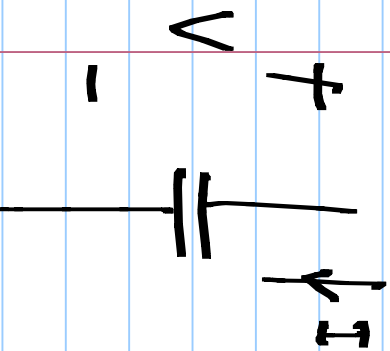


EECS 1010: Lecture 3

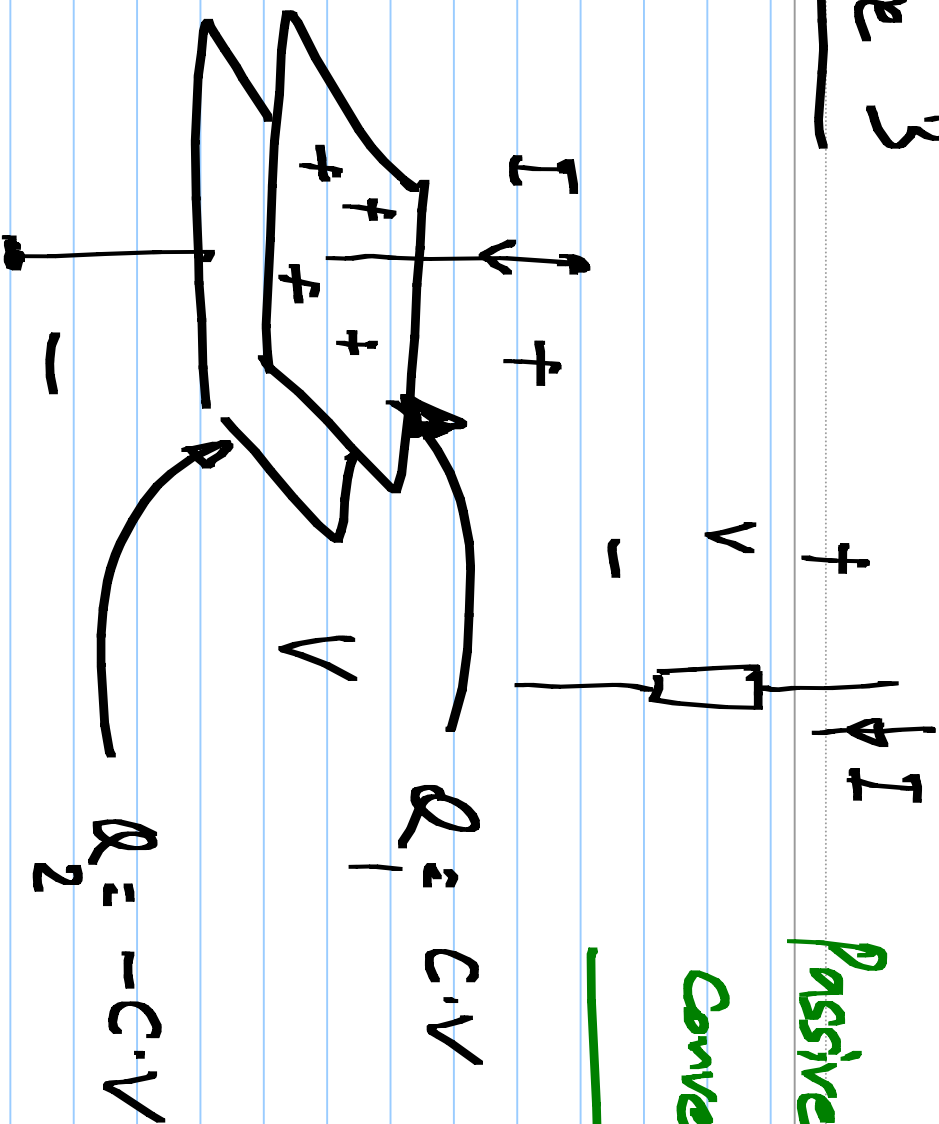
Note title

2014

Capacitors:



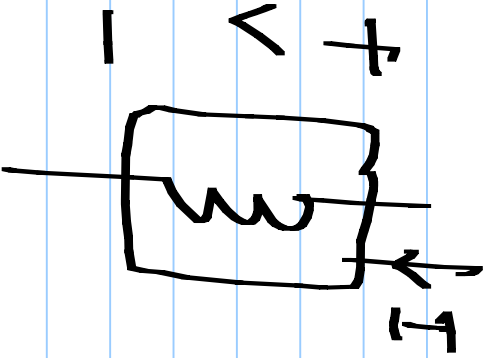
$$I = C \cdot \frac{dV}{dt}$$



$$I = \frac{dQ_1}{dt} = C \cdot \frac{dV}{dt}$$

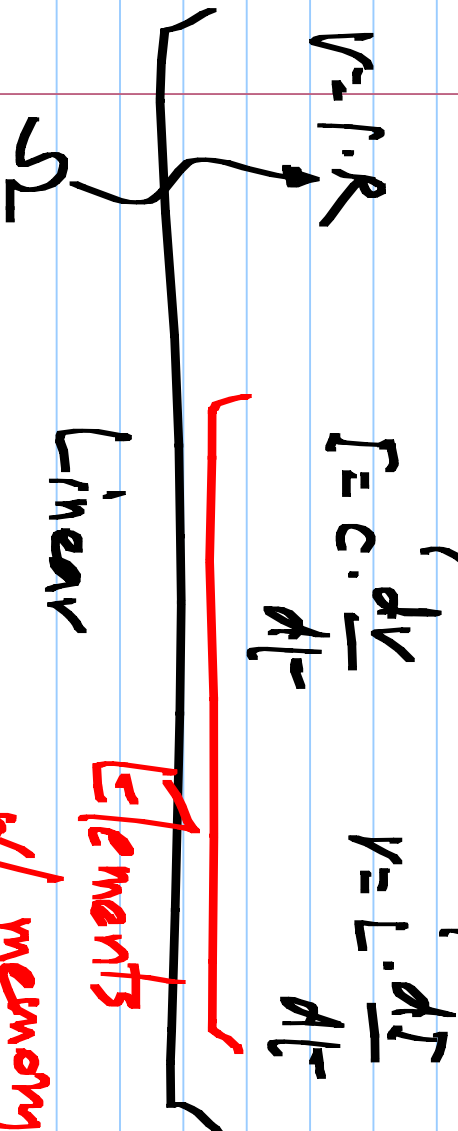
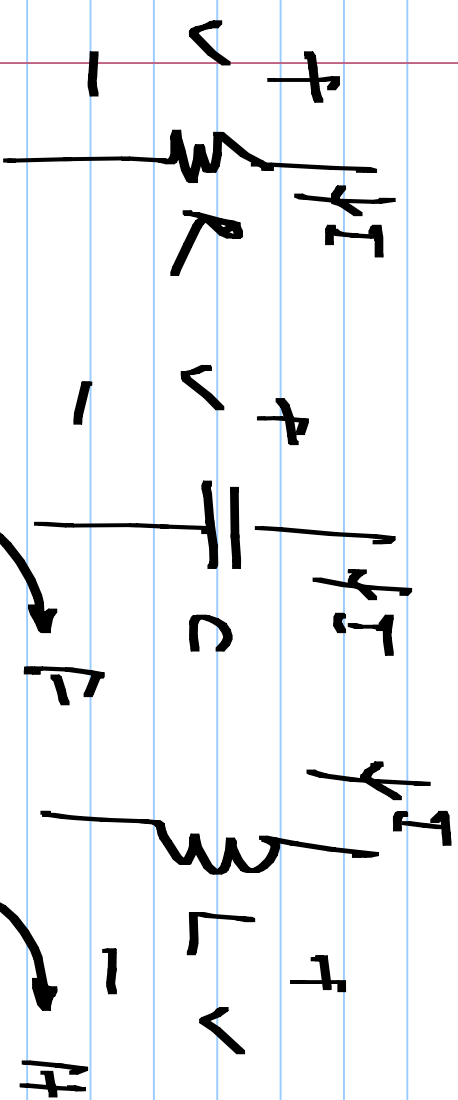
Passive sign convention

Inductor;



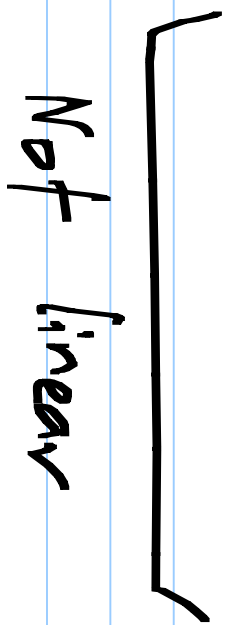
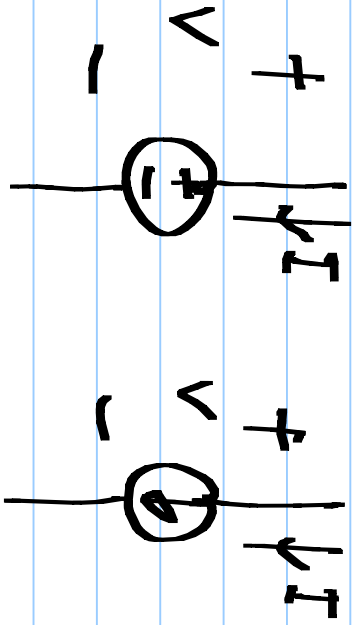
$$V = L \cdot \frac{dI}{dt}$$

Passive elements

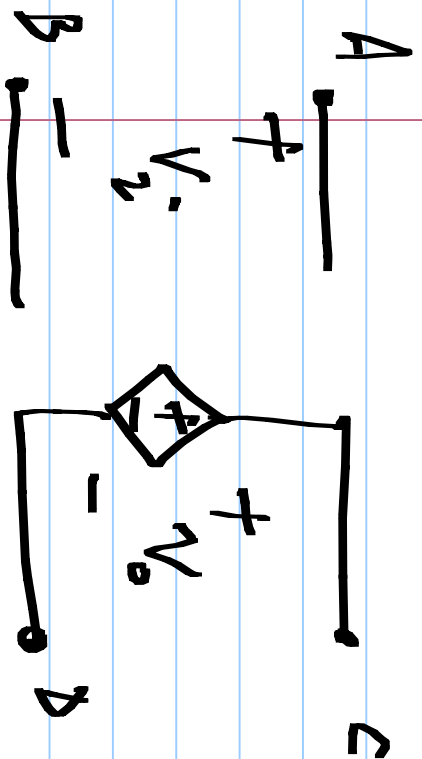


Elements w/ memory.

Independent sources



Controlled Sources:

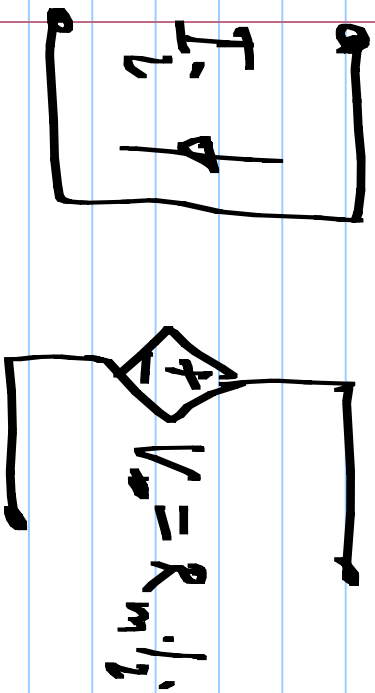


Voltage across the
controlled source between
C & D is dependent
on voltage between
A & B

Voltage controlled
voltage source (VCVS)

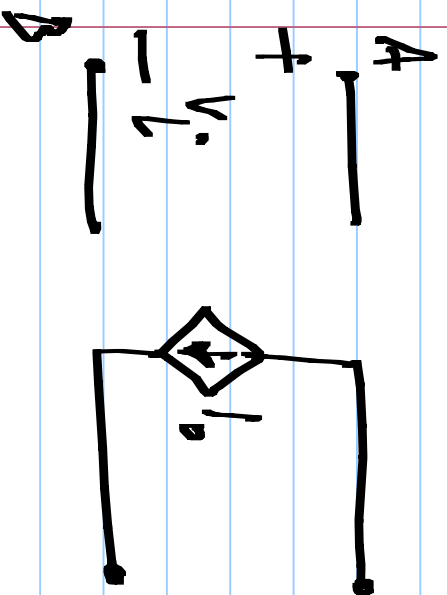
$$V_0 = k \cdot V_2$$

Current controlled voltage source (CCVS)



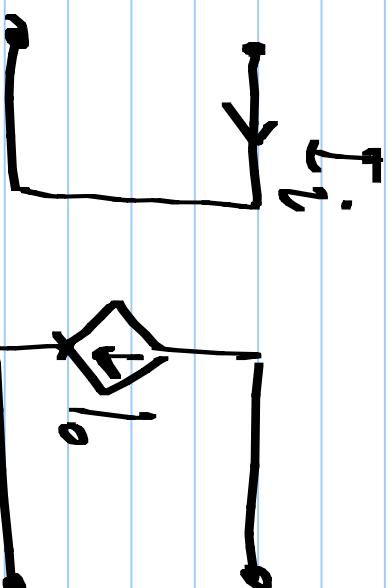
$$V_o = R_m \cdot I_1$$

Voltage controlled current source (VCCS)



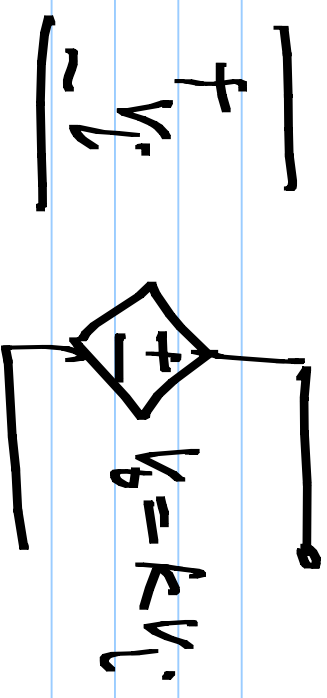
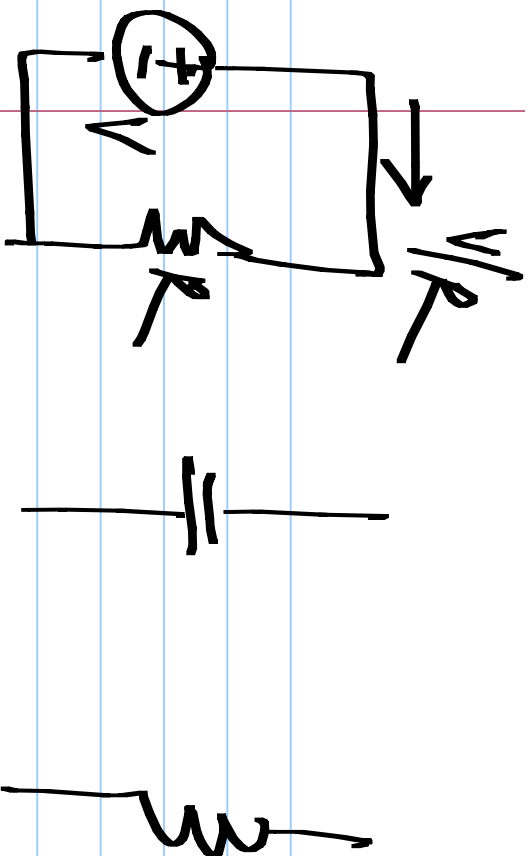
$$I_o = G_m \cdot V_i$$

Current controlled current source (CCCS)



$$I_o = k \cdot I_i$$

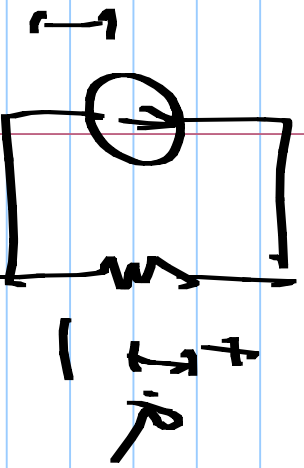
VCVS



$$V_b = kV_i, \quad V_i = \frac{V_o}{k}$$

Unilateral.

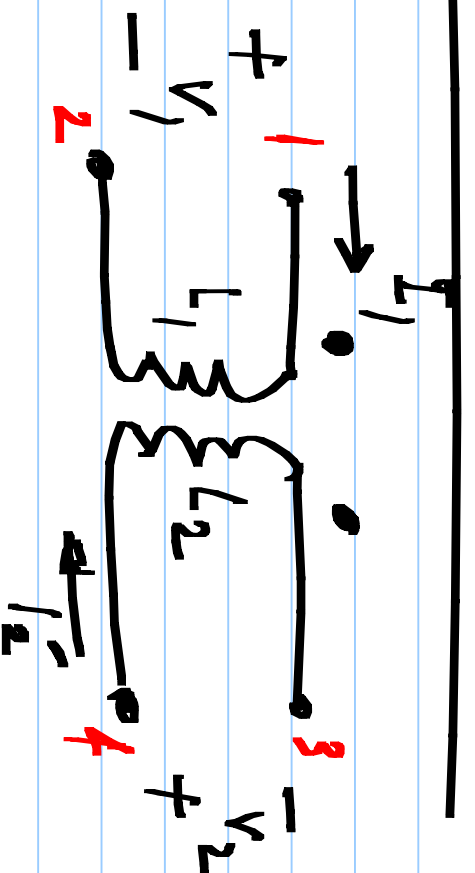
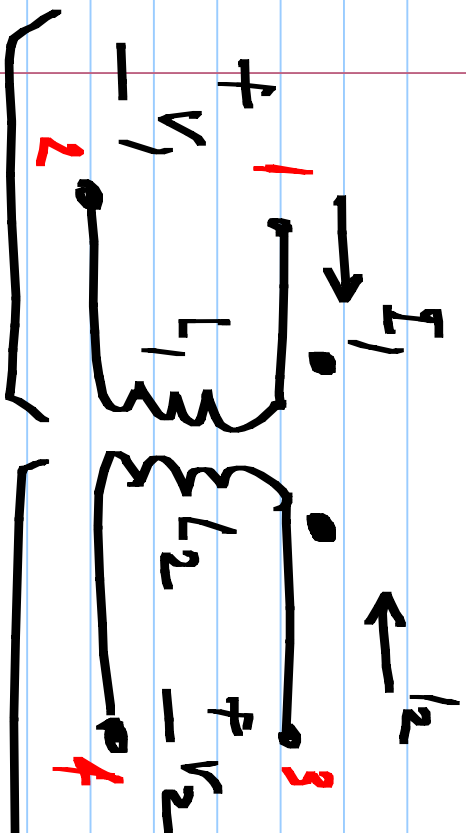
Apply V_i & obtain V_o .



$$V = IR, \quad I = \frac{V}{R}$$

Mutual inductor:

dots used to indicate current directions for "FM"



$$V_1 = L_1 \cdot \frac{dI_1}{dt} + M \frac{dI_2}{dt}$$

$$V_2 = M \cdot \frac{dI_1}{dt} + L_2 \frac{dI_2}{dt}$$

$$V_1 = L_1 \cdot \frac{dI_1}{dt} - M \cdot \frac{dI_2}{dt}$$



$$V_1 = L_1 \frac{dI_1}{dt} + M \frac{dI_2}{dt}$$

$$V_2 = M \frac{dI_1}{dt} + L_2 \frac{dI_2}{dt}$$

L_1 : self inductance
of the first coil

L_2 : self inductance
of the second coil

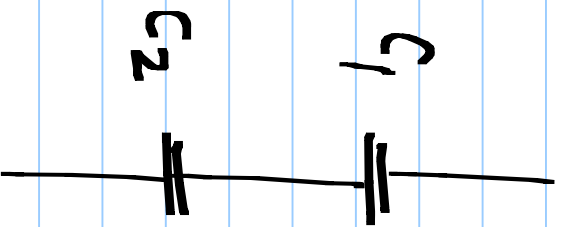
M : Mutual inductance
between L_1 & L_2

$M = k \sqrt{L_1 L_2}$ $|k| \leq 1$
dimensionless

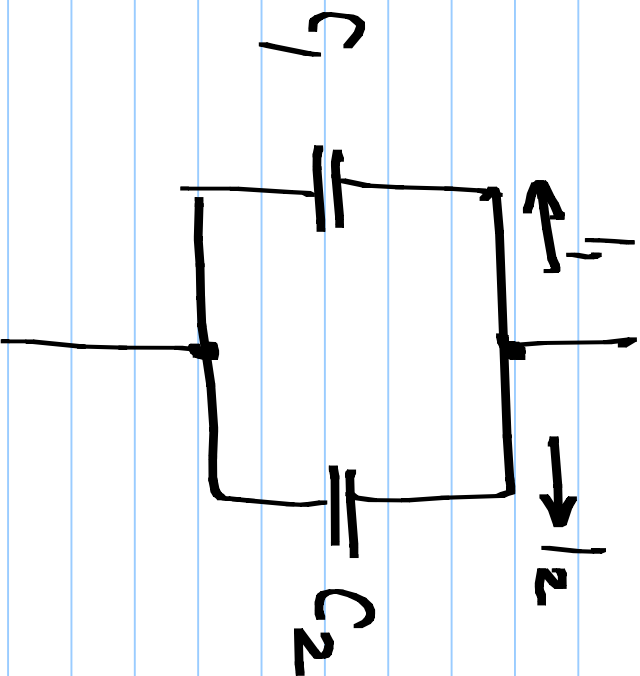
Handwritten notes on lined paper. The text is written in Urdu and includes mathematical symbols and arrows. The visible text includes:

- $\frac{1}{2} \pi$ (written vertically)
- $\frac{1}{2} \pi$ (written horizontally)
- A curved arrow pointing from the horizontal $\frac{1}{2} \pi$ towards the vertical $\frac{1}{2} \pi$.
- Other symbols and arrows, including a small arrow pointing to the right and a larger arrow pointing downwards.

Series capacitors



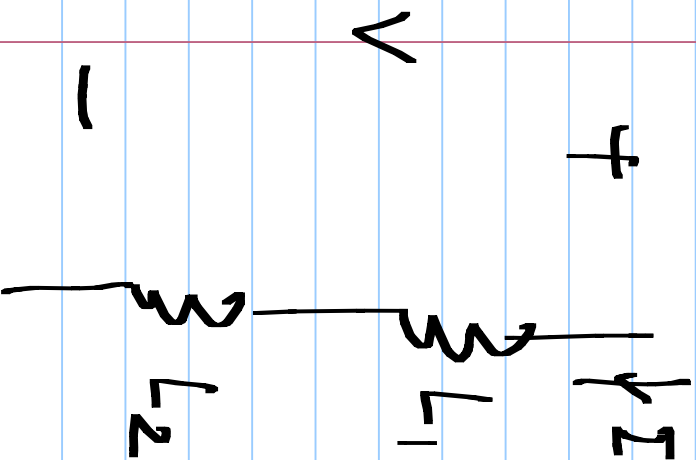
Parallel



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

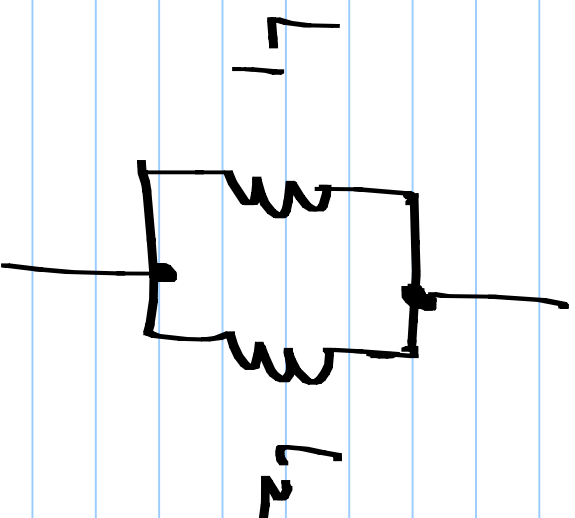
$$I = C_1 \frac{dV}{dt} + C_2 \frac{dV}{dt}$$

Series inductors

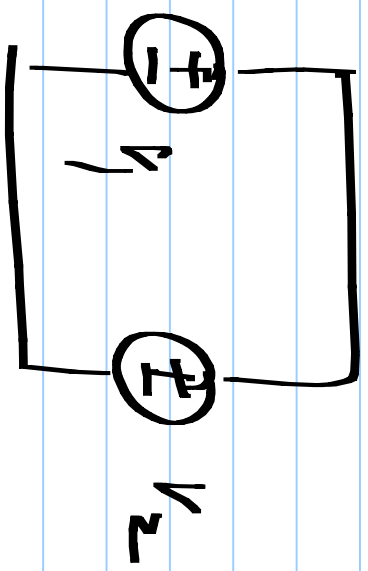
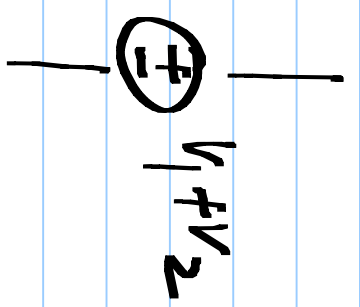
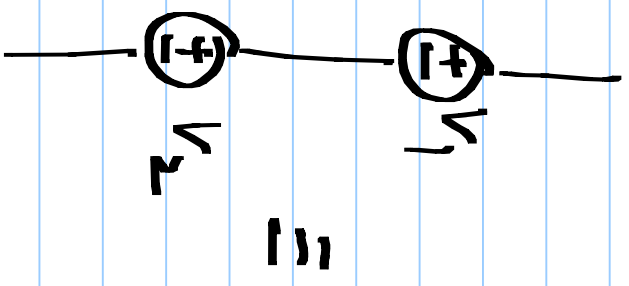


$$V = (L_1 + L_2) \cdot \frac{dI}{dt}$$

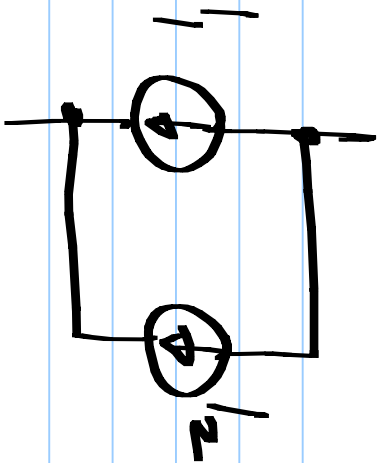
Inductors in parallel



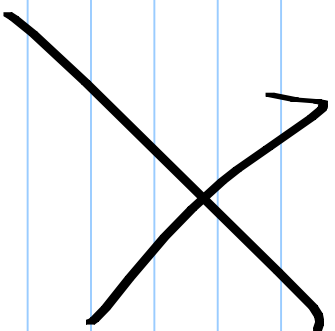
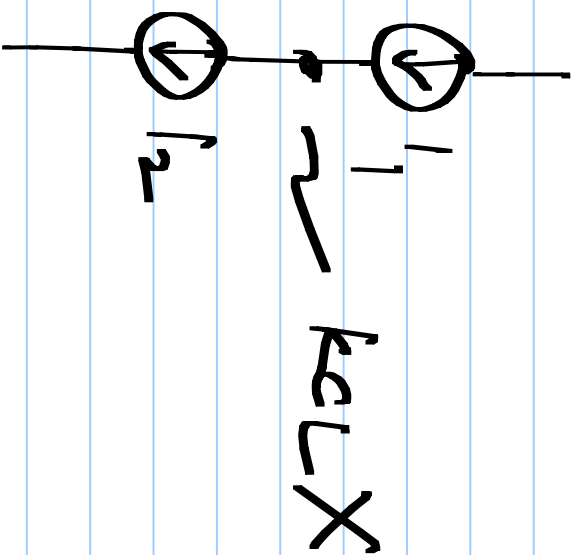
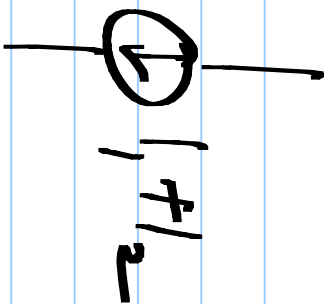
$$\frac{1}{L} = \frac{1}{L_1} + \frac{1}{L_2}$$

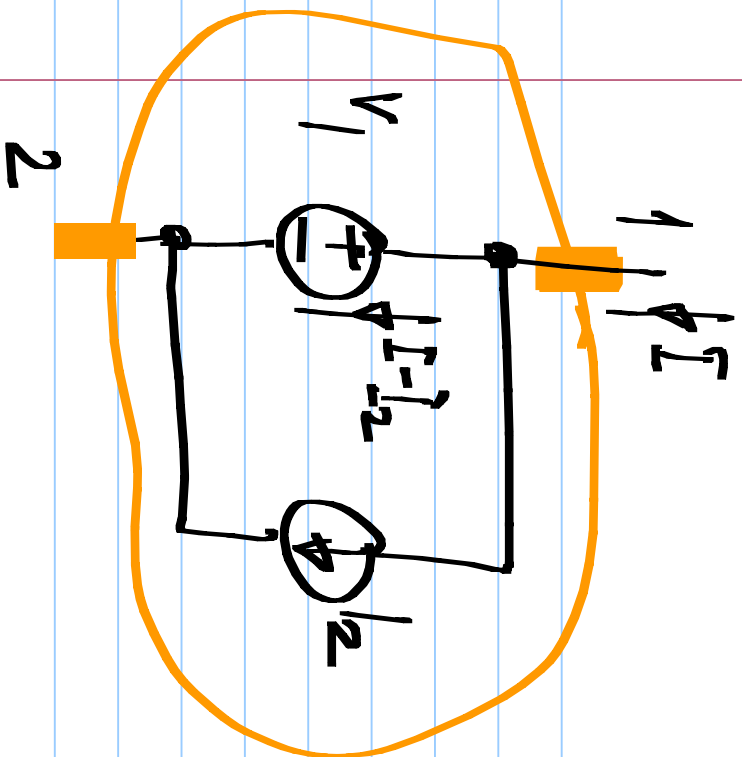


~~X~~

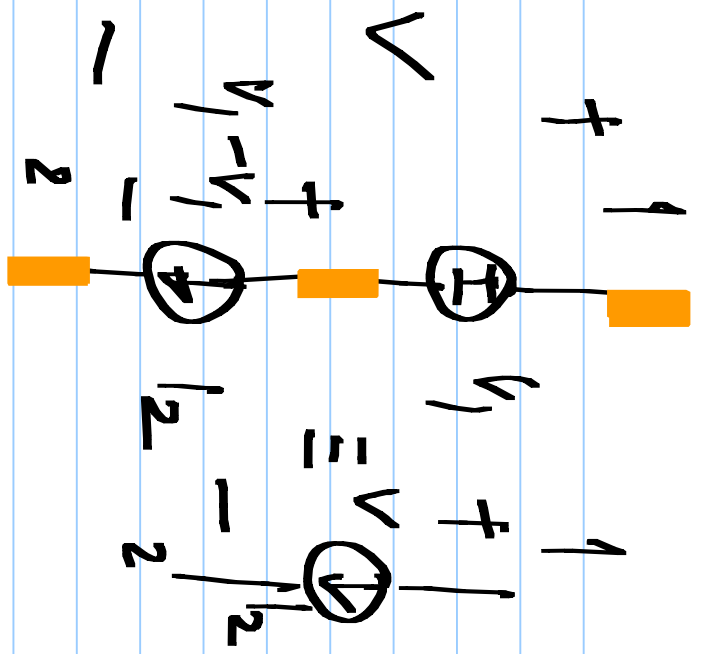
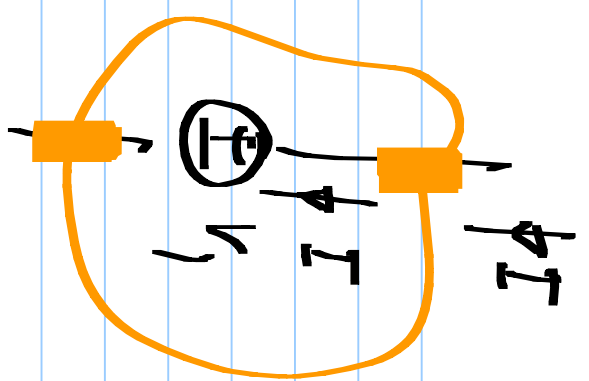


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