Feb 29

EGR 220: Engineering Circuit Theory
Lab 4: Explore Equivalent Circuits

Theme: Equivalent Circuits & Equivalence

In class we have defined 'equivalent' to indicate that two circuits have the same open-circuit voltage, V_{oc}, and short-circuit current, I_{sc}, across specified terminals *a-b*. We say this means that the two circuits have the same, or equivalent, behavior at terminals *a-b*.

Possible Experiments

1) Remember that you are encouraged to explore and analyze circuits during lab that will help improve your understanding of one or more of our Questions of Understanding
    a. You can pursue your own topic if you have a burning question of your own.
2) If you don't have your own topic to explore, since we have been working on Thevenin equivalent circuits in class, this could be a starting point for this week's lab.
3) You could, for example:
    a. Design a circuit with a few resistors and a voltage source from lab power supply. As always, you can get ideas for circuits to build from the text, remembering that you need to use kΩ valued resistors (or higher).
    b. Determine what the theoretical Thevenin equivalent is of this circuit.
    c. Then build this Thevenin equivalent circuit also.
    d. Measure and compare the open-circuit voltage and short-circuit current for both circuits (recall, as with the previous lab, you can have two different voltages supplied from the lab power supply by using the 6V terminals and the +25V terminals).
    e. **OR**, as mentioned in class, you could set up these two circuits, conceal your circuits and the output level from the power supply, and then have a neighboring lab team measure the open-circuit voltage and short-circuit current for both circuits.

Prelab

- For the prelab, design your experiments, including
    - The circuits you will build, with all element values indicated
    - What you will measure, and why
    - What you expect or hope to find (measurements and/or theory) so you will be alerted if you start getting unexpected results
    - The Question(s) of Understanding you are pursuing this week.

Things you could also think about:

1) What did you find that confirms your ideas and theories?
2) What was unexpected?
3) Do you have new questions you can pose about the concepts and theories you are investigating, that will help you deepen your understanding of circuit theory?
4) Do you need to reject some ideas you previously thought were true about circuit theory?

Questions of Understanding

1) How are voltage and current inter-related?
    - What do I understand about the theoretical and practical connections between voltage and current?

2) What is voltage?
   - What do I understand about the concept of voltage?
3) How do conservation laws apply to circuit theory?
   - What is my understanding of how conservation laws are used in circuit analysis?
4) What does "equivalent" mean for electrical circuits?
   - What is my understanding of how "equivalence" is used to design and analyze circuits?

Deepening your understanding, by asking, for example:

- What am I unsure about for the concept of _____?
- What is my theory to explain _____?
- Can I design circuits and analyze their behavior to test my theory?
- How can I experiment with this theory? law? concept?