ECE323 Lab 1 Part 1

The TriFilar Transformer

Start by reading through Lecture 3. Part 1 of Lab 1 runs for 1 week, and includes an exercise that should be completed by Monday April 11 and will be the first part of the lab report you submit to the TA when you have finished both parts.

Each of our four labs this quarter will use measured data obtained remotely, with analysis and simulations on paper and using LTspice. For part 1 of this first lab, begin with the measurements on the ADE-1 data sheet here:

https://www.minicircuits.com/pdfs/ADE-1.pdf

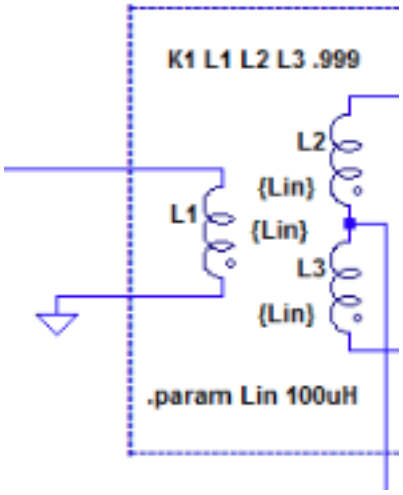
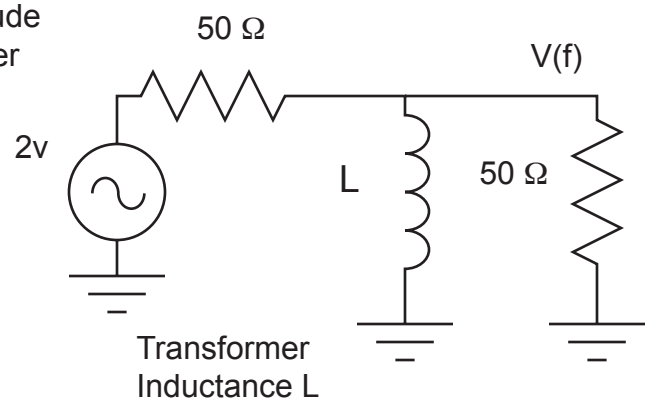


Figure 1

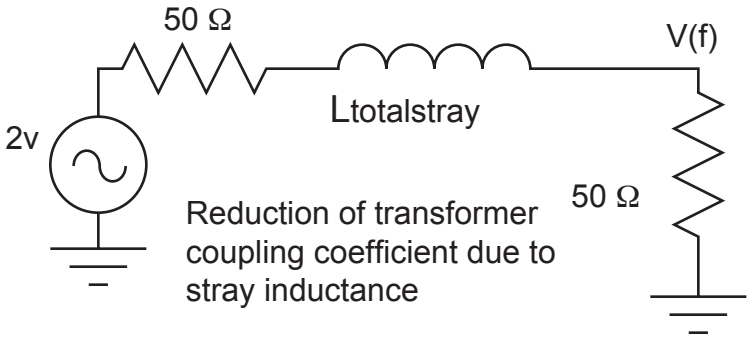
Study the data sheet, but there are only two behaviors we need to see: the rapid increase in conversion loss below 500kHz in the Conversion Loss graph, and the more gradual increase in RF VSWR in that graph at 500 MHz. Since each of these is independent of LO drive level, we may conclude that the 500kHz lower frequency limit and 500 MHz upper frequency limit relate to the transformers.

Use the equivalent circuit with transformer inductance L to ground to find an approximate value of the inductance of the ADE-1, based on a high pass response at 500 kHz. The loss is only a few tenths of a dB higher at 500 kHz than at 10 MHz, so this is not a -3dB point.



You should be able to estimate L using both on-paper analysis and an LTspice AC sim.

Next, use the 500 MHz low-pass character of the ADE-1 to estimate the total stray L in the coupling equivalent model. Again, you should be able to do that on paper and in simulation.



ECE323 Lab 1 Lab Report Part 1

Estimate the inductance and coupling coefficient of the trifilar inductor in figure 1 for a Mini-Circuits ADE-1 mixer. The inductance will be L from the model above. Now assume that all of the low-pass behavior at 500 MHz is due to stray inductance in the 2nd model above, and use that to find a better number than .999 for the coupling coefficient in Figure 1. You should be able to show your work in about 2 pages, to turn in with your completed Lab 1 report. Part 2 of Lab Report 1 explores the use of a diode ring mixer: 2 transformers and 4 diodes; as the phase detector for you Phase Locked Loop.