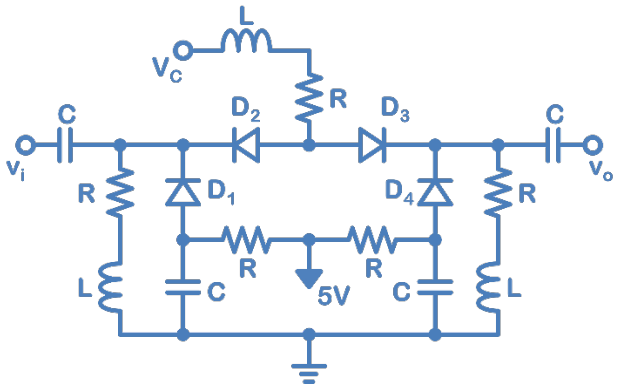
EECS312
Homework 5

Small Signal Analysis

The figure below shows a circuit for an improved Waugh Voltage Controlled Attenuator, where V_C and V_+(5V) are the large-signal voltage sources.

Reference: https://www.microwaves101.com/encyclopedias/waugh-attenuator



Large-Signal Sources.

V_C is the "constant" control voltage.

5V is a constant voltage.

Small-Signal Source.

The small signal input v_i is on the left.

Small-Signal probe.

The small signal output v_o is on the right.

Assume all capacitors and inductors are very large, R=400Ω, and n=2.32 for all diodes.

1. Draw the large-signal circuit.
2. Using the 0.7V CVD model, find the large signal diode currents for large signal control voltages:

V_C = 3V, 5V, 7V, 9V, 11V, 13V

hint: The circuit is symmetrical, so you can just analyze half.
Split the top resistor into two parallel resistors with values 2R=800Ω.
$I_{D1}=I_{D4}$, and $I_{D2}=I_{D3}$

3. Calculate the small signal resistances for the diodes for each control voltage.
4. Draw the small-signal circuit.
5. Find the small signal ratio, v_o/v_i, for each control voltage.
6. Generate a plot of the small signal ratio in terms of V_C using your points.
7. Simulate the circuit using your favorite CAD tool to find and plot v_o/v_i vs. V_C.

Use I_S=2.27e-8 Amps and n=2.23.