Kirchoffs Voltage Law

Kirchoffs Voltage Law (KVL) states that the algebraic sum of the voltages across any set of branches in a closed loop is zero. i.e.

$$\sum_{b=1}^{B} V_b = 0$$

Where B is the number of branches in the circuit and V_b is the voltage across each branch.

Figure 1 shows a single loop circuit. The KVL computation is expressed graphically in that voltages around a loop are summed up by traversing (figuratively walking around) the loop.

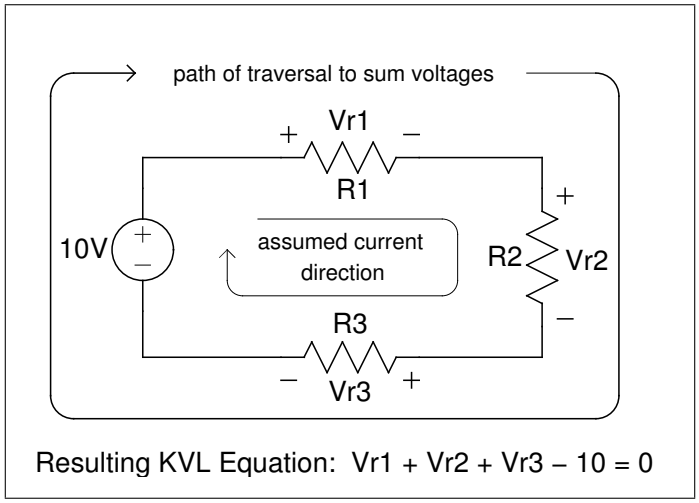

Figure 1: A single loop circuit

The KVL equation is obtained by traversing a circuit loop in either direction and writing down unchanged the voltage of each element whose + terminal is entered first and writing down the negative of every element's voltage where the minus sign is first met. The loop must start and end at the same point. It does not matter where you start on the loop.

Note that a current direction must have been *assumed*. The assumed current creates a voltage across each resistor and fixes the position of the + and - signs so that the passive sign convention is obeyed. The assumed current direction and polarity of the voltage across each resistor must be in agreement with the passive sign convention for KVL analysis to work.

The voltages in the loop may be summed in either direction. It makes no difference except to change all the signs in the resulting equation. Mathematically speaking, its as if the KVL equation is multiplied by -1. See figure 2.

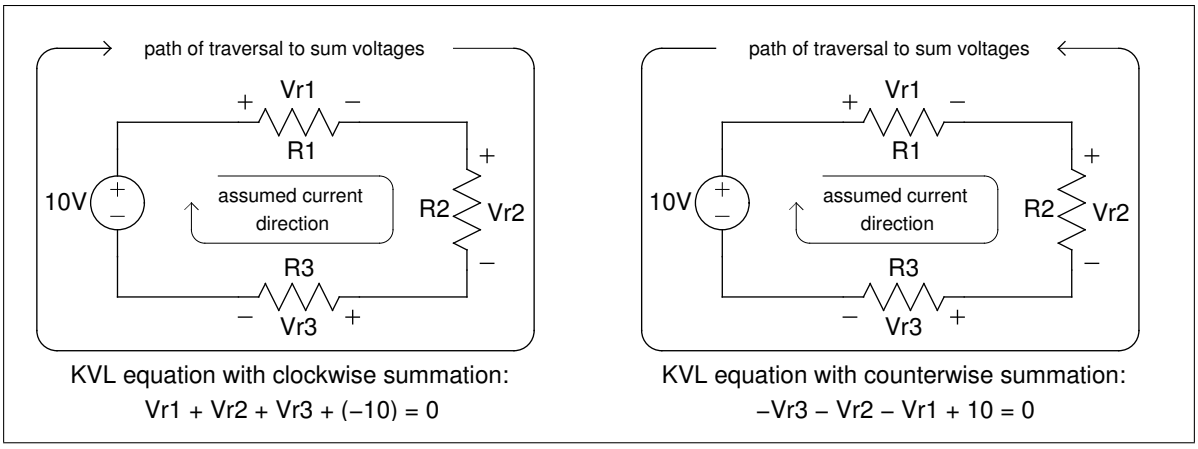

Figure 2: Voltage summation can be done in either direction

The case on the right of figure 3 will obviously result in negative result for the current. This is correct considering the current arrow is pointing in the opposite direction.

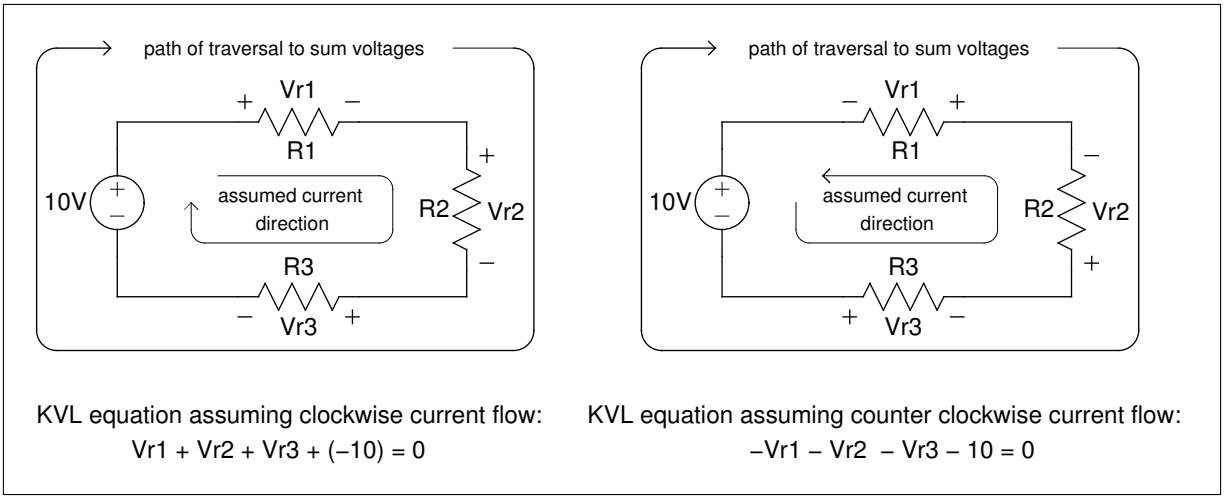

Figure 3: The assumed current direction fixes the voltage references