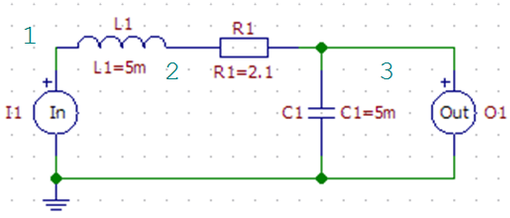
MNA Solver

Include

RLC Examples

Short hands: $V(n) := \left| MNA(\chi, MNA_{AC})_4 \right|_n$ $\quad \chi' := \left| \chi_{[1..rows(\chi)][1..2]} \right|$ $\quad Sym(n) := \left| \frac{MNA(\chi', MNA_{AC})_4}{V_{in}} \right|_n$ Exact transfer fuction (voltage gain)



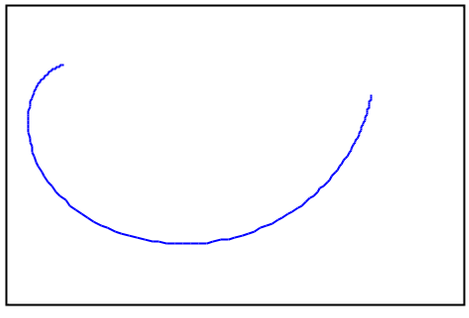
$$\chi := \begin{bmatrix} V_{in} & [1\ 0] & V_{in} \\ L & [1\ 2] & 5\ mH \\ C & [0\ 3] & 5\ mF \\ R & [2\ 3] & R \end{bmatrix}$$

$$H(s) := \frac{V(3)}{V_{in}}$$

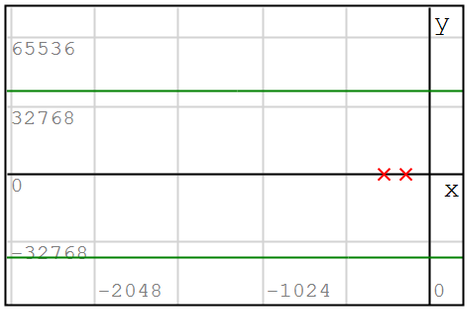
$$Sym(3) = \frac{R}{(1 + s \cdot C \cdot R) \cdot (R + s \cdot L) - s \cdot L}$$

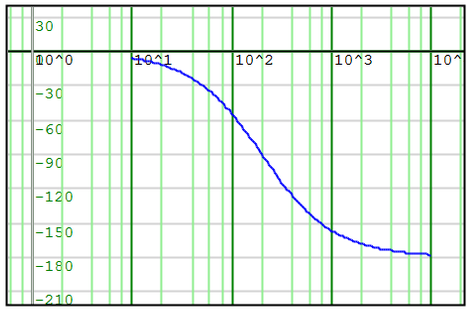
Plots are: BodeMag BodePhase ZP Plot Nyquist Nichols

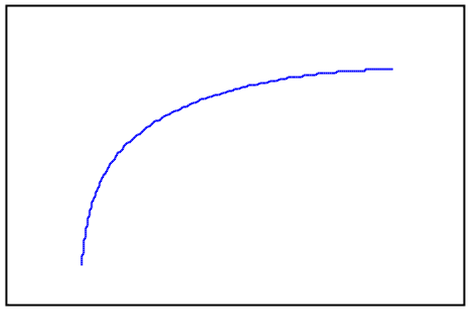
$$\begin{cases} R := 2.1\ \Omega \\ Bode_1 := logspace(1, 4)\ Hz \\ \Pi := Bode(H(s\#)) \end{cases}$$



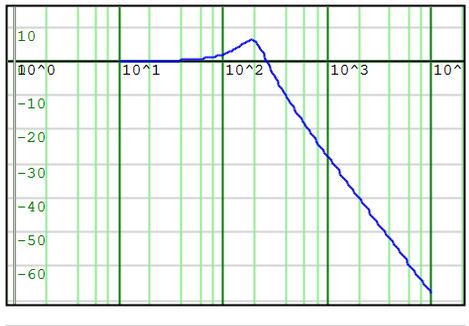
Big losses: R=2.1Ω

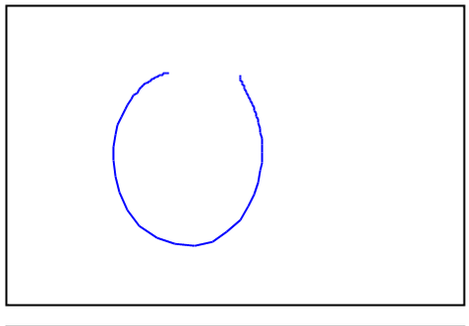




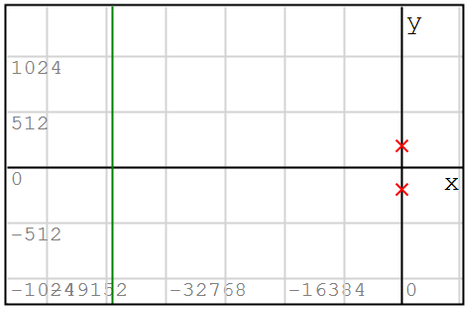


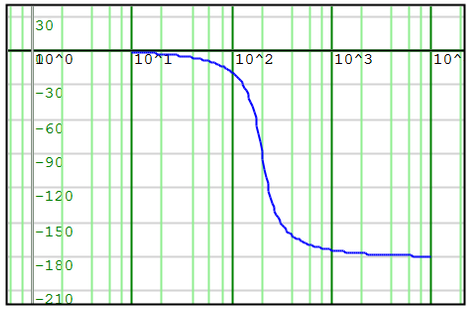
$$\begin{cases} R := 0.51\ \Omega \\ Bode_1 := logspace(1, 4)\ Hz \\ \Pi := Bode(H(s\#)) \end{cases}$$

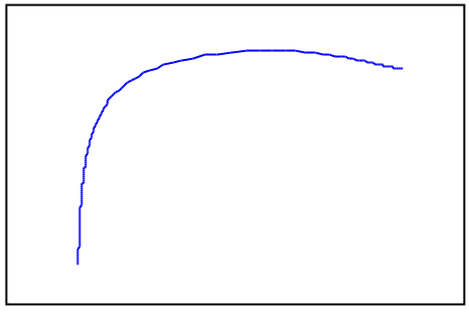




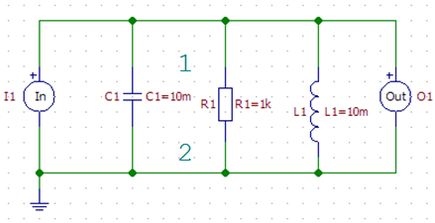
Small losses: R=0.51Ω







Parallel resonant circuit

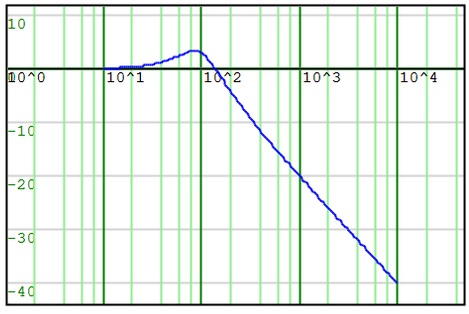


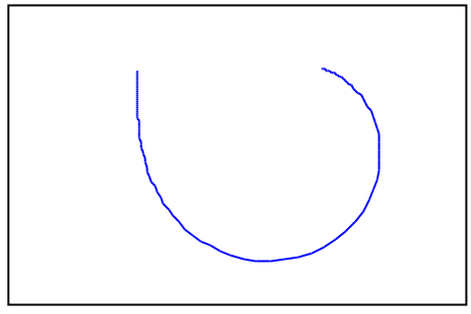
$\text{Clear}(R) = 1$

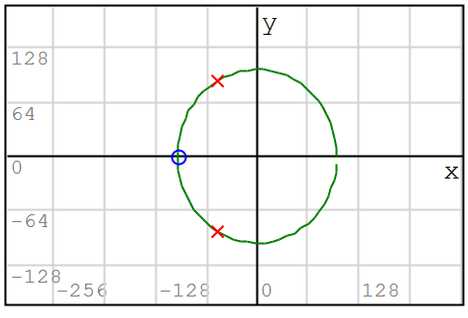
$$\chi := \begin{bmatrix} V_{in} & [1\ 0] & V_{in} \\ L & [1\ 2] & 10\ \text{mH} \\ C & [0\ 3] & 10\ \text{mF} \\ R & [2\ 3] & 1\ \Omega \end{bmatrix} \qquad H(s) := \frac{V(2)}{V_{in}}$$

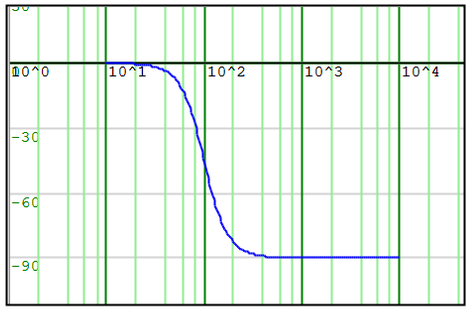
$$Sym(2) = \frac{R \cdot (1 + s \cdot C \cdot R)}{(1 + s \cdot C \cdot R) \cdot (R + s \cdot L) - s \cdot L}$$

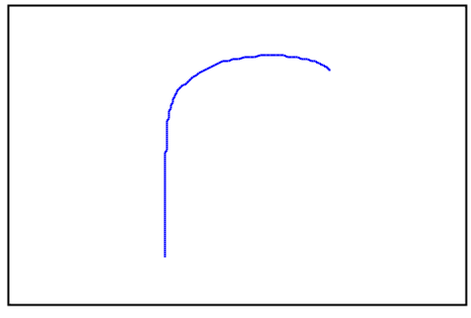
$$\begin{cases} Bode_1 := logspace(1, 4)\ \text{Hz} \\ \Pi := Bode(H(s\#)) \end{cases}$$



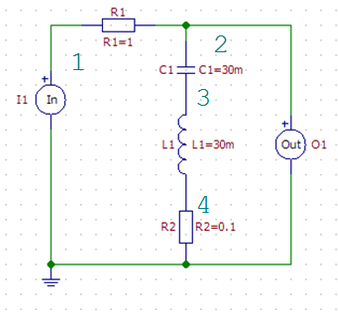








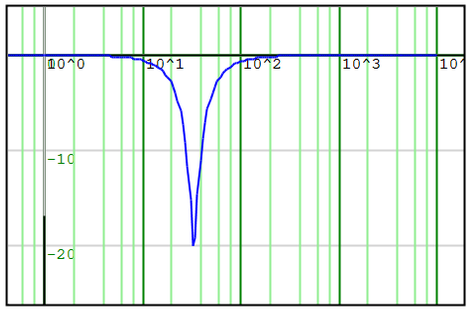
Band resistor with serial resonant circuit

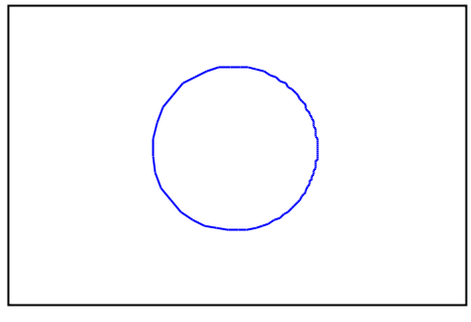


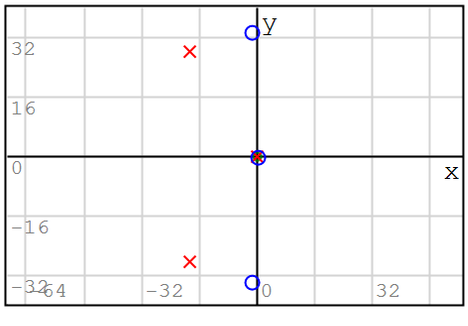
$$\chi := \begin{bmatrix} V_{in} & [1\ 0] & V_{in} \\ L & [3\ 4] & 30\ \text{mH} \\ C & [2\ 3] & 30\ \text{mF} \\ R_1 & [1\ 2] & 1\ \Omega \\ R_2 & [0\ 4] & 0.1\ \Omega \end{bmatrix} \qquad H(s) := \frac{V(2)}{V_{in}}$$

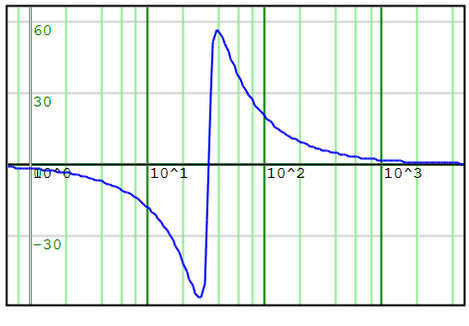
$$Sym(2) = \frac{-R_2 + (1 + s^2 \cdot C \cdot L) \cdot (R_2 + s \cdot L)}{-(1 + s \cdot C \cdot R_1) \cdot R_2 + (R_2 + s \cdot L) \cdot ((1 + s^2 \cdot C \cdot L) \cdot (1 + s \cdot C \cdot R_1) - s^3 \cdot C^2 \cdot R_1 \cdot L)}$$

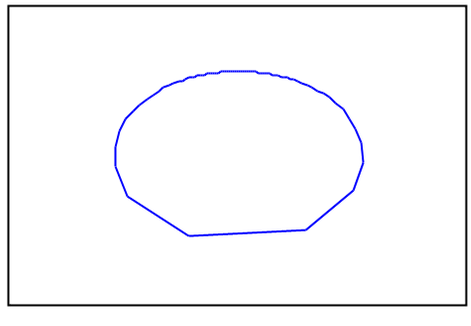
$$\begin{cases} Bode_1 := logspace(-1, 4)\ \text{Hz} \\ \Pi := Bode(H(s\#)) \end{cases}$$











Alvaro