EE100 Lecture 2 - Part II (After break)

(2) Independent Current Source:

Note: Current sources are a little weird!

Loop must be complete

0 = 2 A, not possible
This brings up open circuits & short-circuits.

Warning: Watch out for these concepts = potential pitfalls.

\[ \text{V}_{AB} - 12 = 0 \]
\[ \Rightarrow \text{V}_{AB} = 12 \text{ V} \]

\[ \text{I}_{\text{curr}} \text{ V}_{AB} = 12 \Rightarrow i = \frac{12}{R} \text{ A} \]

Short circuit

Open circuit
Again, watch out for open circuit & short circuit questions = tricky!

\[ \text{(a) Find } V_{AB} \]

\[ V_{AB} = 3 \text{ V} \]

Note: \[ V_{AB} = V_A - V_B \]

i.e., in the question above \[ V_{AB} = V_A - V_B \]

KVL around loop 2: \[ V_B + 6 = 0 \Rightarrow V_B = -6 \text{ V} \]
KVL around loop 1: \( 12 - 3 - V_A = 0 \Rightarrow V_A = 9 \text{ V} \)

\[
V_{AG} = U_A - V_B = 15 \text{ V}
\]

Summary:
- **Open Circuit**
- \( V_A = ? \)
- \( j = 0 \)
- \( v = ? \)
- \( \text{Short circuit} \)
- \( v_{AG} = 0 \)
- \( i = 0 \)
Dependent sources: Sources (voltage or current) whose output depends on a current or voltage elsewhere in the circuit. For type:

\[ v_o = \alpha v_i \]
\[ v_i = \beta i_2 \]
\[ i_i = \gamma i_3 \]
\[ i_3 = \Delta V_4 \]

Voltage controlled voltage source (VCVS)
(A) \[ i_4 = 5 v_i \]
\[ V_4 = 65 \text{ A} \]

\[ 10 + 3 - v_i = 0 \Rightarrow v_i = 13 \text{ V} \]

Resistor:
\[ v = i R \Rightarrow v = -i R \]

Kirchhoff's Loop Law:
\[ 0 = \sum v = v_1 + v_2 + v_3 + v_4 \]

\[ V = i R \]

Ohm's Law:
\[ V = i R \]
Notice: Resistors always absorb energy!

\[ e = \frac{dQ}{dt}, \quad V = 1 \, V, \quad i = 1 \, A, \quad R = 1 \, \Omega \]

\[ V = 1 \, V \]

\[ i = 1 \, A \]

\[ V = 1 \, V \]

\[ R \quad \begin{cases} \frac{i}{i} = 1, \quad V = 1 \, V = (-1 \, V) = (-1 \, A) \, R \\ R = 1 \, \Omega \end{cases} \]
\[ v = -iR \]

Physically:

\[ R = \frac{\rho L}{A} \]

\[ P = \sqrt{\rho \cdot 20} = \sqrt{R = 1 \Omega} \]

Note: Power can be expressed in terms of \( R \) for a resistor: \( P = vi \)

\[ V + \frac{1}{i} R = \rho \cdot (1R) = i^2 R \]
Now we will do circuit, circuit, circuit...

\[ e_8^2 \text{(p. 50)} \] p. 43  Find \( V_x \)

Use KVL, KCL & Ohm's law to find \( V_x \).
(Don't use resistors in parallel and/or series)
Step 1: Use Ohm's law on rightmost resistor.

\[ V_y = \frac{1A \times 5 \Omega}{1A} = 5 \text{ V} \]

Step 2: Use parallel element idea to set voltage across 10 \( \Omega \) as 5 V.

Step 3: KVL around loop 1: \( V_1 + V_2 - 5 = 0 \)

We still need \( V_2 \) using Ohm's law.
Step 4:
Use KCL at node A: \( i + i_3 + i_2 + i = 0 \)

\[ i_2 = \frac{5V}{6\Omega} = \frac{5}{6} A = 1A \]

\[ i_3 = \frac{5V}{10\Omega} = 0.5A \]

\[ i = -(1 + 1 + 0.5) = -2.5A \]
\[ V_2 = IR \quad \text{(Ohm's law)} \]
\[ = (-2.5) (5) = -12.5 \, V \]

\[ \text{Note:} \quad 5^\circ \quad -2.5 \]
\[ \Theta \quad -12.5 \, V \]
\[ \Theta \quad 12.5 \, V \]

\[ V_2 + V_3 - 5 = 0 \quad \Rightarrow \quad \sqrt{V_2} = 17.5 \, V \]
Next time: Chapter 27 READ!

(20 Intro to PSpice (office hour)

START HERE #1, WE OFF FOR QUESTIONS