

Gyrator Macro

The gyrator is a two port network that is designed to transform a load impedance into an input impedance where the input impedance is proportional to the inverse of the load impedance. The gyrator network can be used to transform a load capacitance into an inductance. This feature is extremely useful in integrated circuit technology where it is nearly impossible to realize physical inductors. The gyrator circuit can be created with just two dependent sources. Figure 1 displays the schematic of the gyrator macro.

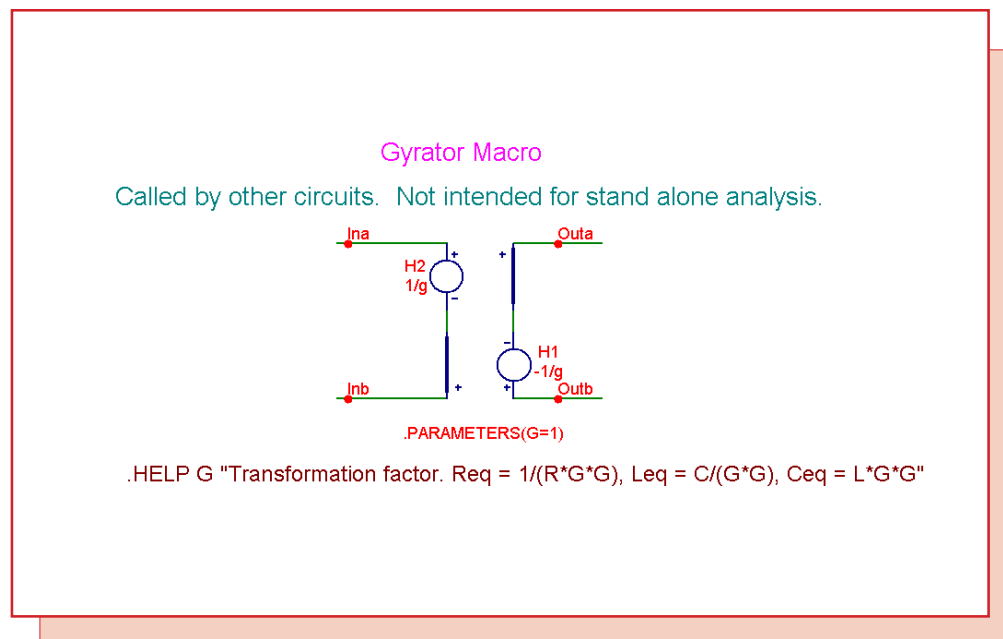


Fig. 1 - Gyrator macro circuit

The gyrator macro consists of just two VofI sources. There is only one parameter in this macro: G. The G parameter defines the gyrator ratio and is used to calculate the gain of the dependent sources. Each source uses the current through the other source as its input. The H1 source has a negative gain because its current input is actually the negative value of the current through H2, and the negative gain will give the two sources the correct opposite polarities.

A test schematic for the gyrator macro appears in Figure 2. The test schematic compares two equivalent circuits: one using an inductor and one using a gyrator and a capacitor. The equation for a gyrator transforming a capacitor to an inductor is as follows:

$$L = C / G^2$$

The 100nF capacitor and gyrator should produce the same output as a 1mH inductor.

As can be seen in Figure 3, the AC output of the gain and the phase for both circuits produce the same results.

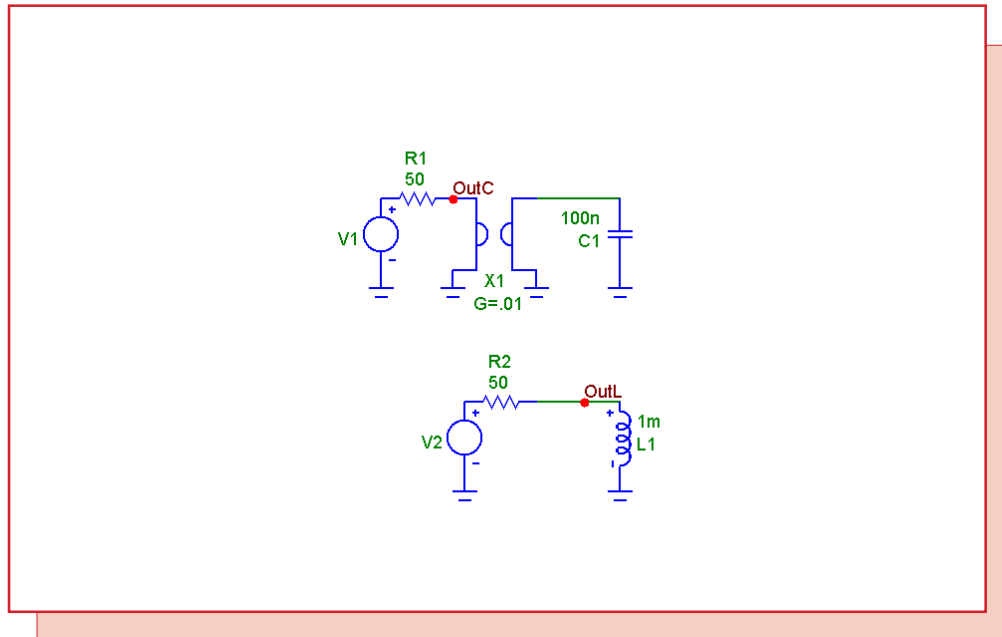


Fig. 2 - Gyrator macro test circuit

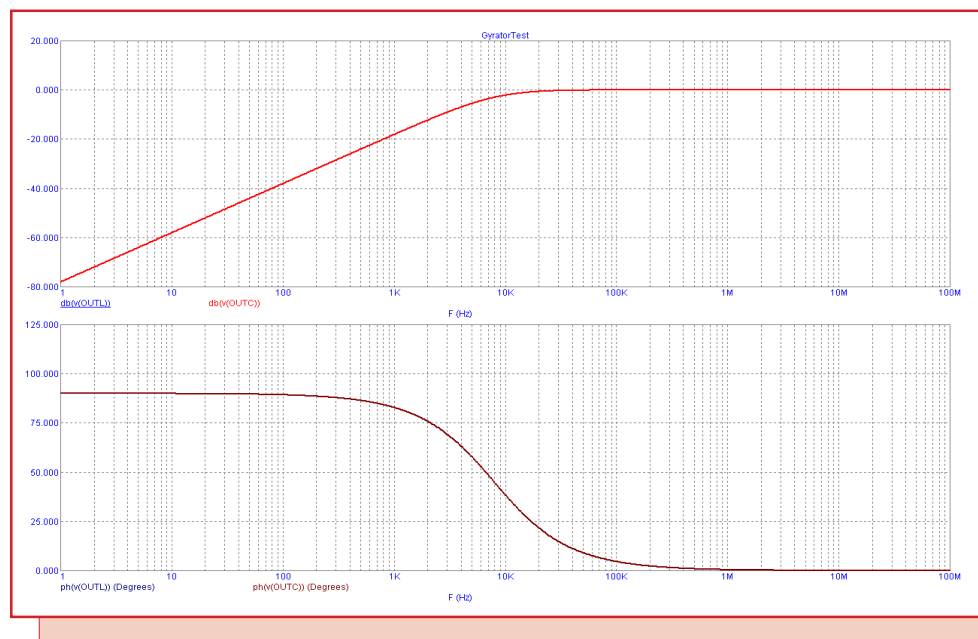


Fig. 3 - AC analysis of the gyrator test circuit