HKUST Dual Program 2019

Level 1 (Engineering – Robotics)

Basic Electronics, Energy and Power

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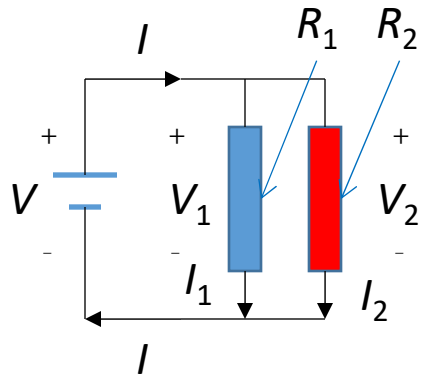
Circuit theory in Mathematics

- Consider two typical circuits, Parallel and Series configuration

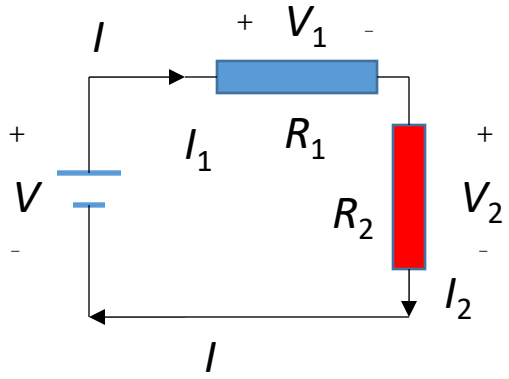
Parallel Configuration



Identities:

$$V = V_1 = V_2$$
$$I = I_1 + I_2$$
$$V_1 = I_1 R_1$$
$$V_2 = I_2 R_2$$

Series Configuration



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$$V = V_1 + V_2$$
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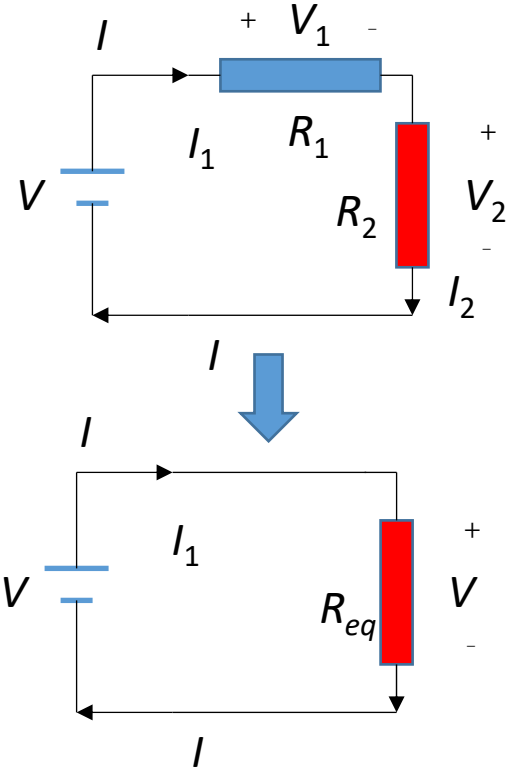
Circuit theory in Mathematics

- Consider Series configuration

Series Configuration



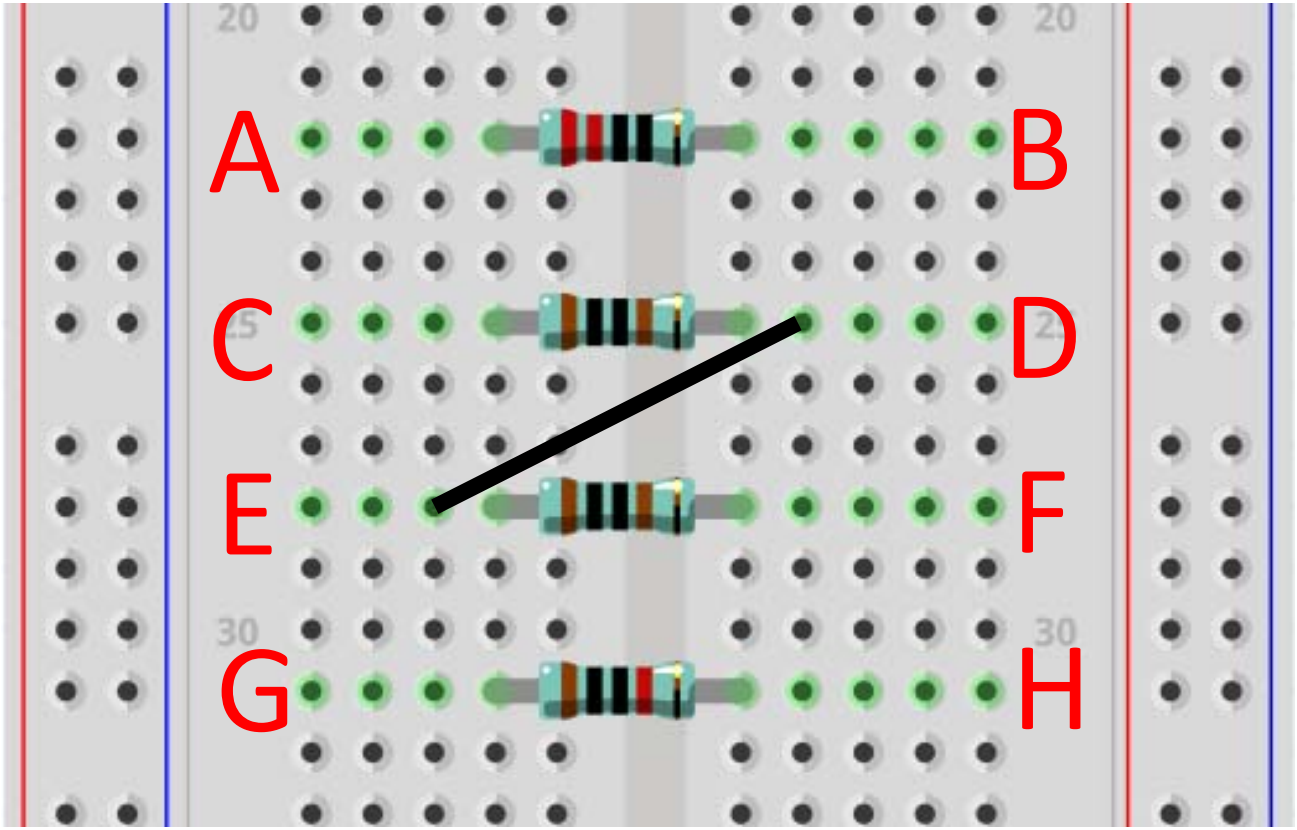
Identities:

$$V = V_1 + V_2$$
$$I = I_1 = I_2$$
$$V_1 = I_1 R_1$$
$$V_2 = I_2 R_2$$

$$V = V_1 + V_2 = IR_1 + IR_2$$
$$IR_{eq} = I(R_1 + R_2)$$
$$R_{eq} = (R_1 + R_2)$$

Series

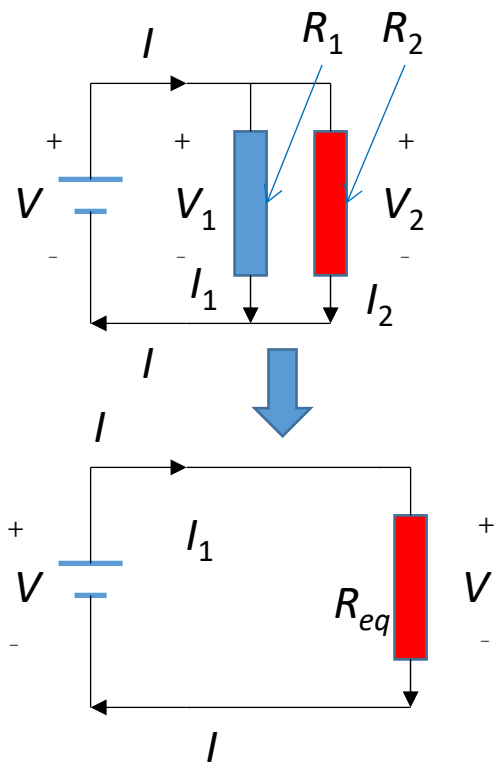
- The 2 middle 1kΩ resistors are said to be in Series



Circuit theory in Mathematics

- Parallel configuration

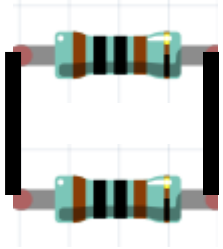
Parallel Configuration



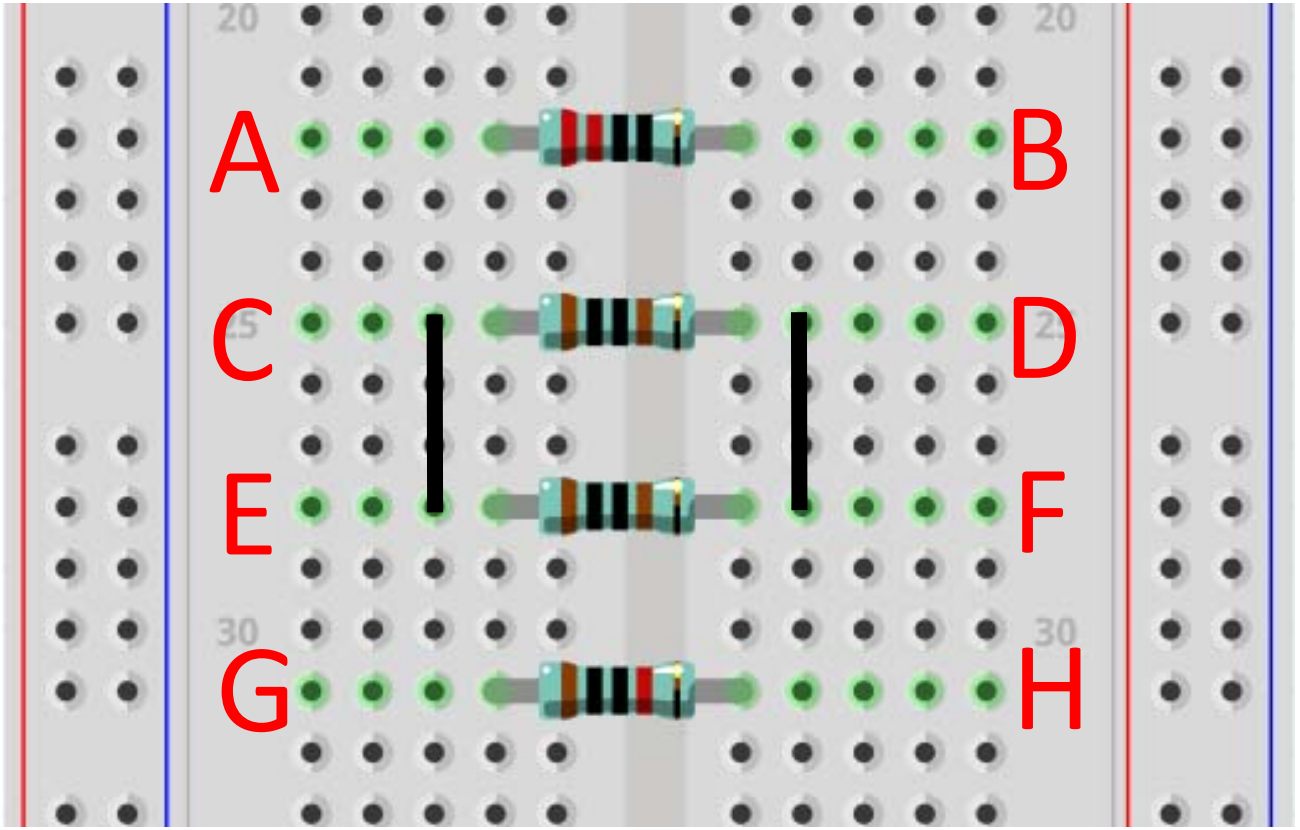
$$V = V_1$$
$$= V_2$$
$$I = I_1 + I_2$$
$$V_1 = I_1 R_1$$
$$V_2 = I_2 R_2$$

$$I = I_1 + I_2 = \frac{V_1}{R_1} + \frac{V_2}{R_2} = \frac{V}{R_1} + \frac{V}{R_2}$$
$$= \left(\frac{1}{R_1} + \frac{1}{R_2}\right) V$$
$$I = \left(\frac{1}{R_1} + \frac{1}{R_2}\right) I R_{eq}$$
$$\frac{1}{R_{eq}} = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

Parallel



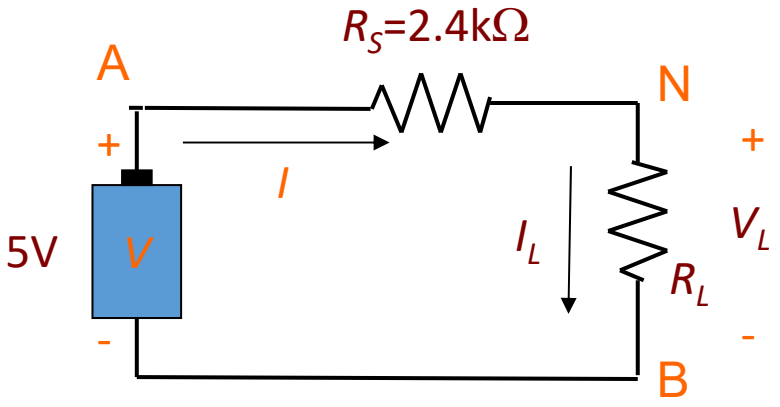
- The 2 middle 1kΩ resistors are said to be in Parallel



A LITTLE MORE CHALLENGING EXAMPLE

- Consider the simple resistor network below. What's the power of the different values of R_L ?

R_L (kΩ)	I_L , Current through R_L (mA)	V_L Voltage at R_L (mV)	P_L Power at R_L (mW)
0.6			
1.2			
1.8			
2.4			2.6
3.0			
3.6			
4.0			



Can you plot the graph Power at R_L vs R_L ?

How does the curve look like?