1 EMF & Terminal Voltage in Batteries

Thus far batteries have been assumed to be "ideal" power sources, i.e. a perfect source of voltage, with no resistance.

This is incorrect, as batteries have an internal resistance. The battery consists of a volatge source called the *Electromotive Force* (EMF). It is written as ε. It is measured in Volts (V) The battery also has an internal resistance, R_i. It is measured in Ohms (Ω)

1.1 Terminal Voltage

The *terminal voltage* is the volatge between the terminals (poles) on a battery with an open circuit. It is the same as ε

1.1.1 The Short-circuit current

The *short-circuit current* is the current that would flow through a completed circuit with no components on it. It can be found by solving for I in the following equation: $\varepsilon = R_i \times I$.

1.1.2 U-I diagram

The U-I diagram is a diagram with voltage (U) on the y-axis and current (I) on the x-axis. The equation of the line on the diagram can be written as $U = \varepsilon - R_I \times I$

1.2 Ohm's 2nd Law

Ohm's 2nd law states that $\varepsilon = (R_i + R_y)I$ where R_i is the internal resistance, R_y is the external resistance[1], I is the current, and ε is the *EMF*

[1] Resistance outside the battery