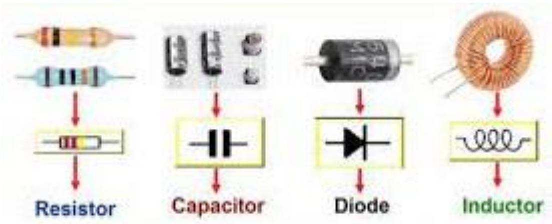
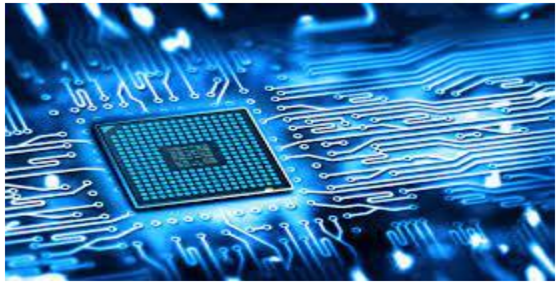
Electronics 1

BSC 113

Summer 2021-2022

Lecture 10





Delta-to-Wye (Pi-to-Tee) Equivalent Circuits

INSTRUCTOR

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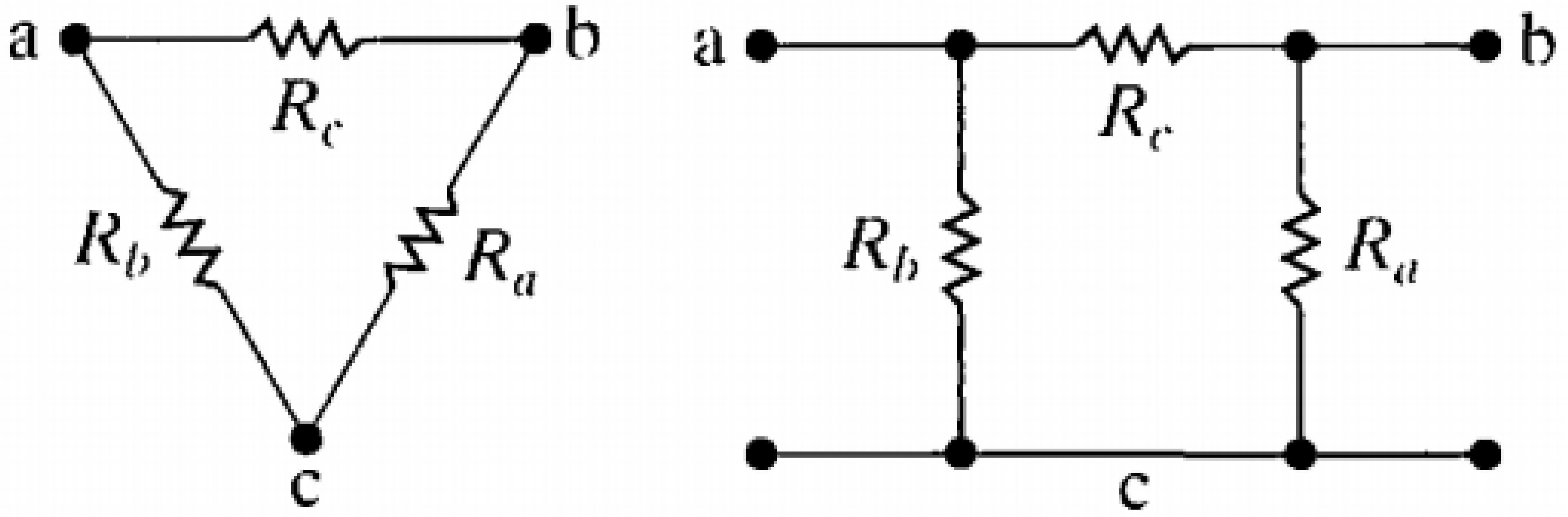
Contents

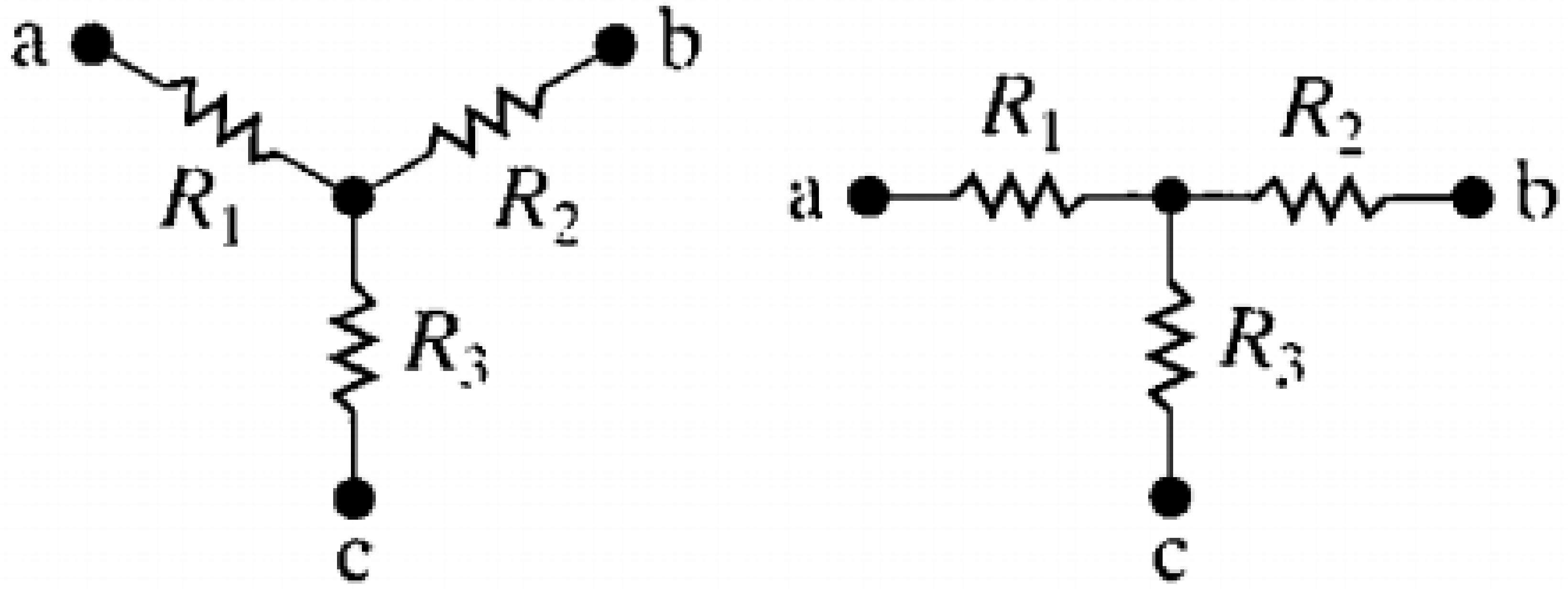
1) Delta-to-Wye Equivalent Circuits
2) The Delta-to-Y transformation
3) Delta-to-Y Equations
4) Y-to-Delta Equations
5) Example

Delta-to-Wye Equivalent Circuits



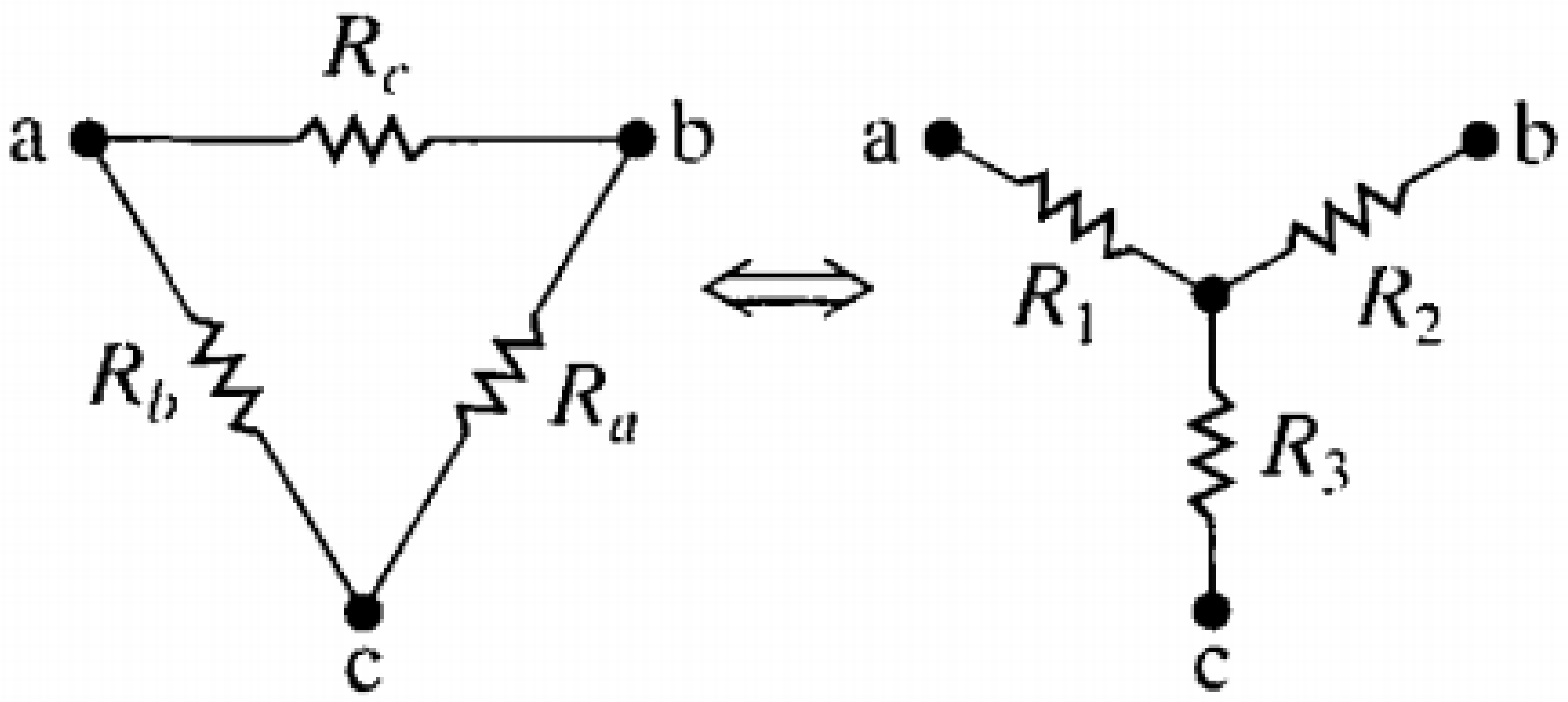
▲ A Δ configuration viewed as a π configuration.

Delta-to-Wye Equivalent Circuits



▲ A Y structure viewed as a T structure.

The Delta-to-Y transformation

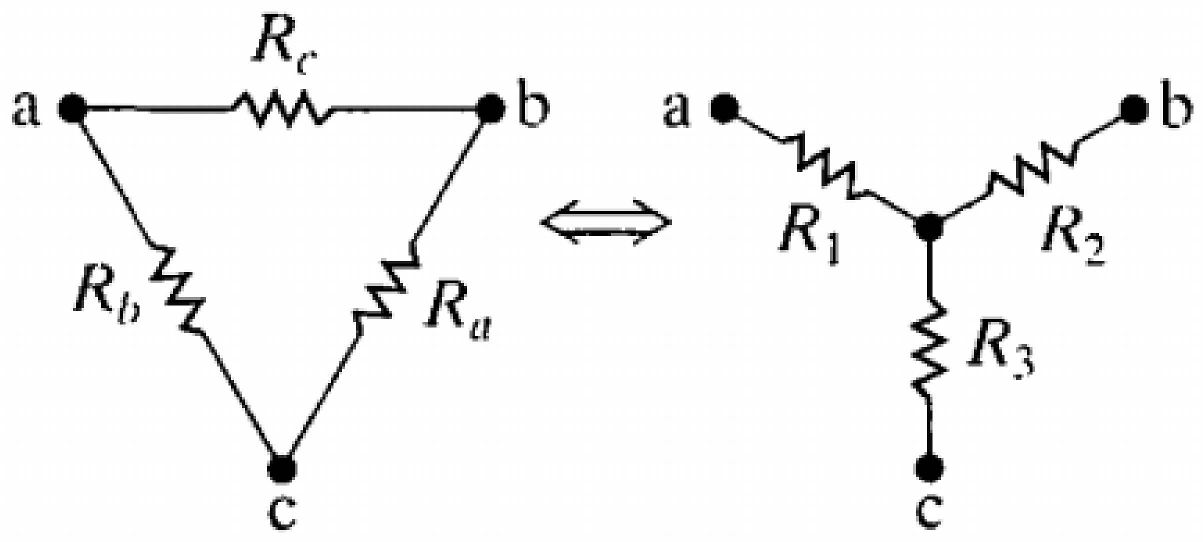


Delta-to-Y Equations

$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c},$$

$$R_2 = \frac{R_c R_a}{R_a + R_b + R_c},$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}.$$

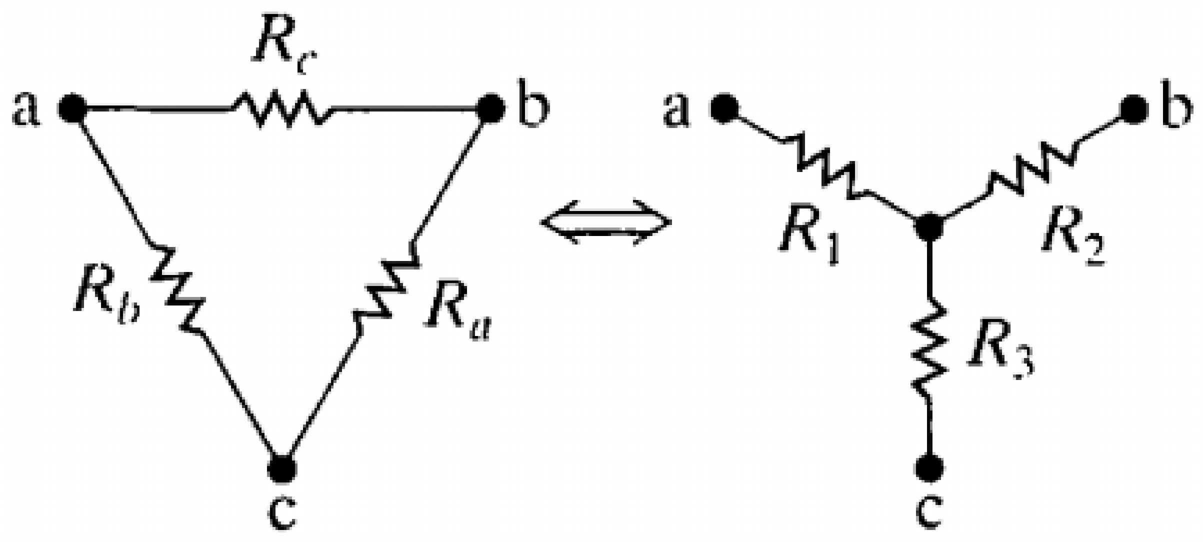


Y-to-Delta Equations

$$R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1},$$

$$R_b = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2},$$

$$R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3}.$$



Example

Find the current and power supplied by the 40 V source in the circuit shown

$$R_1 = \frac{100 \times 125}{250} = 50\ \Omega,$$

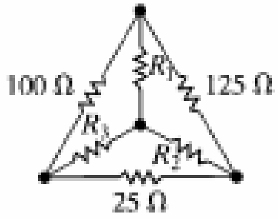
$$R_2 = \frac{125 \times 25}{250} = 12.5\ \Omega,$$

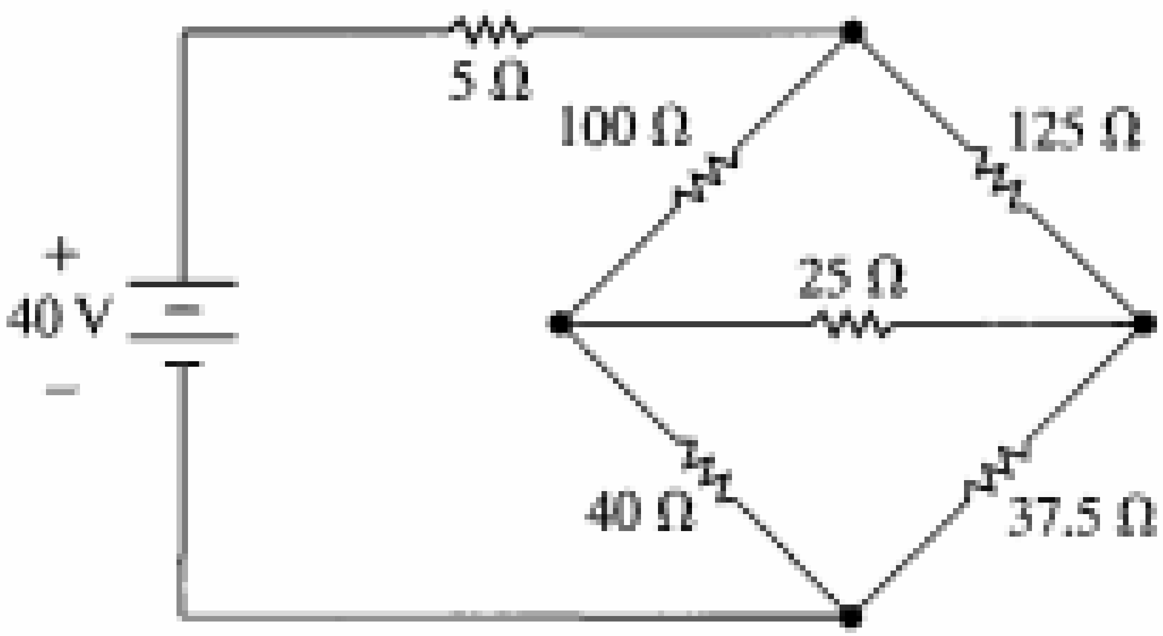
$$R_3 = \frac{100 \times 25}{250} = 10\ \Omega.$$

Substituting the Y-resistors into the circuit shown in Fig. 3.32 produces the circuit shown in Fig. 3.34. From Fig. 3.34, we can easily calculate the resistance across the terminals of the 40 V source by series-parallel simplifications:

$$R_{eq} = 55 + \frac{(50)(50)}{100} = 80\ \Omega.$$

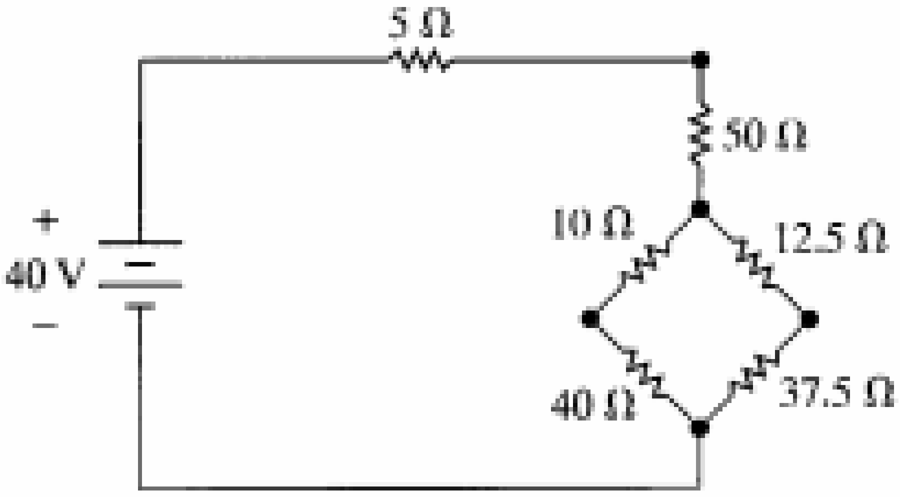
The final step is to note that the circuit reduces to an 80 Ω resistor across a 40 V source, as shown in Fig. 3.35, from which it is apparent that the 40 V source delivers 0.5 A and 20 W to the circuit.





Example

Find the current and power supplied by the 40 V source in the circuit shown



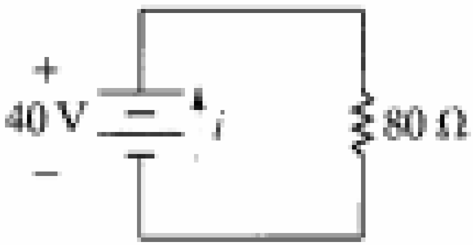


Figure 3.35 ▲ The final step in the simplification of the circuit shown in Fig. 3.32.


Thank you