ADS Application Notes

Wireless Communication Laboratory
Department of Electrical and Electronic Engineering
Hong Kong University of Science and Technology

The Components Characterization Using ADS

Introduction

This application note describes the design procedure of developing accurate models for different component behavior using agilent's ADS. In the following part of this note, I will show the design procedures step by step.

Design procedures

1. SMA model

In this design, the SMA will be modeled as a phase shift plus an inductor and a capacitor. The phase shift will be modeled by an ideal transmission line. The category for select ideal transmission line is given below.
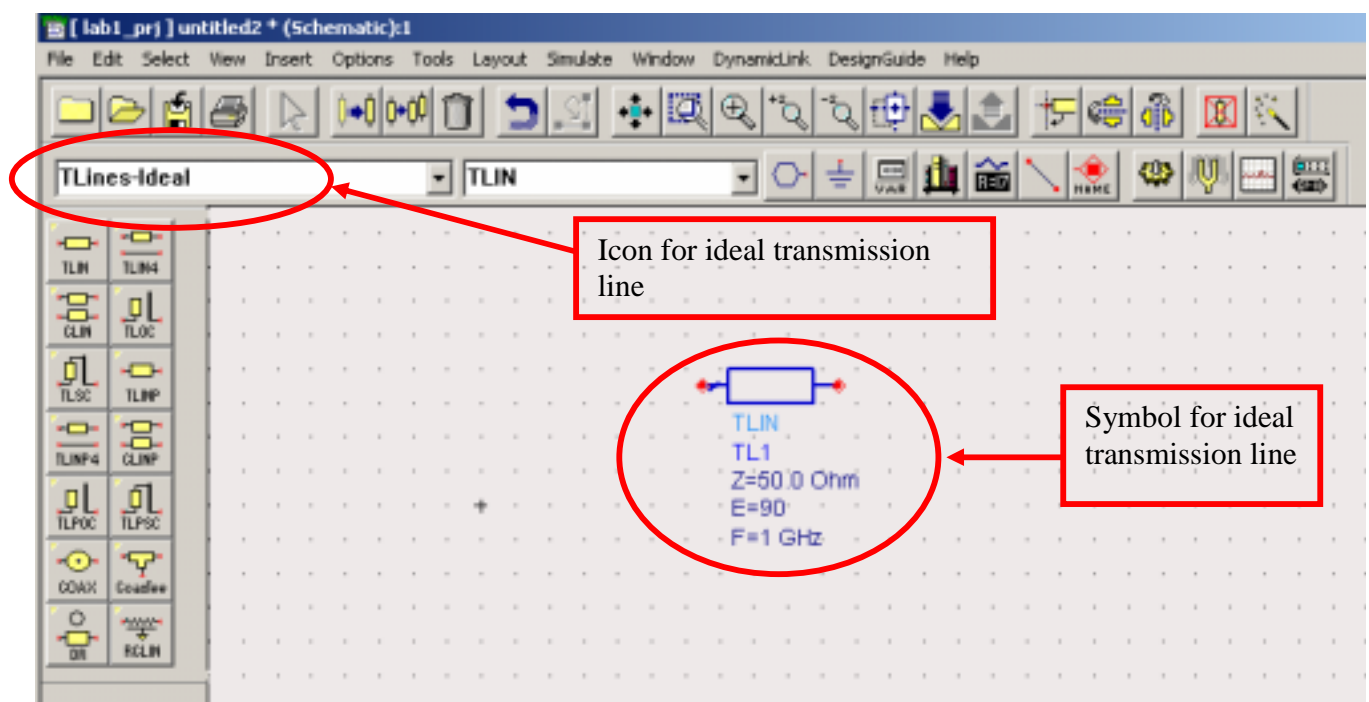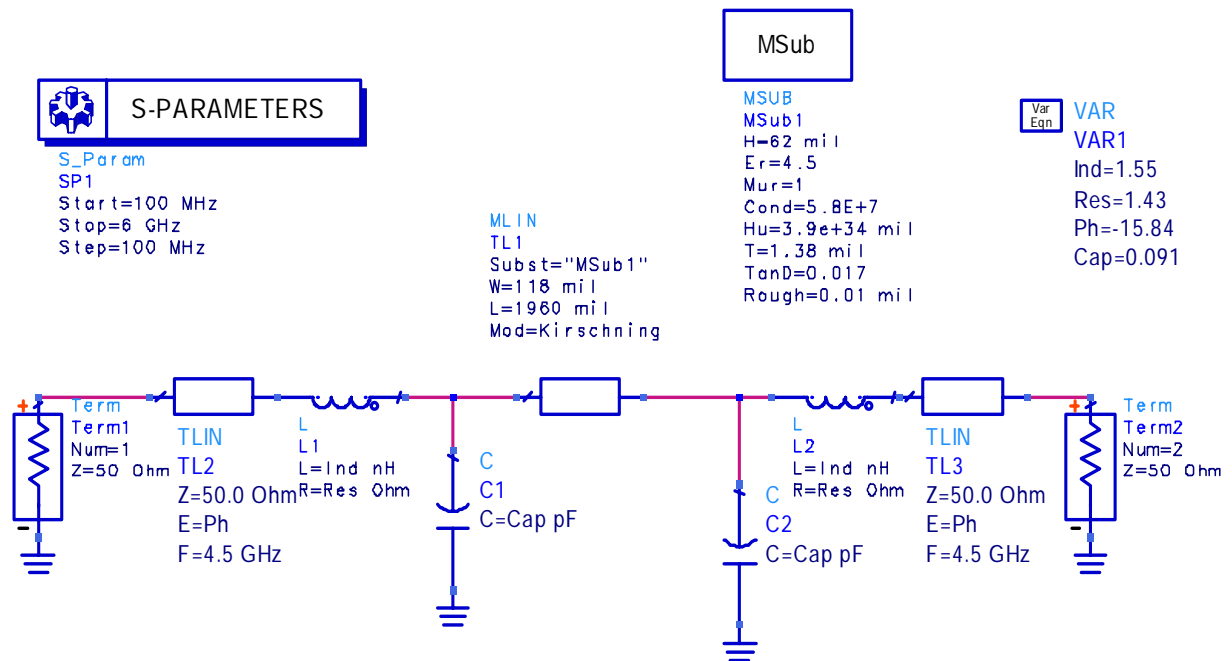

We can choose the electrical length for the transmission line. And after that we need to choose the lumped element for completing the model for the SMA.
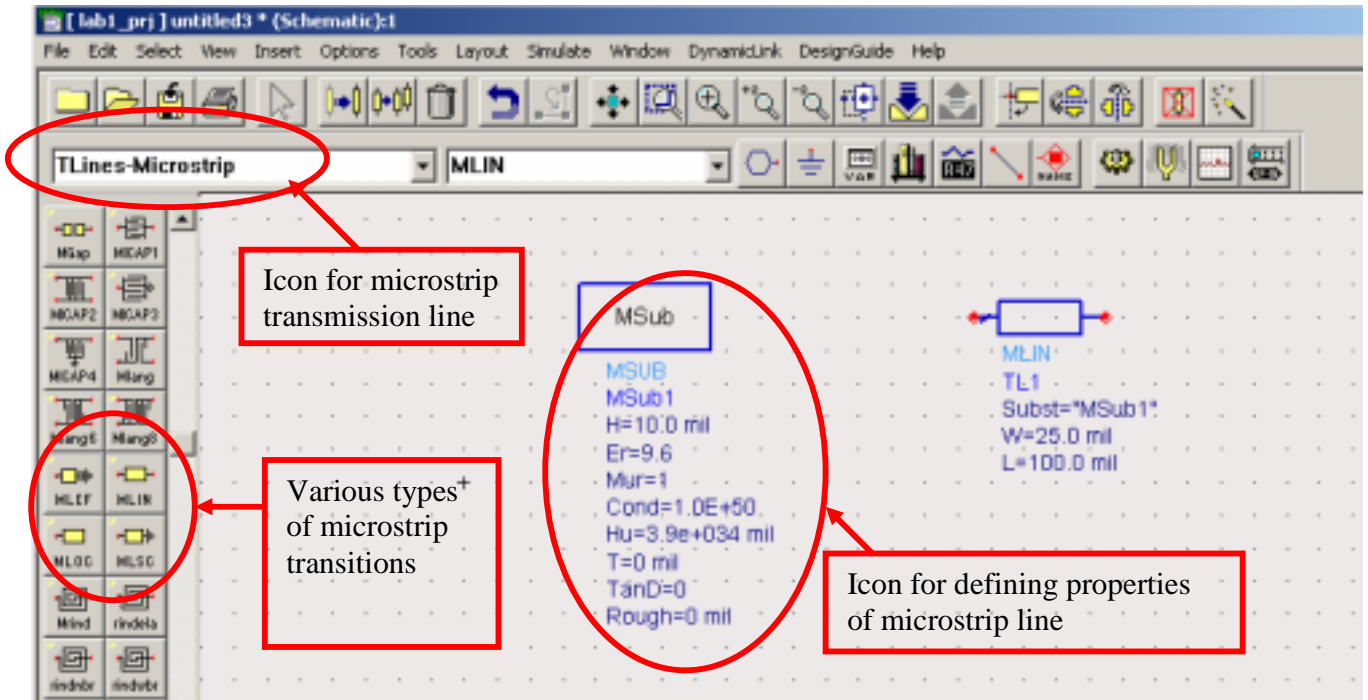
The icon for the lumped element is given below:

Category for lumped components

Symbol for lumped components, resistor, capacitor, inductor
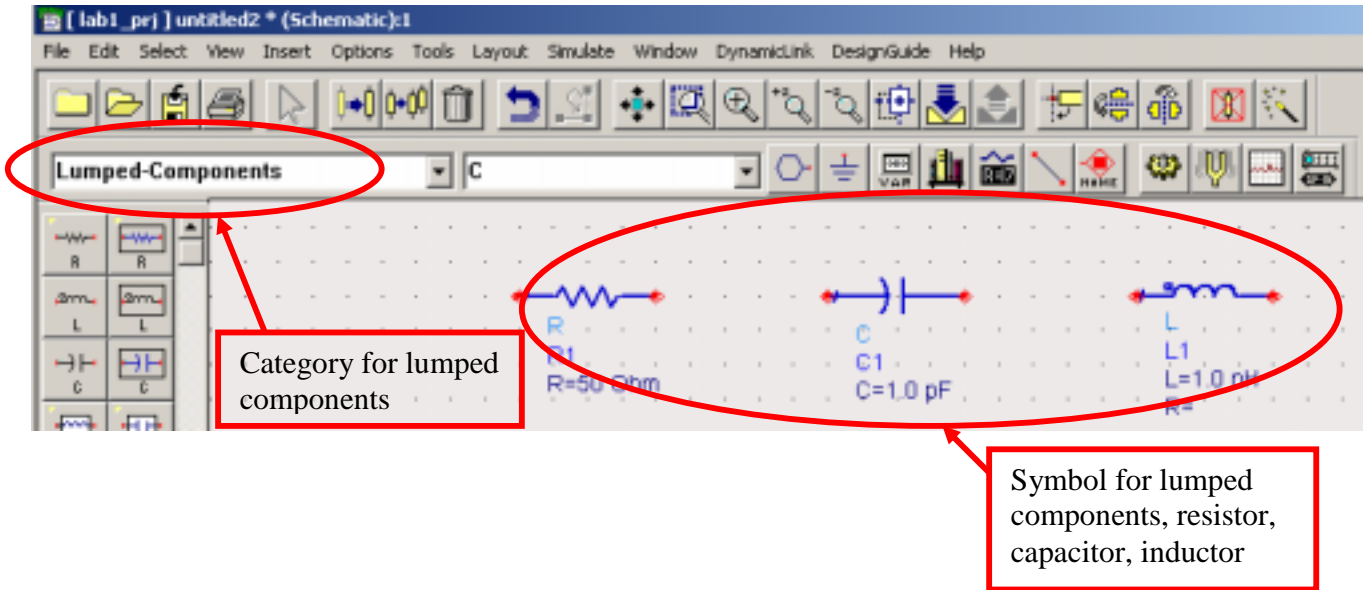
The final schematic for modeling the performance of SMA is shown below:

From it we can see that we need to use the microstrip line to connect the two SMA. So the category for defining microstrip line is given below:

We need to tune the value of the inductor and capacitor and the length of the ideal transmission line to fit the measured S-parameters including the magnitude and phase.

2. Via model

We will not mention the theory of the vias. In a word, we will model the via as a inductor with a shunt parasitic capacitor. The schematic for the via model is shown below:
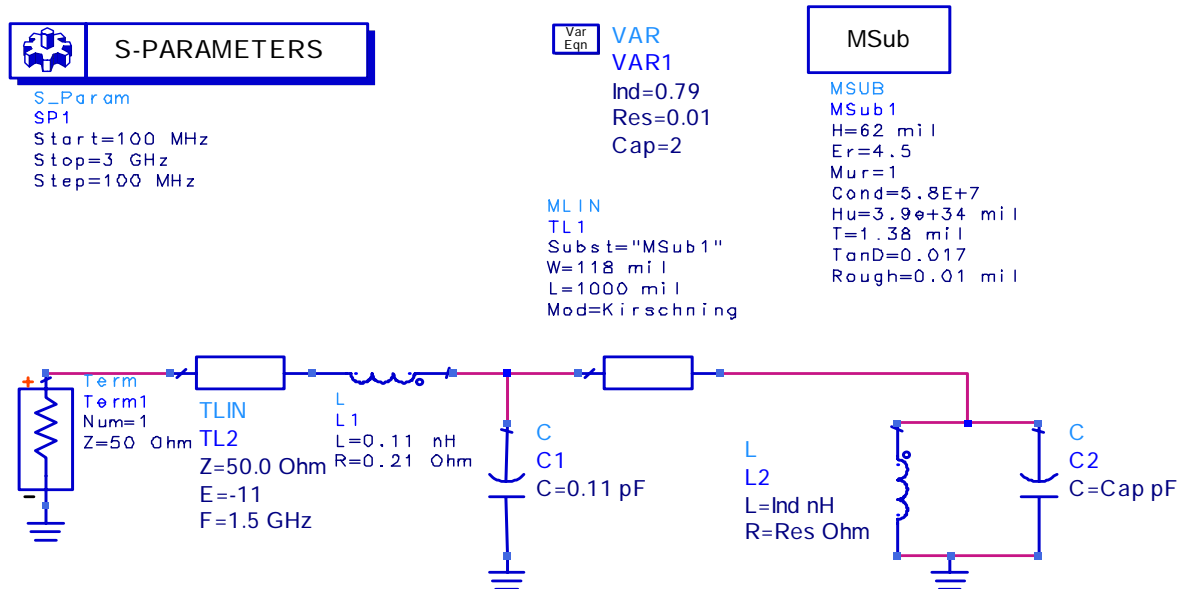
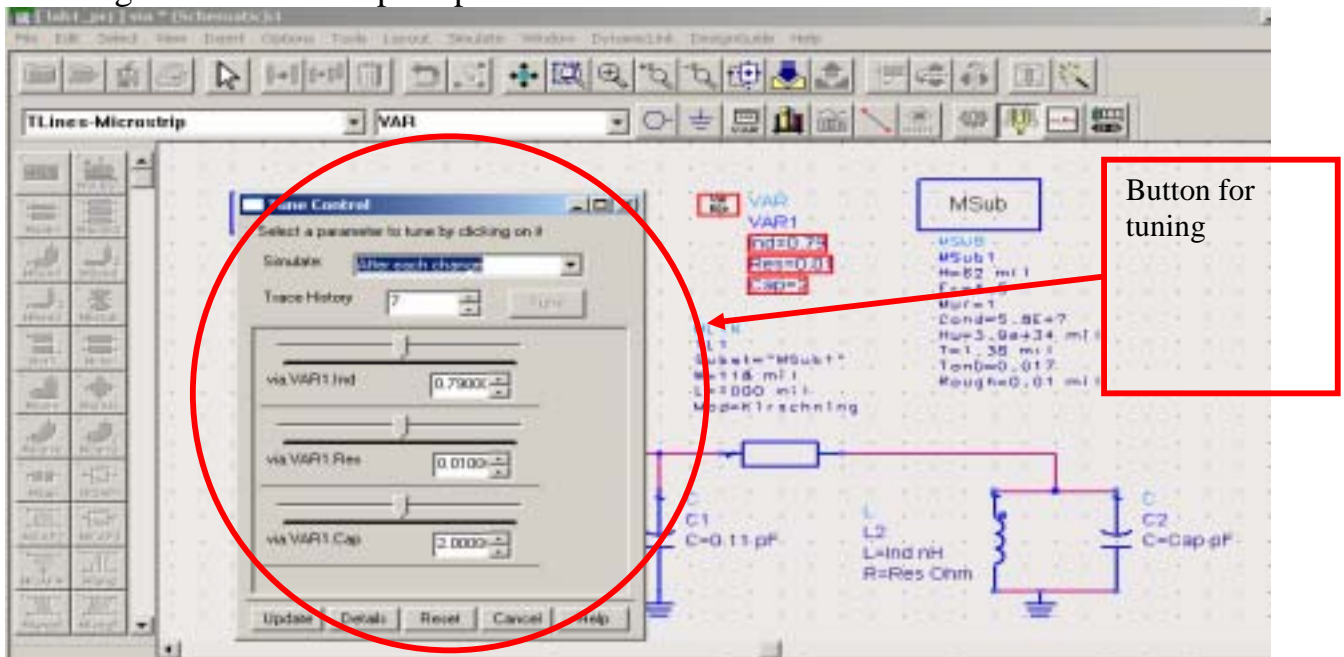We will use the tuning function in the ADS to do the fitting. First we need to define the variables to be tuned. The icons are shown below:
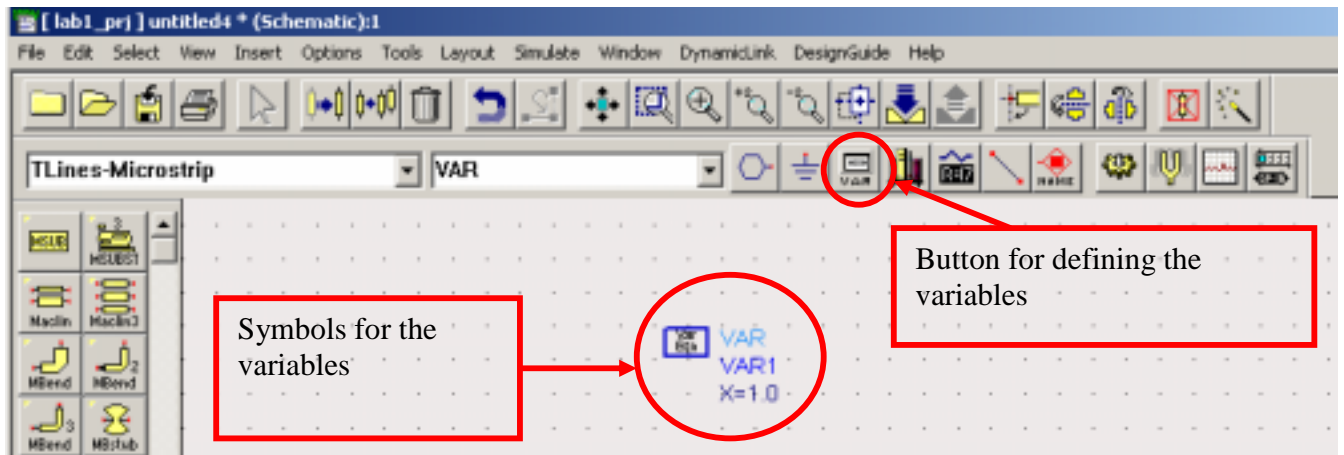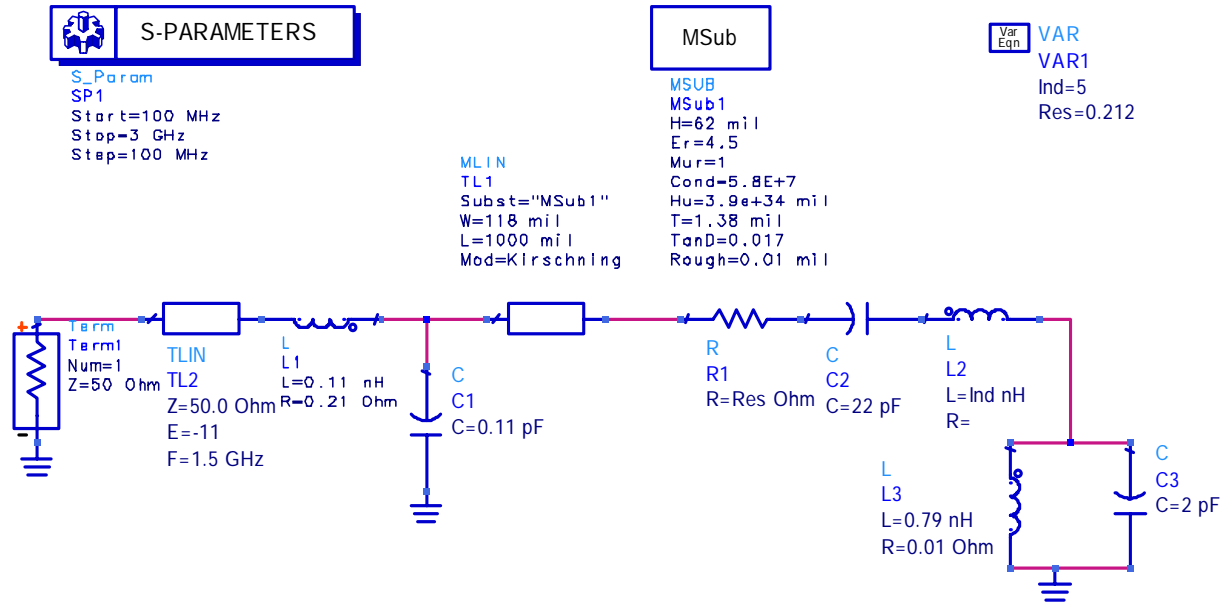

After simulation 'click' the symbols for the variables in the schematic, pressing 'shift', then 'click' the button for the tuning to start the tuning of the circuit. The button for tuning is given below:
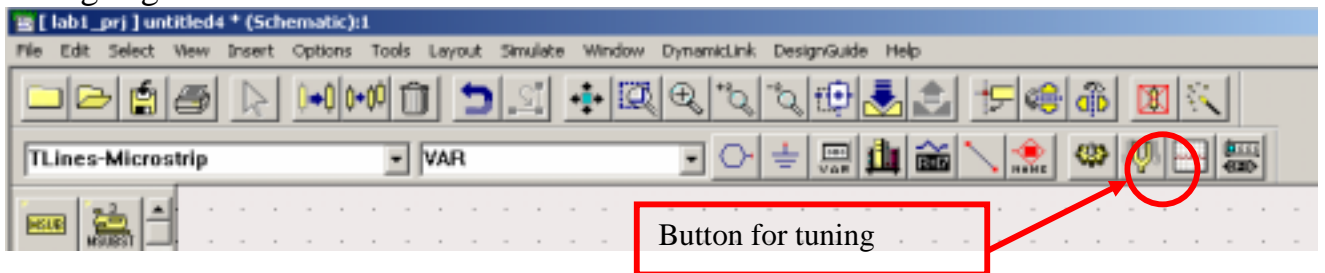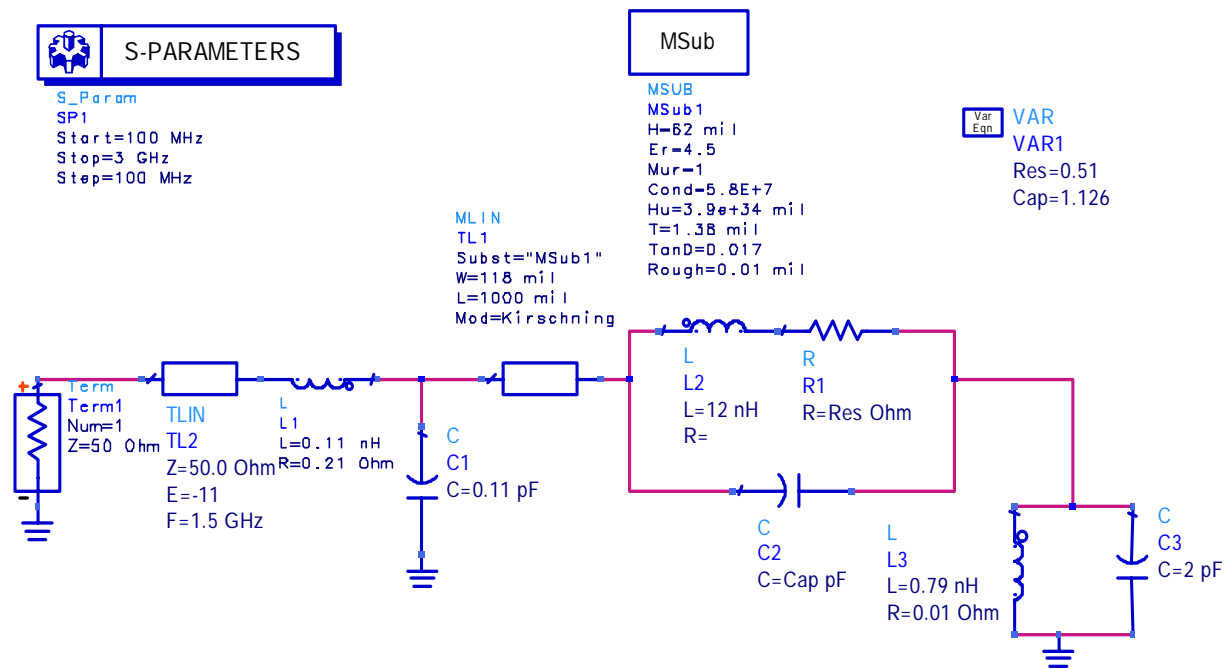

A tuning window will be prompted and is similar to the window below:

3. Resistor, capacitor and inductor

S-PARAMETERS

S_Param
SP1
Start=100 MHz
Stop=3 GHz
Step=100 MHz

MSub

MSUB
MSub1
H=62 mil
Er=4.5
Mur=1
Cond=5.8E+7
Hu=3.9e+34 mil
T=1.38 mil
TanD=0.017
Rough=0.01 mil

VAR
VAR1
Ind=5
Res=0.212

MLIN
TL1
Subst="MSub1"
W=118 mil
L=1000 mil
Mod=Kirschning

Term
Term1
Num=1
Z=50 Ohm

TLIN
TL2
Z=50.0 Ohm
E=-11
F=1.5 GHz

L
L1
L=0.11 nH
R=0.21 Ohm

C
C1
C=0.11 pF

R
R1
R=Res Ohm

C
C2
C=22 pF

L
L2
L=Ind nH
R=

L
L3
L=0.79 nH
R=0.01 Ohm

C
C3
C=2 pF

Schematic for modeling the capacitor

S-PARAMETERS

S_Param
SP1
Start=100 MHz
Stop=3 GHz
Step=100 MHz

MSub

MSUB
MSub1
H=62 mil
Er=4.5
Mur=1
Cond=5.8E+7
Hu=3.9e+34 mil
T=1.38 mil
TanD=0.017
Rough=0.01 mil

VAR
VAR1
Res=0.51
Cap=1.126

MLIN
TL1
Subst="MSub1"
W=118 mil
L=1000 mil
Mod=Kirschning

Term
Term1
Num=1
Z=50 Ohm

TLIN
TL2
Z=50.0 Ohm
E=-11
F=1.5 GHz

L
L1
L=0.11 nH
R=0.21 Ohm

C
C1
C=0.11 pF

L
L2
L=12 nH
R=

R
R1
R=Res Ohm

C
C2
C=Cap pF

L
L3
L=0.79 nH
R=0.01 Ohm

C
C3
C=2 pF

Schematic for modeling the inductor

MSub

MSUB
MSub1
H=62 mil
Er=4.5
Mur=1
Cond=5.8E+7
Hu=3.9e+34 mil
T=1.38 mil
TanD=0.017
Rough=0.01 mil

S-PARAMETERS

S_Param
SP1
Start=100 MHz
Stop=3 GHz
Step=100 MHz

Var
Eqn
VAR
VAR1
Ind=2.436
Cap=0.855

MLIN
TL1
Subst="MSub1"
W=118 mil
L=1000 mil
Mod-Kirschning

Term
Term1
Num=1
Z=50 Ohm

TLIN
TL2
Z=50.0 Ohm
E=-11
F=1.5 GHz

L
L1
L=0.11 nH
R=0.21 Ohm

C
C1
C=0.11 pF

L
L2
L=Ind nH
R=

R
R1
R=62 Ohm

C
C2
C=Cap pF

L
L3
L=0.79 nH
R=0.01 Ohm

C
C3
C=2 pF

Schematic for modeling the resistor

4. Results

The results are something similar to the figure shown below:

S(1,1) Magnitude plot of Resistor

S(1,1) Phase plot of Resistor
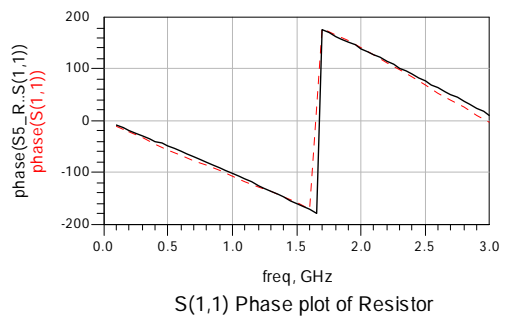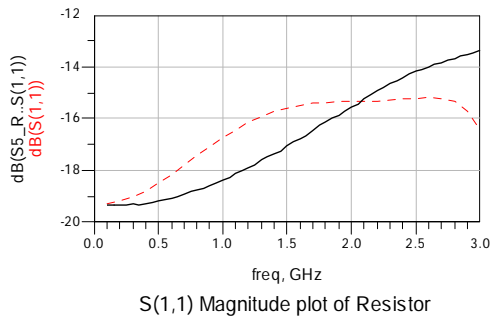
We need to fit both the magnitude and the phase.

Conclusion

In this note we show how to model the behavior of different components using ADS. All the necessary steps including the setting about tuning are given in this note. We can do the

parameters tuning easily with the help of ADS. It is very useful to do the modeling in modern design technique. And the agilent's ADS is powerful to do the circuit modeling.