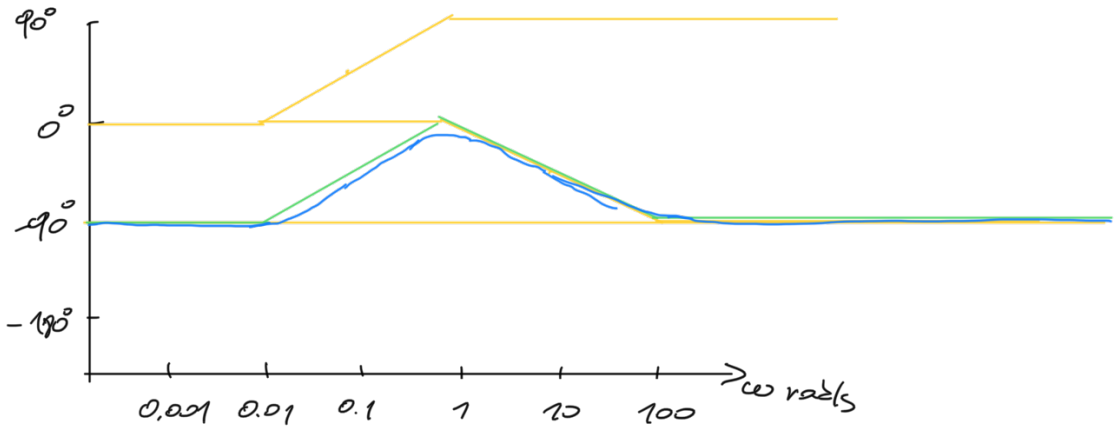
ECE 141

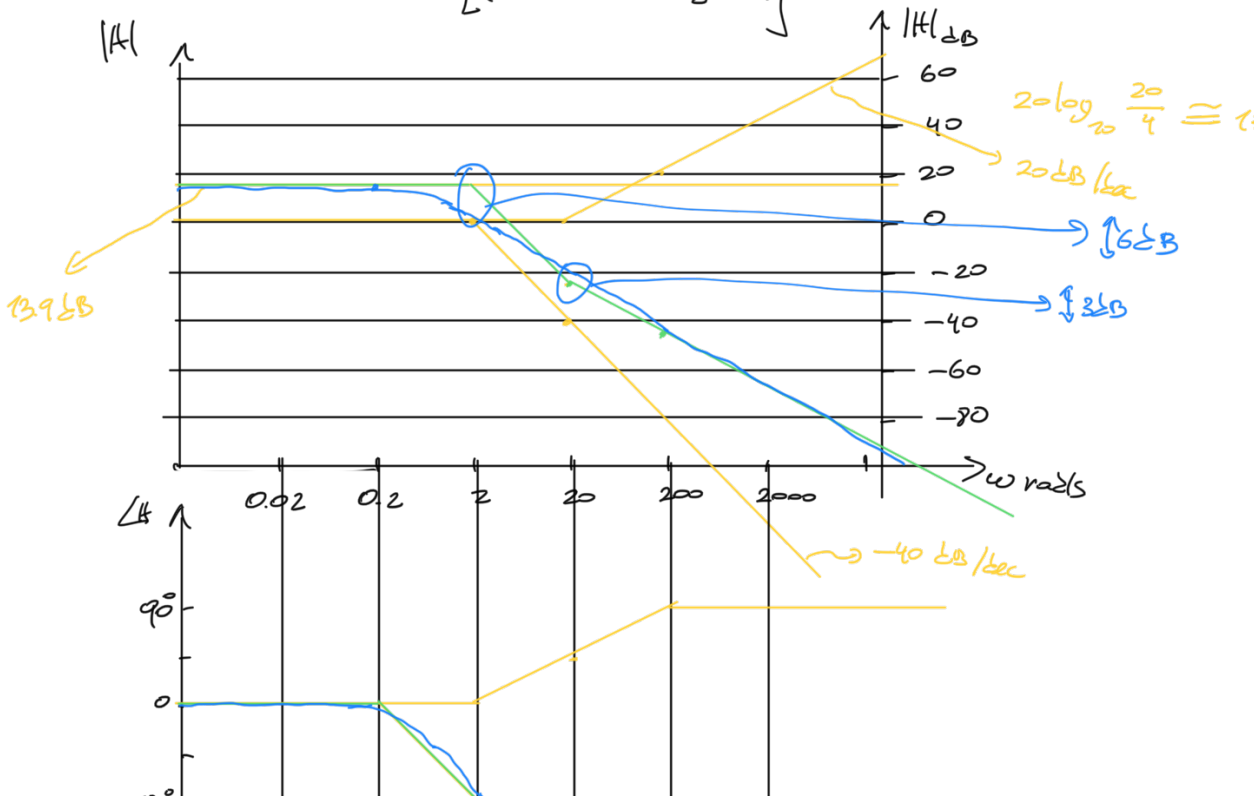
Lecture 14

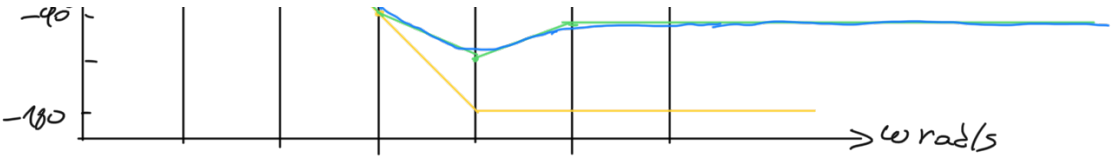
$$G(\omega) = 2\,\frac{j\omega\frac{1}{01}+1}{j\omega\left(j\omega\frac{1}{10}+1\right)}$$



$$H(s) = \frac{s+20}{s^2+4s+4} \longrightarrow \frac{20\left(j\omega\frac{1}{20}+1\right)}{4\left[\left(\frac{j\omega}{2}\right)^2+2\cdot1\cdot\frac{j\omega}{2}+1\right]}$$

$\zeta = 1$





Non-minimum phase zeros

$$H_1(s) = \frac{s+2}{s+1} \qquad H_2(s) = \frac{s-2}{s+1}$$

$j\omega\frac{1}{2}+1$ $\qquad$ $j\omega\left(\frac{1}{2}\right)+1$

$j\omega\tau+1$ $\qquad$ $\tau<0$

$\tau>0$

$\omega \ll \frac{1}{2}$ $\quad |j\omega\frac{1}{2}+1| \cong 1$ $\qquad |j\omega\left(-\frac{1}{2}\right)+1| \cong 1$

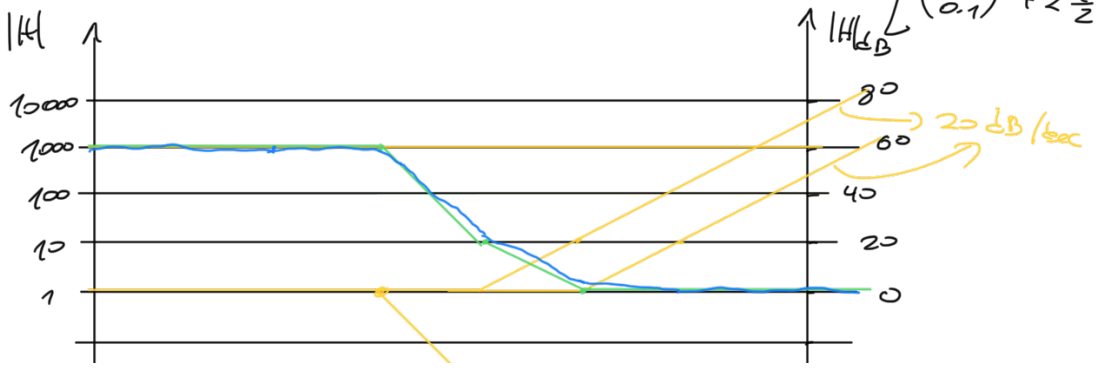
$\omega \gg \frac{1}{2}$ $\quad |j\omega\frac{1}{2}+1| \cong |j\omega\frac{1}{2}|$ $\qquad |j\omega\left(-\frac{1}{2}\right)+1| \cong |-j\omega\frac{1}{2}| = |j\omega\frac{1}{2}|$

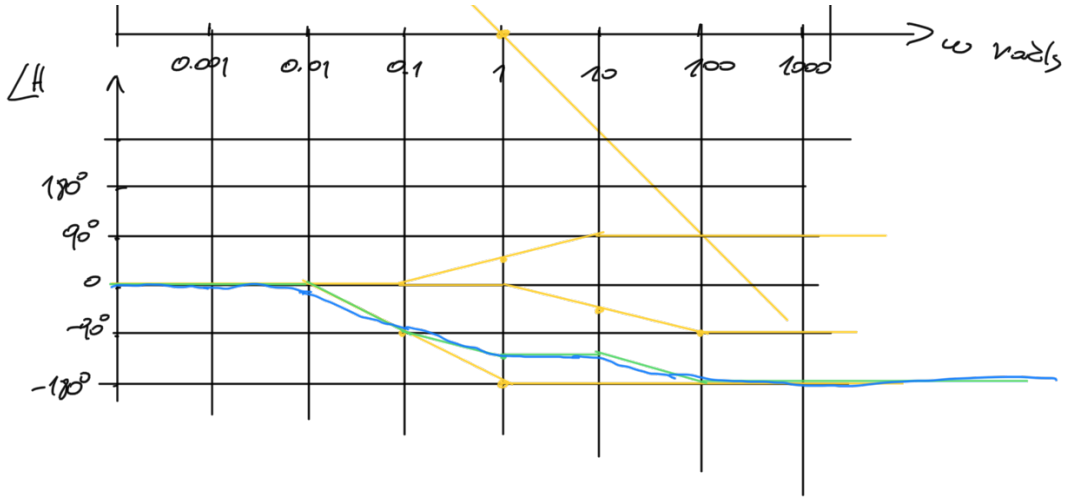
no changes for magnitude plot.

$\omega \ll \frac{1}{2}$ $\quad \angle j\omega\frac{1}{2}+1 \cong \angle 1$ $\qquad \angle j\omega\left(-\frac{1}{2}\right)+1 \cong \angle 1$

$\omega \gg \frac{1}{2}$ $\quad \angle j\omega\frac{1}{2}+1 \cong \angle j\omega\frac{1}{2} = 90°$ $\qquad \angle j\omega\left(-\frac{1}{2}\right)+1 \cong \angle -j\omega\frac{1}{2} = -90°$

$$H(s) = \frac{(s+1)(s-10)}{s^2+0.1s+0.01} \xrightarrow{\tau<0} \frac{(j\omega+1)(j\omega-10)}{(j\omega)^2+0.1j\omega+0.01} = \frac{-10(j\omega+1)(j\omega+\frac{1}{10})}{0.01\left[\left(\frac{j\omega}{0.1}\right)^2+2\frac{1}{2}\frac{j\omega}{0.1}\right]}$$




∠H
0.001
0.01
0.1
1
10
100
1000
ω rad/s
180°
90°
0
-90°
-180°