02.1 can.sgn Sign convention

We use the **passive sign convention** of electrical engineering, defined below and illustrated in Fig. sgn.1.

Definition 02 can.1: passive sign convention

Power flowing *in* to a component is considered to be *positive* and power flowing *out* of a component is considered *negative*.

Because power $\mathcal{P} = vi$, this implies the current and voltage signs are prescribed by the convention. For **passive elements**, the electrical potential must drop in the direction of positive current flow. This means the assumed direction of voltage drop across a passive element must be the same as that of the current flow. For **active elements**, which supply power to the circuit, the converse is true: the voltage drop and current flow must be in opposite directions. Fig. sgn.2 illustrates the possible configurations. When analyzing a circuit, for each passive element, draw an arrow beside it pointing in the direction of assumed current flow and voltage drop. Try it out on Fig. sgn.3.
The purpose of a sign convention is to help us

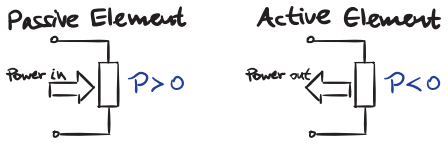

Figure sgn.1: passive sign convention in terms of power $\mathcal{P}$.

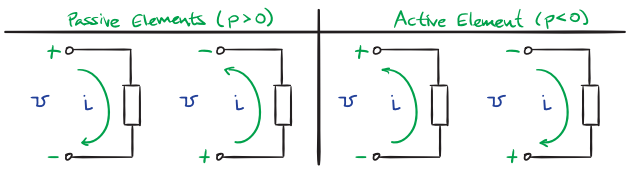

Figure sgn.2: passive sign convention in terms of voltage v and current i.

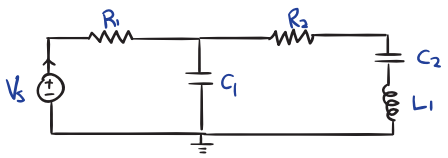

Figure sgn.3: an illustration of the passive sign convention on a circuit.

interpret the signs of our results. For instance, if, at a given instant, a capacitor has voltage $v_C = 3$ V and current $i_C = -2$ A, we compute $\mathcal{P}_C = -6$ W and we know 6 W of power is flowing *from* the capacitor into the circuit.
For passive elements, there is no preferred direction of "assumed" voltage drop and current flow. If a voltage or current value discovered by performing a circuit analysis is positive, this means the "assumed" and "actual" directions are the same. For a negative value, the directions are opposite.
For active elements, *we don't get to choose* the direction. The physical situation prescribes it. For instance, if a positive terminal of a battery is connected to a certain terminal in a circuit, I cannot simply say "meh, I'm going to call that negative." It's positive whether you like it or not, Nancy.