Circuit Analysis Techniques

• Review
  o Bring questions to office hours

• Equivalent resistance, \( R_{eq} \)
  o Series and parallel resistors

• Current divider and voltage divider

• Mesh and nodal analysis
  o Building on KVL and KCL

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 the elements?

\[ \text{Voltage Divider: Series } R \]

• Find \( v_1, v_2 \) in terms of \( v_{src} \) → derive the expression
Voltage Divider: Series R

- Solve for \( v_1 \) and \( v_2 \)
  - Which resistor will have the larger V drop?

![Voltage Divider Diagram](image)

Current Divider Rule

- Resistors, elements and branches in Parallel...
- Current Divider:
  - \( I \) is partitioned, flowing through these resistors
  - What is the relationship of \( V \) for each element?

![Current Divider Rule Diagram](image)

V-Divider Discussion

- 12.5 A
- 8 Ω
- 2 Ω
- 1 Ω
- 4 Ω
- 50 V
- 100 V

![V-Divider Discussion Diagram](image)

Current Divider: Parallel R

- Find \( i_1 \), \( i_2 \) in terms of \( i_{src} \)
- Derive the expression...

![Current Divider Parallel Diagram](image)
Current Divider: Parallel R

• Solve for $i_1$ and $i_2$
  o Which R will carry the larger current?

I-Divider Discussion

Ammeter – Introduced Error

• Find the current $i$ in circuit (a).
• An ammeter with an internal resistance of 1 $\Omega$ is inserted in the network to measure $i'$ as shown circuit (b). What is $i'$?
**Voltmeter – Introduced Error**

- Obtain the voltage $V_o$ in circuit (a).
- Determine the voltage $V'_o$ measured when a voltmeter with 6-kΩ internal resistance is connected as in figure (b).
  
- Calculate the percent error as $\left| \frac{V_o - V'_o}{V_o} \right| \times 100\%$
- Find the percent error if the internal resistance were 36kΩ.

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**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