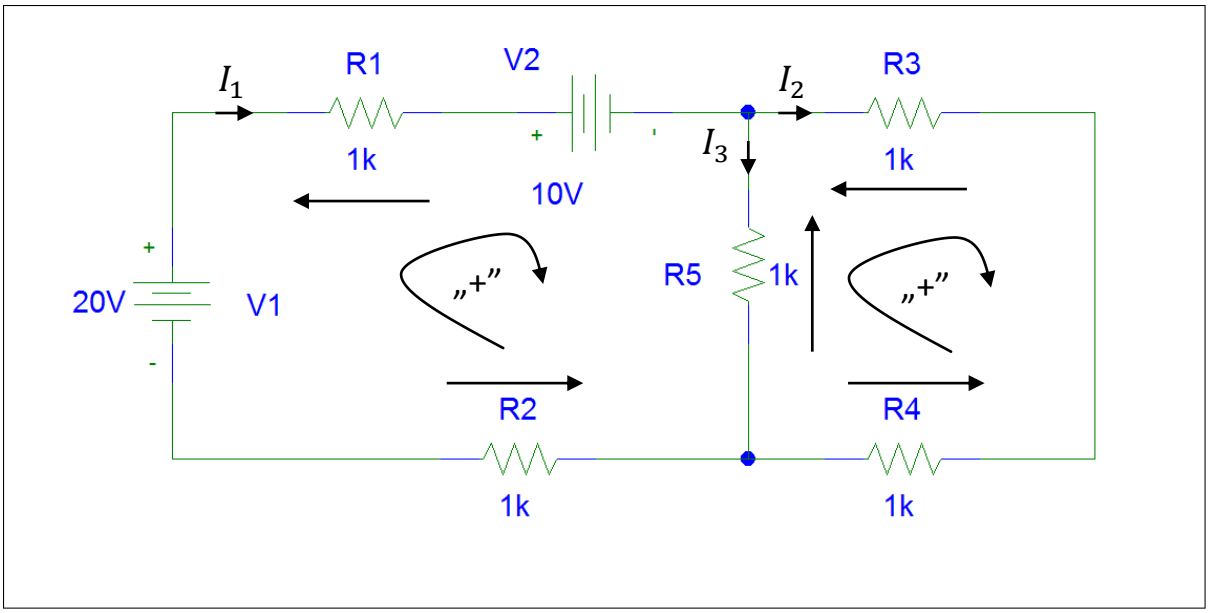
Application of branch current method to DC circuit.

Branch currents will be calculated for DC electrical circuit. Electric circuits contains in its topology two voltage sources and five resistors.



Drawing 1. Electrical DC circuit.

Before we will write Kirchhoff's current and voltage equations. We have to calculate value of current I_1. To do this we have to know how looks total resistance of considered circuit.

Total resistance of this circuit is given by following equation

$$R = R1 + R2 + \frac{R5 \cdot (R3 + R4)}{R5 + (R3 + R4)}$$

$$R = 1k + 1k + \frac{1k \cdot 2k}{3k} = 2k + \frac{2}{3}k = 2\frac{2}{3}k$$

$$I_1 = \frac{U}{R}$$

$$I_1 = \frac{V1 - V2}{R} = \frac{20[V] - 10[V]}{2\frac{2}{3}k[\Omega]} = 0{,}00375[A] = 3{,}75[mA]$$

Kirchhoff's current law (KCL) equation

$$I_1 - I_2 - I_3 = 0$$

Kirchhoff's voltage law (KCL) equations

for mesh 1

$$-I_1 \cdot R2 + V1 - I_1 \cdot R1 - V2 - I_3 \cdot R5 = 0$$

for mesh 2

$$I_3 \cdot R5 - I_2 \cdot R3 - I_2 \cdot R4 = 0$$

$$I_3 = \frac{-I_1 \cdot R2 + V1 - I_1 \cdot R1 - V2}{R5}$$

$$I_3 = \frac{-I_1 \cdot (R1 + R2) + V1 - V2}{R5} = \frac{-3{,}75 \cdot 10^{-3} \cdot 2 \cdot 10^3 + 10}{10^3}$$

$$I_3 = \frac{10 - 7{,}5}{10^3} = 0{,}0025[A] = 2{,}5[mA]$$

$$I_2 = I_1 - I_3$$

$$I_2 = 3{,}75 - 2{,}5 = 1{,}25[mA]$$