Voltage Divider Rule & Current Divider Rule

EGR 220, Chapter 2
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Recap Concepts

• Series Elements (draw example)
  • Exclusively share a single node and
  • Carry the same current.
• Parallel Elements (draw example)
  • Share the same two nodes and
  • Have the same voltage drop across them.

Circuit Analysis Techniques

• Equivalent resistance, $R_{eq}$
  • Series and parallel resistors
• Current divider and voltage divider
  • Mesh and nodal analysis
  • Building on KVL and KCL
• Review what we have done...
  • Bring questions to office hours

Find $R_{eq}$ and $I$
Different $R_{eq}$ for Different Terminals

We will discuss the role of $V_s$ and $I_s$ later (with Thevenin equivalent)

![Circuit Diagram]

Voltage Divider Rule

- **Resistors and elements in Series**...
- **Current or voltage** is the same for $R_1$ & $R_2$?
- **Current or voltage** is partitioned across $R_1$ & $R_2$?
- Prove, or demonstrate, using KCL and KVL.
Voltage Divider: Series R

• Find $v_1$, $v_2$ in terms of $v_{src}$, $R_1$ & $R_2$ → derive the expression

Voltage Divider: Series R

• Solve for $v_1$ and $v_2$
  • Which resistor will have the larger V drop?

V-Divider Discussion

Current Divider Rule

• Resistors, elements and branches in Parallel...
• Current Divider:
  o $I$ is partitioned, flowing through these resistors
  o What is the relationship of $V$ for each element?
  o Prove, or demonstrate, using KCL and KVL
Current Divider: Parallel R

- Find $i_1$, $i_2$ in terms of $i_{src}$, $R_1$ & $R_2$
- Derive the expression...

I-Divider Discussion

Lab Experiments – Find $R_{\text{Multimeter}}$

(1) $R = 10M\Omega$
(2) $R = 10k\Omega$
Lab Experiments – Find $R_{\text{Multimeter}}$

$R = 10\text{M}\Omega$

![Image of circuit diagram with multimeter configuration](image1)

Lab Experiments – Find $R_{\text{Multimeter}}$

$R = 10\text{k}\Omega$

![Image of circuit diagram with multimeter configuration](image2)

Ammeter – Introduced Error

- Find the current $I$ in circuit (a).
- An ammeter with an internal resistance of 1\text{\,}\Omega is inserted in the network to measure $I'$ as shown circuit (b). Does current, $I'$, increase or decrease relative to part (a)?

![Image of circuit diagram with ammeter configuration](image3)

Ammeter – Introduced Error

![Image of circuit diagram with ammeter configuration](image4)
Voltmeter – Introduced Error

• Calculate the voltage $V_o$ in circuit (a).
• Is the voltage $V'_o$, measured when a voltmeter with 6-kΩ internal resistance is connected as in figure (b), greater or less than $V_o$ in circuit (a)?

Fundamental Analysis Tools for the Semester

• Basic analysis laws
  • Ohm’s law
  • KVL: Kirchhoff’s voltage law
  • KCL: Kirchhoff’s current law
• Analysis tools using the basic laws
  • Equivalent resistance
  • Current divider
  • Voltage divider
  • Mesh analysis
  • Nodal analysis
  • Equivalent Circuits

Questions?