How to measure Inductance in Ltspice

1) Consider the reactive circuit in figure 1

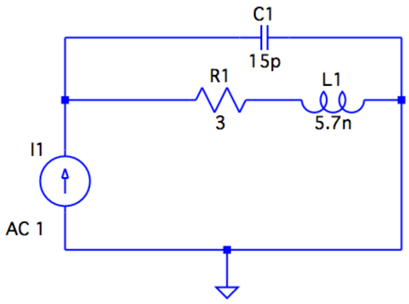


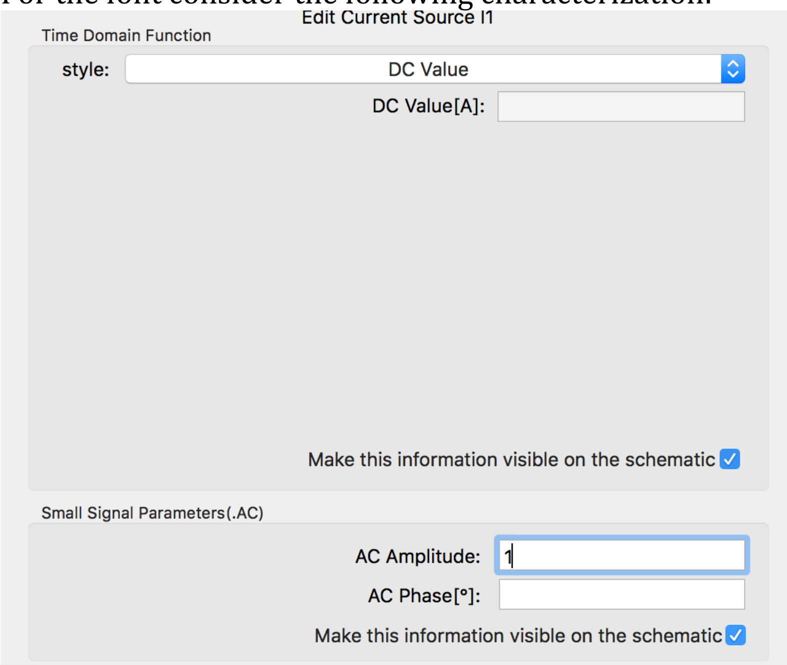
Figure 1

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

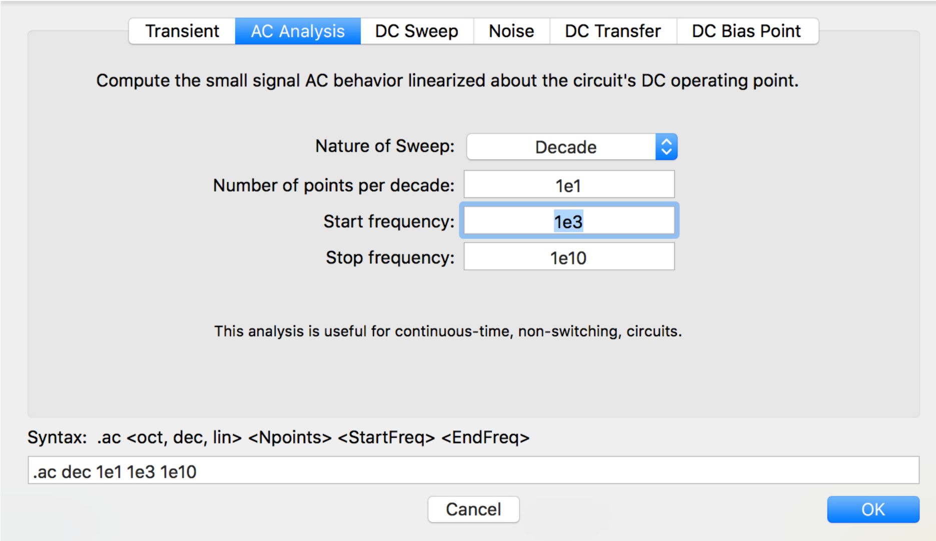
2) Simulation of the Ltspice circuit:

Edit the circuit schematic

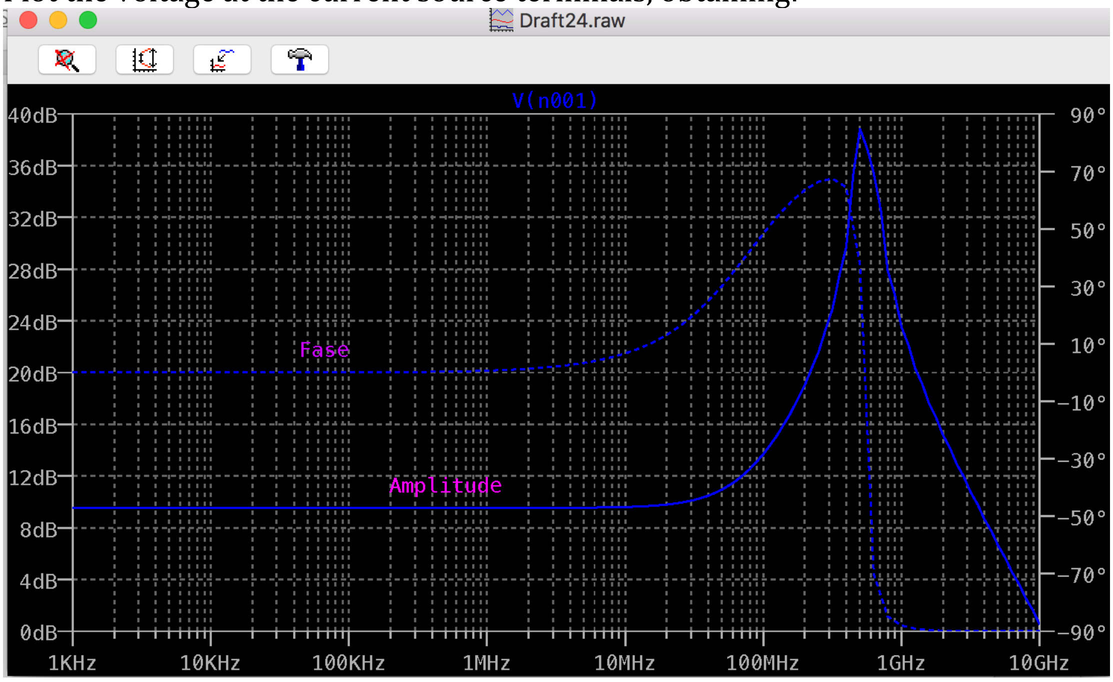
For the font consider the following characterization:



Perform an AC analysis by selecting



Plot the voltage at the current source terminals, obtaining:



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

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

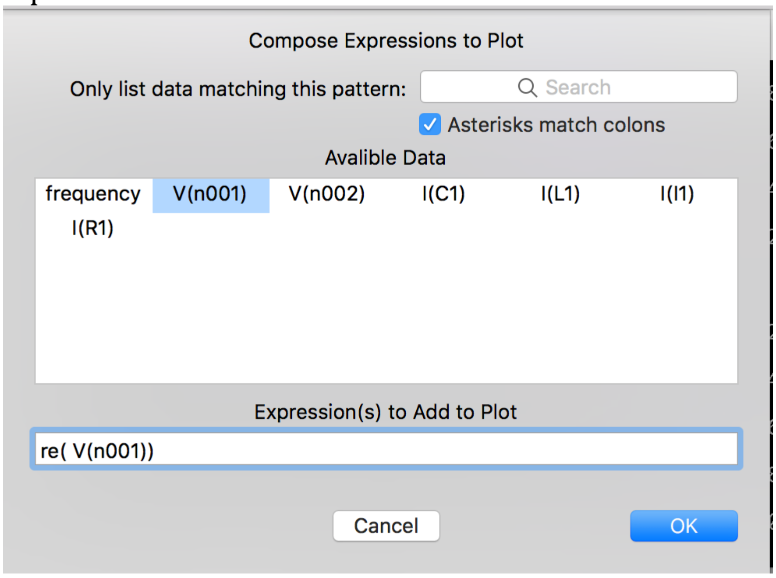
Analyzing the graph we see that there is an initial range of frequencies for which the phase is positive, i.e., the circuit has an inductive behavior. And there is a range of high frequencies, for which the circuit has a capacitive behavior.
We also conclude that there is a resonance frequency around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

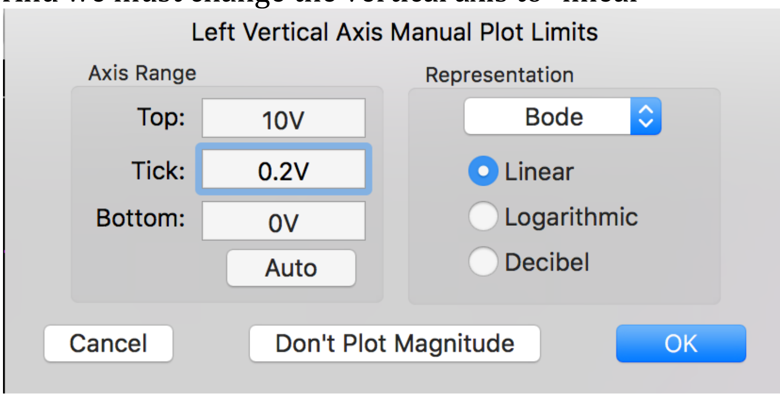
$$\bar{Z}_i = R1 + j\omega . L0$$

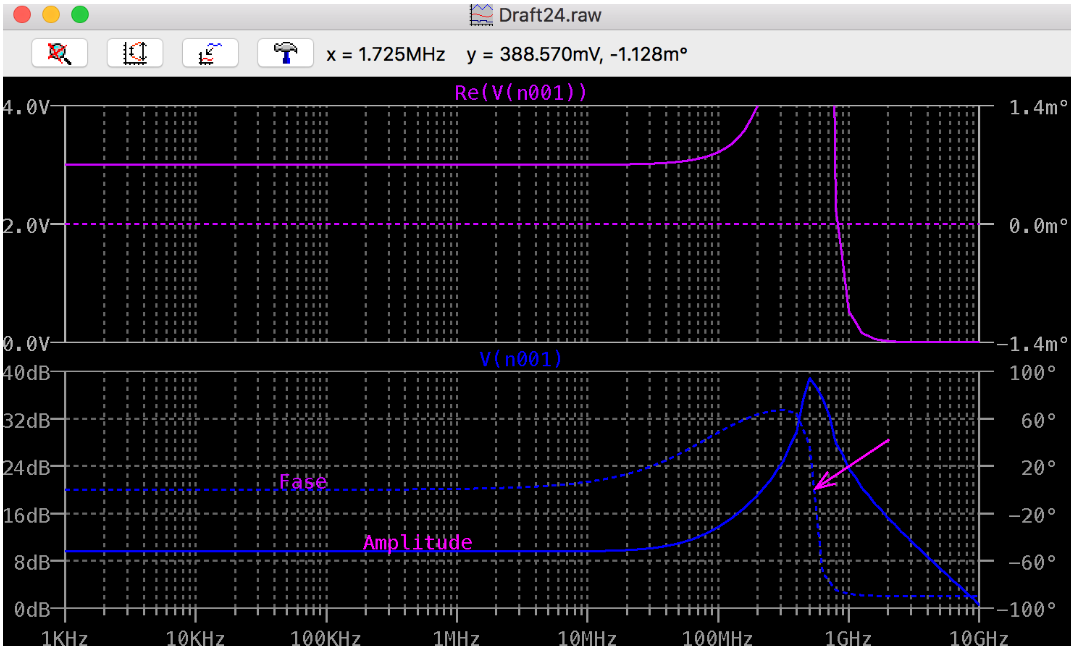
To obtain the resistance graphs, ie R1 = Real {Z_in}, the inductance, ie, L0 = Imag {Z_in} /ω, and the quality factor, ie, Q = Imag {Z_in} /Real {Z_In}, proceed as follows:

"Add plot" and then "add trace"



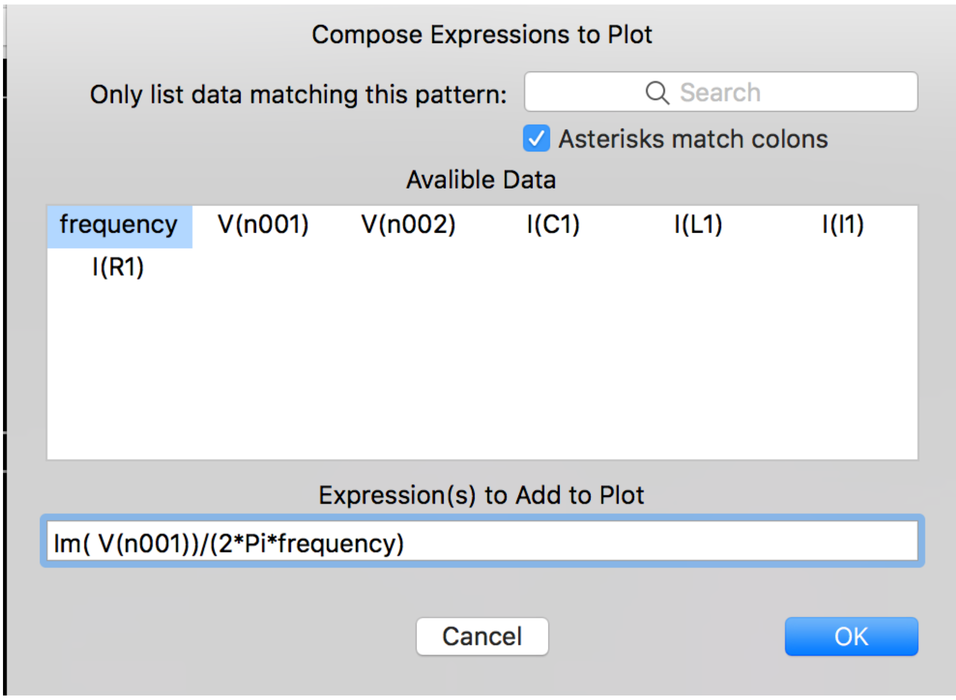
And we must change the vertical axis to "linear"



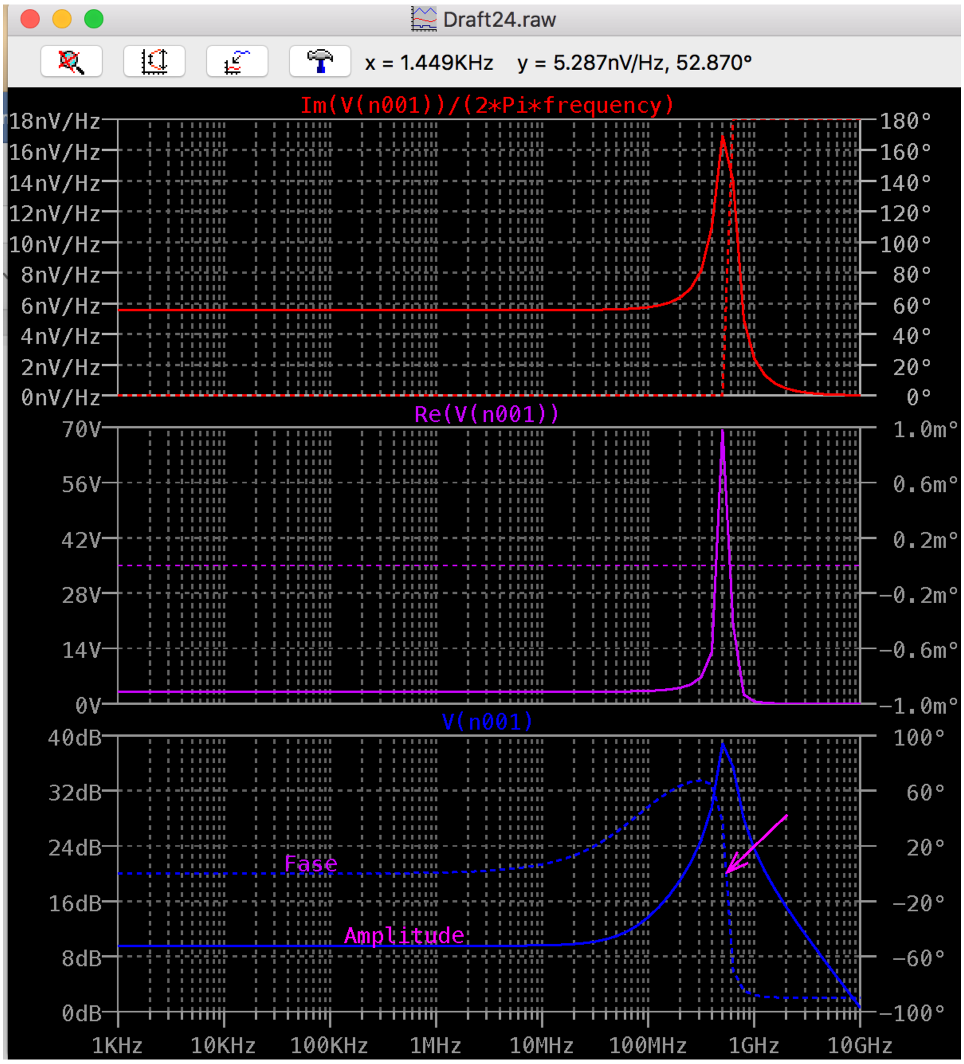


Obtaining for low frequencies a real part of the impedance of 3, which corresponds to the resistance value, R1.

To obtain the equivalent inductance value, just divide the imaginary part of the impedance, by ω = 2.π.f
Then we select "add plot" again, and "add trace" and select



To obtain



Draft24.raw
x = 1.449KHz y = 5.287nV/Hz, 52.870°
Im(V(n001))/(2*Pi*frequency)
18nV/Hz
16nV/Hz
14nV/Hz
12nV/Hz
10nV/Hz
8nV/Hz
6nV/Hz
4nV/Hz
2nV/Hz
0nV/Hz
180°
160°
140°
120°
100°
80°
60°
40°
20°
0°
Re(V(n001))
70V
56V
42V
28V
14V
0V
1.0m°
0.6m°
0.2m°
-0.2m°
-0.6m°
-1.0m°
V(n001)
40dB
32dB
24dB
16dB
8dB
0dB
100°
60°
20°
-20°
-60°
-100°
Fase
Amplitude
1KHz
10KHz
100KHz
1MHz
10MHz
100MHz
1GHz
10GHz