



# **Tutorial on running sp-analysis**

**Advanced Analog Circuits**

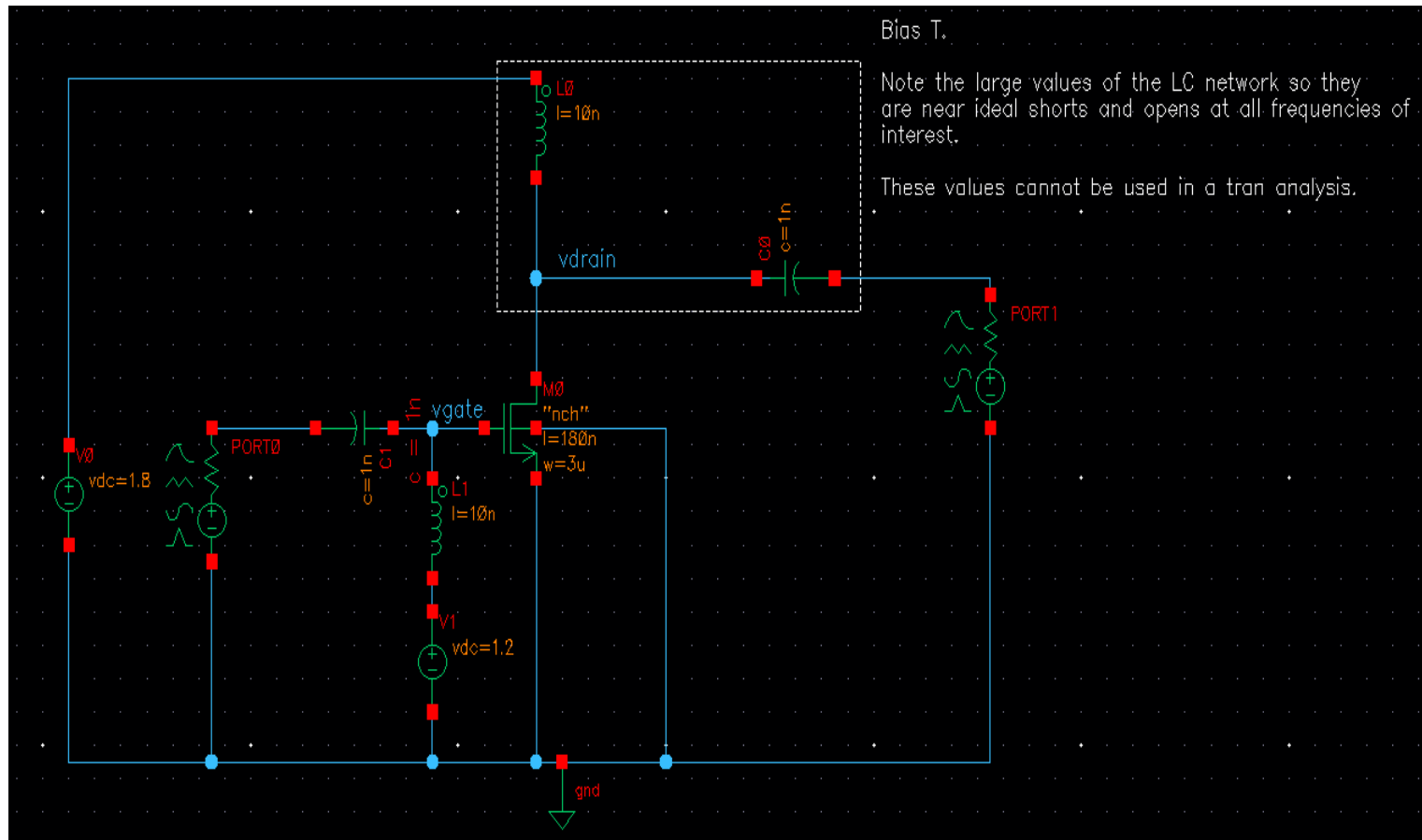
**Spring 2015**

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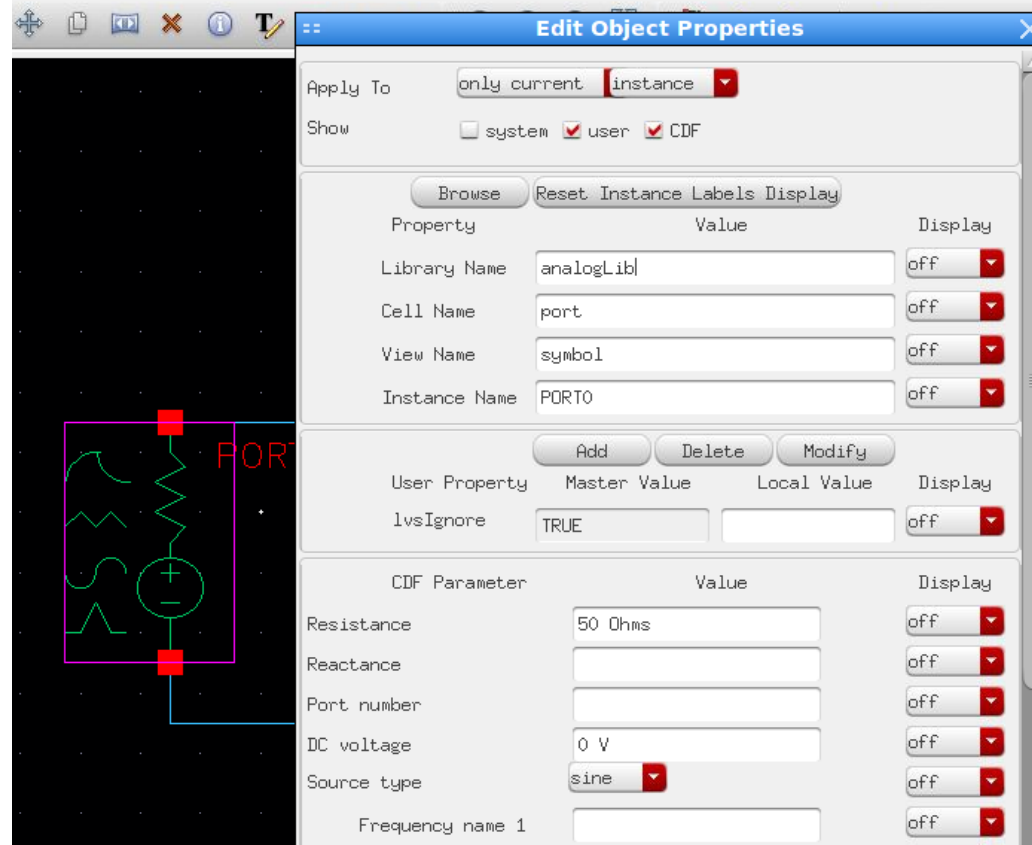
# Schematic setup for sp analysis

- Here is a typical testbench for an sp-analysis of an NMOS transistor.
- Instantiate the schematic as detailed in the tutorial on getting started with Cadence.
- You can instantiate the port component using the “port” cell from analogLib.



# Schematic setup for sp analysis

- The port component menu used in sp-analysis.



The screenshot shows the 'Edit Object Properties' dialog box for a port component. The dialog is divided into several sections:

- Apply To:** Set to 'only current' and 'instance'.
- Show:** Checkboxes for 'system' (unchecked), 'user' (checked), and 'CDF' (checked).
- Buttons:** 'Browse', 'Reset Instance Labels Display'.
- Property Table:**

Property	Value	Display
Library Name	analogLib	off
Cell Name	port	off
View Name	symbol	off
Instance Name	PORT0	off
- User Property Table:**

User Property	Master Value	Local Value	Display
lvsIgnore	TRUE		off
- CDF Parameter Table:**

CDF Parameter	Value	Display
Resistance	50 Ohms	off
Reactance		off
Port number		off
DC voltage	0 V	off
Source type	sine	off
Frequency name 1		off

On the left side of the dialog, a schematic diagram shows a port component (a circle with a plus sign) connected to a network of resistors and inductors. The port is labeled 'PORT' in red text.



# Simulation setup

- Choose Analyses-> sp from the ADE-L window.
- The menu in the example run an sp-analysis from 100 MHz to 10 GHz in steps of 100 MHz.

**Choosing Analyses -- Virtuoso® Analog Design**

Analysis  tran  dc  ac  noise  
 xf  sens  dcmatch  stb  
 pz  sp  envlp  pss  
 pac  pstb  pnoise  pxf  
 psp  qpss  qpac  qpnoise  
 qpxf  qpasp  hb  hbac  
 hbnoise

S-Parameter Analysis

Ports    
**/PORT0 /PORT1**

Sweep Variable  
 Frequency  
 Design Variable  
 Temperature  
 Component Parameter  
 Model Parameter

Sweep Range  
 Start-Stop Start  Stop   
 Center-Span

Sweep Type  
  Step Size   
 Number of Steps

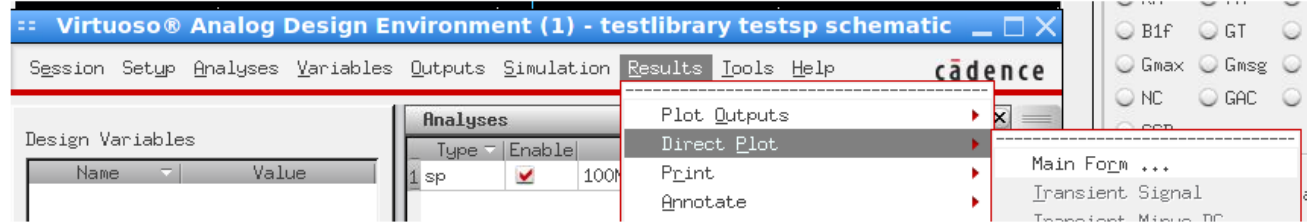
Add Specific Point

Do Noise  
 yes  
 no

**The order of ports entered here is the order for the ports in the SP matrix. The port number in the query menu of the port in schematic view is immaterial.**



# Results from sp-analysis



- To view the results, on the ADE-L menu select Results-> Direct Plot -> Main Form
- In Homework 1, we use SP analysis for plotting the device two-port characteristics. It can also be used to plot different types of gain like MAG, MUG etc, and also in a noise figure analysis.
- For more details on what can be done with the results of an sp-analysis, refer to Spectre RF manual provided on the webpage.

The Direct Plot Form dialog box is shown with the following settings:

- Plotting Mode: Append
- Analysis: sp
- Function: SP (selected), ZP, YP, HP, GD, VSWR, NFmin, Gmin, Rh, rn, NF, Kf, B1f, GT, GA, GP, Gmax, Gmsg, Gmxx, ZM, NC, GAC, GPC, LSB, SSB
- Description: S-Parameter
- Plot Type: Rectangular (selected), Z-Smith, Y-Smith, Polar
- Modifier: Magnitude, Phase, dB20, Real (selected), Imaginary
- Buttons: S11, S12, S21, S22
- Add To Outputs: checked

The plot shows S-Param 0 vs frequency (GHz). The curve for S11 re starts at approximately -1.0 at 0 GHz and rises to 1.0 by 10 GHz, remaining constant thereafter. The frequency is set to 30.6GHz and the value is .9983.

*To plot, press Sij-button on this form*