EE 40 MT1

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$= (R \cdot I) \cdot I = I^2 R$ (R: current delivers power)

$P = \frac{dw}{dt} = \frac{dw}{dq}\frac{dq}{dt} = VI$ — $P > 0$ delivered to device; $P < 0$ supplied by device; open circuit: $R = \infty$; short circuit: $R = 0$

$1W = 1A \times 1V$ $\quad e^- = 1.6 \times 10^{-19} C$

$E = qV_{AB}$ — voltage difference
↳ Sdq or q(+)

Resistor — affect voltage and current

branch — single element

node — connection point

Extraordinary node — connection between 3 branches

loop — closed path

$V = IR$

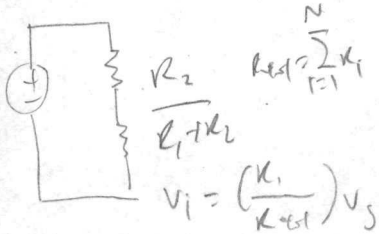
$R = \frac{l}{\sigma A} = \rho \frac{l}{A}$ $\quad l$ = length, σ = conductivity, A = Area, ρ = resistivity

Thermister — Resistivity vs temp

Piezoresistor — R sensitive to pressure

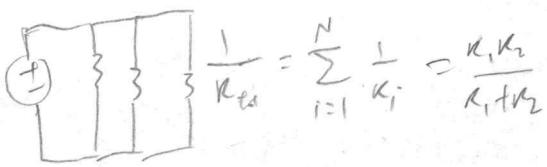
KCL: sum of currents entering node = 0 / closed boundary

KVL: sum of voltages around closed path = 0



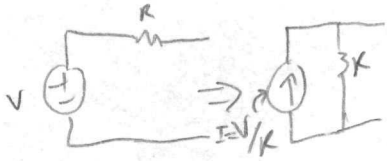
$R_{eq} = \sum_{i=1}^{N} R_i$

$V_i = \left(\frac{R_i}{R_{eq}}\right) V_s$



$\frac{1}{R_{eq}} = \sum_{i=1}^{N} \frac{1}{R_i} = \frac{R_1 R_2}{R_1 + R_2}$

Source transformation



$I = V/R$

Y-Δ

Δ → Y

$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$

$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$

$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$

Y → Δ

$R_a = \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_1}$

$R_b = \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_2}$

$R_c = \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_3}$

for wheatstone bridge
- if no current, V = 0
+ resist.

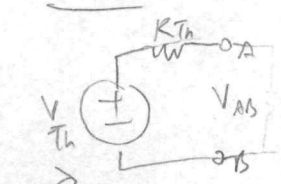
Nodal/Voltage: Apply KCL

Supernode: voltage connects 2 extraordinary nodes — treat as 1 node

Mesh/Current: Apply KVL

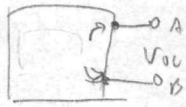
Supermesh: 2 meshes have current source in common — write equation for large loop, then write second w/ current.

Thévenin



$V_{oc} = V_{AB} = V_A - V_B$

V_B = ground = 0



doesn't matter if resis. between A and B

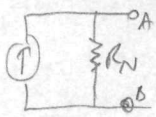
1) open/short circuit
↳ V_{Th} ↳ I/R

2) no flow → short
current → open

* No dependent sources!

3) add external voltage source & solve/mesh

Norton



$R_{Th} = R_N$

$i_N = \frac{V_{Th}}{R_{Th}}$