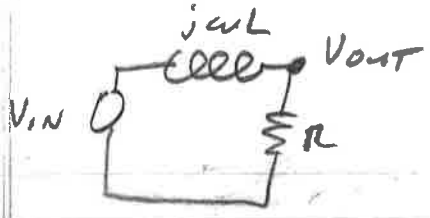
W. FUNDERBURK



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

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

$V_{OUT} = IR$

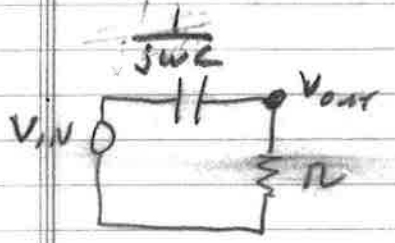
$= \left(\dfrac{V_{IN}}{R + j\omega L}\right) R$

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

$= \dfrac{R}{R + j\omega L}$ Plot in Maple

* **LOW-PASS, RL**

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



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

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

$V_{OUT} = IR$

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

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

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

* **HIGH-PASS, RC**

* Let $\begin{cases} R = 1\,k\Omega \\ C = 4.7\,\mu F \end{cases}$ 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

$$V_{out} = I R$$

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

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

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

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

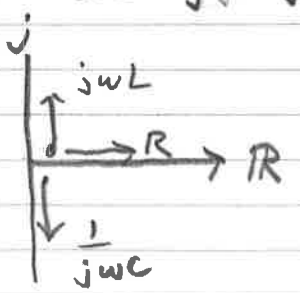
* let $\begin{cases} R = 1\,k\Omega \\ L = 0.1\,H \\ C = 4.7\,\mu F \end{cases}$ and plot in Matlab

W. F.

* NOTES: $[R] = \left[\frac{\Sigma}{I}\right] = \frac{V}{A} = \frac{J/C}{C/S} = \frac{J \cdot S}{C^2} = \Omega$

$$[j\omega L] = \frac{1}{S/C} \cdot H = \left(\frac{1}{J}\right)\left(\frac{J S^2}{C^2}\right) = \frac{J \cdot S}{C^2} = \Omega$$

$$-\frac{j}{\omega C} \cdot \frac{j}{j} = \frac{1}{j\omega C}, \quad \left[\frac{1}{j\omega C}\right] = \frac{1}{\frac{1}{S} \cdot F} = \frac{S}{C^2/J} = \frac{J \cdot S}{C^2} = \Omega$$



$with(plots)$:

$R := 1000$ Ω

$$1000 \tag{1}$$

$C := 4.7e-6$ F

$$0.0000047 \tag{2}$$

$L := .1$ H

$$0.1 \tag{3}$$

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

$$\frac{1000}{-\frac{2.127659574\ 10^5\ I}{w} + 1000} \tag{4}$$

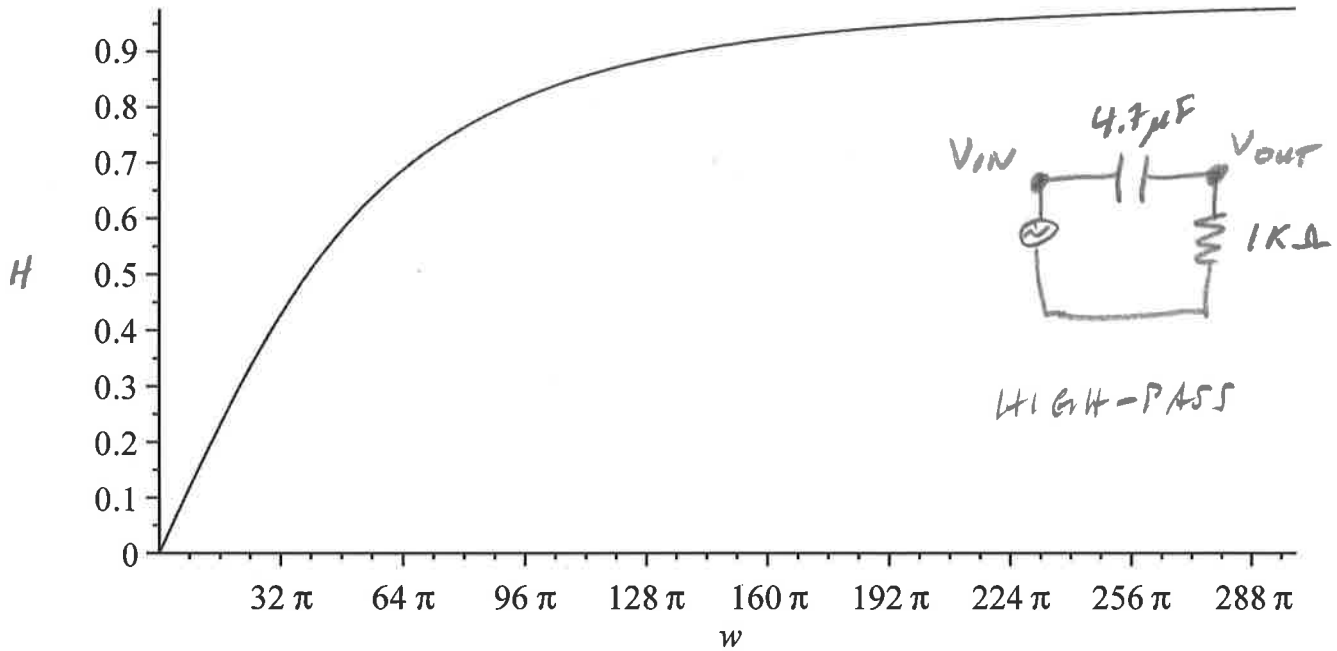
$$H2 := \frac{R}{(I \cdot w \cdot L + R)}$$

$$\frac{1000}{0.1\ I\ w + 1000} \tag{5}$$

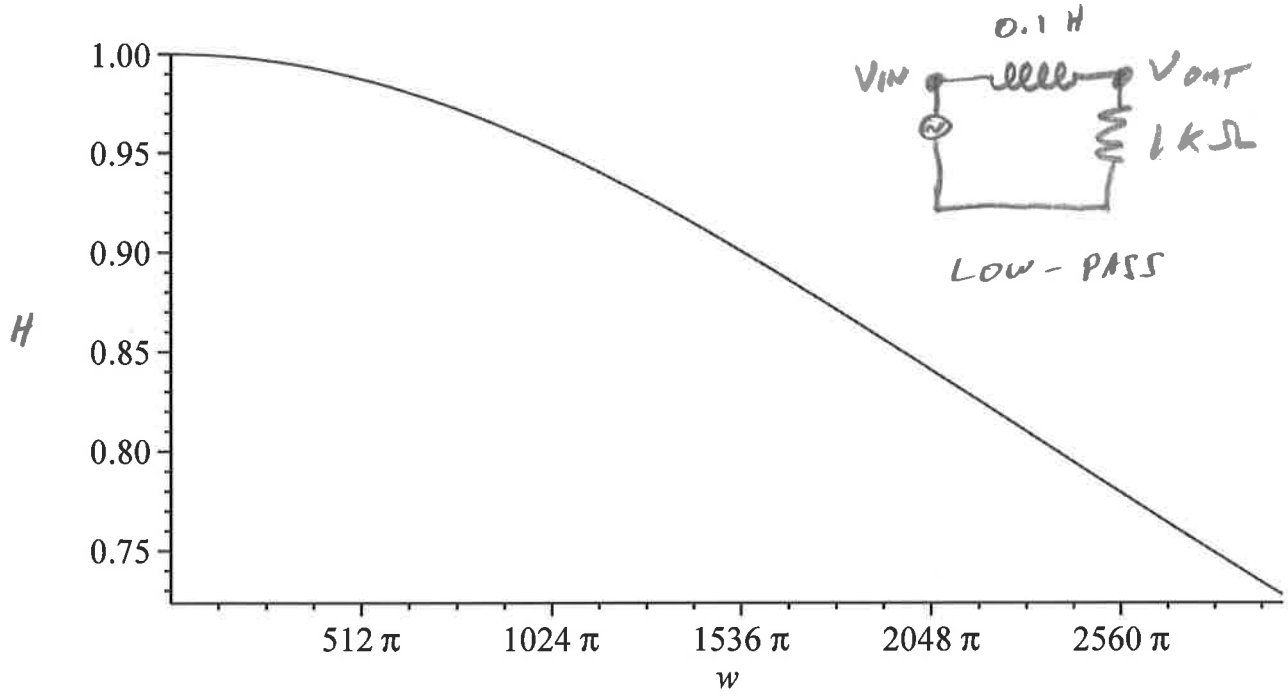
$$H3 := \frac{R}{\left(I \cdot w \cdot L + \left(\frac{1}{I \cdot w \cdot C}\right) + R\right)}$$

$$\frac{1000}{0.1\ I\ w - \frac{2.127659574\ 10^5\ I}{w} + 1000} \tag{6}$$

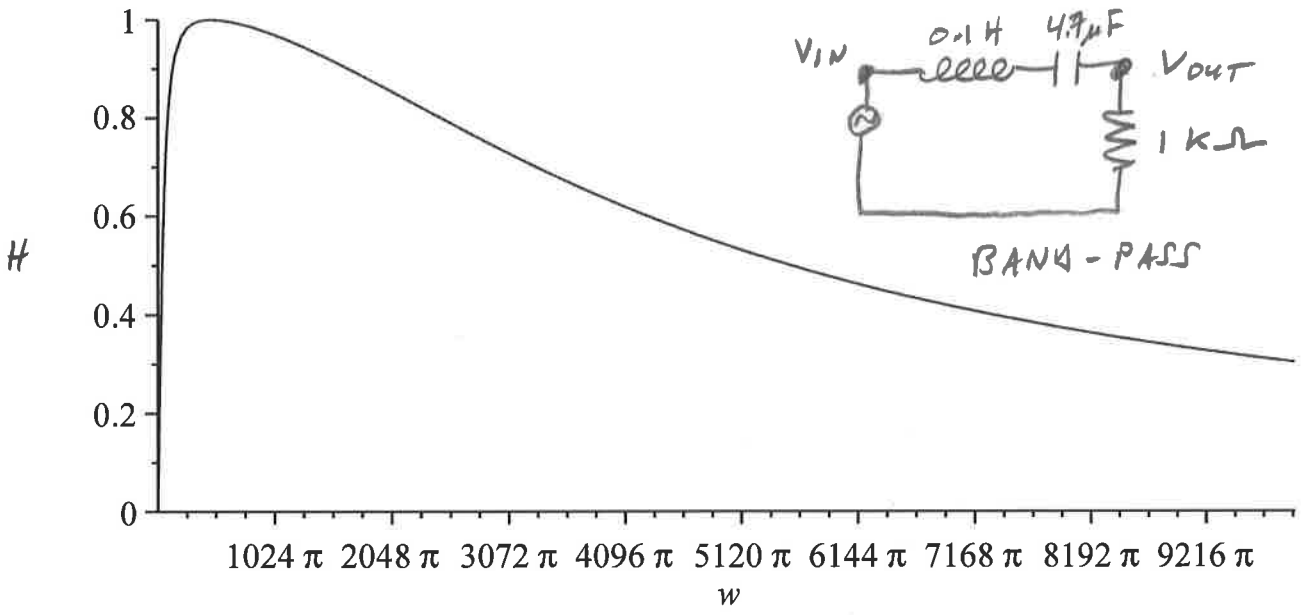
$plot(\mathrm{abs}(H1), w = 0..300 \cdot \pi)$



$plot(\mathrm{abs}(H2), w = 0..3000 \cdot \pi)$



$plot(\text{abs}(H3), w = 0..10000 \cdot \pi)$



$$A := \frac{1}{(\sqrt{L \cdot C})}$$

$$\frac{A}{(2 \cdot 3.14159)}$$

$\omega_R =$ 1458.649915 rad/s **(7)**

$f_R =$ 232.1515403 Hz **(8)**