EGRE 224 Introduction to Microelectronics

Laboratory No. 3

Design of a Diode Amplifier
I. Introduction

In this laboratory you will design an amplifier based on the 1N270 diode and analyze it using simulation, to determine its frequency response.

II. Procedure

Using your knowledge of DA, construct a schematic of the diode amplifier shown below. Note that the 0V DC source represents the input source and the 1µF capacitor is necessary to decouple the bias circuit from the input source.

![Schematic Diagram]

The graph of $I_D$ vs. $V_D$ for the measured diode and AccuParts simulation is shown below. The input source for the amplifier will be a 200mV peak-to-peak AC source. From the graph, it can be seen that the diode should be biased at approximately the point where $I_D=30mA$ to provide a linear response for a 200mV AC input. Calculate the proper value for the 500Ω resistor to bias the diode at that operating point.

![Graph of $I_D$ vs. $V_D$]
Simulate your diode amplifier using Accusim. Run a DC operating point simulation and adjust the value of the resistor you calculated to obtain the proper operating point $I_D$ current.

Once the operating point is properly established, force an AC frequency source on the $Vin$ node and run an AC sweep from 1 Hz to 1GHz. Plot the voltage at $Vin$ and $vbias$ and determine the cut-off frequency for the high-pass filter on the input.

Finally, setup a sine wave time source on $Vin$ and perform a transient analysis. Plot the voltage at $Vin$ and $Vout$ and the diode current, $I_D$. The transient analysis should be run at every decade between 100Hz and 100KHz, at the frequency of 1GHz, and at the cut-off frequency noted above. At each transient analysis, place cursors on the plot as necessary to calculate the phase angle and magnitude of the $I_D/Vin$ gain.

### III. Write-up

The write-up should include the following sections:

1. Abstract
2. Introduction
3. Theory - reproduce the $I_D$ vs. $V_D$ curve shown in section II from your own data. Show the operating point you selected and the limits that result from a 200mV peak-to-peak AC input source. Show the calculations you used to find the proper resistor value for the diode circuit. Use the circuit diagram to estimate the cut-off frequency, assuming it is a single time constant circuit.
4. Results and conclusions - include a printout of your circuit with the final bias resistor values, a printout of the DCOP for the properly biased circuit, a plot of the AC analysis with a cursor showing the cutoff frequency, plots of the transient analysis at each test frequency with the cursors you used to measure the gain magnitude and phase, and a table showing your measured gain and phase angles at each measured frequency. Discuss any differences between your calculations and your simulation data.