a_1-a_3$

STR: 1/2

ZA $\omega = 3$

$I(\omega) = \phi$ $\quad R(\omega) = -\frac{1}{4}$

$3a_1 - 27a_3 = \phi$

$a_1 = 9a_3$

$$\frac{K(1 - 9a_2)}{(1 - 9a_2)^2 + (3a_1 - 27a_3)^2} = -\frac{1}{4}$$

($1 - 9a_2 \to 1$, $(3a_1 - 27a_3)^2 \to \phi$)

$$K\frac{-8}{64} = -\frac{1}{4}$$

$$K = \frac{1}{4} \cdot \frac{64}{8}$$

$K = 2$

$K = a_1 - a_3$

$2 = 9a_3 - a_3$

$a_3 = \frac{1}{4}$

$a_1 = 9a_3$

$a_1 = \frac{9}{4}$ $\quad * \quad a_2 = 1$

$$G_0(s) = \frac{2}{\frac{1}{4}s^3 + s^2 + \frac{9}{4}s + 1} = \frac{8}{s^3 + 4s^2 + 9s + 4}$$

(B) $u(t) = \underbrace{-2}_{u_1(t)} + \underbrace{3\sin t}_{u_2(t)} \underbrace{- 4\cos(3t)}_{u_3(t)}$

PRIJENOSNU FJU RAČUNAMO ZA ONU FREKVENCIJU NA KOJOJ JE POBUDA! (iščitavamo iz nyquista)

$Y(t) = u(t) \cdot G(j\omega)$

$y(t) = u_1(t) \cdot G(j\omega) + u_2(t) \cdot G(j\omega) + u_3(t) \cdot G(j\omega)$

$u_1(t) = 2$ $\quad G(j\phi) = K$ $\quad Y_1(t) = u_1(t) \cdot G(j\phi) = -2K$

$u_2(t) = 3\sin t$ $\quad G(j1) = e^{-j\frac{\pi}{2}}$ $\quad Y_2(t) = u_2(t) \cdot G(j1) = 3\sin t \cdot 1\angle -\frac{\pi}{2} = 3\sin\left(t - \frac{\pi}{2}\right)$

$u_3(t) = -4\cos(3t)$ $\quad G(j3) = \frac{1}{4}e^{-j\pi}$

$= -4\sin\left(3t + \frac{\pi}{2}\right)$

$Y_3(t) = u_3(t) \cdot G(j3) = -4\sin\left(3t + \frac{\pi}{2} - \pi\right) \cdot \frac{1}{4}$

$= -\sin\left(3t - \frac{\pi}{2}\right)$

$Y(t) = Y_1(t) + Y_2(t) + Y_3(t)$

$y(t) = -2K + 3\sin\left(t - \frac{\pi}{2}\right) - \sin\left(3t - \frac{\pi}{2}\right)$