ECE214: Electrical Circuits Laboratory

Lab #6 — DC Voltage Multiplier

Week of 17 March 2015

1 Introduction

With this lab we add another component to our toolkit: the diode. There are many variations of DC/DC voltage multipliers. We will use a Villard voltage multiplier as discussed in class to convert a 10 V DC input voltage to an output voltage greater than 15 V DC.

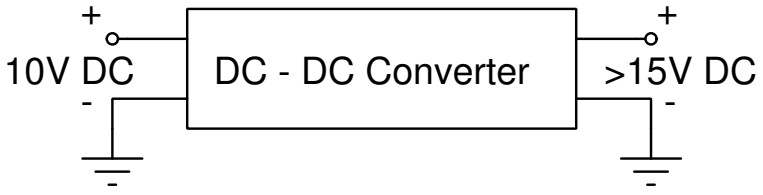

Figure 1: Block diagram of a DC–DC Converter.

2 Pre-lab

1. Design a circuit that takes only a single 10 V DC input and produces a voltage $>$ 15 V DC at the output.

2. You can use The Villard voltage doubler, as shown in Figure 2, as a basis for the DC/DC converter.

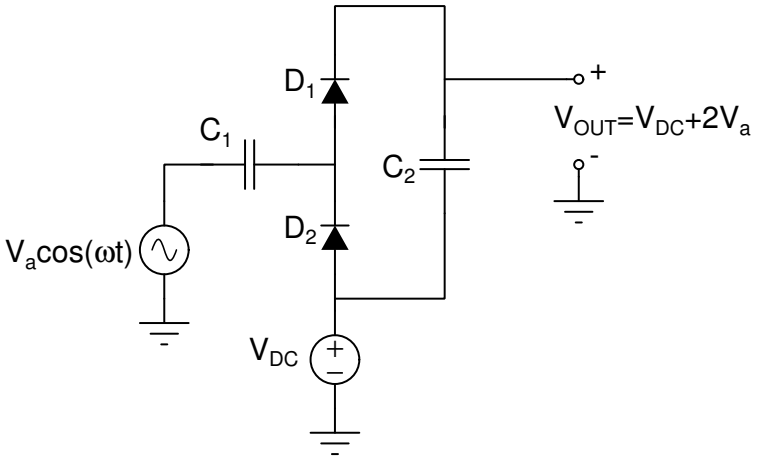

Figure 2: Villard voltage doubler circuit.

3. Simulate your design in Micro-cap. Use 1N4001 diodes and a suitable capacitor value (50nF - 100nf). Be sure to include the oscilloscope load and probe values.

4. Select an input voltage Va that will give you over 15V out.

5. Record the microcap values in a table similar to below. Include the plot for the 100Hz results.
   Va=_____ C=_____

Frequency	Vout	Vripple
100Hz		
500Hz		
1kHz		
5kHz		

3 Lab Procedure

1. Build the circuit you designed in the pre-lab. The lab has 1N4004 diodes which you can use instead of 1N4001.

2. Measure the "ripple" at the DC input voltage and at the DC output voltage. You might need to use AC coupling mode.

4 Post-Lab

1. Analyze your design:

   - Describe how it works.
   - Compare simulated with experimental results.

Frequency	Simulated Vout	Simulated Vripple	Measured Vout	Measured Vripple
100Hz				
500Hz				
1kHz				
5kHz				

   Why is the output voltage not exctly Vin + 2*Va?

   - State any conclusions.

2. Will cascading additional voltage multiplier stages increase the output voltage? If so, what is the maximum output voltage that can be achieved with the components used in your design?