ENGG 225
Fundamentals of Electrical Circuits and Machines

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1 Introduction

1.1 Electric Circuits:

The interconnection of circuit elements in a closed path by conductors. The concept of electrical charge is the basics for describing all electrical phenomena. Charge exists in discrete quantities of integer multiples of $1.60 \times 10^{-19} C$. In circuit analysis there are two fundamental electrical quantities voltage and current.

1.2 Electical Current:

Electrical current is defined as the rate of flow of electrical charges.

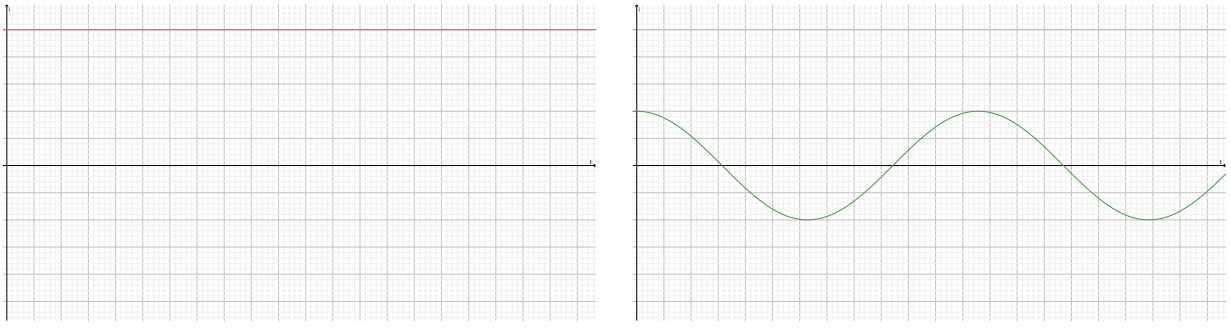
$$i(t) = \frac{dq(t)}{dt}$$

It is assumed that i is a measure of the equivalent flow of positive charge flow. Given $i(t)$, we can also find $q(t)$

$$q(t) = \int_{t_0}^{t} i(t)\, dt + q(t_0)$$

Normally there is an assigned reference direction for current. Often the direction is unknown and is assumed. The actual direction is determined by the sign of i

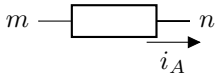
1.2.1 Direct and Alternating Current:



(a) Direct Current

(b) Alternating Current

1.2.2 Notation for Current in Circuit Diagrams



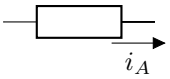


Figure 2: Branch Current

2 Resistive Circuits

3 Operational Amplifiers

4 Capacitors and Inductors

5 Sinusoidal Currents and Voltages