

How to measure Inductance in Ltspice

1) Consider the reactive circuit in figure 1

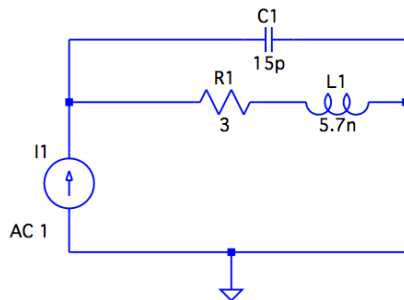


Figure 1

Determine the expression of the input impedance of the circuit.

Determine the resonance frequency of the circuit

Determine the circuit inductance value for a frequency of 100Hz.

Determine the quality factor, for a frequency of 100Hz

2) Simulation of the Ltspice circuit:

Edit the circuit schematic

For the font consider the following characterization:

Time Domain Function

Edit Current Source I1

style: DC Value

DC Value[A]:

Make this information visible on the schematic ☒

Small Signal Parameters(,AC)

AC Amplitude: 1

AC Phase[°]:

Make this information visible on the schematic ☒

Perform an AC analysis by selecting

Transient **AC Analysis** DC Sweep Noise DC Transfer DC Bias Point

Compute the small signal AC behavior linearized about the circuit's DC operating point.

Nature of Sweep: Decade

Number of points per decade: 1e1

Start frequency: 1e3

Stop frequency: 1e10

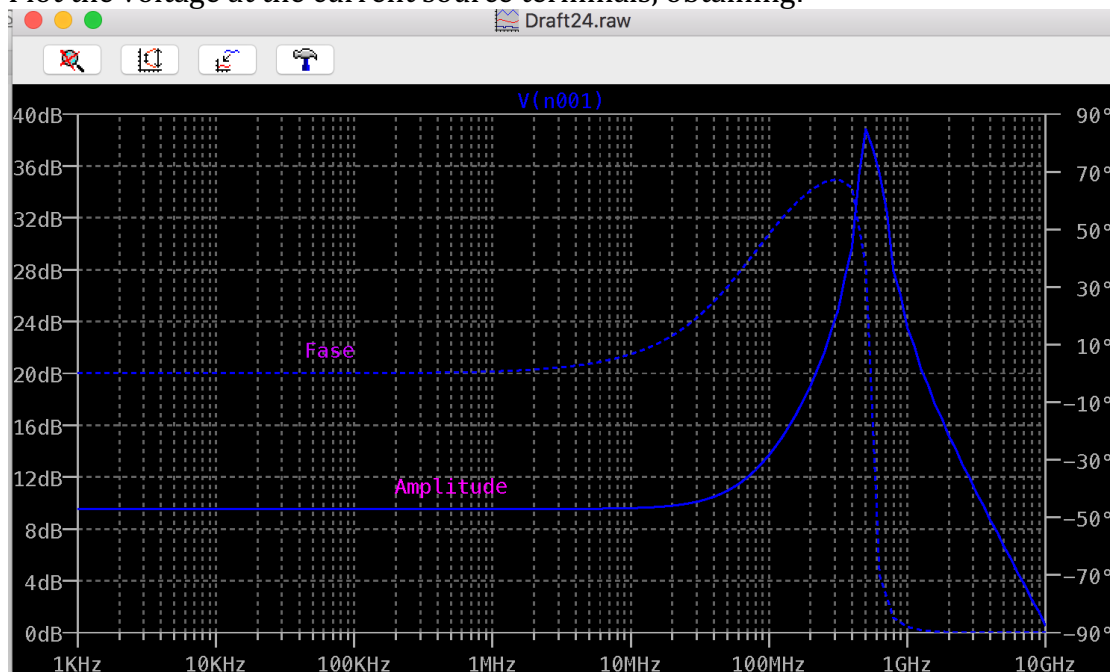
This analysis is useful for continuous-time, non-switching, circuits.

Syntax: .ac <oct, dec, lin> <Npoints> <StartFreq> <EndFreq>

.ac dec 1e1 1e3 1e10

Cancel OK

Plot the voltage at the current source terminals, obtaining:



This graph constitutes the Bode diagram of the voltage at the current source terminals.

Since $v_i(f) = Z(f) \cdot i(f)$, once we consider a unitary current source, we conclude that the graph we obtained corresponds to the circuit impedance graph.

Analyzing the graph we see that there is an initial range of frequencies for which the phase is positive, i.e., the circuit has an inductive behavior. And there is a range of high frequencies, for which the circuit has a capacitive behavior.

We also conclude that there is a resonance frequency around 500MHz on the circuit.

We will now analyze the behavior of the circuit, for low frequencies, i.e. for frequencies below the resonance frequency. Considering the generic expression for the impedance of an inductive circuit given by

$$\bar{Z}_i = R1 + j\omega.L0$$

To obtain the resistance graphs, ie $R1 = \text{Real}\{Z_{in}\}$, the inductance, ie, $L0 = \text{Imag}\{Z_{in}\} / \omega$, and the quality factor, ie, $Q = \text{Imag}\{Z_{in}\} / \text{Real}\{Z_{in}\}$, proceed as follows:

“Add plot” and then “add trace”

Compose Expressions to Plot

Only list data matching this pattern:

☒ Asterisks match colons

Available Data

frequency	V(n001)	V(n002)	I(C1)	I(L1)	I(I1)
I(R1)					

Expression(s) to Add to Plot

re(V(n001))

Cancel OK

And we must change the vertical axis to “linear”

Left Vertical Axis Manual Plot Limits

Axis Range

Top: 10V

Tick: 0.2V

Bottom: 0V

Auto

Representation

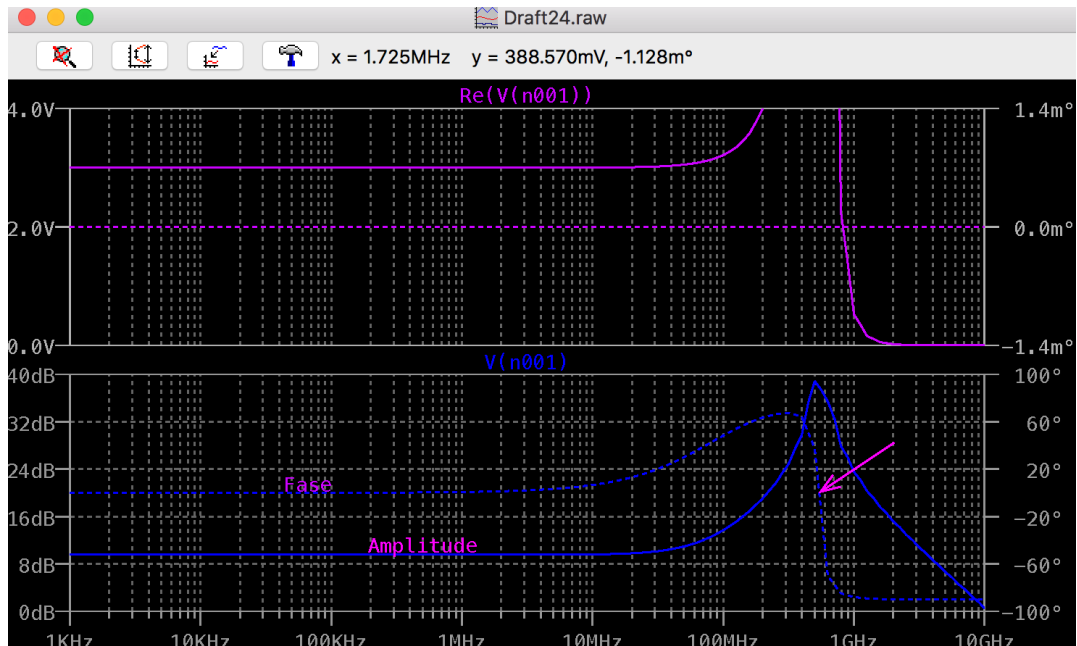
Bode

☒ Linear

☐ Logarithmic

☐ Decibel

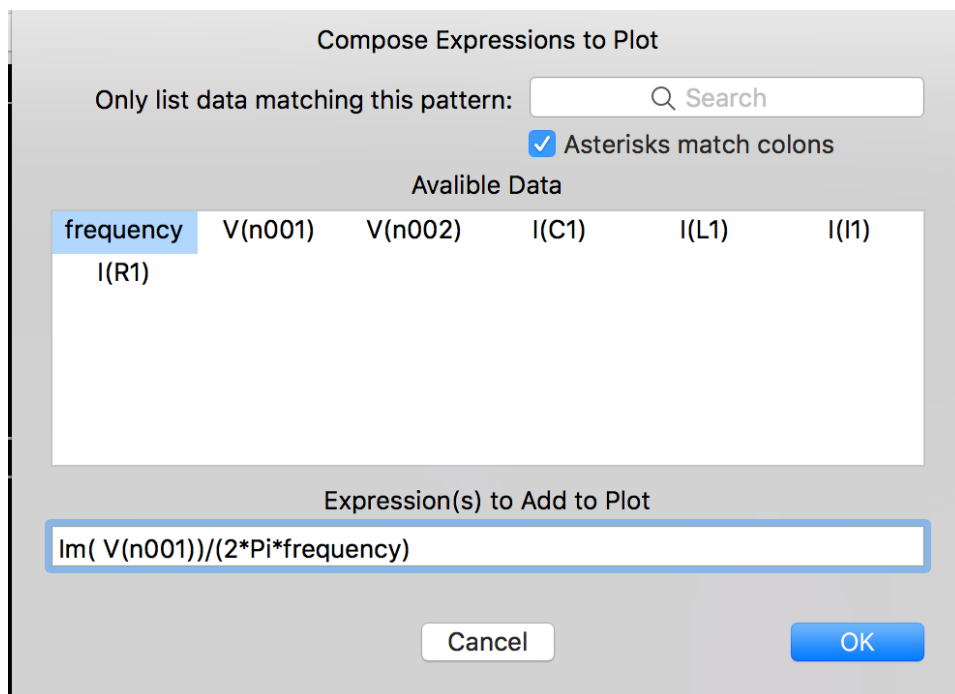
Cancel Don't Plot Magnitude OK



Obtaining for low frequencies a real part of the impedance of 3, which corresponds to the resistance value, R1.

To obtain the equivalent inductance value, just divide the imaginary part of the impedance, by $\omega = 2\pi \cdot f$

Then we select "add plot" again, and "add trace" and select



To obtain

