PARALLEL ELECTRIC CIRCUITS

Lesson 8

EET 150

Lesson Objectives

In this presentation you will learn:

how to recognize a parallel circuit

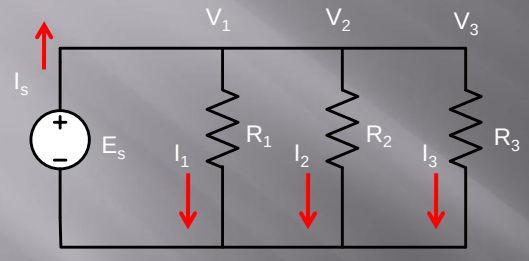
the characteristics of a parallel electric circuit

how to find the currents flowing in each branch of a parallel circuit using Ohm's Law

how to find the total current flowing in a parallel circuit

how to compute the equivalent resistance of a group of parallel loads

Parallel Electric Circuits



$I_s = I_1 + I_2 + I_3$

Commonly used in house wiring

Characteristics

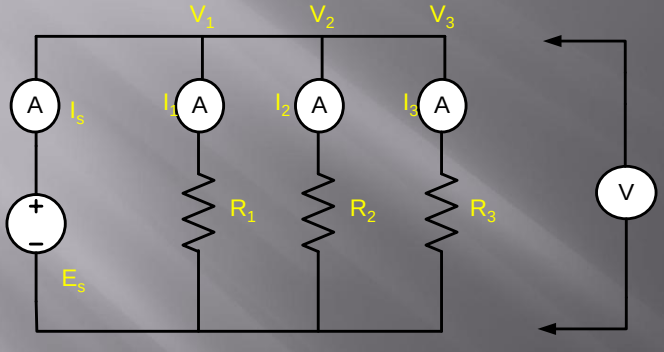
Loads connected "across" voltage source
(Each load has connections to terminals of voltage source)

Voltage the same across each load.

Current divides among loads based on load resistance
(smaller R greater I)

Sum of load currents equals source current
(Kirchhoff's Current Law)

Parallel Circuits



$V_1 = V_2 = V_3 = E_s$

$$I_1 = \frac{E_s}{R_1}$$

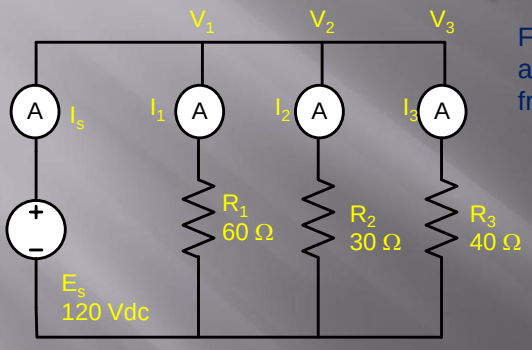
$$I_2 = \frac{E_s}{R_2}$$

$$I_3 = \frac{E_s}{R_3}$$

$$I_s = I_1 + I_2 + I_3$$

Solving Parallel Circuits Using Ohm's Law

Parallel Circuits Example



Find the load current values and the total current supplied from the load.

$$I_1 = \frac{E_s}{R_1} = \frac{120\ V}{60\ \Omega} = 2\ A$$

$$I_2 = \frac{E_s}{R_2} = \frac{120\ V}{30\ \Omega} = 4\ A$$

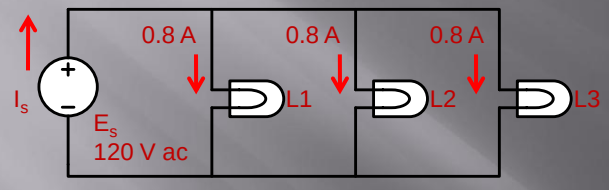
$$I_3 = \frac{E_s}{R_3} = \frac{120\ V}{40\ \Omega} = 3\ A$$

What is the value of I_s?

$$I_s = I_1 + I_2 + I_3$$

$$I_s = 2\ A + 4\ A + 3\ A = 9\ A$$

Parallel Circuits Example



Find the equivalent resistance of the lamps shown. What is the value of I_s?

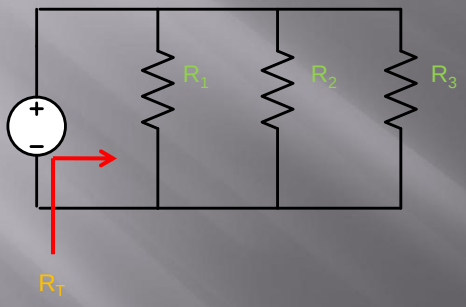
$$I_s = I_1 + I_2 + I_3$$

$$I_s = 0.8\ A + 0.8\ A + 0.8\ A = 2.4\ A$$

$$R_{L1} = \frac{E_s}{I_1} = \frac{120\ V}{0.8\ A} = 150\ \Omega$$

$$R_{L1} = R_{L2} = R_{L3}$$

Simplifying Parallel Resistors



Calculating Equivalent Parallel Resistances

Two resistors only:

$$R_T = \frac{R_1 R_2}{R_1 + R_2}$$

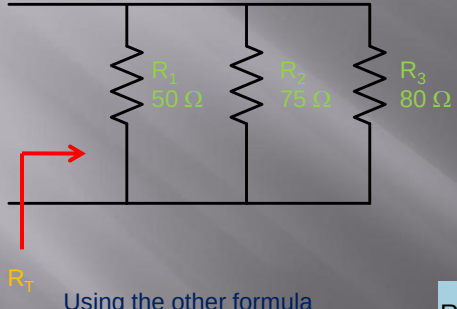
R_T is equivalent value of parallel resistors

R_T draws the same current as R_1 R_2 and R_3 in parallel.

Two or more resistors:

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots \frac{1}{R_N}}$$

Parallel Resistors Example



Find R_T for the circuit shown

Using two resistor formula twice

$$R_T = \frac{R_1 R_2}{R_1 + R_2}$$

$$R_{T1} = \frac{50(75)\,\Omega}{50 + 75\,\Omega} = 30\,\Omega$$

$$R_T = \frac{R_{T1} R_3}{R_{T1} + R_3} = \frac{30(80)\,\Omega}{30 + 80\,\Omega} = 21.82\,\Omega$$

Using the other formula

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots \frac{1}{R_N}}$$

$$R_T = \frac{1}{\frac{1}{50\,\Omega} + \frac{1}{75\,\Omega} + \frac{1}{80\,\Omega}} \Rightarrow R_T = \frac{1}{0.02 + 0.01333 + 0.0125} = \frac{1}{0.045833} = 21.82\,\Omega$$

Parallel Electric Circuits

End Lesson 8 EET 150

Coming Next: Electronic Component Data Sheets