Blackboard Lecture

15 October 2020

This material is uploaded to compensate for the technical problems with the video recording

$u = U_0 \sin(\omega t)$

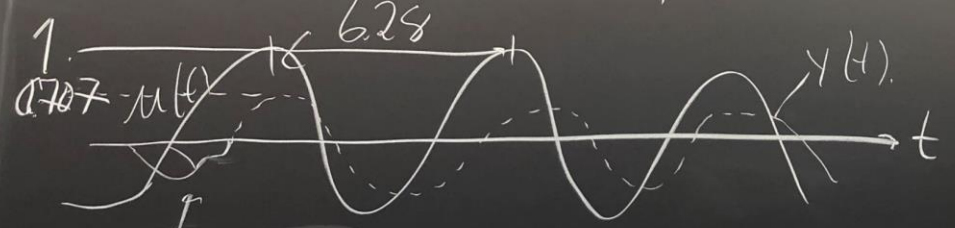
$\omega = 1$ rad/s

$\tau = 1$s

$y(t)$

$$g(j\omega) = \frac{1}{j\omega\tau + 1} = \frac{1}{1+j}$$

Two ways.



$\Delta t = 0.78$s

$$AR = |g(j\omega)| = \sqrt{0.5^2 + 0.5^2} = \sqrt{\frac{1}{2}} = 0.707$$

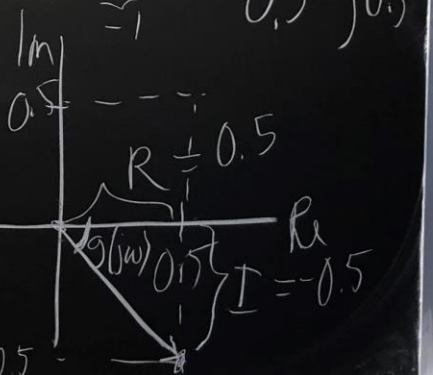
$$\angle g(j\omega) = \arctan\left(\frac{I}{R}\right) = \arctan(-1) = -45^\circ = -\frac{\pi}{4}\text{ rad}.$$

$$\Delta t = \frac{-\varphi}{\omega} = \frac{\pi/4\text{ rad}}{1\text{ rad/s}} = \frac{\pi}{4}\text{s} = 0.78\text{s}$$

$$g(j\omega) = \frac{1-j}{(1+j)(1-j)} = \frac{1-j}{2}$$

$(1+j)(1-j) = 1 - j^2 = 1$

$$= 0.5 - j0.5$$



NB!

Slå på projektoren med ON-knappen, velg den stillen du ønsker å bruke med knappene til høyre, for eksempel PC.
For å slå av projektoren må du holde OFF-knappen inne i noen sekunder, det holder ikke med et lett trykk.
Hvis projektoren ikke starter, kan det hende at noen har trukket ut strømmen til racket der kontrollenheten er plassert. Spør om det er lys på i racket/skapet til venstre for tavlen, well / stikkpluget hvis det er trukket ut.

Turn on the projector using the ON-button. Select the source you wish to use with the four buttons on the right, for instance PC.
To turn the projector off, you need to press the OFF-button for several seconds, a light push will not be sufficient.
If the projector will not start, it might be that someone has pulled the plug to the rack where the Control Unit is situated. Check if there are any lights on in the rack to the left of the blackboard, pull back the plug if it has been pulled out.

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$$G(s) = \frac{K}{\tau s + 1}$$

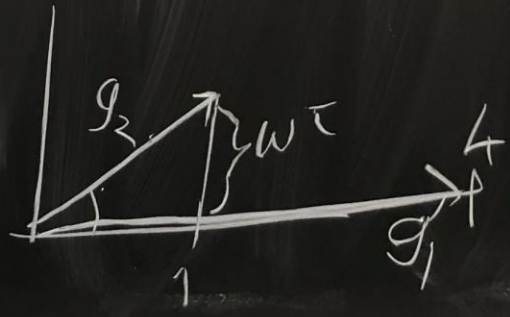
$$G(j\omega) = \frac{K}{j\omega\tau + 1} = \frac{g_1}{g_2}$$

$$AR = |G(j\omega)| = \frac{|g_1|}{|g_2|} = \frac{K}{\sqrt{(\omega\tau)^2 + 1}}$$

$$\varphi = -\omega \cdot \Delta t$$

rad rad/s s

$$g_2 = 1 + j\omega\tau$$

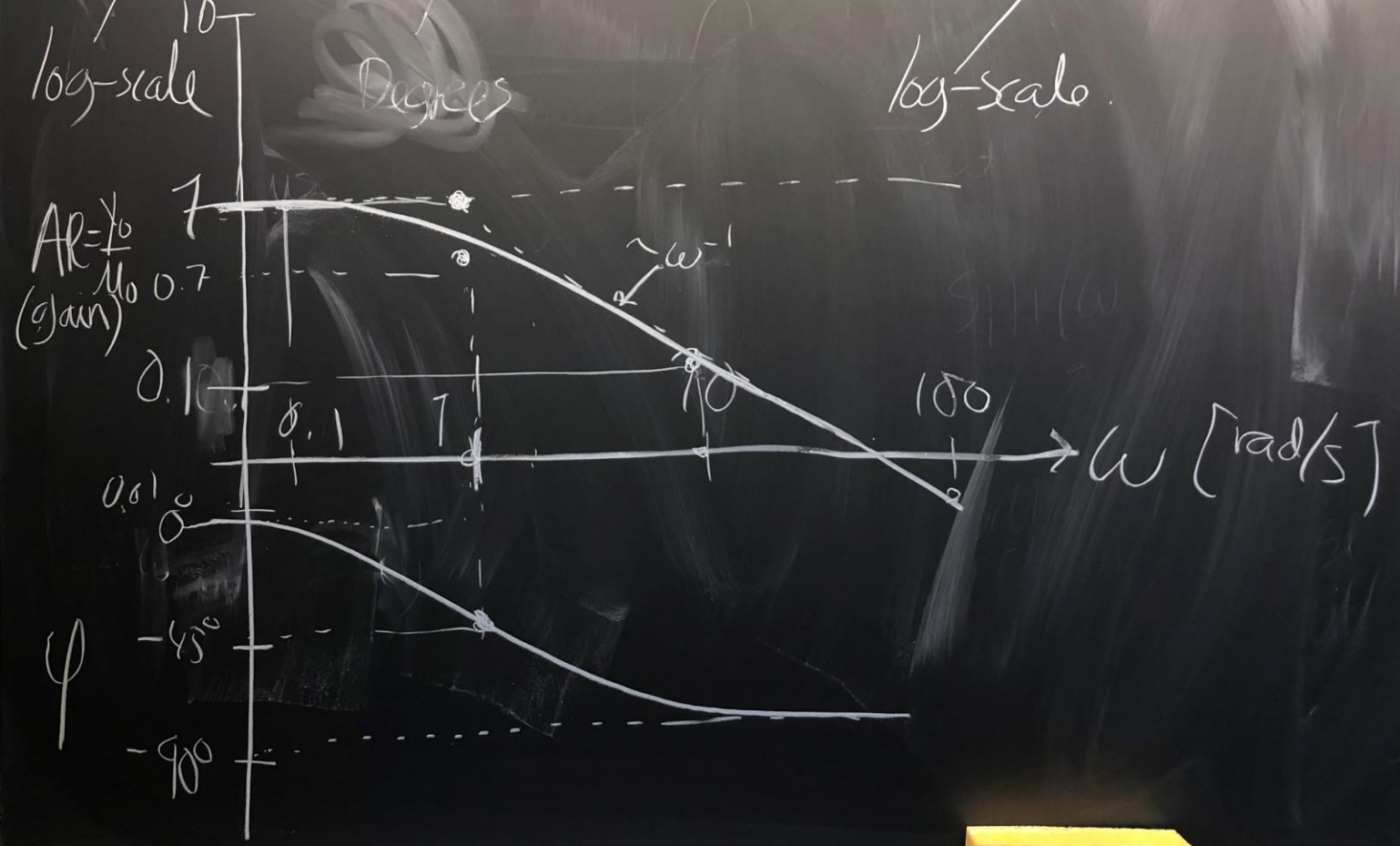


$$\varphi = \angle g(j\omega) = \angle g_1 - \angle g_2 = 0^\circ - \arctan\left(\frac{\omega\tau}{1}\right)$$

$$= -\arctan(\omega\tau)$$

Frequency ↓

$\omega\tau$	$\lvert g(j\omega)\rvert$	$\angle g(j\omega)$
0	k	0°
0.1	$k/\sqrt{1.01}$	$-\arctan(0.1) = -5.7^\circ = -0.01$
1	$k/\sqrt{2}$	$-\arctan(1) = -0.78\,\text{rad} = -45^\circ$
2	$k/\sqrt{5}$	
10	$\frac{k}{\sqrt{101}} \approx \frac{k}{10}$	$-\arctan(10) = -84.3^\circ$

Bode plot.

AR and φ as function of ω