Push_Push_Oscillator

Where To Find This Example

Select Help > Open Examples... from the menus and type either the example name listed above or one of the keywords below.

Or in Version 14 or higher you can open the project directly from this page using this button. Make sure to select the Enable Guided Help before clicking this button.

Open Install Example

Design Notes

Voltage Spectrum Measurement for Transient Oscillator Analysis

There are several ways to look at voltage spectrums from transient simulations (Aplac Transient, Spectre, etc). To demonstrate, this example uses a simple push-push oscillator configuration. This example is interesting because there are different frequencies present in different parts of the circuit. This example also shows that one schematic can easily be simulated with multiple simulators by just changing the measurement to use a different simulator. The final results will show the voltage spectrum at two locations in the circuit.

Overview

Previously, you could only look at the voltage spectrum if you solved the oscillator using Harmonic Balance. In Harmonic Balance, AWR uses a technique to search for the fundamental frequency and once this is found then the entire spectrum can be determined. This is a difficult problem for transient simulators since there is no information about what the fundamental frequency of oscillation is before the simulation is completed. In a transient simulation, the measurement must be done completely by post-processing the time results. Two measurements are shown, the Vspec measurement and Vfft measurement. As can be seen, the two measurements produce the same results when properly setup. The Vfft measurement, however, offers the user significantly more flexibility.

Please see the help for the Vfft and Vspec measurement for a detailed description of the different settings on the measurement and how it was implemented. With the Vfft measurement it is very important to properly set the time span to be an integer number of waveform periods, and to capture several steady state waveforms.

Schematics

Push Pull Oscillator Schematic - contains the oscillator being simulated. Note the DC voltage and current annotation shown on the schematic. The measurement results are plotted at both PORT1 and the emitters of both GBJT3 elements.

Graphs

Each measurement is setup Aplac Transient in this example, the simulator uses is appended to the name of each graph.

Full Transient Graphs - show the voltages from time 0 and shows the startup characteristics of the oscillator.

Steady State Transient Graphs - shows only the last 1 ns of the simulation, which is assumed to be the steady state oscillation. You can see from these graphs that the frequency of oscillation at the device emitters is half of the frequency at the output of the circuit.

Spectrum From Graphs - shows the voltage spectrum of both of the different locations in the circuit. Note that the red spectral data is computed with the Vfft measurement, while the blue spectral data is computed with the VSpec measurement.

Schematic - Push_Push_Oscillator
Graph - Spectrum From Aplac

Full Transient Aplac

Voltage (V)

Time (ns)

Oscillator Output (V)  Device 2 Emitter (V)

Device 1 Emitter (V)

Graph - Spectrum From Aplac
Graph - Steady State Transient Aplac

Spectrum From Aplac

- Device Emitter (VSpec) (dB)
- Oscillator Output (VSpec) (dB)
- Oscillator Output (Vfft) (dB)
- Device Emitter (Vfft) (dB)

Frequency (GHz)

Voltage (V)

Voltage (V)
Steady State Transient Aplac

Voltage (V)

Oscillator Output (V)  Device 1 Emitter (V)  Device 2 Emitter (V)

Time (ns)