EC 1010: Electrical and Magnetic circuits.

Note Title 1/28/2013

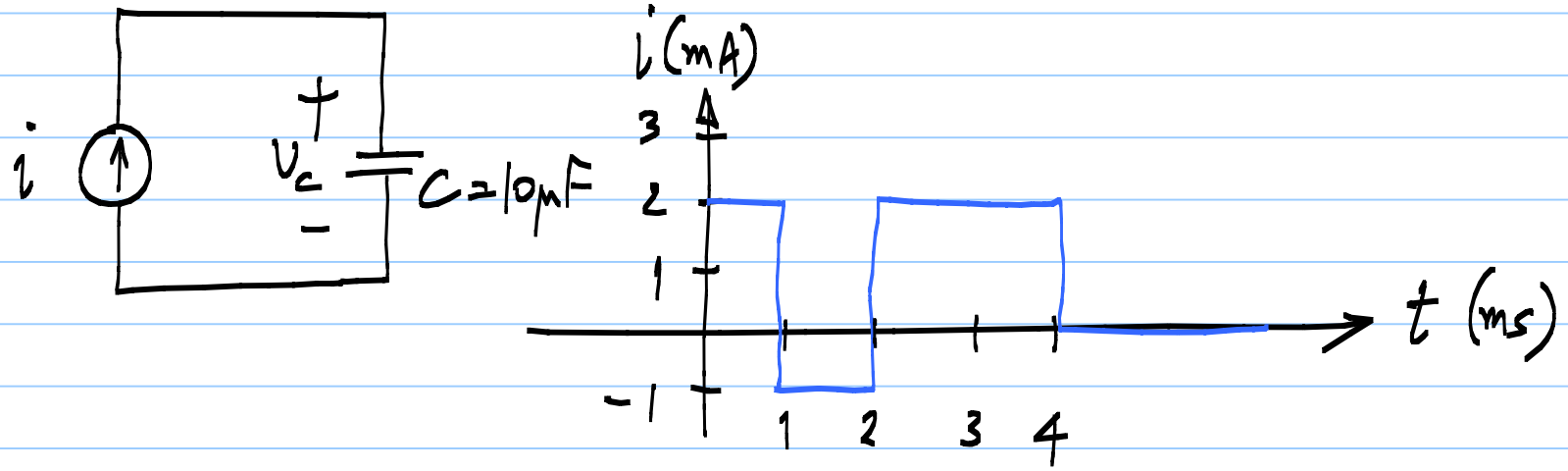
Problem set #1 (Due on 25 Jan. 2014)

HKD: Hayt, Kemmerly, and Durbin

Engineering circuit analysis, 7th Edition

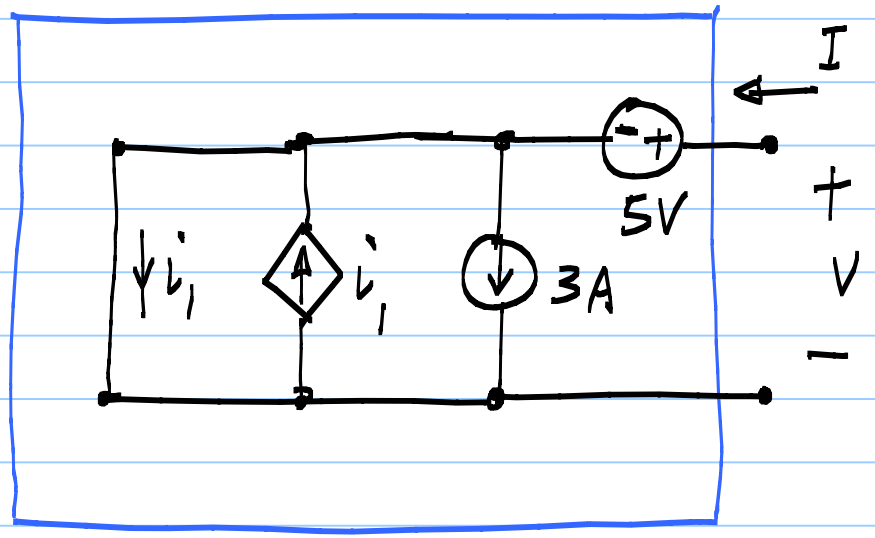
Tata McGraw Hill 2010, 2006

1

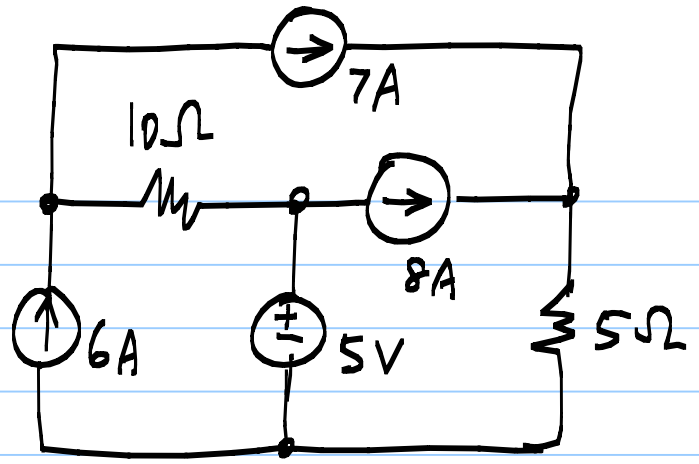


Sketch the voltage v_c across the capacitor.

② Sketch the I-V characteristics of the box shown below

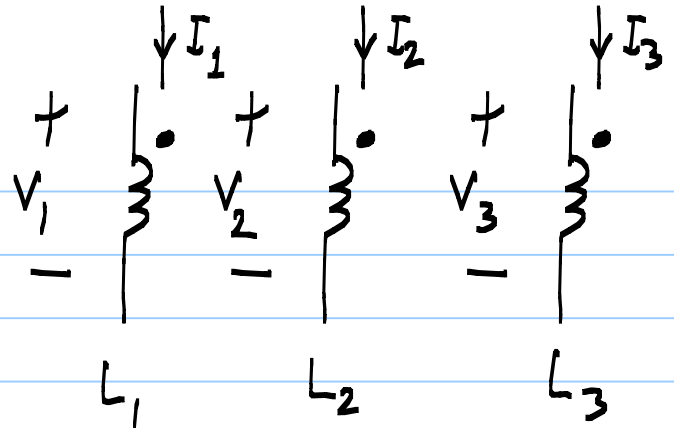


(3)



Calculate the power dissipated or generated in each element. (state clearly whether it is dissipated or generated)

④



The figure shows three mutually coupled coils. The voltages are given by equations similar to the two coil case.

$$V_1 = L_1 \frac{dI_1}{dt} + M_{12} \frac{dI_2}{dt} + M_{13} \frac{dI_3}{dt}$$

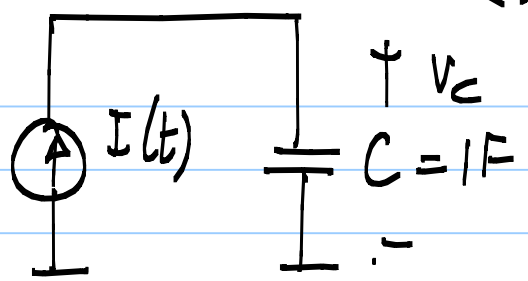
and so on. $M_{ij} = M_{ji}$;

$M_{ij}^2 = k_{ij}\, L_i L_j$;

If M_{13} is given to be zero, find the constraint on k_{12} & k_{13}

(Assume symmetry: $L_1 = L_2 = L_3$; $M_{12} = M_{23}$)

(5)



(initially discharged)

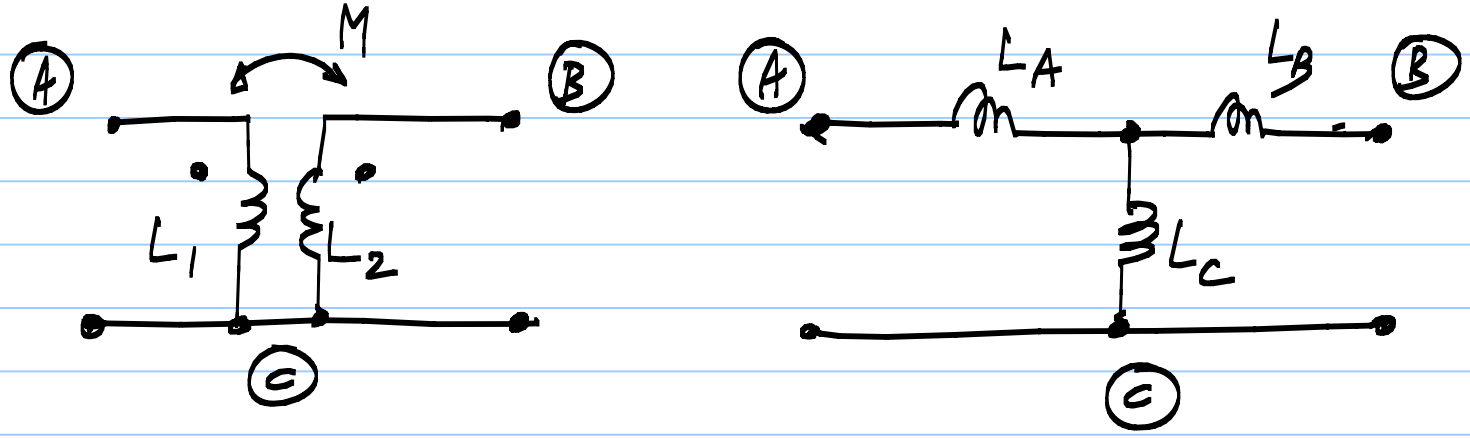
(a) $I(t) = \begin{cases} 0 & t < 0 \\ 1A \cdot \cos(2\pi t) & t \geq 0 \end{cases}$

(b) $I(t) = \begin{cases} 0 & t < 0 \\ 1A \cdot \sin(2\pi t) & t \geq 0 \end{cases}$

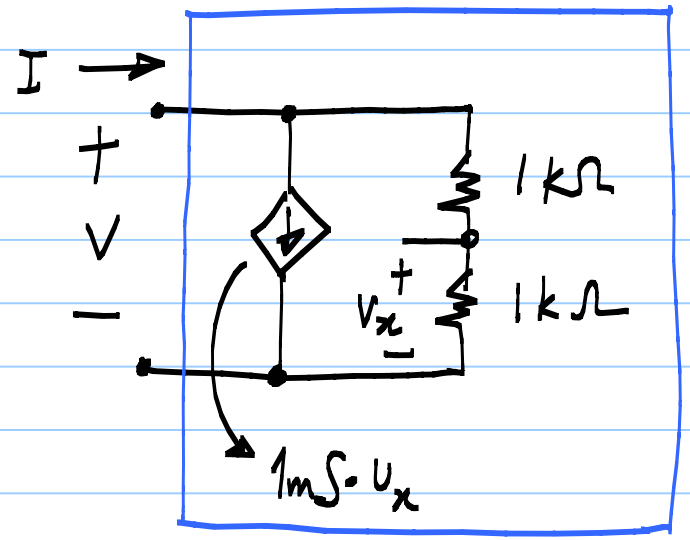
Determine $v_c(t)$ in the two cases

⑥ The following two networks are equivalent.

Determine L_A, L_B, L_C in terms of L_1, L_2, M



(7)



Draw the I-V characteristics of the box shown in blue at the external terminals shown.

Mark the axes and key quantities clearly.