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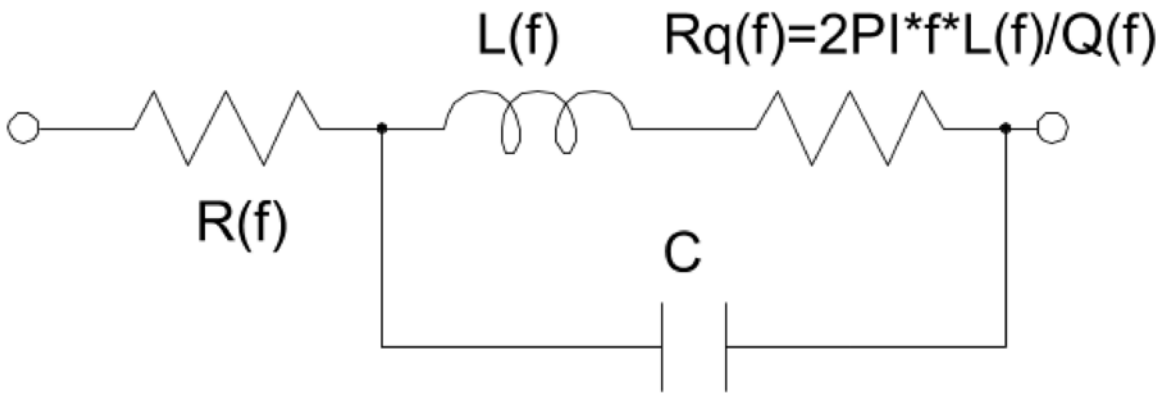
Inductor with Frequency-dependent Inductance, Parasitic and Loss: INDQP

Symbol

Summary

INDQP models an inductor with user-specified frequency-dependence of inductance and loss. Frequency dependencies are specified as lookup tables (vectors) in model parameters. This model uses interpolation to obtain parameter values at each project evaluation frequency.

Equivalent Circuit



Parameters

Name	Description	Unit Type	Default
ID	Name	Text	IND#

Name	Description	Unit Type	Default
F	Vector of frequencies at which L, Q, and R are specified	Frequency	{1}
L	Inductance (vector)	Inductance	Li[1]
Q	Quality factor (vector)	Scalar	{1000}
C	Capacitance	Parasitic capacitance	C[1]
R	Series resistance (vector)	Resistance	{0}

[1] User-modifiable default. Modify by editing under $DEFAULT_VALUES in the *default.lpf* file in the root installation directory. See the AWR Microwave Office Layout Guide for details.

Parameter Details

F. Vector of frequencies at which L, Q, and R parameters are specified. Frequencies must be sequential and specified in ascending order.

L. Vector of series inductance L(f) (see the "Equivalent Circuit" section) specified in inductance project units. You must specify each vector entry at the corresponding frequency entry from frequency vector F.

Q. Vector of quality factor; specifies series resistance Rq (f) (see the "Equivalent Circuit" section). You must specify each vector entry at the corresponding frequency entry from frequency vector F.

C. Parasitic capacitance (see the "Equivalent Circuit" section).

R. Vector of series resistance R(f) (see the "Equivalent Circuit" section) specified in resistance project units. You must specify each vector entry at the corresponding frequency entry from frequency vector F.

Parameter Restrictions and Recommendations

1. The size of vector parameters L, Q, and R must be equal to the size of frequency vector F.
2. If the project evaluation frequency is out of range of frequencies in F, then L, Q, and R parameters are extrapolated as constant values equal to the first/last entries of corresponding vectors. No warning is issued.
3. You can specify the vector in three ways: First, by entering it as a right side value of the model parameter, for example R={100,102,110,113,120}; second, by specifying the vector elsewhere in the equation; and third, by specifying the vector in a column or row of a text file. The third way provides a convenient and flexible method of specifying L, Q, and R parameters at a single location. For example, you can create the file *indqp.txt* containing space separated columns of L, Q, and R. The first column must represent frequency in project units (note that changing project default frequency units demands manual scaling of frequencies in this file). Import or link this file to your project and name it, for example, INDQP_1. Now you can specify, for example, parameter R as R = Col(datafile("INDQP_1"),4) so that values of vector R are copied to the model from column 4 of file *indqp.txt* imported under the name indqp_1. If you prefer to deploy your data row-wise use R = Row(datafile("INDQP_1"),2).
4. If your project uses a text file input to feed data to this model be aware what frequency, resistance, inductance or conductance units this file implies. Your project default units may differ from those in your data file. If this happens, you must scale input values, multiplying the call of function Col or Row by a scaling coefficient. For example, if your project uses

inductance in nanohenries and the data file contains data in microhenries you may get inductance data from column 2 of the data file INDQP_1 such as: L= 1e+3*Col(datafile("INDQP_1"),2).

Implementation Details

This model is implemented as a series connection of lossy inductor and frequency-dependent resistor. A parasitic capacitor shunts a lossy inductor.

Model implementation is based on linear interpolation of L, Q, and R parameters at each project evaluation frequency. Interpolation uses user-supplied lookup tables via parameters. If the project evaluation frequency is out of range of frequencies in F, then L, Q, and R parameters are extrapolated as constant values equal to the first/last entries of corresponding vectors.

Layout

This element does not have an assigned layout cell. You can assign artwork cells to any element. See "Assigning Artwork Cells to Layout of Schematic Elements" for details.

Recommendations for Use

Time transient analysis is sensitive to the number of frequency points. Also, time domain measurements may be inaccurate due to non-causal behavior of the model at specified parameter values.

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