University of Maryland Baltimore County Department of

Computer Science and Electrical Engineering

CMPE 314 Spring 2011 Lab 3:

Clippers and Clampers

I. Objective

Construct and measure clippers and clampers circuits. Study clippers and clampers circuit characteristics.

II. Introduction

Clippers limit or constrain signals by "clipping off" part of the signal in some region or compressing it in that region using a resistive voltage divider. Clampers, like clippers, can set a minimum or maximum value on an output AC waveform. However they achieve this by shifting the DC level of the steady-state AC signal instead of altering its shape.

III. Equipment and Parts

DC power supply, function generator, oscilloscope, digital multimeter, breadboard, diodes, resistors, and capacitor.

IV. Experiments and Procedures

Part (A) Clipper I

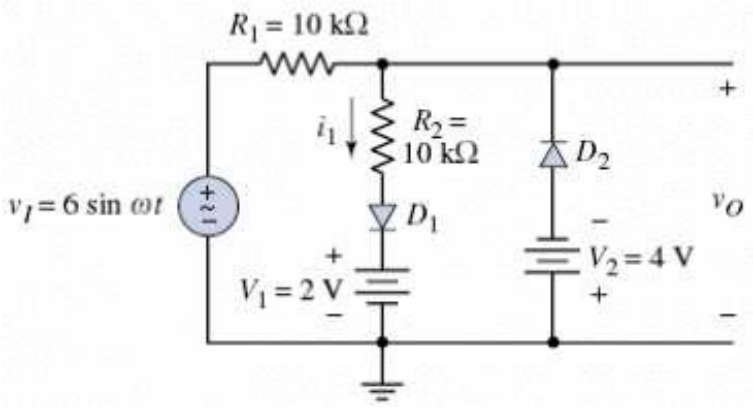

Figure 1: Clipper circuit

Components used:

- D1, D2 – diodes – (diode 1N4738 works here)
- R1, R2– resistors – 10 kOhms

(1) Construct the circuit in Figure 1, but without resister R_2.

(2) Apply a sinusoidal wave with amplitude of 6 V and frequency 10 kHz as the input voltage V_I. Show the input V_I and output V_o waveforms on oscilloscope and capture both waveforms using MATLAB. Save the waveform data. In your report, plot input and output experimental results on the same plot. Also overlay the theoretical calculation of input and output on the same plot. That means you will have four waveforms on one plot. Use different markers or colors to differentiate them. Below in each part, do the same for the sine wave input. Square wave or saw-tooth wave is not required for calculation.

(3) Repeat (2) with a square wave of the same amplitude and frequency. No calculation needed for this step.

(4) Repeat (2) with a saw-tooth wave of the same amplitude and frequency.

Part (B) Clipper II

Now construct the circuit shown in Figure 1 with R_2. Repeat steps (2)-(4) for the Part (A) Clipper I. Observe the differences, capture waveforms and save your data.

Part (C) Clamper

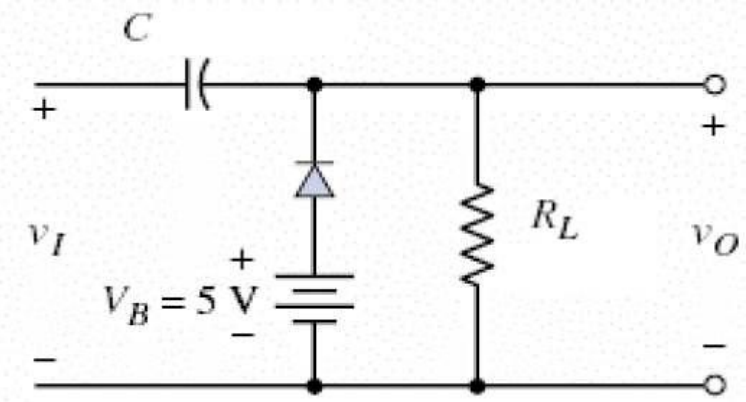

Figure 2: Clamper circuit

Components used:

- D – diodes – (diode 1N4740 works here)

- R_L – resistor –100 kOhms
- C – capacitor – .22 uF, non-polarized ceramic cap

(1) Construct circuit shown in Figure 2.

(2) Apply a sinusoidal wave with amplitude of 4 V and frequency 10 kHz as the input voltage V_I. Show the input V_I and output V_o waveforms on oscilloscope and capture both waveforms using MATLAB. In your report, plot input and output experimental results on the same plot. Overlay the theoretical calculation of input and output on the same plot.

(3) Repeat (2) with a square wave with a peak of +2 V and valley of −4 V. (Think about how you will generate this wave using function generator.) No calculation needed for square wave.

(4) Repeat step (2) and (3) after changing V_B to 1 V.

Part (D) Extra credit (5 points)

Use PSPICE to simulate part (A), (B), and (C). Save your data and plot them in MATLAB.

Report: All plots should be generated in MATLAB or other graphic software. Screen shot of oscilloscope is not accepted!

For Part (A)(B)(C): In the second step of each part, which is using the sine wave as input, plot the input and output waveforms in MATLAB. Also overlay the theoretical output result on the same plot! No calculation is required for square wave or saw-tooth wave input.