UOS EEE Society LTSPICE Lectures

Advanced Simulation and Graphing Tools

The University Of Sheffield.

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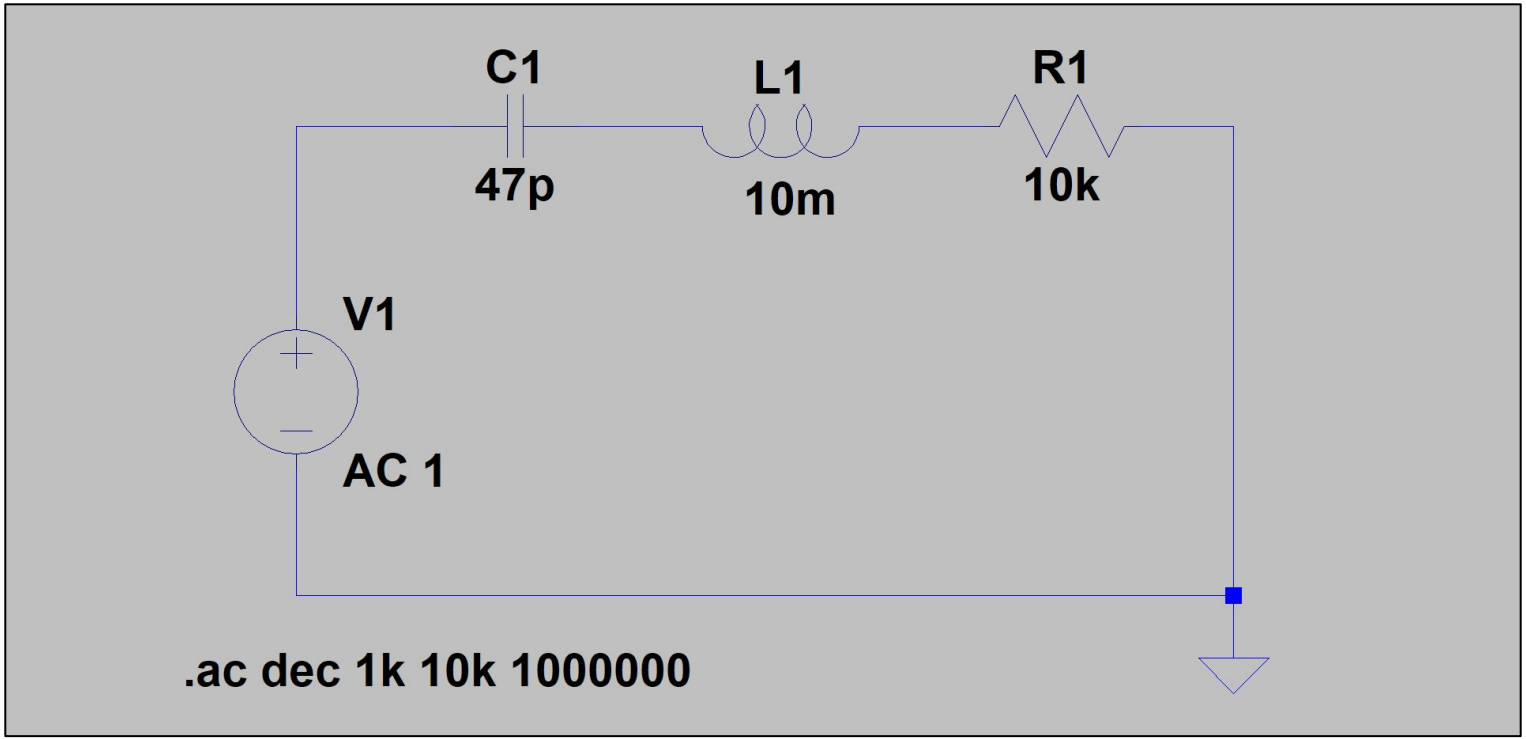
What is AC Sweep Analysis?

What is AC Sweep Analysis?

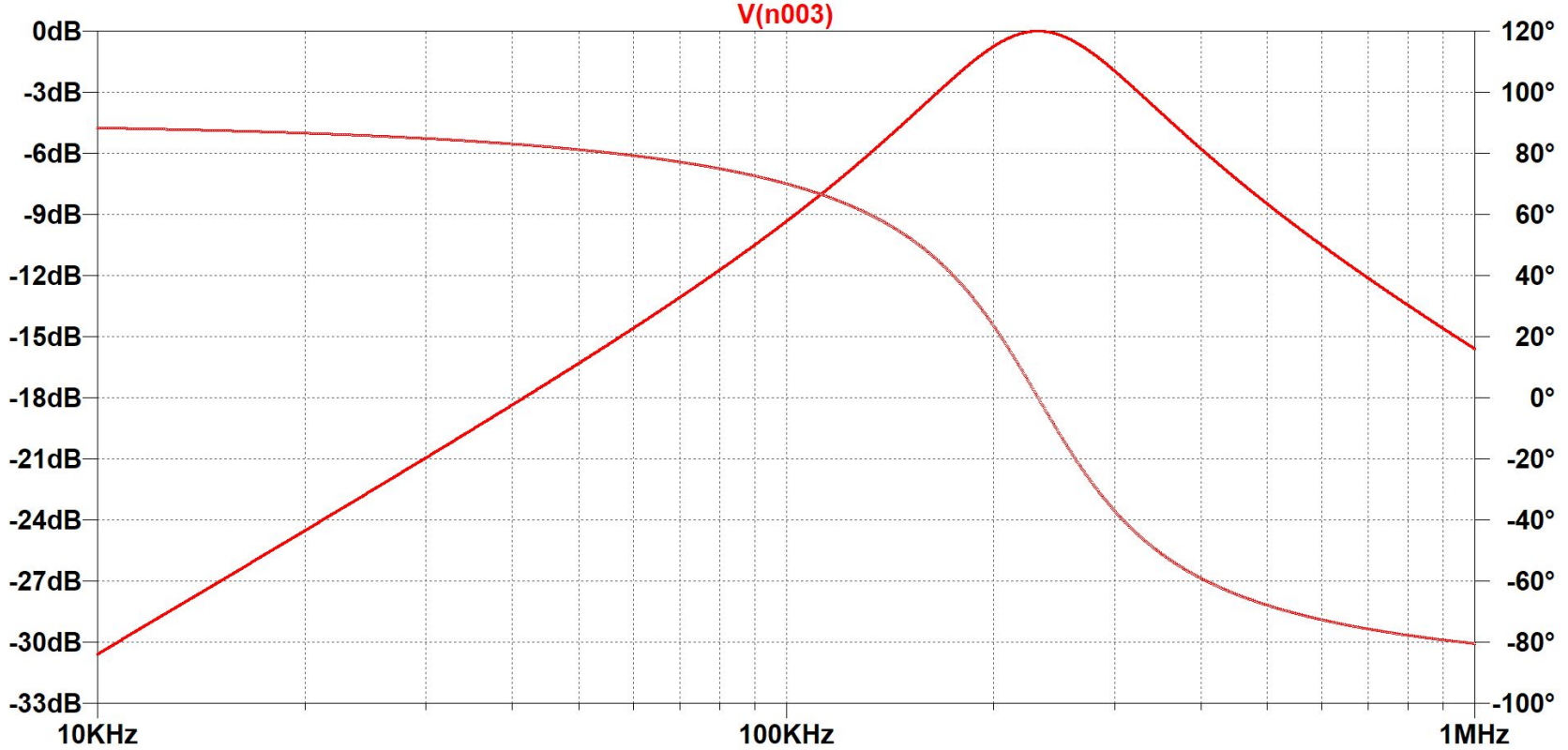
- Inputs a frequency sweep of AC Signals into a circuit.
- Measures the Gain and Phase of the circuit response.
- Very useful for circuits involving Transistors or Operational Amplifiers.
- Can be used to identify the frequency at which a circuit will oscillate.

A standard test for all Analogue Circuit Design!

What is AC Sweep Analysis?

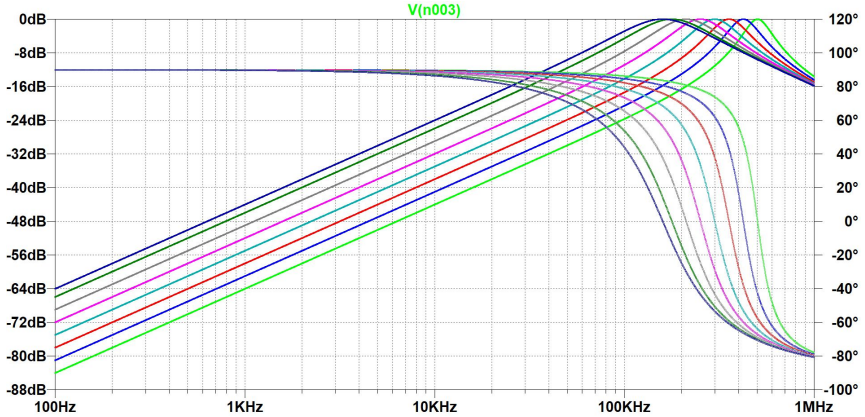


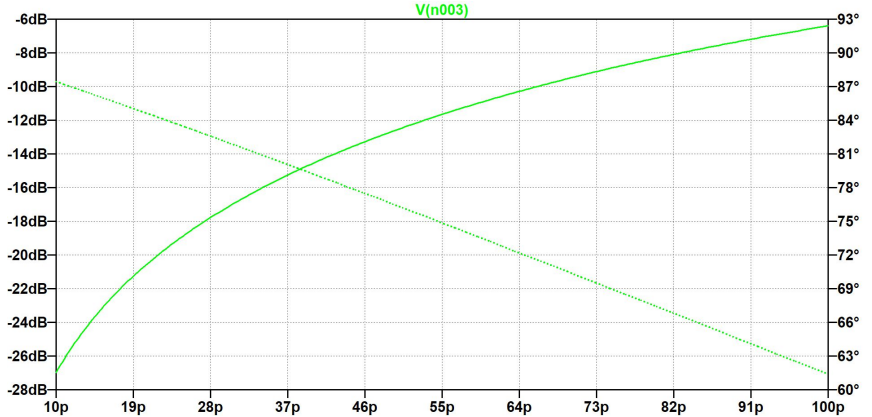
What is AC Sweep Analysis?



Component Selection using Sweep Analysis

- LTSpice can be used to aide in the selection of specific component values.
- This can be done using AC Sweep Analysis using one of two methods:
  - Performing a frequency sweep for varying component values.
  - Varying a component value at a constant frequency.





Component Selection using Sweep Analysis

- Need to use **SPICE Directives** in order to achieve this analysis.
- SPICE Directives look like text on the schematic.

```
.ac list 70k
.step oct param C 10p 100p 30
```

```
.op
```

- SPICE Directives describe the test you are going to run, when you create one LTSPICE will help you enter the correct parameters.

AC Sweep Analysis Example

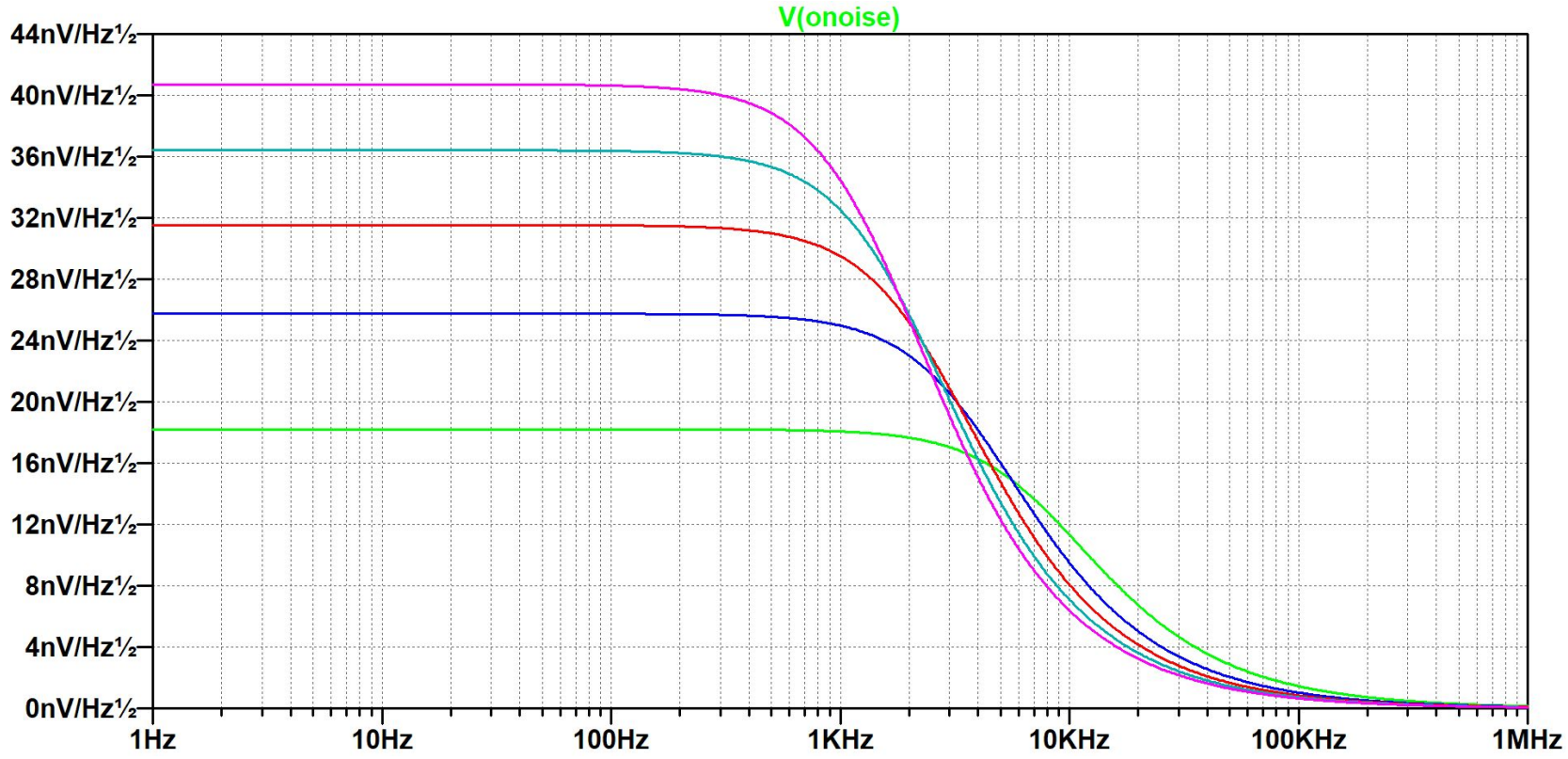
What is Noise Analysis?

What is Noise Analysis?

- Allows you to calculate how the Power Spectral Density of noise in a circuit varies with component values.
- LTSpice can calculate Flicker (Semiconductor Production), Shot (PN Junctions) and Johnson noise (Resistor/Thermal Noise).
- LTSpice also has the ability to inject types of noise (White, Random, etc.) into a circuit. These are simulated using Voltage sources.

Stack Exchange Noise in LTSpice Post

What is Noise Analysis?

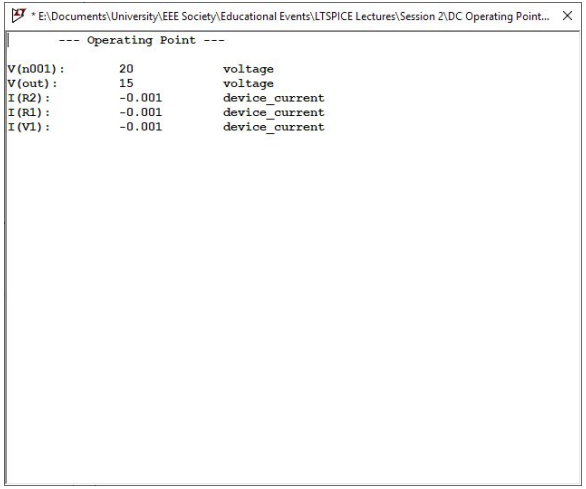


Noise Analysis Example

What is the DC Operating Point?

DC Operating Point Analysis

- Allows you to calculate the DC conditions (quiescent) of a circuit with a given set of component values.
- Very useful for calculating biasing conditions for transistor circuits.
- Allows for DC analysis of circuits very quickly and easily.



DC Operating Point Example

Graphing Tools

- Further calculations can be completed within the graph using algebraic expressions. For example calculating Power.
- Trace colours and line widths can be edited, making it easier to place a graph in a report.
- Cursors allow for the measurement of values from a generated waveform. This is similar to an oscilloscope.
- FFT (Fast Fourier Transform) plots can be quickly generated straight from the graph.
- Text and Lines can be added to plots straight in the software. This can be useful for report annotation.
- BITMAP images can be taken directly from LTSpice to place in other documents. Alternatively the plot data can be exported as text.

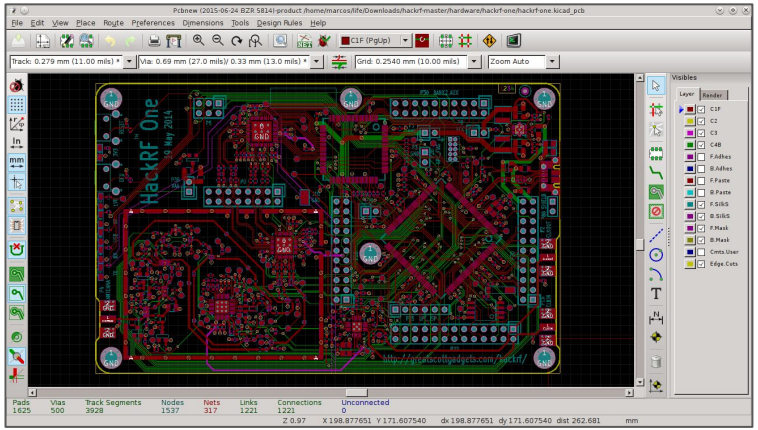
Graphing Tools Demonstration

Summary

- AC Sweep Analysis can show a circuits frequency response.
- AC Sweep Analysis can be used to select component values/models for the correct frequency response.
- Noise Analysis can show how much noise a circuit produces.
- Noise Analysis can be used to test a circuit with some noise injected into the input.
- LTSpice can quickly calculated the DC Conditions of most analogue circuits.
- Graphing tools within LTSpice can be used to calculate values from the simulation data and tailor the graph to the style of your report.

KiCAD Lectures

- Next lecture on Monday 4th March from 5-6pm in Diamond LT08!
- Free sessions!
- Teaches you about circuit board design and schematic capture!
- DON'T MISS OUT!



Thanks for listening!

This is the final LTSpice Session!

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Written by Sam Maxwell