Closed node sequence

Definition:

A sequence of node { n_a, n_b, … n_j … n_k …, n_m } is said to form a **closed node sequence** iff

1. $n_a = n_m$
2. $n_j \neq n_k$, for all $j \neq a$ and $k \neq m$

Remarks:

We do not require that there be a 2-terminal circuit element present between any **consecutive** pair of nodes belonging to a **closed node sequence**.

Kirchhoff Current Law (KCL)

The **algebraic sum** of **all currents leaving** a **Gaussian** surface is equal to **zero** at all times.

KCL

Corollary 1 **(KCL at nodes)**

Algebraic sum of all currents **leaving** any **node** is equal to **zero** at all times.

KCL

Corollary 2 **(KCL at cut sets)**

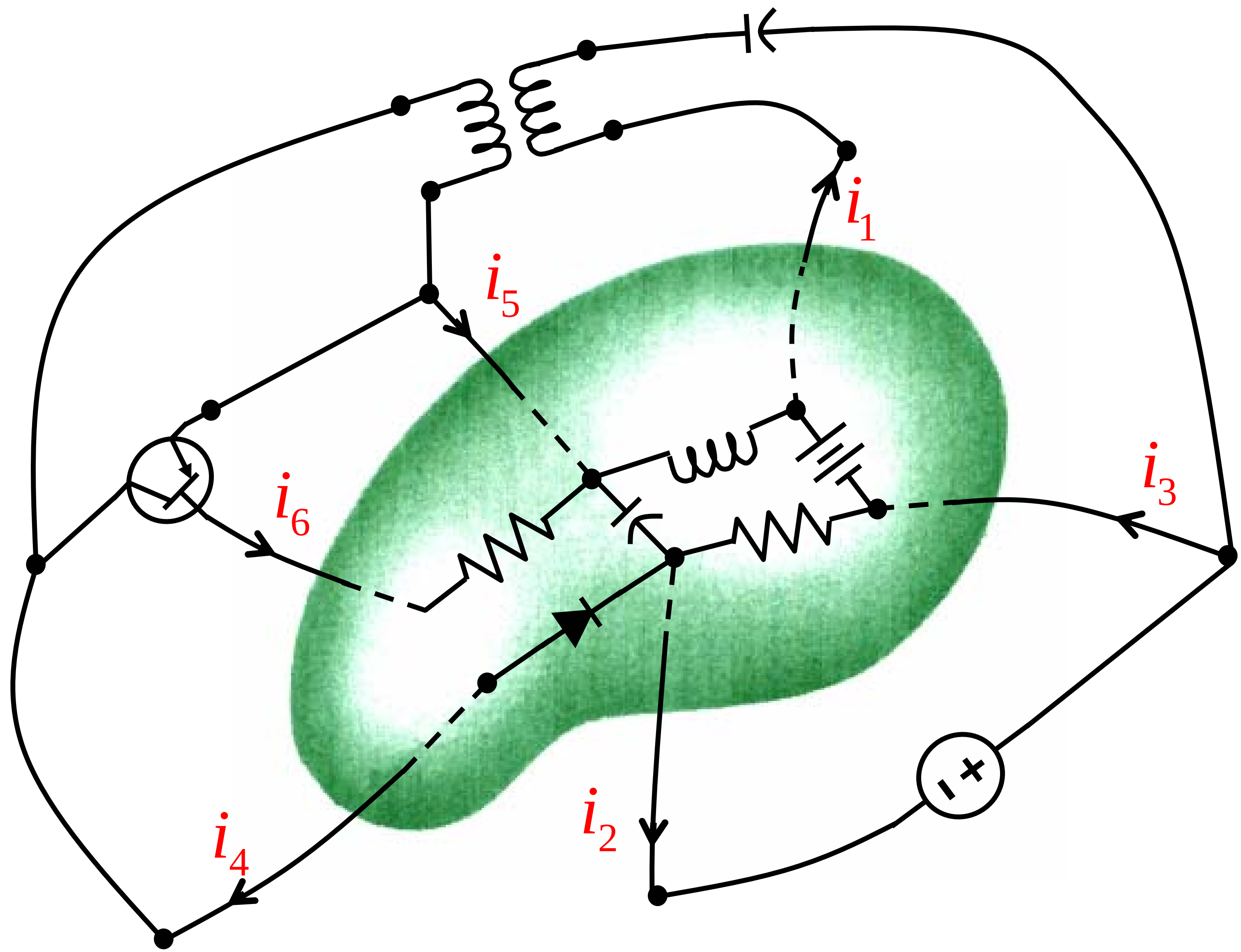
Algebraic sum of **all** currents **leaving** a ***cut set*** is equal to **zero** at all times.

KCL

Corollary 3

(KCL at n-terminal device)

Algebraic sum of **all** currents **leaving** **all** terminals of an **n-terminal device** is equal to **zero** at all times.



$$KCL \Rightarrow i_1 + i_2 - i_3 + i_4 - i_5 - i_6 = 0$$

Instantaneous Power

$$vi = \frac{dw}{dq}\frac{dq}{dt} = \frac{dw}{dt}$$

Since w represents energy, dw/dt represents the rate of change of energy, or the power p; ∂ hence

$$p(t) = v(t)i(t) \qquad , \textit{watts}\ (W)$$

6 Fundamental Circuit Variables

Current	$i(t) = \frac{dq(t)}{dt}$	Ampere (A)
Voltage	$v(t) = \frac{d\varphi(t)}{dt}$	Volt (V)
Power	$p(t) = v(t)\, i(t) = \frac{dw(t)}{dt}$	Watt (W)
Energy	$w(t) = \int_{-\infty}^{t} p(\tau)d\tau = \int_{-\infty}^{t} v(\tau)i(\tau)d\tau$	Watt-Hour
Charge	$q(t) = \int_{-\infty}^{t} i(\tau)d\tau$	Coulomb (C)
Flux	$\varphi(t) = \int_{-\infty}^{t} v(\tau)d\tau$	Weber