SIMPLE CIRCUIT DIAGRAM

http://www.phys.uconn.edu/~rozman/Courses/m3510_17f/

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Figure 1 is the circuit diagram for a small network of resistors.

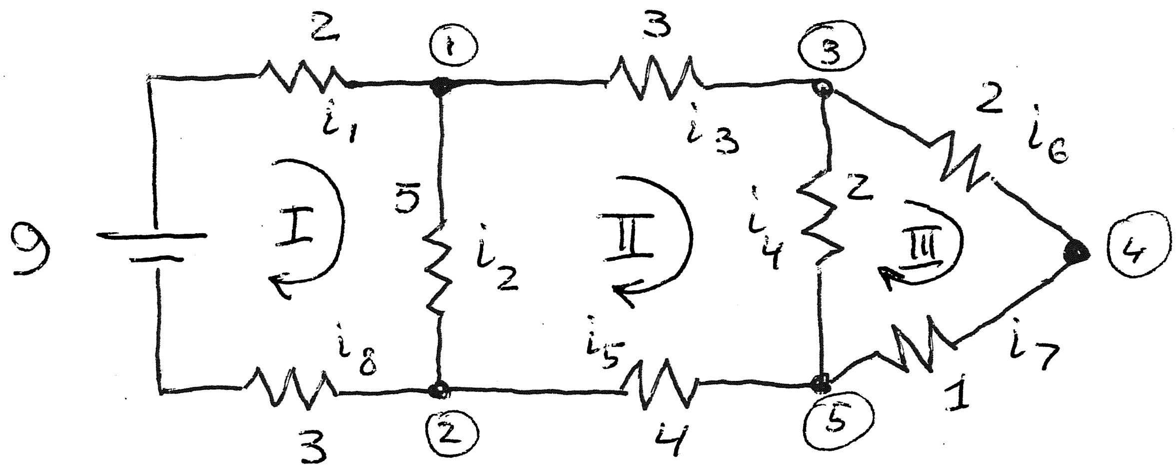

Figure 1: A resistor network

There are five nodes, eight resistors, and one constant voltage source. We want to compute the currents in each of the resistors.

Let i_k, $k = 1, \ldots, 8$ denote the (clockwise) current in each of the resistors in the diagram. Ohms law says that the voltage drop across a resistor is the resistance times the current. Kirchhoffs voltage law says that the sum of the voltage differences around each loop is zero.

For example, around loop I,

$$2\,i_1 + 5\,i_2 + 3\,i_8 - 9 = 0.$$

Similarly, around loops II and III,

$$i_3 + 2\,i_4 + 4\,i_5 - 5\,i_2 = 0,$$

$$2\,i_6 + i_7 - 2\,i_4 = 0.$$

Kirchhoff s current law says that the sum of the currents at each node is zero.

For example, at node 1,

$$i_1 - i_2 - i_3 = 0.$$

Similarly, at node 2,

$$i_2 + i_5 - i_8 = 0.$$

At node 3,

$$i_3 - i_4 - i_6 = 0.$$

At node 4,

$$i_6 - i_7 = 0.$$

At node 5,

$$i_4 + i_7 - i_5 = 0.$$

In matrix notations,

$$\begin{bmatrix} 2. & 5. & 0. & 0. & 0. & 0. & 0. & 3. \\ 0. & -5. & 3. & 2. & 4. & 0. & 0. & 0. \\ 0. & 0. & 0. & -2. & 0. & 2. & 1. & 0. \\ 1. & -1. & -1. & 0. & 0. & 0. & 0. & 0. \\ 0. & 1. & 0. & 0. & 1. & 0. & 0. & -1. \\ 0. & 0. & 1. & -1. & 0. & -1. & 0. & 0. \\ 0. & 0. & 0. & 0. & 0. & 1. & -1. & 0. \\ 0. & 0. & 0. & 1. & -1. & 0. & 1. & 0. \end{bmatrix} \begin{bmatrix} i_i \\ i_2 \\ i_3 \\ i_4 \\ i_5 \\ i_6 \\ i_7 \\ i_8 \end{bmatrix} = \begin{bmatrix} 9. \\ 0. \\ 0. \\ 0. \\ 0. \\ 0. \\ 0. \\ 0. \end{bmatrix}$$