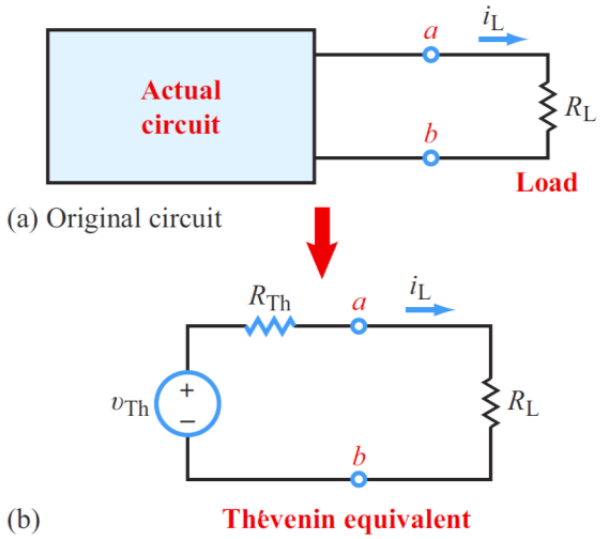
Thévenin Equivalent Circuits

In the 1880s, a French engineer named Leon Thévenin introduced the concept known today as Thévenin's theorem, which asserts:

A linear circuit can be represented at its output terminals by an equivalent circuit consisting of a series combination of a voltage source v_{Th} and a resistor R_{Th}, where v_{Th} is the open-circuit voltage at those terminals (no load) and R_{Th} is the equivalent resistance between the same terminals when all independent sources in the circuit have been deactivated.

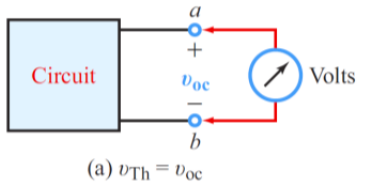


A circuit can be represented in terms of a Thévenin equivalent comprised of a voltage source v_{Th} in series with a resistance R_{Th}.

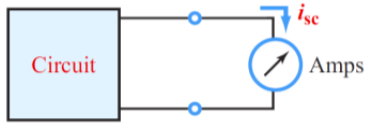
There are several methods for obtaining the Thévenin equivalent components, v_{Th} and R_{Th}, given a linear circuit. Most introductory circuits textbooks discuss the various methods and their application.

One basic method is as follows:

- The Thévenin voltage v_{Th} is obtained by removing the load R_L (replacing it with an open circuit), and then measuring or computing the open-circuit voltage at the same terminals.
- The short-circuit current is obtained by replacing he load with a short circuit and then measuring or computing the short circuit current flowing through it.



(a) $v_{Th} = v_{oc}$



(b) $R_{Th} = v_{oc}/i_{sc}$

The Thévenin voltage is equal to the open-circuit voltage and Thévenin resistance is equal to the ratio of v_{oc} to i_{sc}, where i_{sc} is the short-circuit current between the output terminals.