

EEO352 Lab 2

RC Filters and Diodes

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1a

Using the LTspice simulator, design an RC filter with $R=1k\Omega$ and $C=4.7nF$

a

Simulate and plot the response to a 1V 10kHz sinusoidal signal

b

Simulate and plot the response to a 1V 100kHz sinusoidal signal and extract the phase shift

c

Simulate and plot the frequency response (Bode plot: magnitude and phase)

d

Extract the -3dB frequency and the corresponding phase shift

1b

Using the Analog Discovery 2 and the components, build and measure the RC filter at (1a) (35 pts):

a

Measure and plot the response to a 1V 10kHz sinusoidal signal

b

Measure and plot the response to a 1V 100kHz sinusoidal signal and the phase shift

c

Measure (network function) and plot the frequency response (magnitude and phase)

d

Extrapolate, from the measurement of the resistor and the -3dB frequency, the exact value of the total capacitance

e

Remove the capacitor and extrapolate, from the measurement of the resistor and the -3dB frequency, the value of the residual capacitance from the oscilloscope input

2a

Using the LTspice simulator (15pts):

a

Simulate and plot the diode 1N4148 current for a -1V to +1V diode voltage swing

b

Place the marker at the 20mA current, report the corresponding voltage and the dynamic resistance (derivative)

2b

Using the Analog Discovery 2 and the diode 1N4001 (35 pts):

a

Trace the diode current

- Use a 100Ω series resistor
- Use a +/- 4V 100Hz triangular waveform

b

Zoom to the 20mA current, report the diode voltage, extrapolate the dynamic resistance