IAT 267 Introduction to Technological Systems

Week 3 Workshop

Series and Parallel Circuits.

Topics

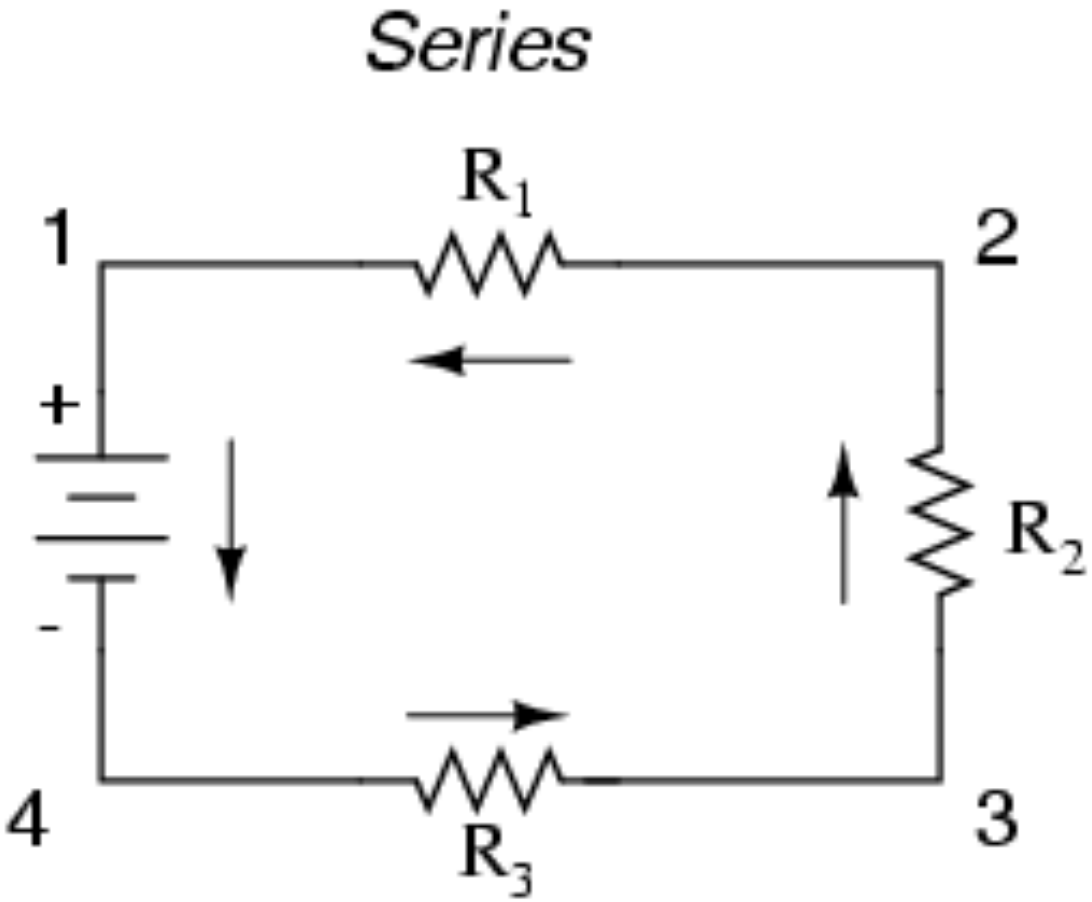
- Series Circuits
- Parallel Circuit

Series Circuit

- Circuits consisting of just one battery and one load resistance are very simple to analyze, but they are not often found in practical applications.

- Usually, we find circuits where more than two components are connected together.

Example of a Series Circuit



- The defining characteristic of a series circuit is that there is only one path for electrons to flow.

- In this circuit the electrons flow in a counter -clockwise direction, from point 4 to point 3 to point 2 to point 1 and back around to 4.

- Let's apply the laws of a circuit:
  - **In any given circuit, the total voltage around the path of the circuit is zero**.
- So, for our example circuit we have:

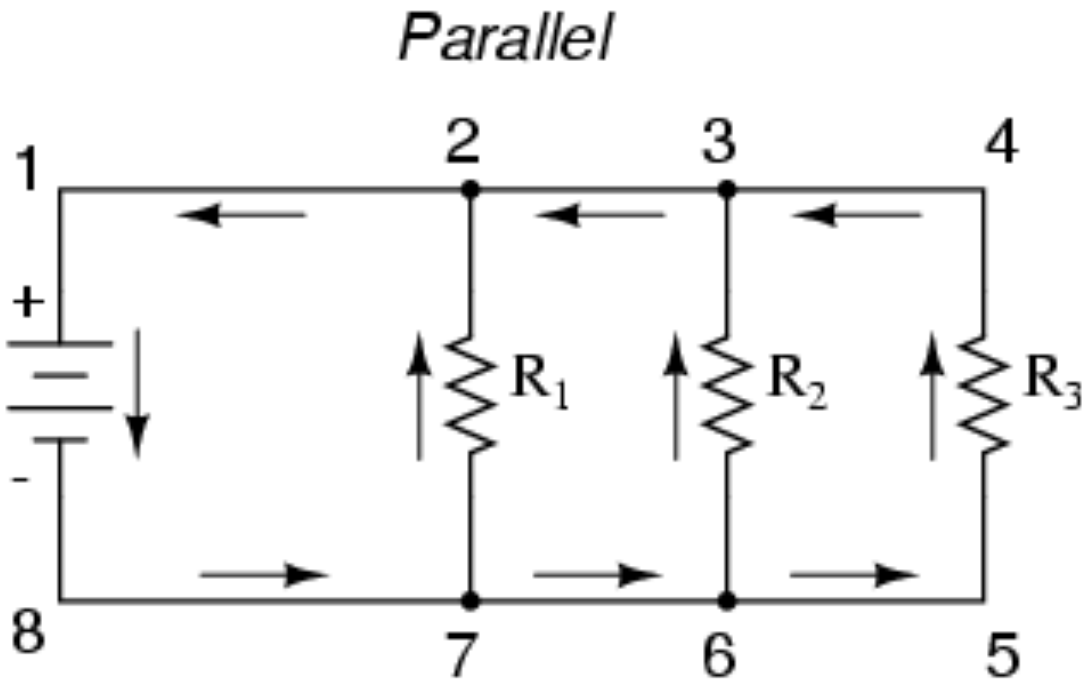
  $V = IR_1 + IR_2 + IR_3$

  Or: $IR_e = IR_1 + IR_2 + IR_3$

  ➔ $R_e = R_1 + R_2 + R_3$ (smaller current value)

  ➔ the total resistance of any series circuit is equal to the sum of the individual resistances. This should make intuitive sense: the more resistors in series that the electrons must flow through, the more difficult it will be for those electrons to flow.

Example of a parallel circuit



- The defining characteristic of a parallel circuit is that all components are connected between the same set of electrically common points.

- Looking at the schematic diagram, we see that points 1, 2, 3, and 4 are all electrically common. So are points 8, 7, 6, and 5.

- Note that all resistors as well as the battery are connected between these two sets of points.

- Let's apply the laws of a circuit:
  - **The amount of current going into any point in a circuit is the same as the amount coming out of that point.**
- So, for our example circuit we have:

$I_{R1} = V / R_1$

$I_{R2} = V / R_2$

$I_{R3} = V / R_3$

The three currents add up to the total current flowing out from point 2.

$I = I_{R1} + I_{R2} + I_{R3}$

Or: $V / R_e = V / R_1 + V / R_2 + V / R_3$

➔ $1 / R_e = 1 / R_1 + 1 / R_2 + 1 / R_3$

➔ Or:

$$R_e = R_1 \times R_2 \times R_3 / (R_1R_2 + R_2R_1 + R_3R_2)$$

or, if the resistances are equal:

$R_e = R / 3$

➔ Total resistance in a parallel circuit is *less* than any of the individual resistances.

➔ This means larger current value