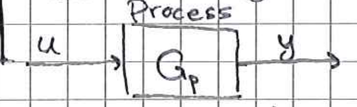
$\boxed{23/_1 \text{ - } 2012 \quad (4)}$

Frekvensanalys



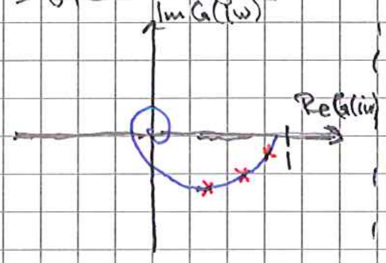
$u(t) = \sin \omega t$ $\qquad a = |G_p(i\omega)|$

$y(t) = a \sin(\omega t + \varphi)$ $\qquad \varphi = \arg G_p(i\omega)$

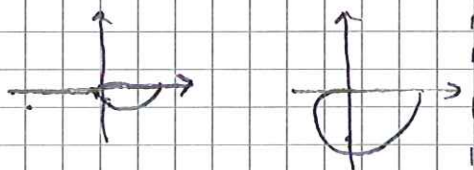
Frekvensanalysen ger tabell:

ω	a	φ
0.1	0.9	$-10°$
0.2	0.8	$-20°$
0.5	0.6	$-40°$

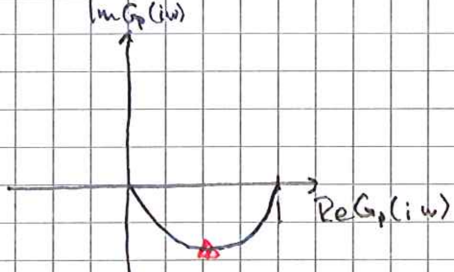
Nyquistdiagram



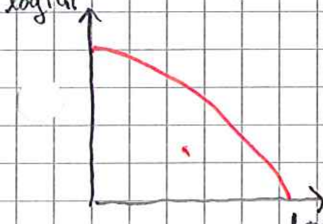
Labprocessen: Övre tank. Undre tank



Ex $G_p(s) = \frac{1}{s+1}$; $G_p(i\omega) = \frac{1}{1+i\omega} = \frac{1-i\omega}{1+\omega^2} = \frac{1}{1+\omega^2} - i\frac{\omega}{1+\omega^2}$



Bodediagram



$G = G_1 G_2 G_3$

$\log|G| = \log|G_1 G_2 G_3| = \log|G_1| + \log|G_2| + \log|G_3|$

$\arg G = \arg G_1 G_2 G_3 = \arg G_1 + \arg G_2 + \arg G_3$

$\Rightarrow$ Det räcker att kunna rita Bodediagram för några enkla typöverföringsfunktioner.

Typöverförings funktioner:

$G_1 = K$

$G_2 = s^n$ n heltal

$G_3 = (1+sT)^n$

$G_4 = \left(1 + 2\zeta\frac{s}{\omega_0} + \left(\frac{s}{\omega_0}\right)^2\right)^n$

$G_5 = e^{-sL}$

1) $G_1(s) = K$

$\log|G_1(i\omega)| = \log K$. $\quad \arg G_1(i\omega) = 0$

2) $G_2(s) = s^n$

$\log|G_2(i\omega)| = \log|i\omega|^n = n \log\omega \quad \arg G_2(i\omega)^n = \arg(i\omega)^n = n\cdot\frac{\pi}{2}$

T.ex. $n = 1$ $\qquad Y = sU$

$u = \sin\omega t$ $\qquad y = \dot{u}$

$y = \omega\cos\omega t = \omega\sin(\omega t + \frac{\pi}{2})$

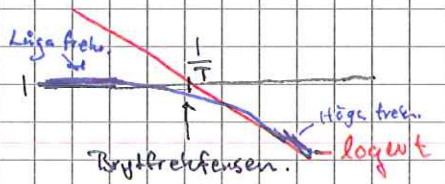
3) $G_3(s) = (1+sT)^n$

$\log|G_3(i\omega)| = n\log|1+i\omega T| = n\cdot\log\sqrt{1+\omega^2T^2}$

$\arg G_3(i\omega) = n\arg(1+i\omega T) = n\cdot\arctan(\omega T)$

Låga frekvenser: Beter sig som 1)

Höga frekvenser: Beter sig som 2).



4) $G_5 = e^{-sL}$ $\qquad Y = e^{-sL}U(s)$

$Y(t) = U(t-L)$ 'dödtid', tidsfördröjning

Ex $G = \frac{100(s+2)}{s(s+20)^2} = \frac{100\cdot 2(1+0.5s)}{s\cdot 400(1+0.05s)^2} = 0.5 \cdot s^{-1} \cdot (1+0.5s) \cdot (1+0.05s)^{-2}$