



$$V_{IN} = I(R + j\omega L)$$

$$I = \frac{V_{IN}}{R + j\omega L}$$

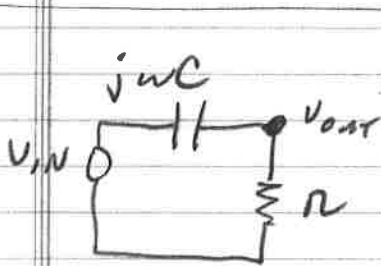
$$V_{OUT} = IR$$

$$= \left( \frac{V_{IN}}{R + j\omega L} \right) R$$

$$H(\omega) = \frac{V_{OUT}}{V_{IN}} = \frac{1}{R + j\omega L} \left( \frac{V_{IN}}{R + j\omega L} \right) R$$

$$= \frac{R}{R + j\omega L} \quad \text{Plot in Maple}$$

\* Let  $\begin{cases} R = 1 \text{ k}\Omega \\ L = 0.1 \text{ H} \end{cases}$  and plot  $H(\omega)$



$$V_{IN} = I \left( R + \frac{1}{j\omega C} \right)$$

$$I = \frac{V_{IN}}{R + \frac{1}{j\omega C}}$$

$$V_{OUT} = IR$$

$$= \left( \frac{V_{IN}}{R + \frac{1}{j\omega C}} \right) R$$

$$H(\omega) = \frac{V_{OUT}}{V_{IN}} = \frac{1}{R + \frac{1}{j\omega C}} \left( \frac{V_{IN}}{R + \frac{1}{j\omega C}} \right) R$$

$$= \frac{R}{R + \frac{1}{j\omega C}}$$

\* Let  $\begin{cases} R = 1 \text{ k}\Omega \\ C = 4.7 \mu\text{F} \end{cases}$  and plot  $H(\omega)$



$$V_{in} = I \left( R + j\omega L + \frac{1}{j\omega C} \right)$$

$$I = \frac{V_{in}}{R + j\omega L + \frac{1}{j\omega C}}$$

\* BAND PASS, RLC

$$V_{out} = I R$$

$$= R \left( \frac{V_{in}}{R + j\omega L + \frac{1}{j\omega C}} \right)$$

$$H(\omega) = \frac{V_{out}}{V_{in}} = \frac{1}{V_{in}} \left( \frac{V_{in}}{R + j\omega L + \frac{1}{j\omega C}} \right) R$$

$$= \frac{R}{R + j\omega L + \frac{1}{j\omega C}}$$

$$= \frac{R}{R + j(\omega L - \frac{1}{\omega C})}$$

\* Let  $\begin{cases} R = 1 \text{ k}\Omega \\ L = 0.1 \text{ H} \\ C = 4.7 \mu\text{F} \end{cases}$

and plot in Maple

W. F.

# \* VARIOUS FILTERS

$$H1 := \frac{R}{\left(\left(\frac{1}{w \cdot C \cdot I}\right) + R\right)}$$

$$H = \frac{V_{out}}{V_{in}}$$

$$\frac{R}{-\frac{I}{wC} + R} \quad (1)$$

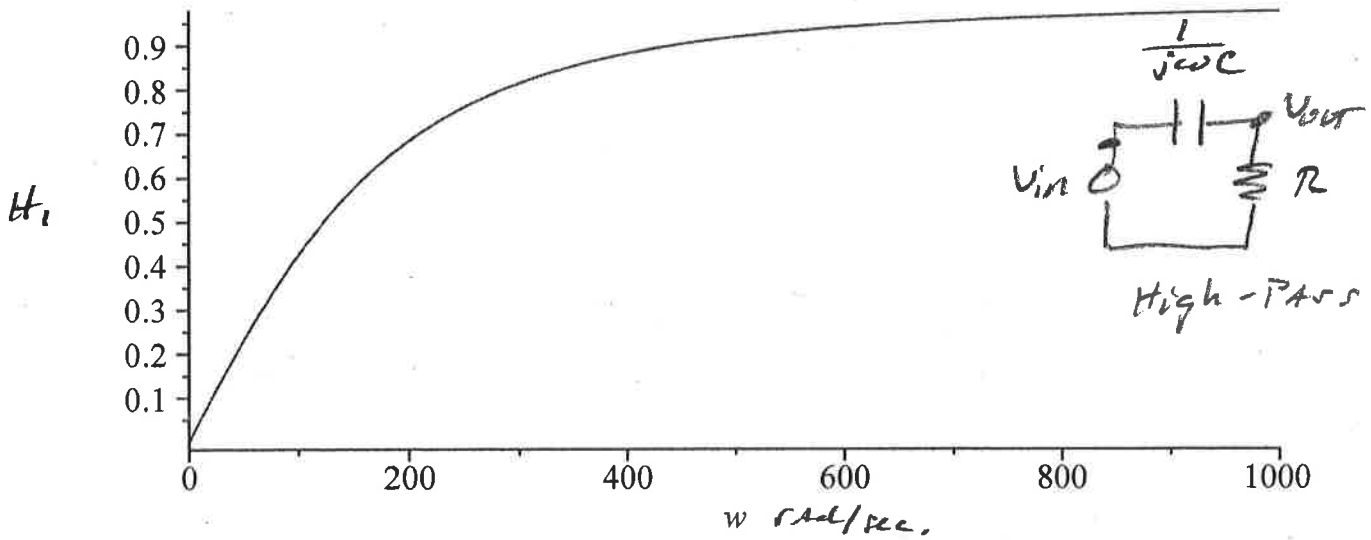
$$R := 1000 \ \Omega$$

$$1000 \quad (2)$$

$$C := .0000047 \text{ FARAAD}$$

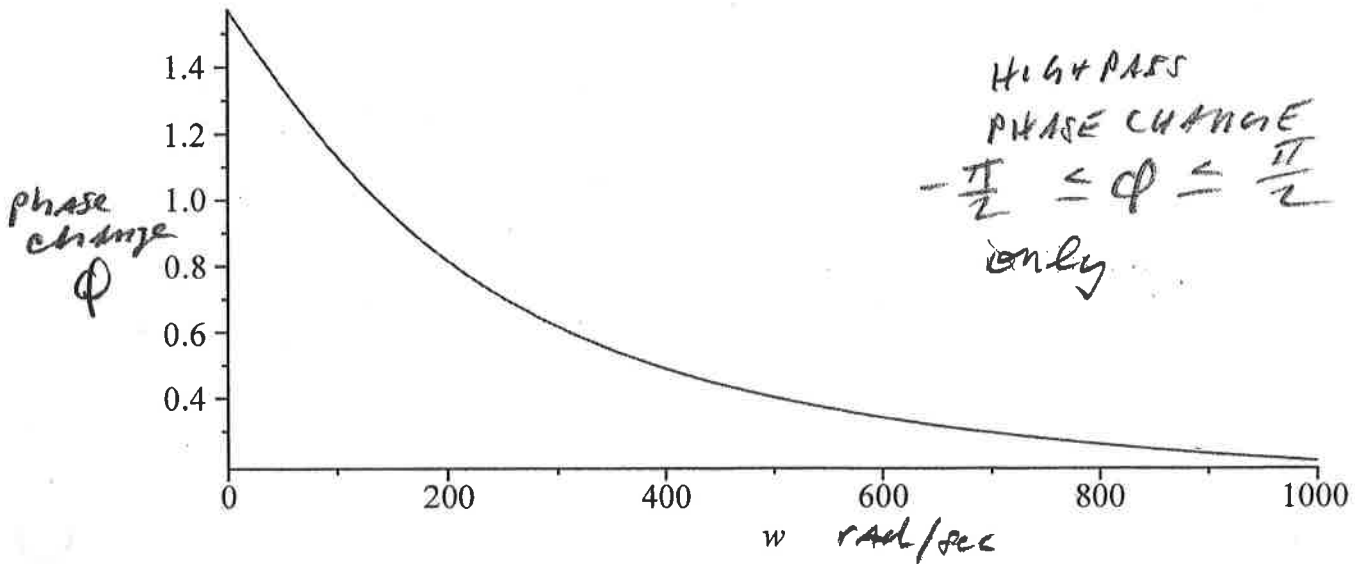
$$0.0000047 \quad (3)$$

plot(abs(H1), w = 0..1000)



(4)

plot(arctan(Im(H1)/Re(H1)), w = 0.001..1000)



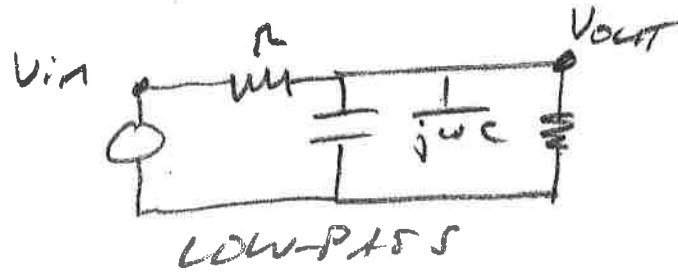
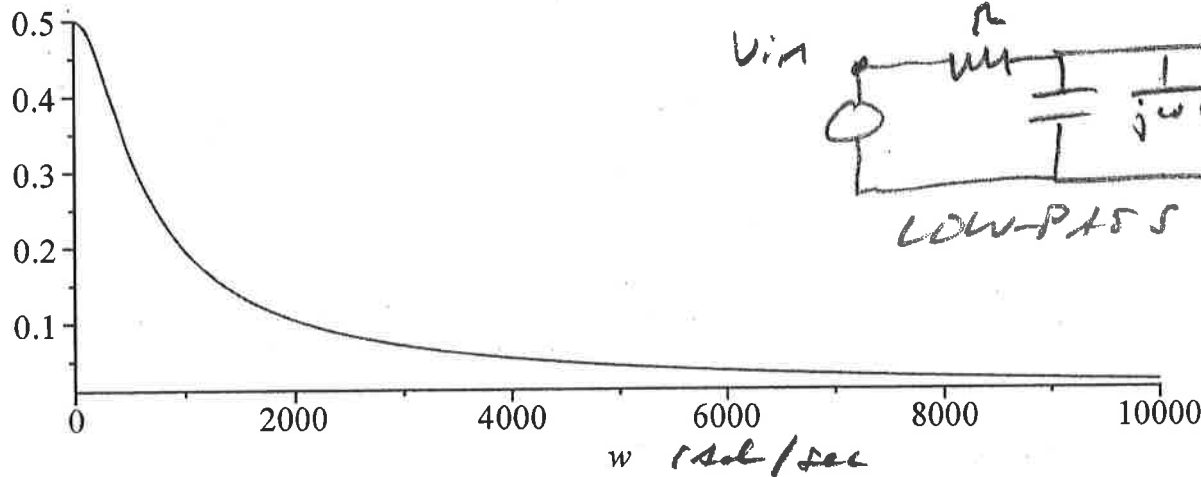
$$H2 := \frac{\left( \left( w \cdot C \cdot I + \frac{1}{R} \right)^{-1} \right)}{\left( R + \left( w \cdot C \cdot I + \frac{1}{R} \right)^{-1} \right)}$$

$$\frac{1}{\left( 0.0000047 I w + \frac{1}{1000} \right) \left( 1000 + \frac{1}{0.0000047 I w + \frac{1}{1000}} \right)}$$

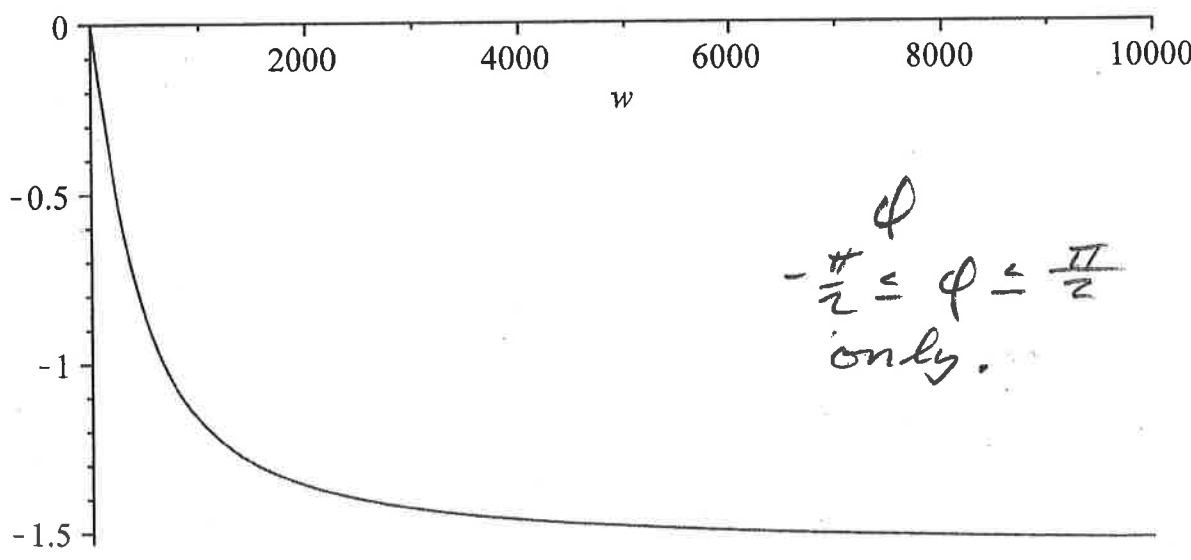
(5)

plot(abs(H2), w = 0..10000)

$H_2$



plot(arctan(Im(H2)/Re(H2)), w = 0.001..10000)



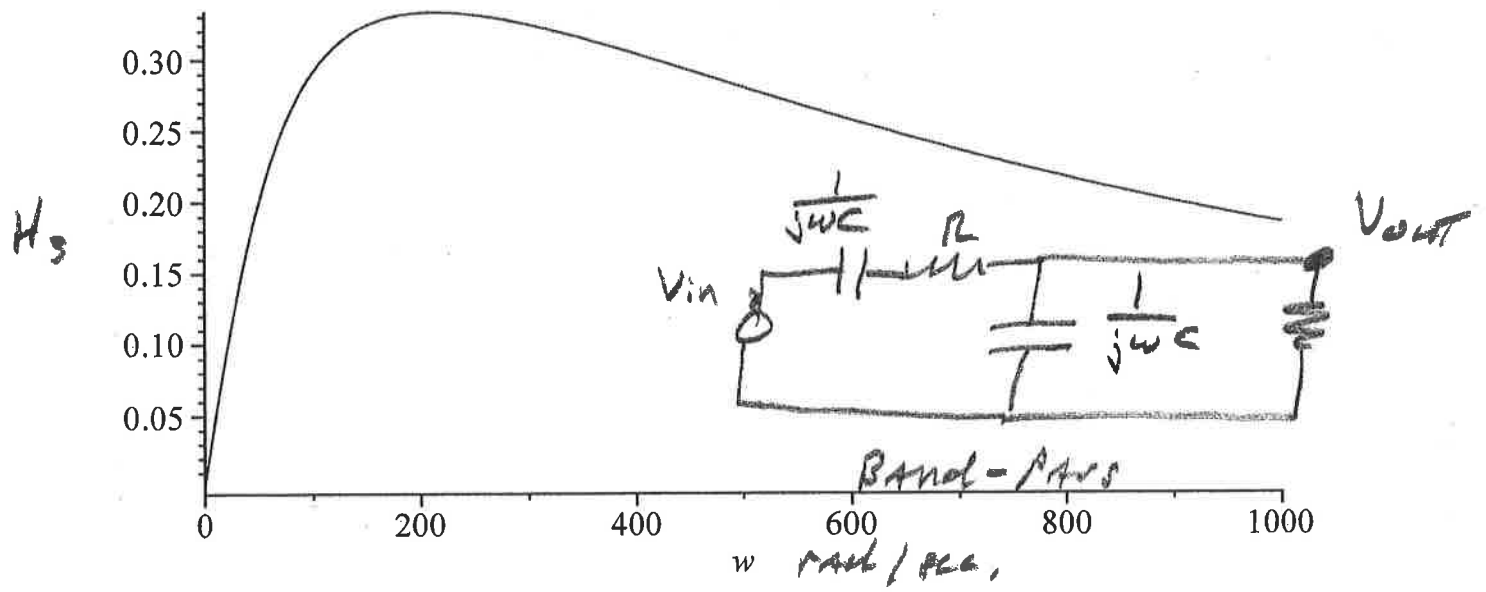
$\phi$   
 $-\frac{\pi}{2} \leq \phi \leq \frac{\pi}{2}$   
 only.

$$H3 := \frac{\left( w \cdot C \cdot I + \frac{1}{R} \right)^{-1}}{R + \frac{1}{(w \cdot C \cdot I)} + \left( w \cdot C \cdot I + \frac{1}{R} \right)^{-1}}$$

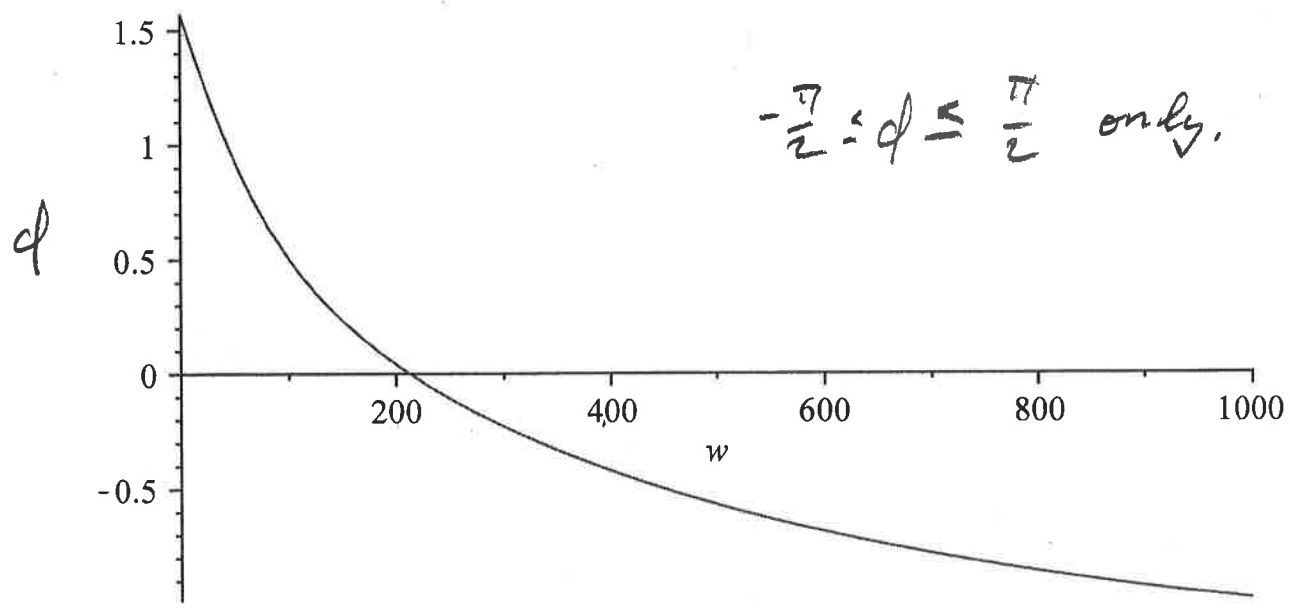
(6)

$$\frac{1}{\left(0.0000047 I w + \frac{1}{1000}\right) \left(1000 - \frac{2.127659574 \cdot 10^5 I}{w} + \frac{1}{0.0000047 I w + \frac{1}{1000}}\right)}$$

plot(abs(H3), w = 0 .. 1000)



plot(arctan(Im(H3)/Re(H3)), w = 0.001 .. 1000)



$L := .1$  Henry

0.1

(7)

$$H4 := \frac{R}{R + w \cdot L \cdot I}$$

$$\frac{1000}{1000 + I w L}$$

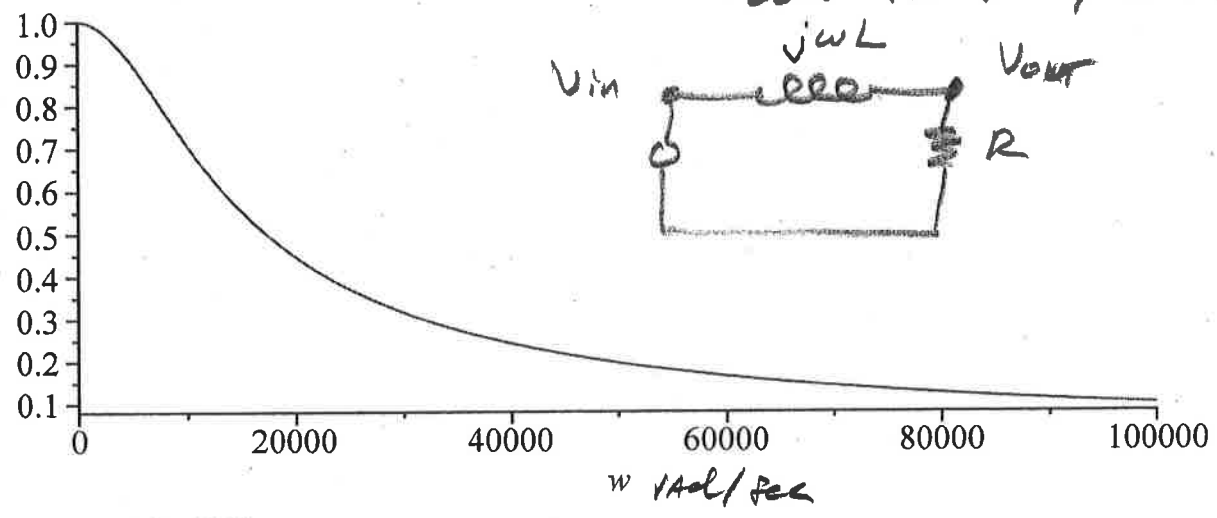
(8)

plot(abs(H4), w = 0 .. 100000)

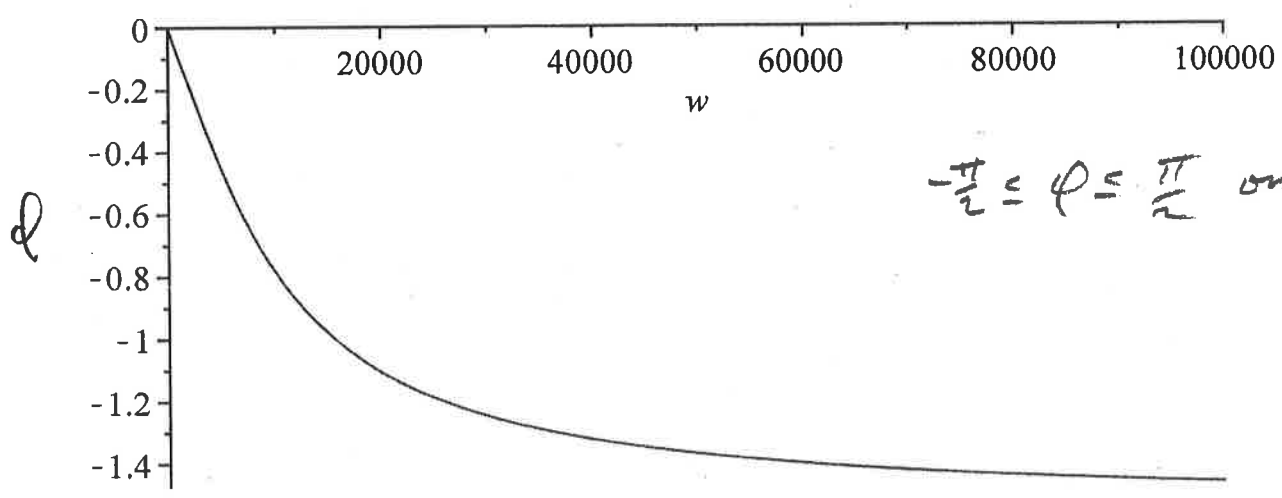
LOW-IMPEDANCE w/ INDUCTOR



H4



plot(arctan(Im(H4)/Re(H4)), w = 0.001 .. 100000)



$-\frac{\pi}{2} \leq \phi \leq \frac{\pi}{2}$  only.

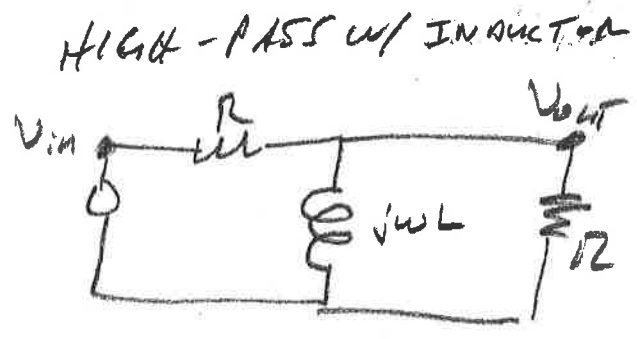
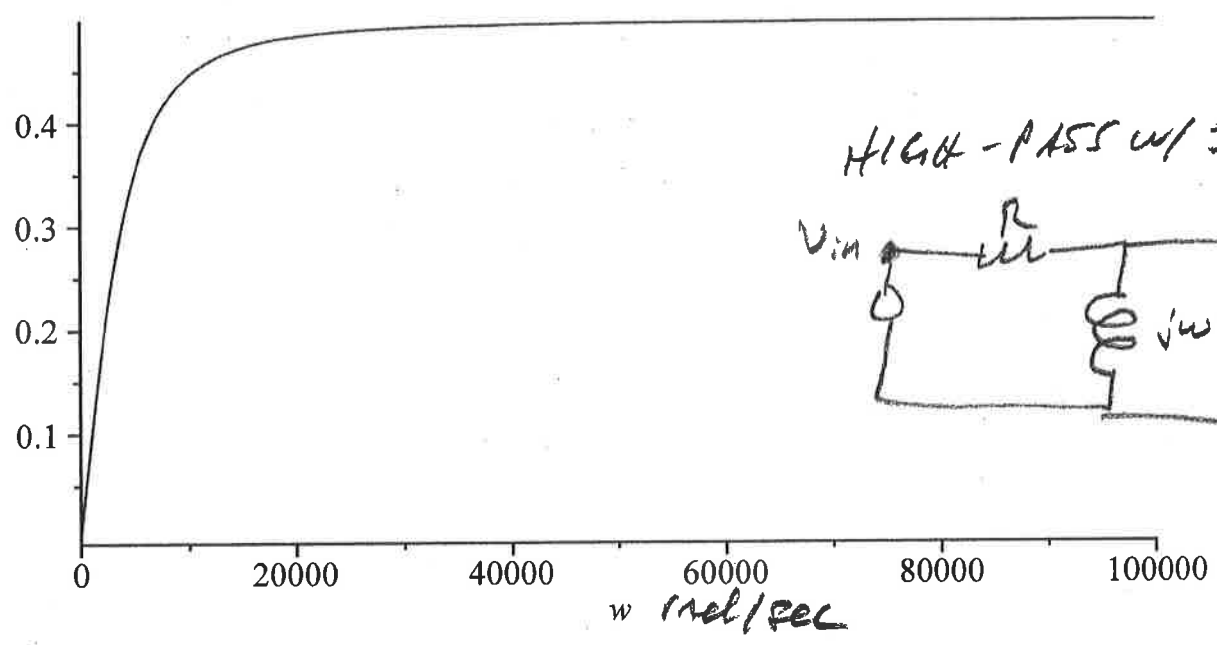
$$H5 := \frac{\left(\frac{1}{w \cdot L \cdot I} + \frac{1}{R}\right)^{-1}}{R + \left(\frac{1}{w \cdot L \cdot I} + \frac{1}{R}\right)^{-1}}$$

$$\frac{1}{\left(-\frac{10 \cdot I}{w} + \frac{1}{1000}\right) \left(1000 + \frac{1}{-\frac{10 \cdot I}{w} + \frac{1}{1000}}\right)}$$

(9)

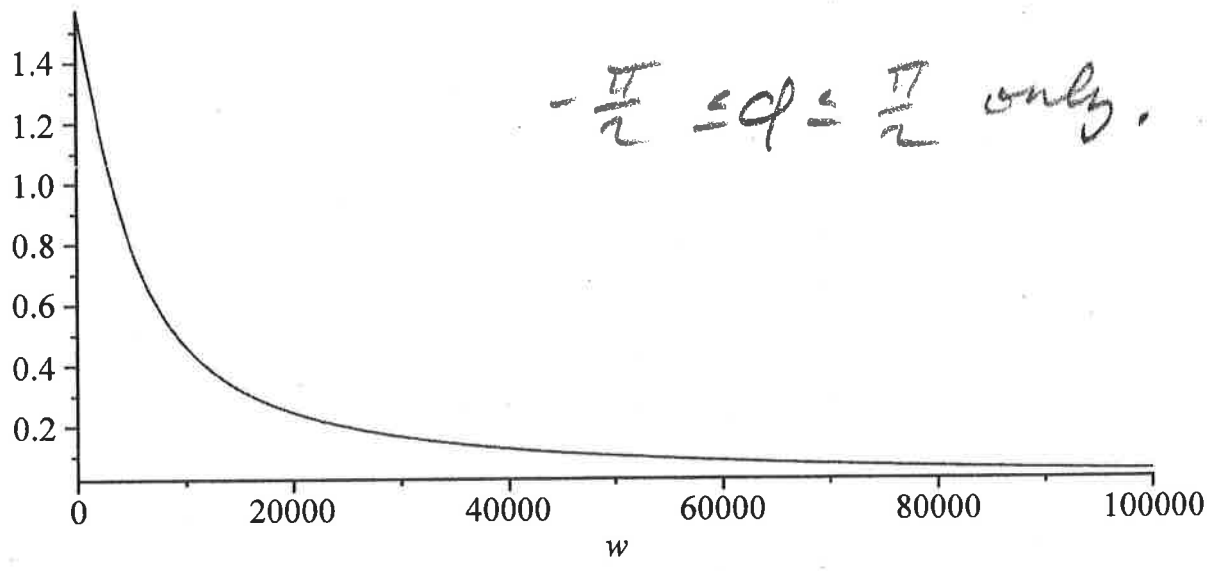
plot(abs(H5), w = 0 .. 100000)

$H_5$



plot( arctan(  $\frac{\text{Im}(H_5)}{\text{Re}(H_5)}$  ), w = 0.001 .. 100000 )

$\phi$



$$H_6 := \frac{R}{R + \left( w \cdot L - \frac{1}{w \cdot C} \right) \cdot I}$$

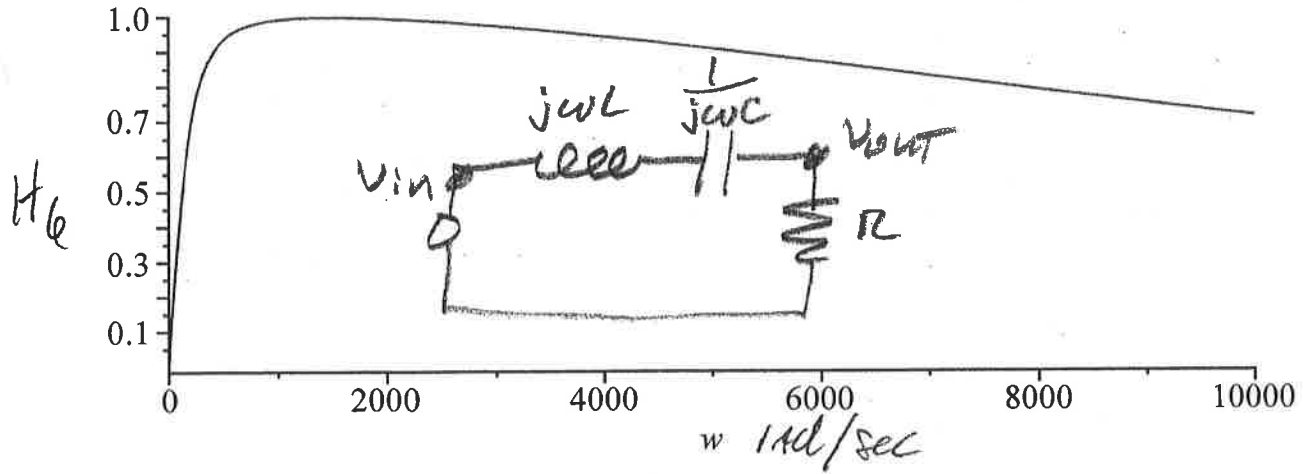
i.e.,  $R/LC$ .

$$\frac{1000}{1000 + I \left( 0.1 w - \frac{2.127659574 \cdot 10^5}{w} \right)}$$

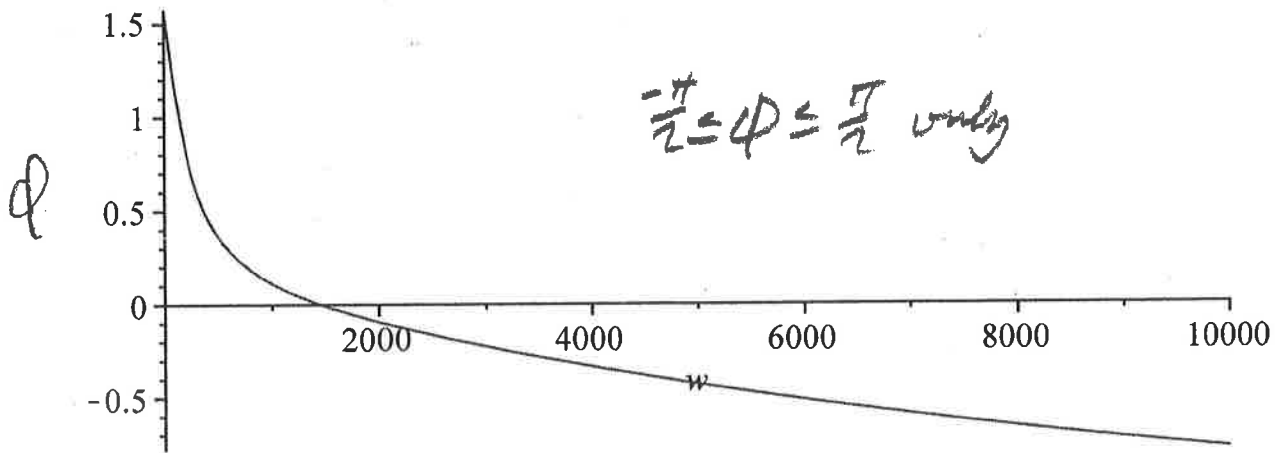
(10)

plot(abs(H6), w = 0 .. 100000)

### BAND-PASS, RLC



plot( $\arctan\left(\frac{\text{Im}(H6)}{\text{Re}(H6)}\right)$ ,  $w = 0.001 \dots 10000$ )



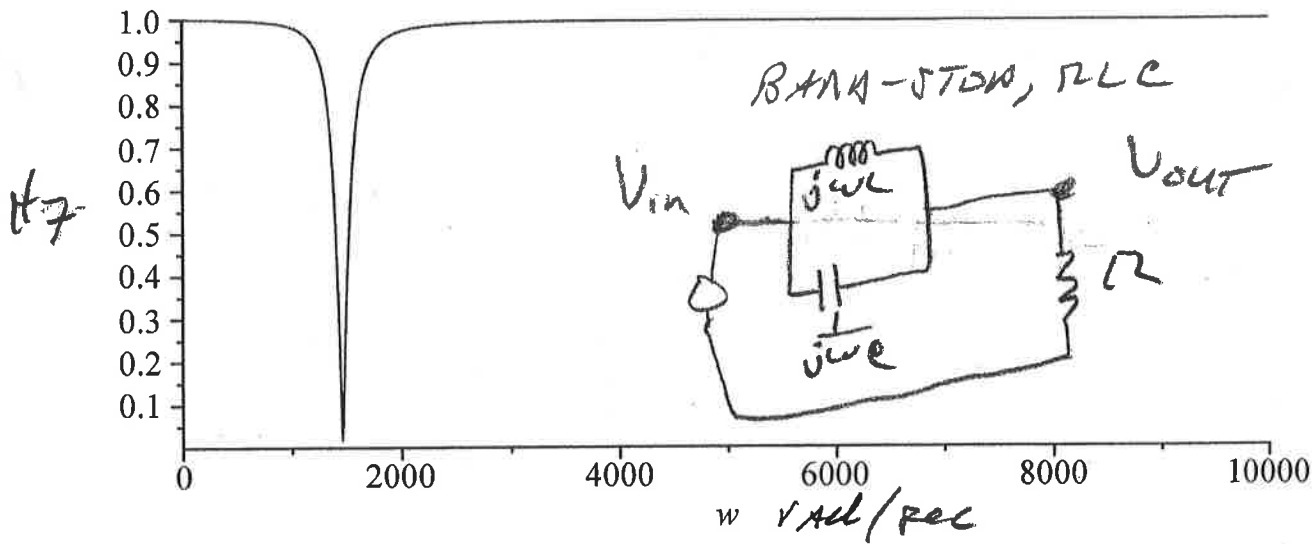
$$H7 := \frac{R}{R + \left( w \cdot C \cdot I + \frac{1}{w \cdot L \cdot I} \right)^{-1}}$$

$$\frac{1000}{1000 + \frac{1}{0.0000047 I w - \frac{10 \cdot I}{w}}}$$

(11)

plot(abs(H7),  $w = 0 \dots 10000$ )





$plot\left(\arctan\left(\frac{\text{Im}(H7)}{\text{Re}(H7)}\right), w = 0.001 \dots 10000\right)$

