

Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science
 6.061/6.690 Introduction to Power Systems

Problem Set 1

Issued February 2, 2011
 Due February 09, 2011

Reading Assignment: Text, Chapter 1

Problem 1: Do problems 1 through 4 from Chapter 1 of the text.

Problem 2: 1. Find the voltage indicated for the circuit of Figure 1.

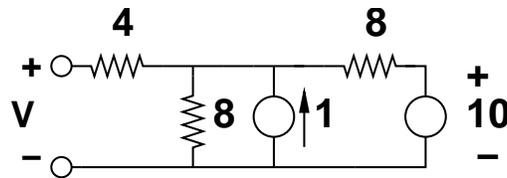


Figure 1: Circuit

2. Find the current indicated for the circuit of Figure 2

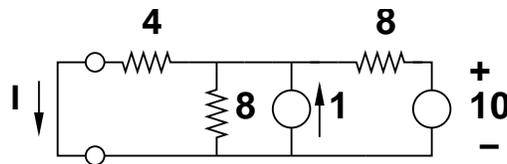


Figure 2: Circuit

3. Find the voltage indicated for the circuit of Figure 3.

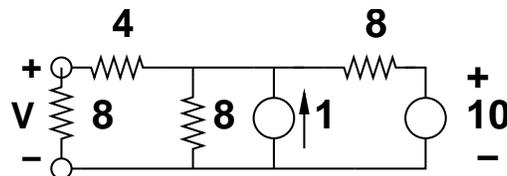


Figure 3: Circuit

Problem 3: Figure 4 shows two circuits, one with resistor values, the other with symbols. Show that these two circuits are equivalent if the values represented by the symbols are chosen correctly. Find the value of the symbols.

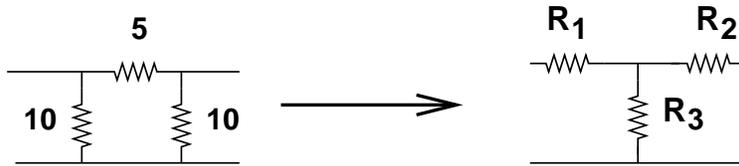


Figure 4: Circuit

Problem 4: Figure 5 shows a circuit known as a 'Wheatstone Bridge'. Find the equivalent circuit at the terminals in the center.

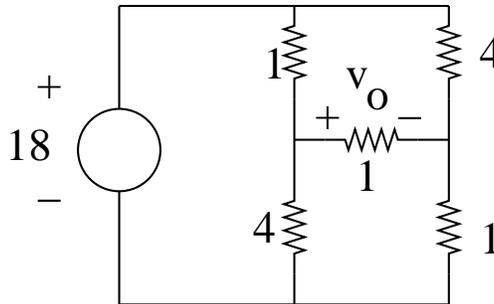


Figure 5: Loaded Bridge

Problem 5: Find a computer that can run MATLAB and get it to plot a nice copy of the function

$$F(t) = e^{-t/\alpha} \sin \omega t$$

over the interval $0 < t < 0.5\text{Sec}$, for values of

$$\alpha = 100\text{mS}$$

$$\omega = 120\text{Rad/S}$$

Problem 6: For 6.690 only Figure 6 shows a 'magic ladder' network driven by two voltage sources. Assume the value of each of the resistors is either R or $2R$ where $R = 1k\Omega$. Find the Thevenin Equivalent Circuit at the output terminals. Assuming there is nothing more connected to the right-hand end of the circuit, and that $V_1 = V_2 = 5\text{v}$, what is the output voltage V ? What is the equivalent resistance?

Hint: There is an easy way of doing this problem and there is a very hard way of working it. This circuit has some very nice properties, which is why it is called a 'magic ladder'. If you peer at it for a moment and consider the 'driving point' impedance at each of its nodes you can probably figure the easy way of working this problem.

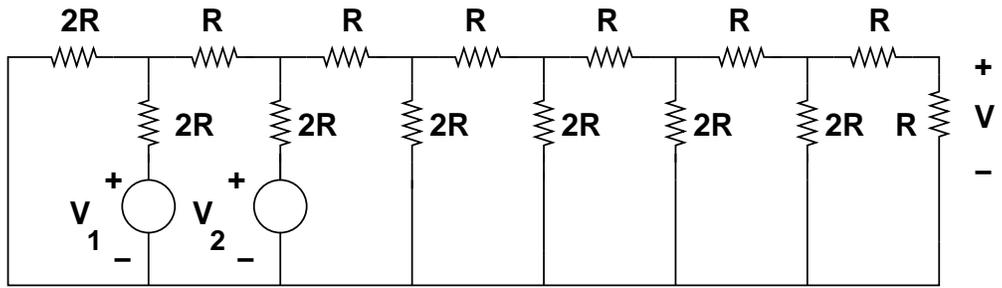


Figure 6: Magic Ladder Circuit

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Spring 2011

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