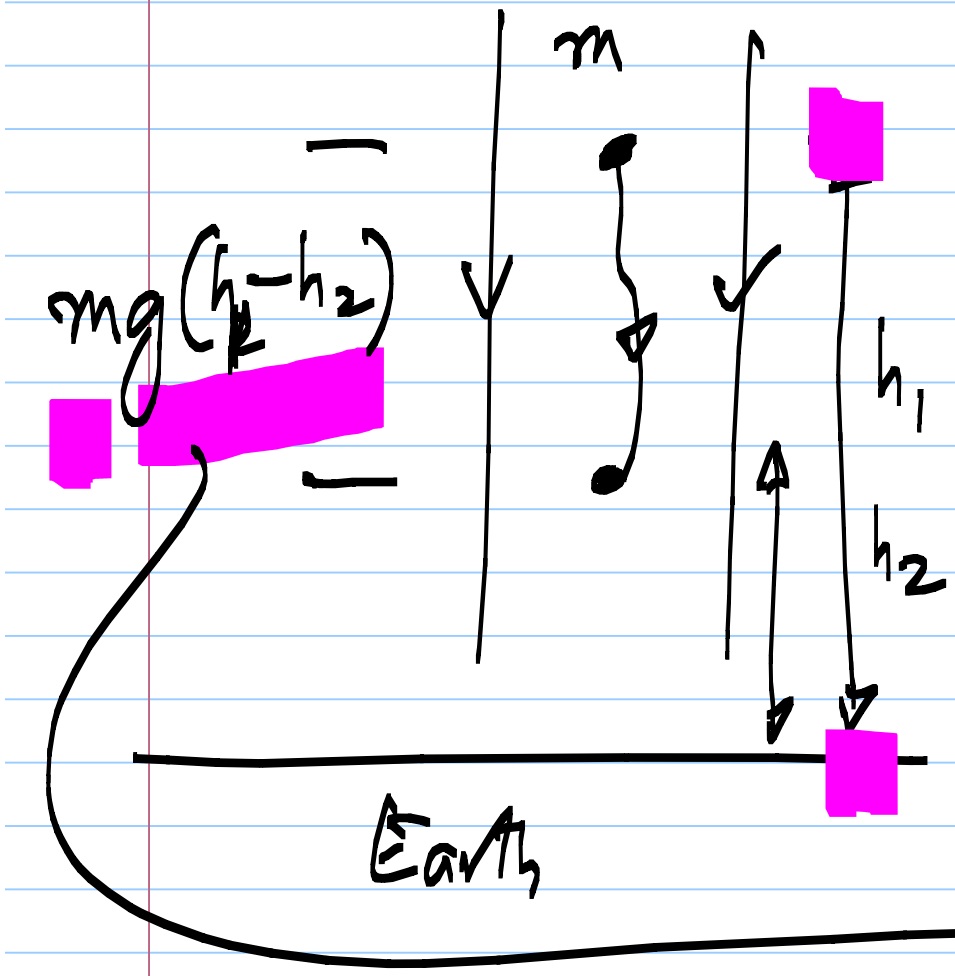
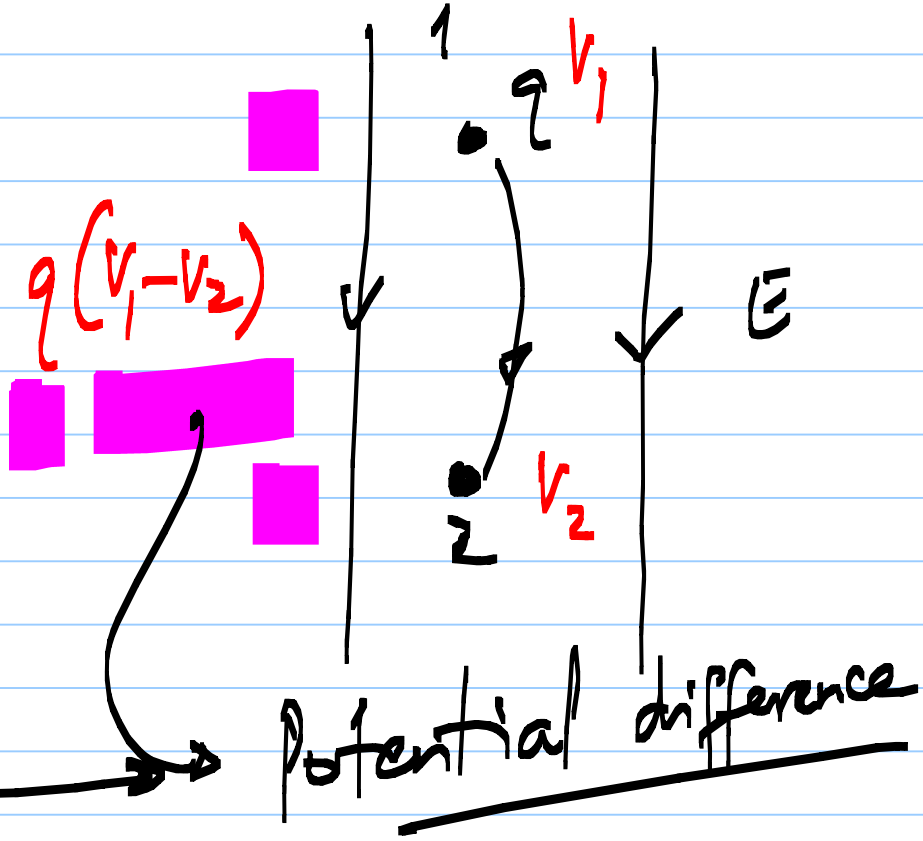
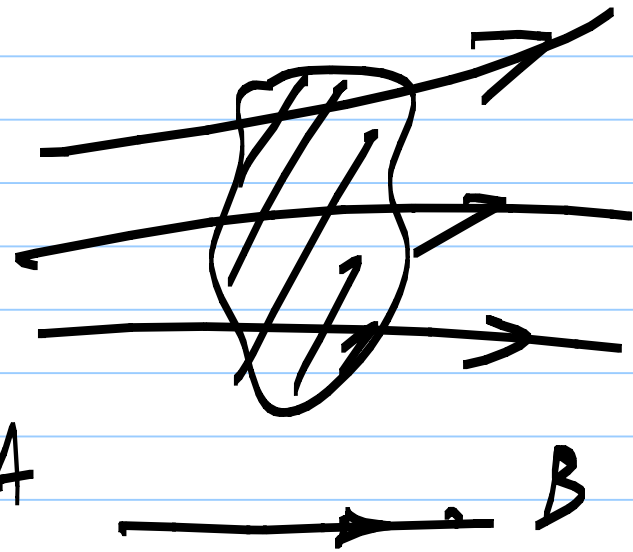
EC1010: Lecture 2

Note Title 1/16/2014



moves from higher to lower PE





q $\quad i = \dfrac{dq}{dt}$

"Aggregated" quantities

Spatial extent ignored.

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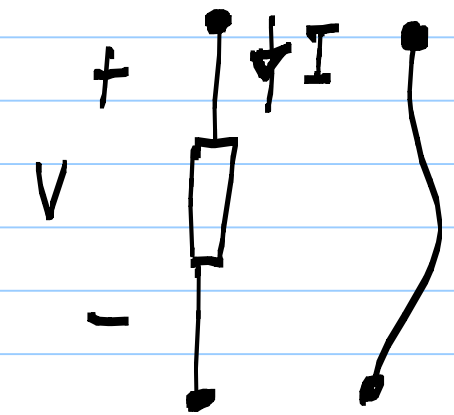
q —— Electric current i

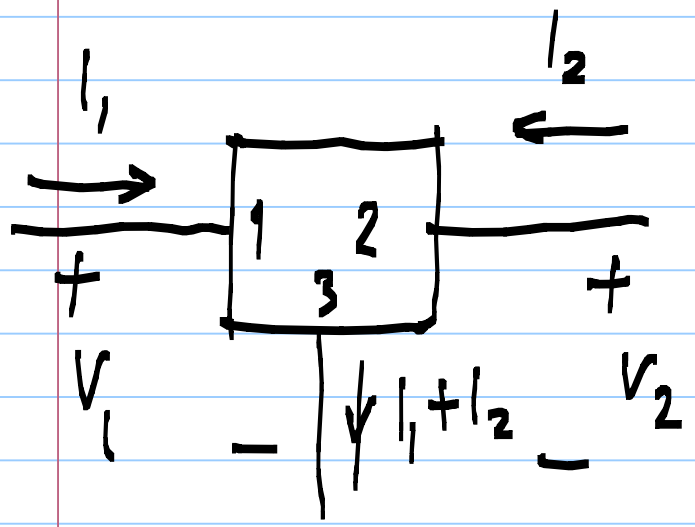
$\bar{E}$ —— Potential difference (Voltage) V

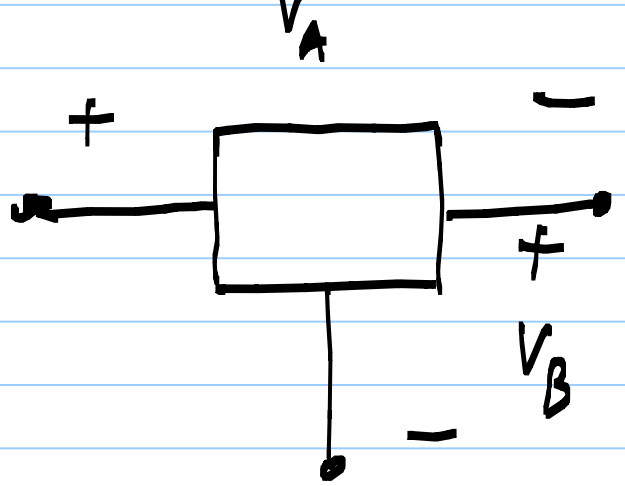
Electrical elements:



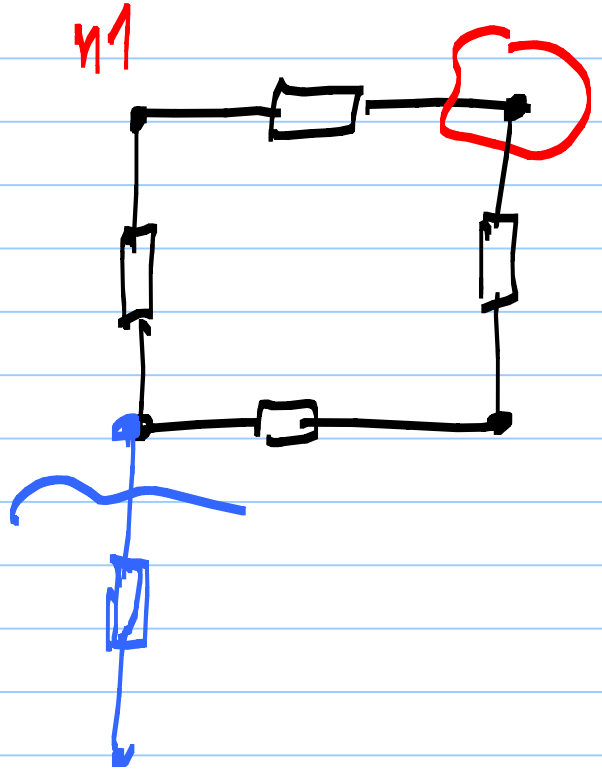
Terminals (≥ 2)

N terminals (N−1 currents, N−1 voltages)

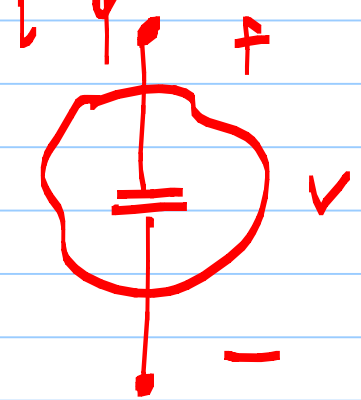




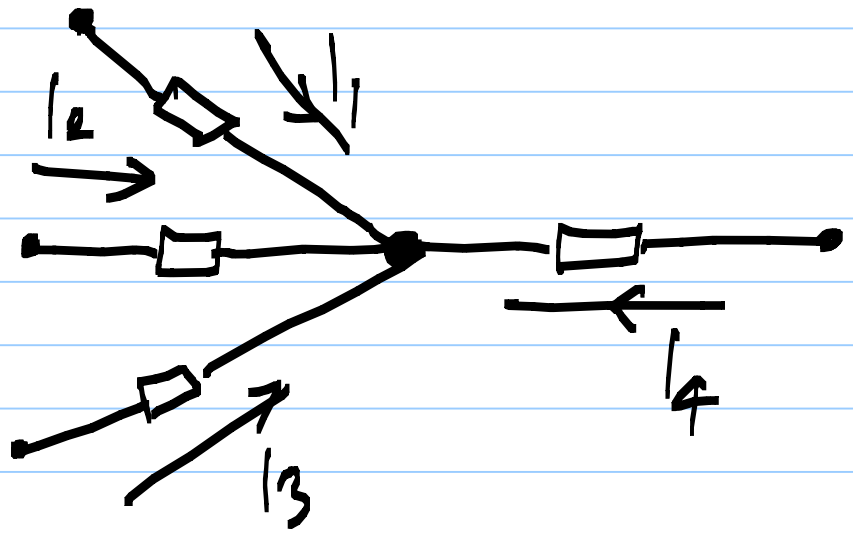
Electrical circuit : Interconnection of elements with at least one loop



node : point of interconnection of two terminals



Node: Point of connection of 2 or more terminals

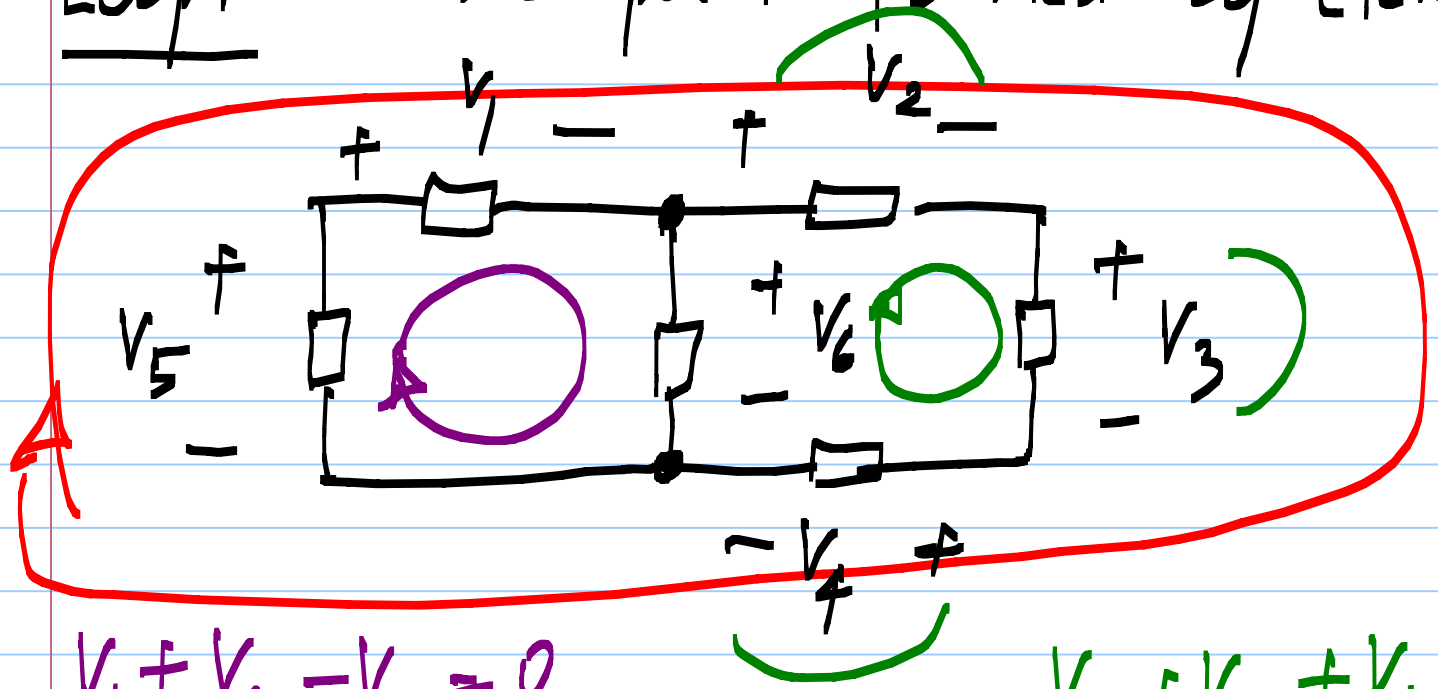


KCL

Kirchhoff's current law

$$\sum I_{\text{entering the node}} = 0$$

Loop: closed path formed by elements



KVL

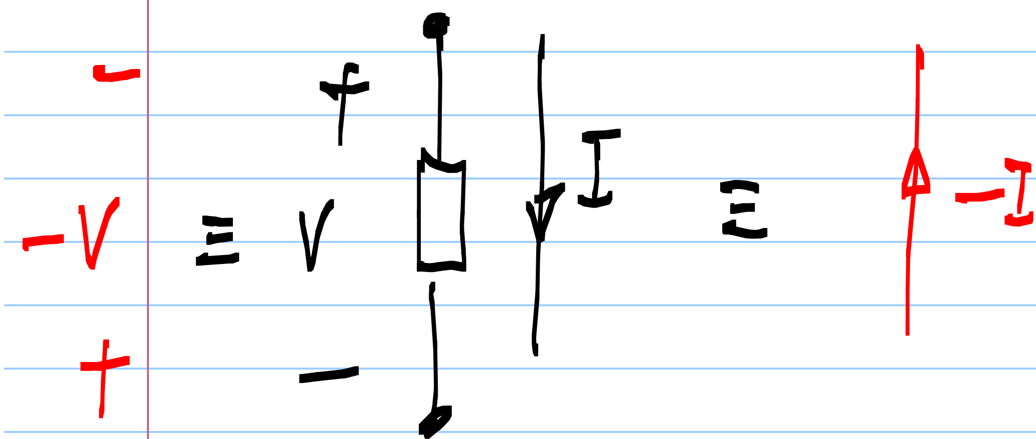
Kirchhoff's Voltage Law

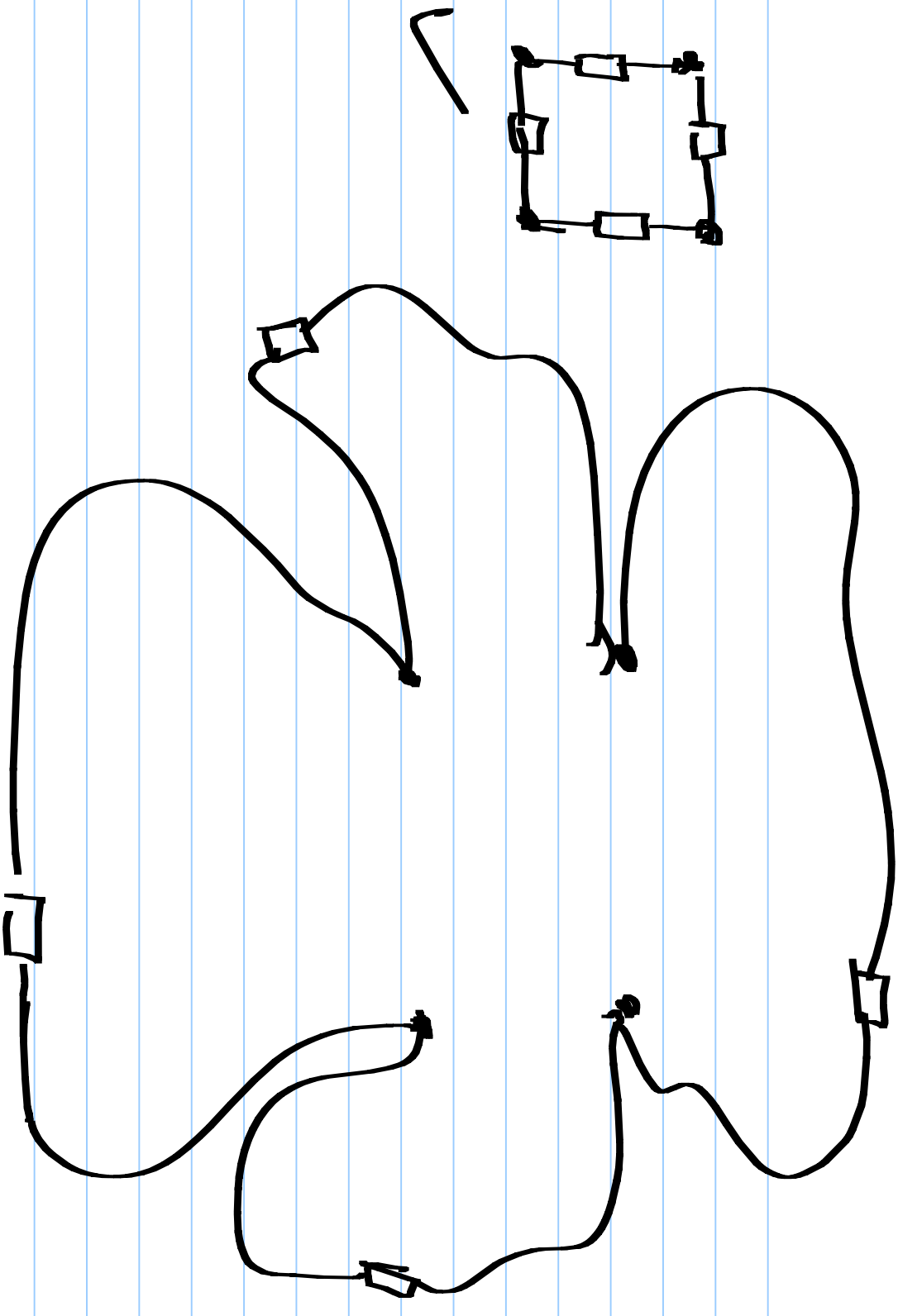
$v_1 + v_6 - v_5 = 0$

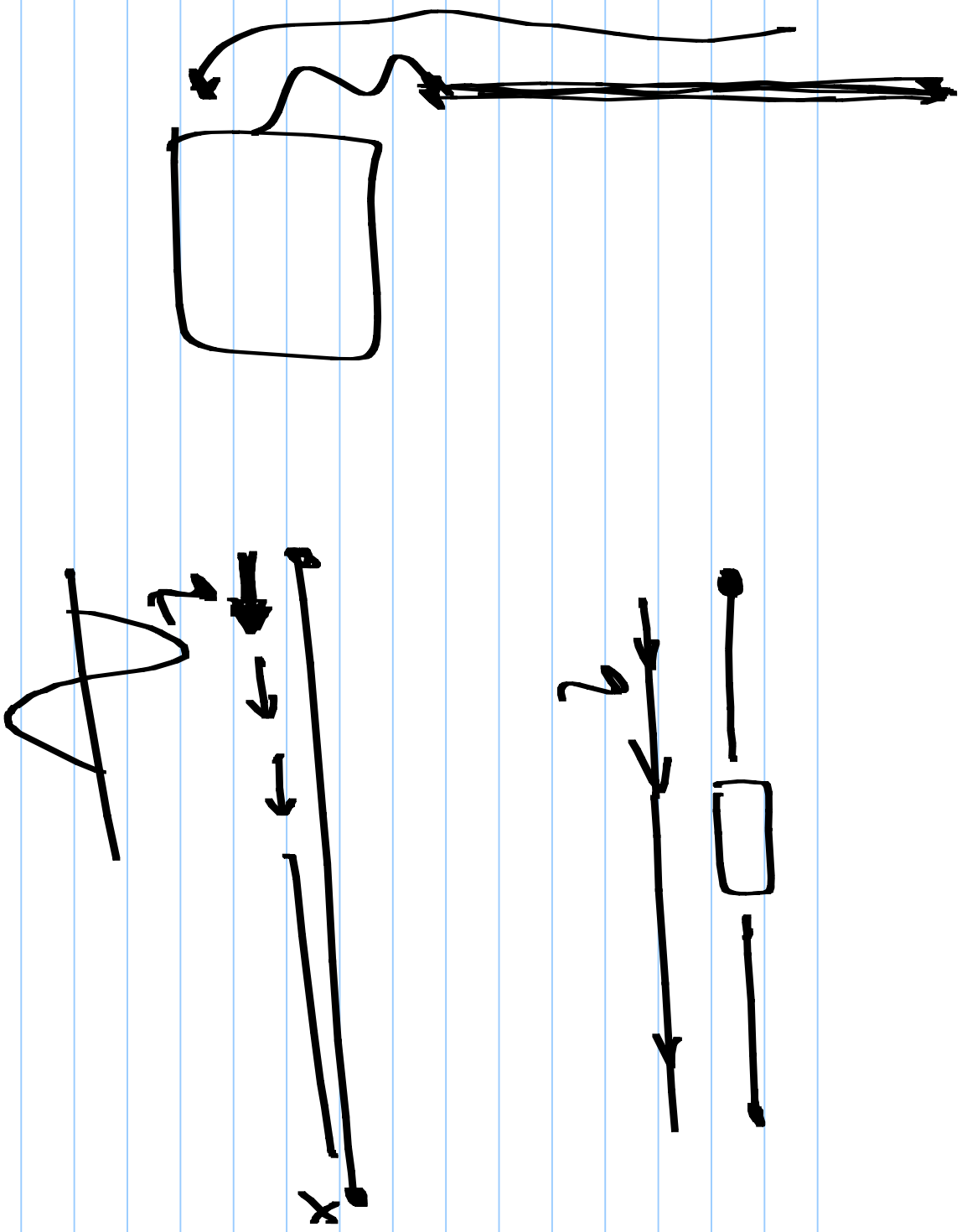
$v_2 + v_3 + v_4 - v_6 = 0$

$v_1 + v_2 + v_3 + v_4 - v_5 = 0$

$\left(\frac{d\Phi}{dt} \Big|_{Loop} \text{ negligible} \right)$


-
-V
+
≡
+
V
-
I
≡
-I




x

KCL, KVL: Can be violated at high frequencies & for large structures

KCL, KVL: valid for all circuits

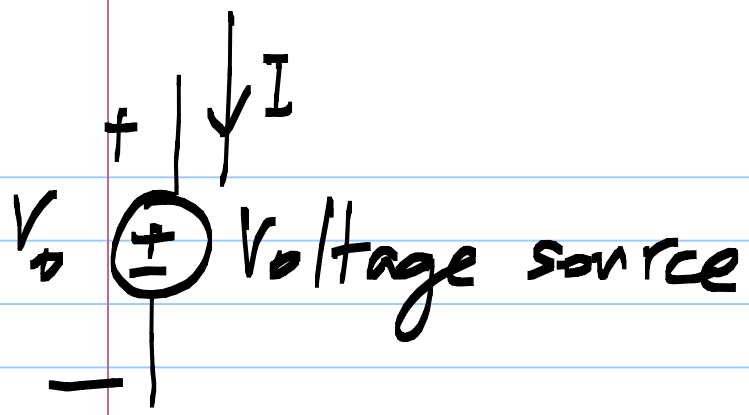
Resistor:

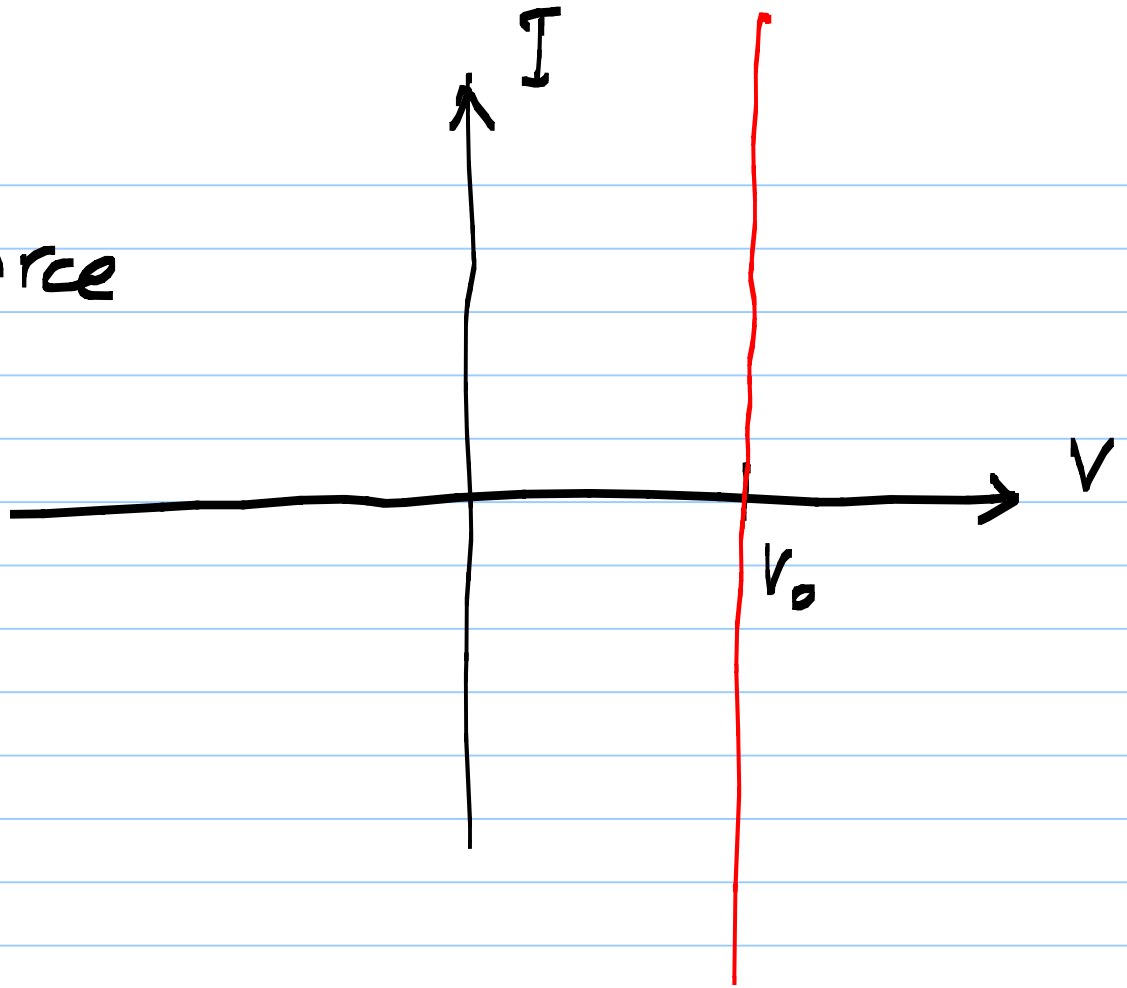
Resistance (Ω)

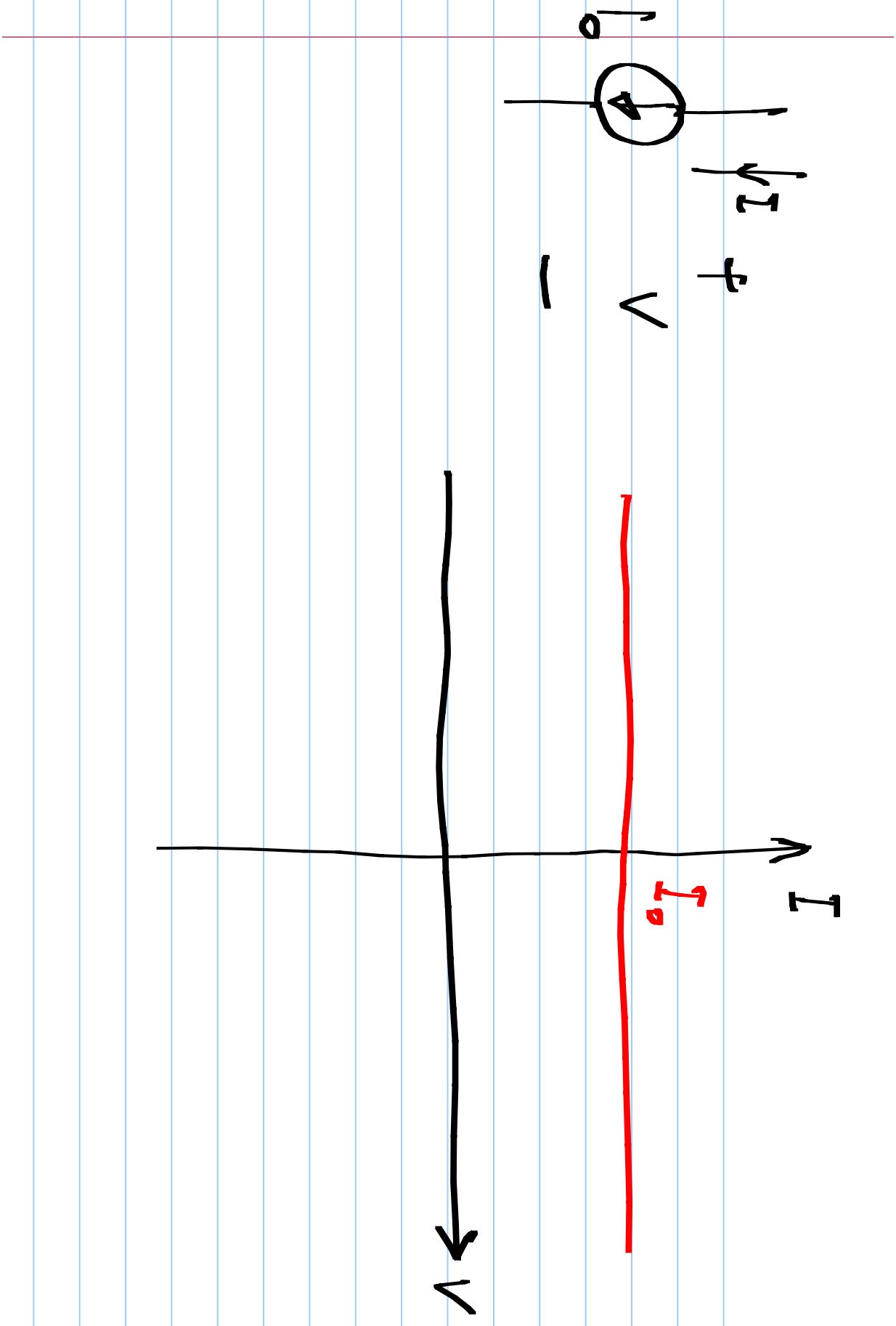
$V = I \cdot R$

$I = G \cdot V$

Conductance (S)


+
I
V_0
Voltage source
−


I
V
V_0


O
1
1
+
<
1
1
<

+
V
-
I
+
V
-
1
2
I
$I = C \frac{dV}{dt}$
$V = L \frac{dI}{dt}$