

Custom Compiler

Simulation and Analysis Environment (SAE)

HSPICE HF Integration

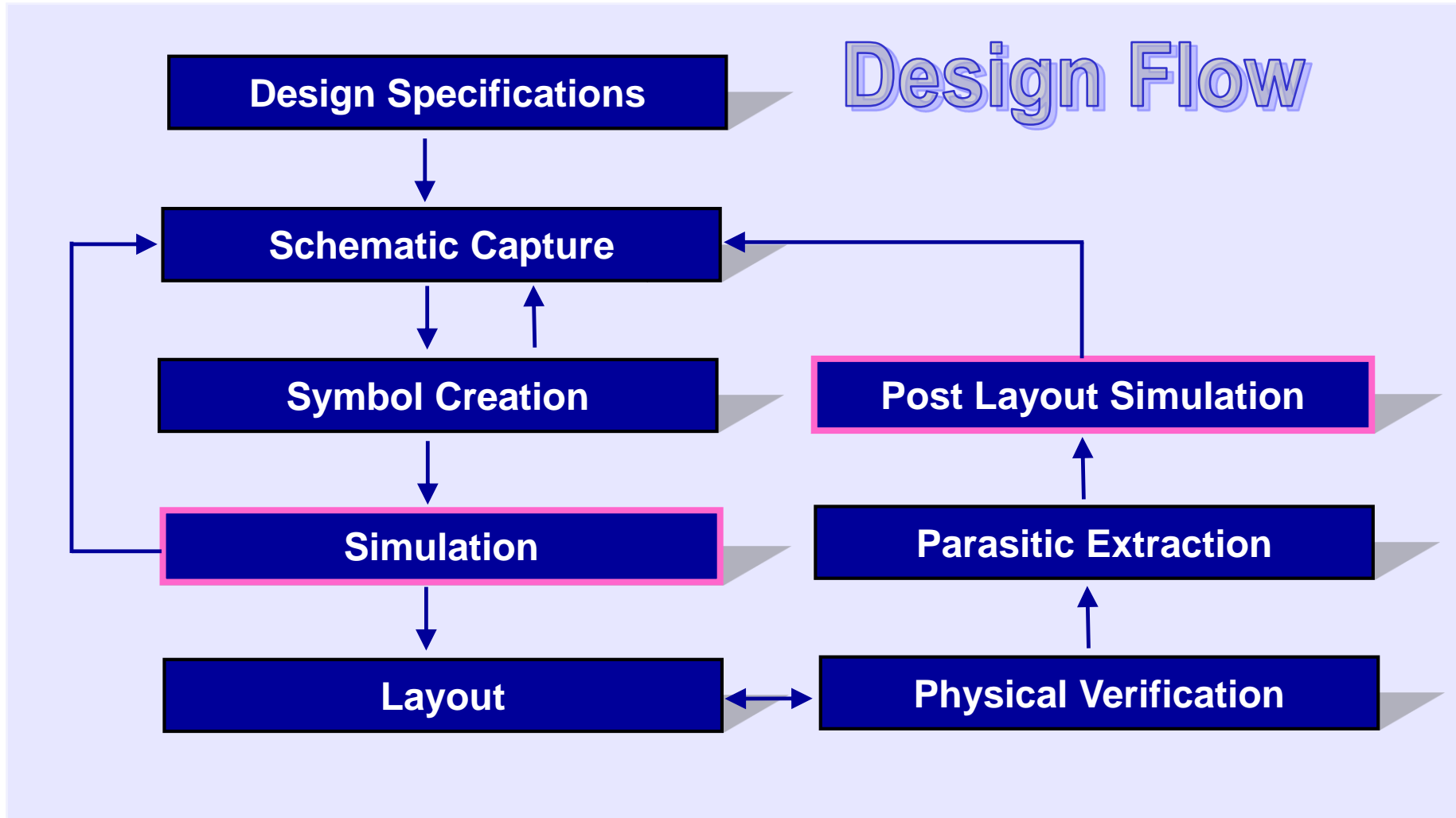
O-2018.09

Unit Objectives



Use Custom Compiler SAE to simulate your high frequency design in an environment that enables easy set up and gives flexibility to analyze and post-process the results with improved productivity.

Full Custom Compiler Flow



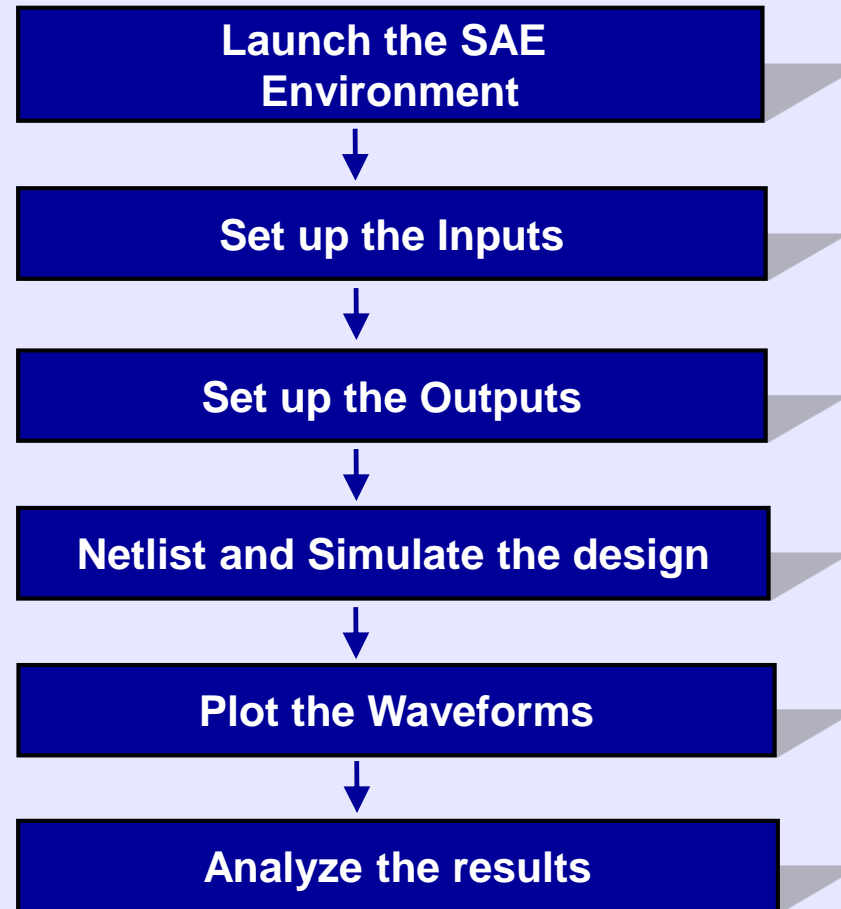
Unit Objectives



- **After completing this unit, you should:**
 - Have a good overview of the SAE HF features of the HSPICE HF integration in SAE
 - Set up all simulator settings needed for a testbench
 - Run simulation
 - Post process the results

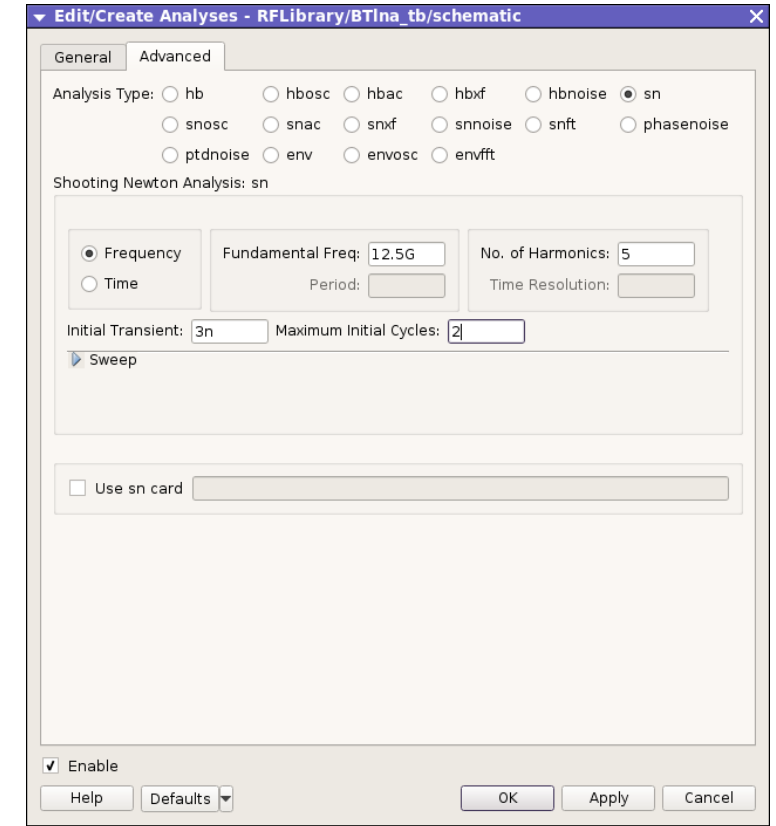
SAE Flow

Simulation and Analysis Environment



HSPICE HF Integration Overview

- HSPICE HF is a special set of analysis and design capabilities that support the design of high frequency and high-speed circuits
- Thus functionality is built on the top of the HSPICE HF feature set, it is also useful for analog and signal integrity applications
- HSPICE HF analyses integration



HSPICE HF Analysis

- AC Analysis
- Noise Analysis
- FFT Analysis
- Linear Network Parameter Analysis (LIN)
- Trans Noise Analysis

The screenshot shows the 'Edit/Create Analyses' dialog box for the RFLibrary/BTlna_tb/schematic project. The 'Advanced' tab is selected. The 'Analysis Type' section includes radio buttons for 'tran' (selected), 'op', 'dc', 'ac' (highlighted with a blue box), 'noise' (highlighted with a blue box), 'fft' (highlighted with a blue box), 'lin' (highlighted with a blue box), 'acmatch', 'dcmatch', 'trannoise', 'stateye', and 'lstb'. The 'Transient Analysis: tran' section contains fields for 'Start Time' (0), 'Number of Intervals' (1), 'Time Step', and 'Stop Time'. There is a checkbox for 'UIC'. The 'Advanced Settings' section includes a 'Method' dropdown (Temp Sweep selected), 'Temp Values' and 'Temp Step' fields, and an 'Other Options' field. A 'Use tran card' checkbox is also present. At the bottom, there is a 'Save/Restore' section, an 'Enable' checkbox, and buttons for 'Help', 'Defaults', 'OK', 'Apply', and 'Cancel'.

HSPICE HF Advanced Analysis

- Harmonic Balance Analysis (hba)
- Harmonic Balance Oscillator Analysis (hbosc)
- Harmonic Balance AC Analysis (hbac)
- Harmonic Balance Transfer Function Analysis (hbxf)
- Harmonic Balance Noise Analysis (hbnoise)
- Shooting Newton Analysis (sn)
- Shooting Newton Oscillator Analysis (snosc)
- Shooting Newton AC Analysis (snac)
- Shooting Newton Transfer Function Analysis (snxf)
- Shooting Newton Noise Analysis (snnoise)
- Shooting Newton with Fourier Transform Analysis (snft)
- Phase Noise Analysis (pasennoise)
- Periodic Time-Dependent Noise Analysis (ptdnoise)
- Envelope Analysis
- Envelope Oscillator Analysis (envosc)
- Envelope Fast Fourier Transform Analysis (envfft)

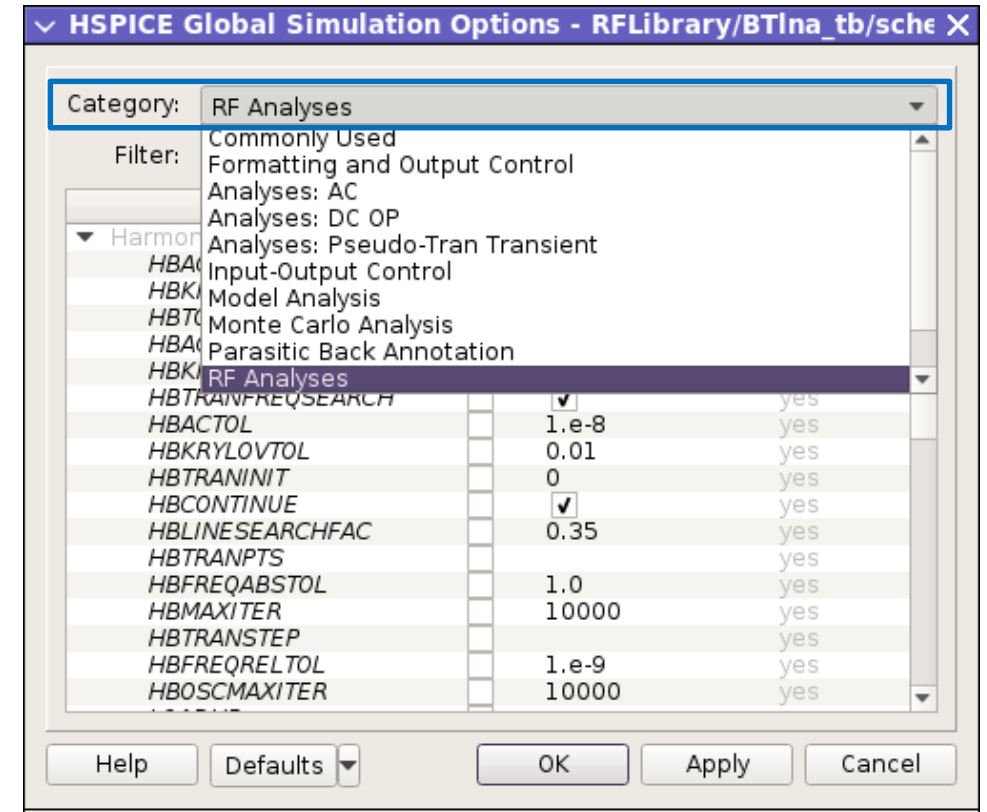
The screenshot shows the 'Edit/Create Analyses' dialog box for 'RFLibrary/BTlna_tb/schematic'. The 'Advanced' tab is selected. The 'Analysis Type' section is highlighted with a blue box and contains the following options:
Analysis Type: ☐ hb ☐ hbosc ☐ hbac ☐ hbxf ☐ hbnoise ☒ sn
☐ snosc ☐ snac ☐ snxf ☐ snnoise ☐ snft ☐ phasenoise
☐ ptdnoise ☐ env ☐ envosc ☐ envfft

Below this, the 'Shooting Newton Analysis: sn' section is visible. It includes:
- A group box with 'Frequency' (selected) and 'Time' (unselected) radio buttons.
- 'Fundamental Freq: 12.5G' and 'Period: ' (empty).
- 'No. of Harmonics: 5' and 'Time Resolution: ' (empty).
- 'Initial Transient: 3n' and 'Maximum Initial Cycles: 2'.
- A 'Sweep' button.
- A checkbox 'Use sn card' which is unchecked.

At the bottom, there is an 'Enable' checkbox which is checked, and buttons for 'Help', 'Defaults', 'OK', 'Apply', and 'Cancel'.

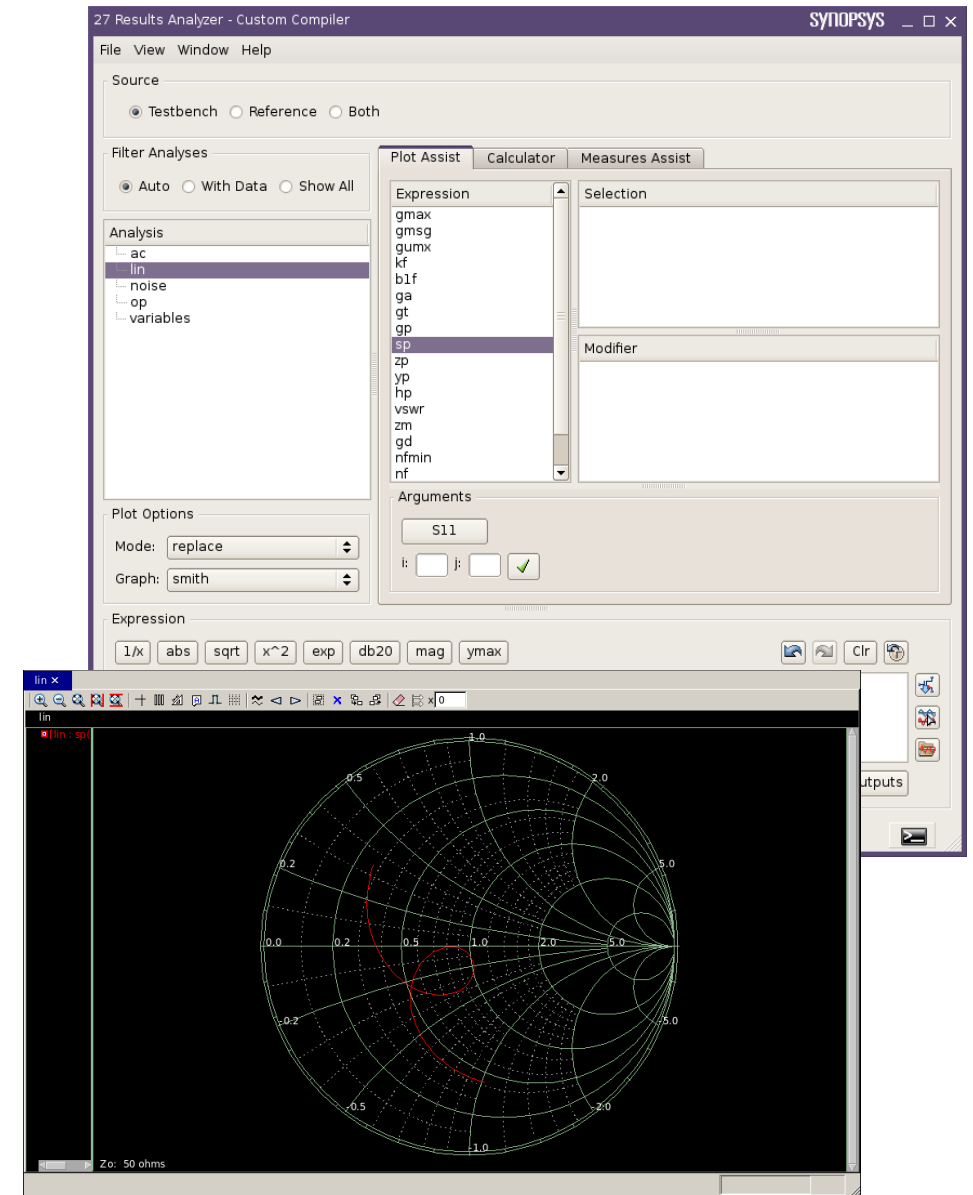
Simulator Options

- “RF Analyses” category is available in Simulation Option dialog
- The category contains three sub-groups
 - Harmonic Balance
 - Shooting Newton
 - Phase Noise



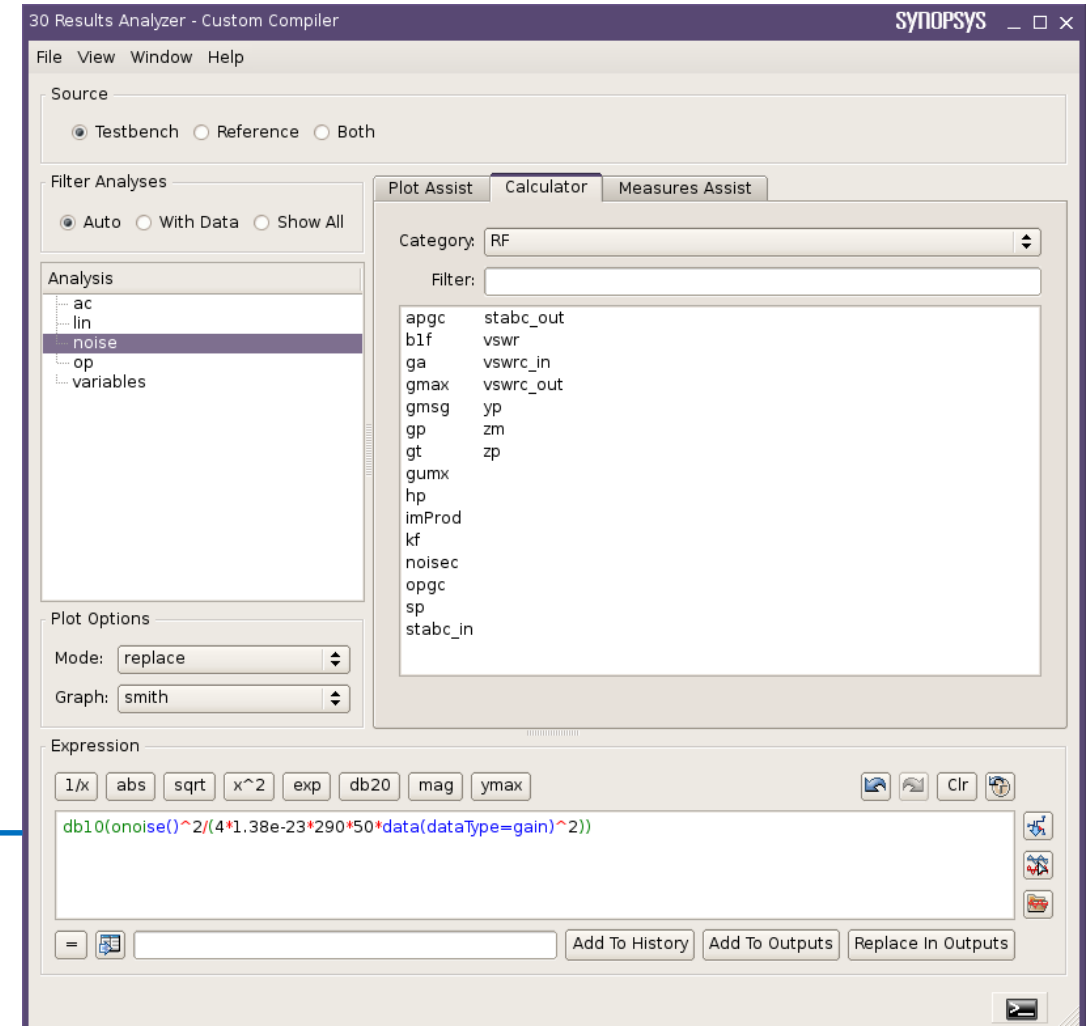
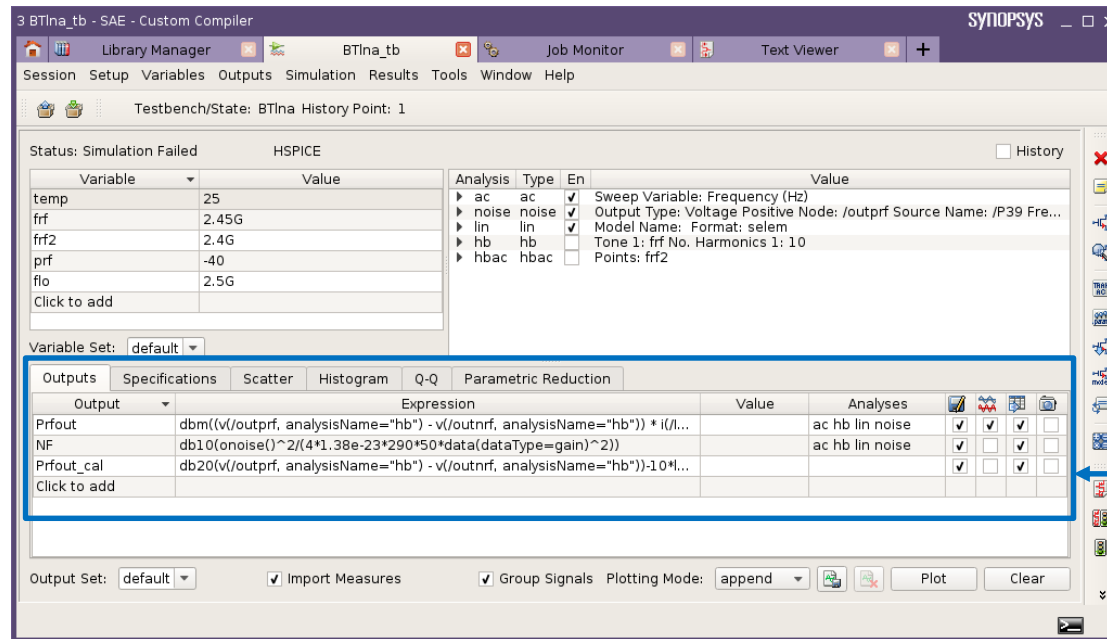
Results Analyzer: Plots

- **Plotting Assistants available for HF analyses**
 - Voltage/current/signal/(Power calculation) for all RF analyses which have such signals
 - IPn plotting assistant for Harmonic Balance and Shooting Newton results
 - Gain compression plotting assistant for Harmonic Balance and Shooting Newton



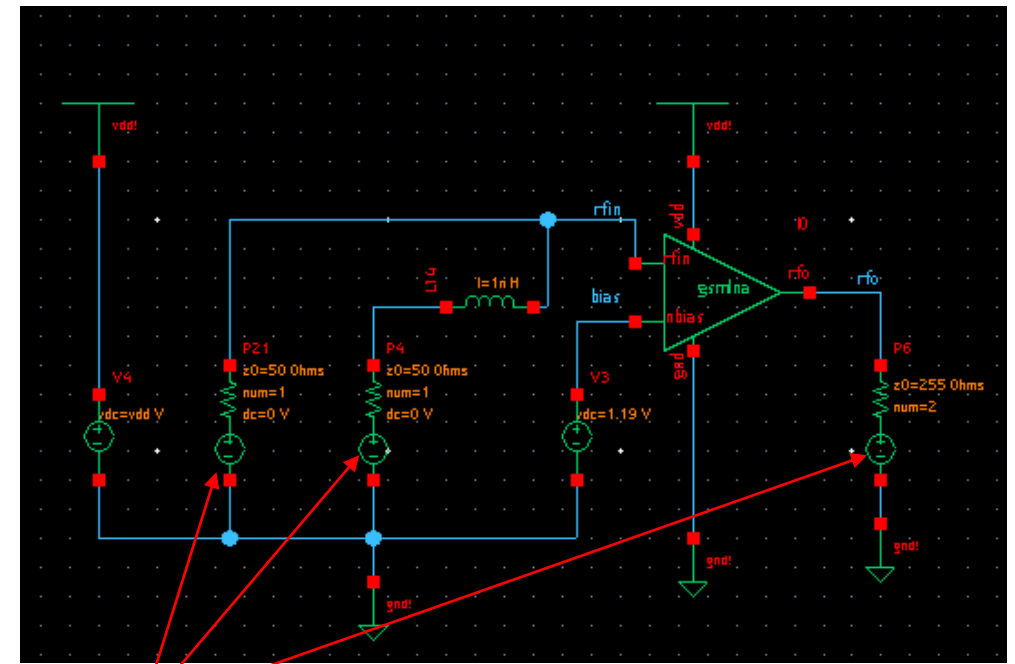
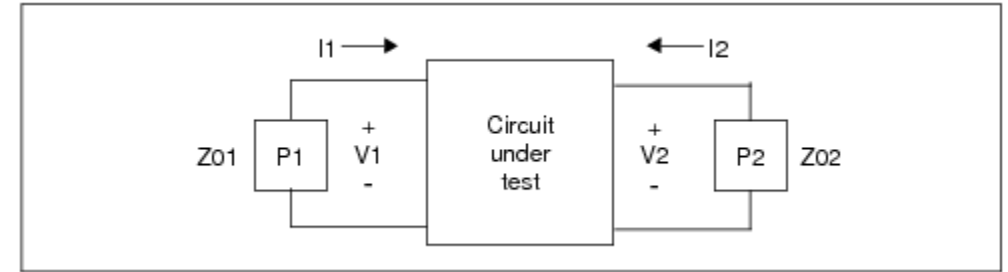
Results Analyzer: Calculator

- RF category in Calculator field
- Support for frequently used RF measurements



HSPICE Linear Network Parameter Analysis

- **.LIN** command extracts noise and linear transfer parameters for a general multi-port network
- **The .LIN** command computes
 - S- (scattering), Y- (admittance), Z- (impedance), H-(hybrid) parameters directly based on the location of the port (PORT) elements in your circuit
 - specified values for their reference impedances
- **The port element identifies the ports used in LIN analysis.**



anaogLib/port

Lab 1: HSPICE HF Simulation Setup



30 minutes

Goals:

- Setup HSPICE Simulator
- Setup HF Analysis
- Modify necessary parameters
- Simulate and analyze results

