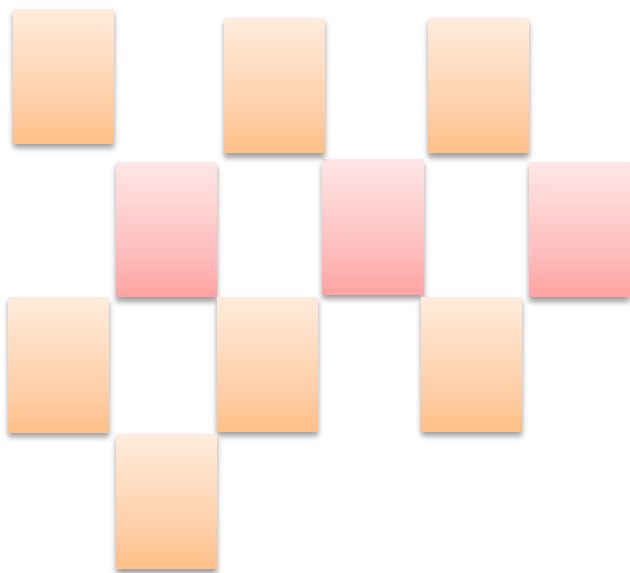




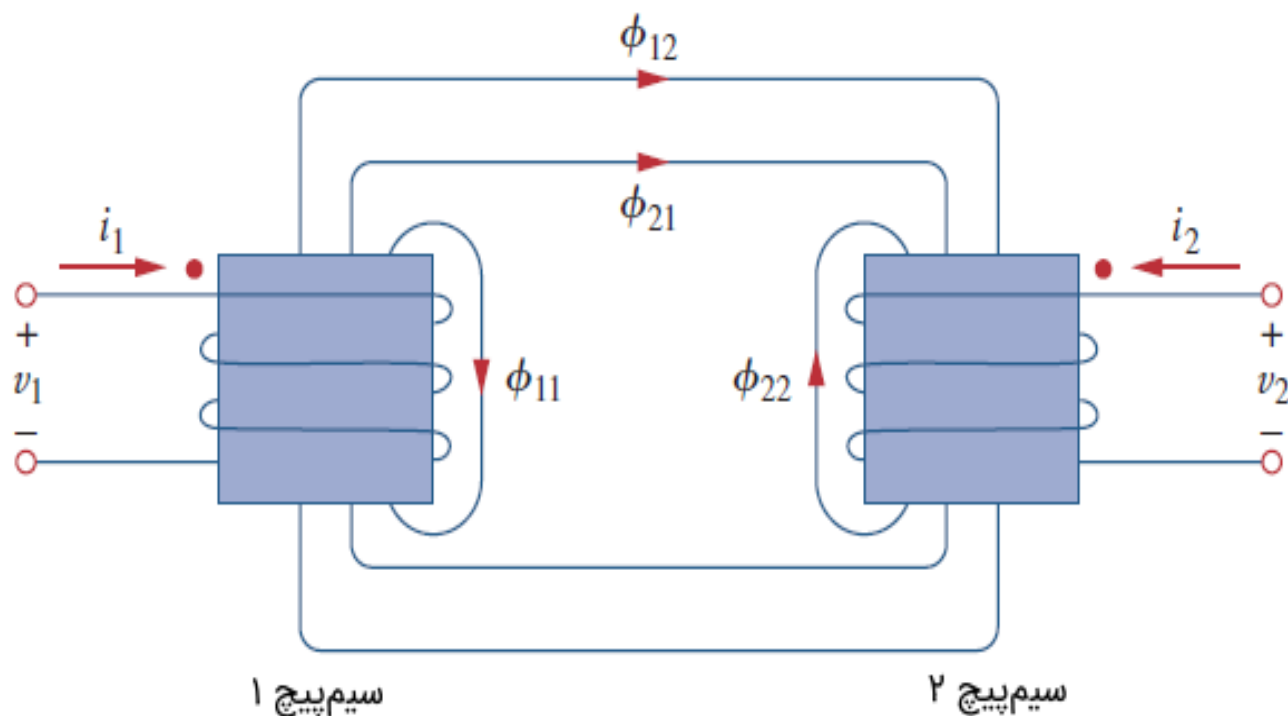
دانشگاه فنی حرفه ای انقلاب اسلامی
دانشکده مهندسی برق

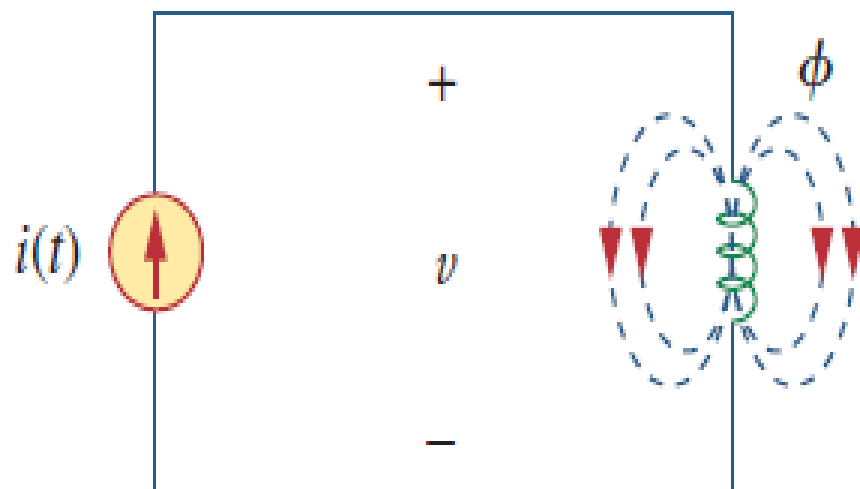
آموزش مجازی درس
تحلیل مدارهای جریان متناوب

جلسه ششم
القای متقابل

ارائه دهنده: دکتر علیرضا ناطقی

بررسی اثر القای متقابل در خطوط انتقال

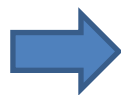




شکل ۱: شار مغناطیسی تولیدی با یک سیم پیچ N دوری

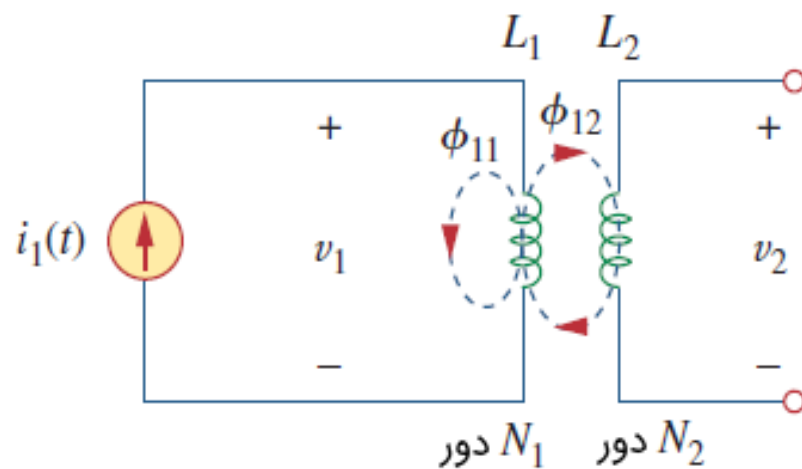
$$v = N \frac{d\phi}{dt} \quad (1)$$

$$\left\{ \begin{array}{l} v = N \frac{d\phi}{dt} \quad (1) \\ v = N \frac{d\phi}{di} \frac{di}{dt} \quad (2) \end{array} \right.$$



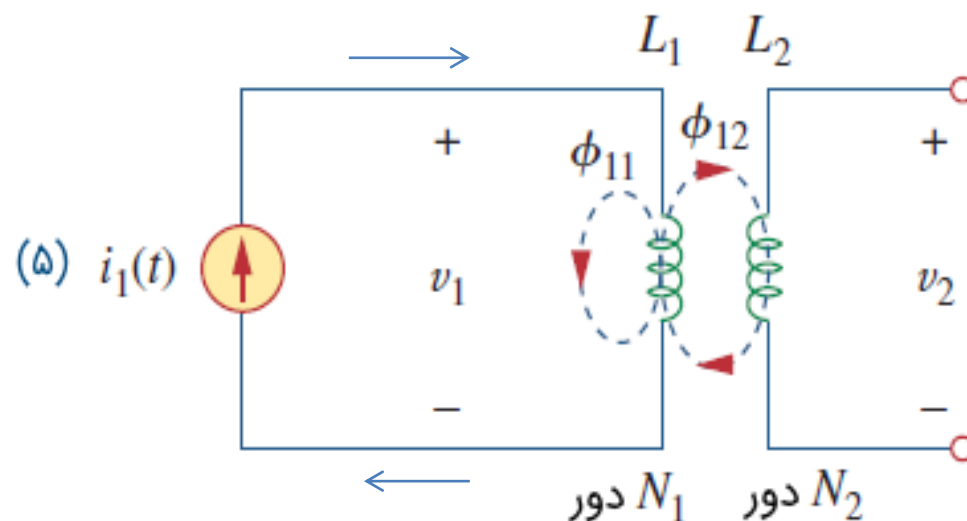
$$\left\{ \begin{array}{l} v = L \frac{di}{dt} \quad (3) \\ L = N \frac{d\phi}{di} \quad (4) \end{array} \right.$$

بررسی اثر تغییرات شار در اولیه
با فرض باز بودن ثانویه



$$\phi_1 = \phi_{11} + \phi_{12} \quad (5)$$

$$\phi_1 = \phi_{11} + \phi_{12}$$

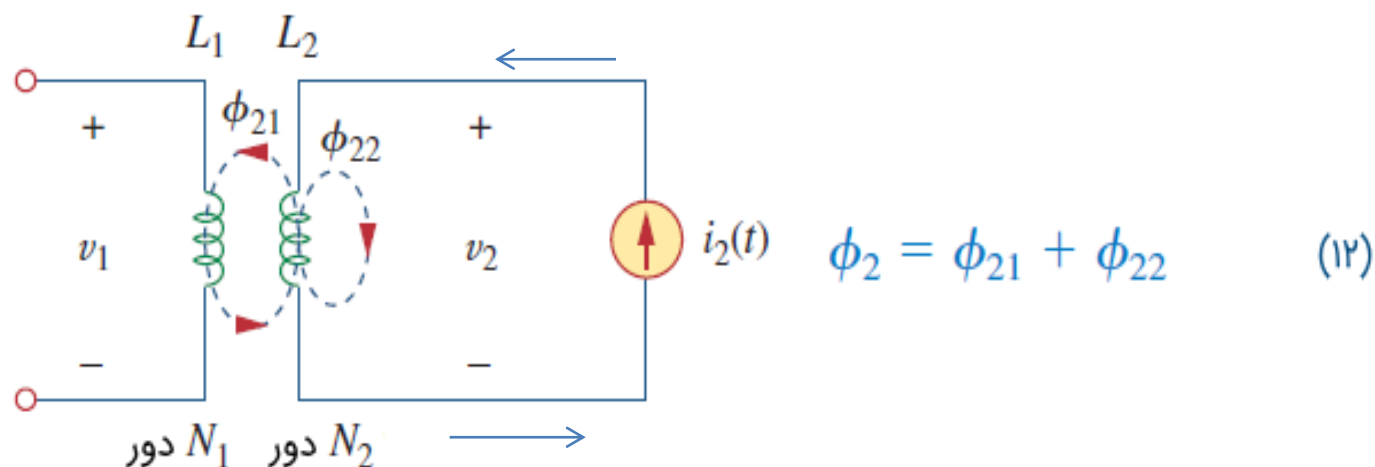


$$v_1 = N_1 \frac{d\phi_1}{dt} \quad (۶) \quad \Rightarrow \quad v_1 = N_1 \frac{d\phi_1}{di_1} \frac{di_1}{dt} = L_1 \frac{di_1}{dt} \quad (۷)$$

$$v_2 = N_2 \frac{d\phi_{12}}{dt} \quad (۸) \quad \Rightarrow \quad v_2 = N_2 \frac{d\phi_{12}}{di_1} \frac{di_1}{dt} = M_{21} \frac{di_1}{dt} \quad (۹)$$

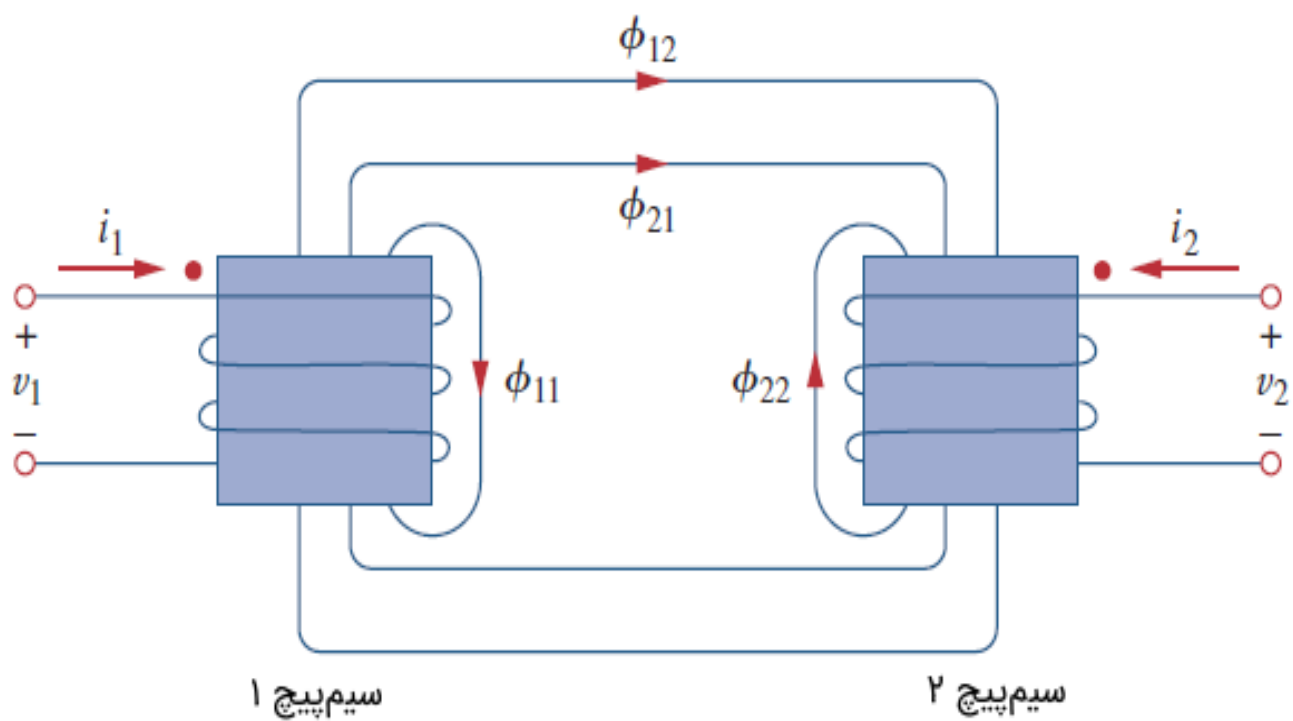
$$\left\{ \begin{array}{l} M_{21} = N_2 \frac{d\phi_{12}}{di_1} \end{array} \right. \quad (۱۰)$$

بررسی اثر تغییرات جریان و شار ثانویه
با فرض باز بودن اولیه

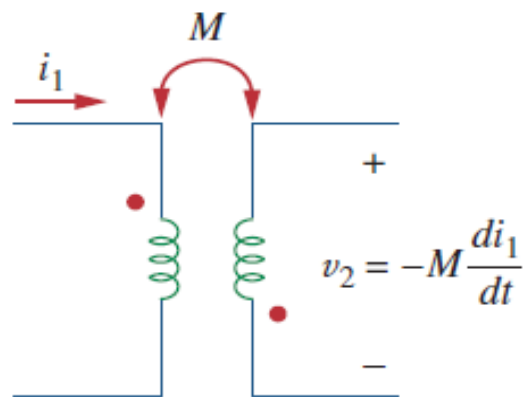


$$v_2 = N_2 \frac{d\phi_2}{dt} = N_2 \frac{d\phi_2}{di_2} \frac{di_2}{dt} = L_2 \frac{di_2}{dt} \quad (13)$$

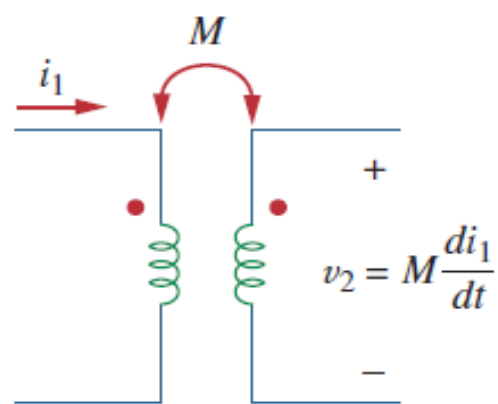
$$v_1 = N_1 \frac{d\phi_{21}}{dt} = N_1 \frac{d\phi_{21}}{di_2} \frac{di_2}{dt} = M_{12} \frac{di_2}{dt} \quad (14) \quad \Rightarrow \quad M_{12} = N_1 \frac{d\phi_{21}}{di_2} \quad (15)$$



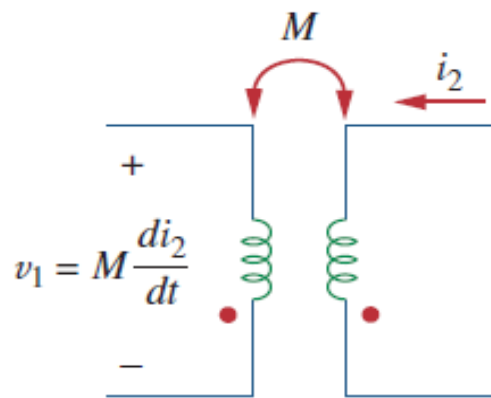
$$M_{12} = M_{21} = M \quad (۱۷)$$



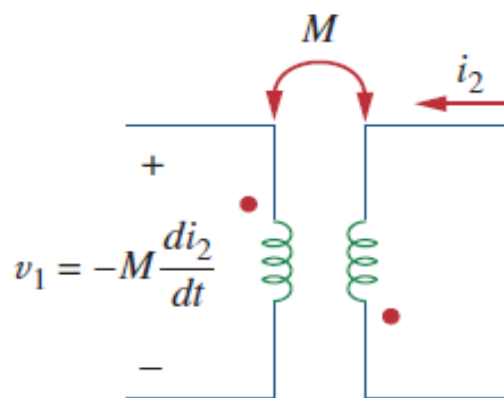
(ب)



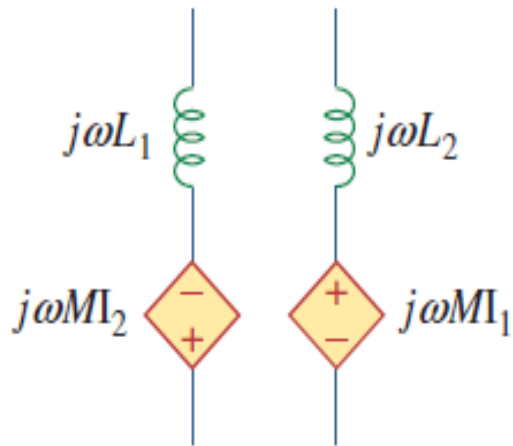
(الف)



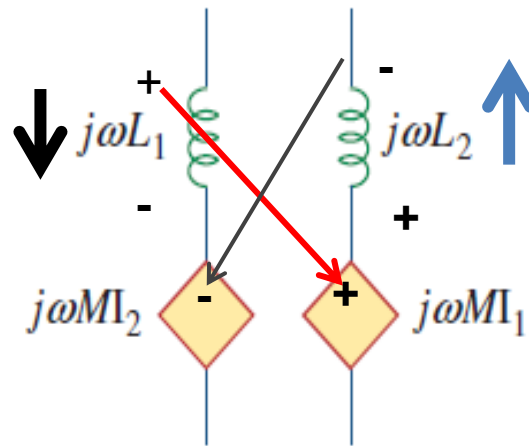
(د)



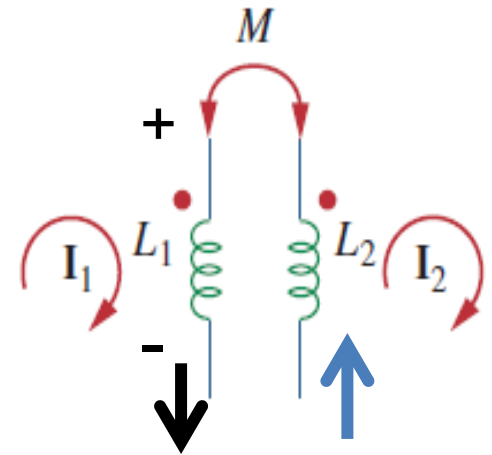
(ج)



(ج)

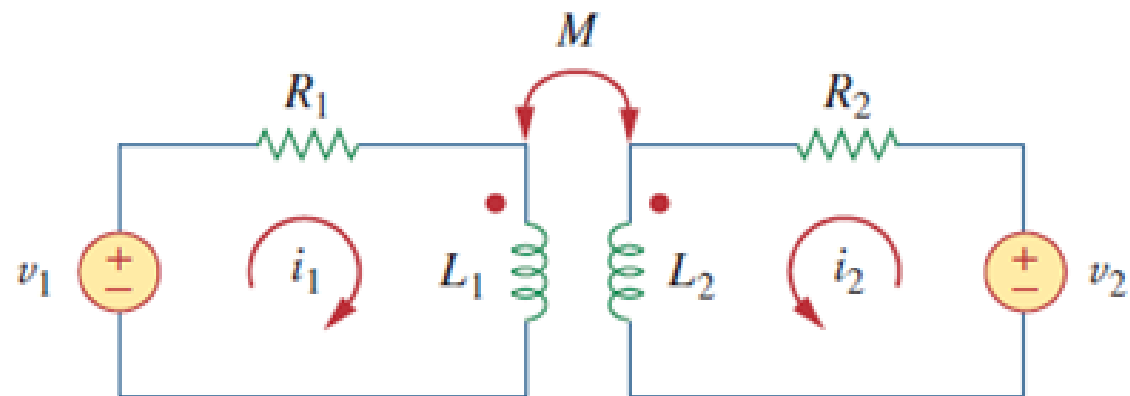


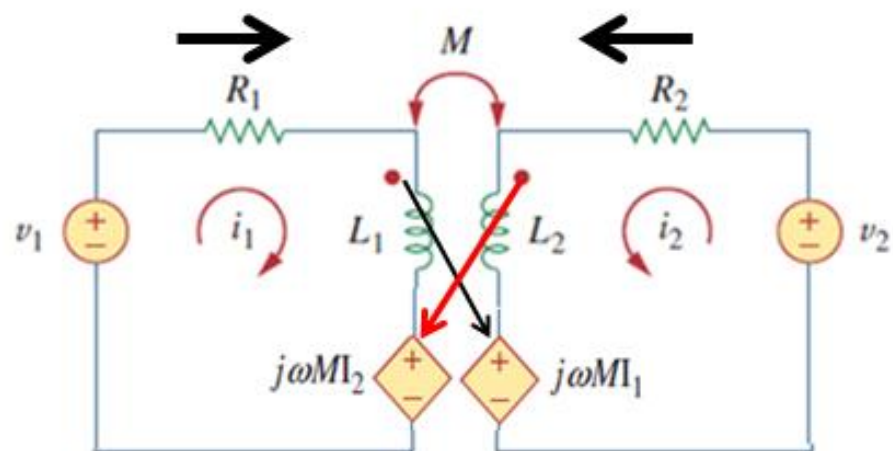
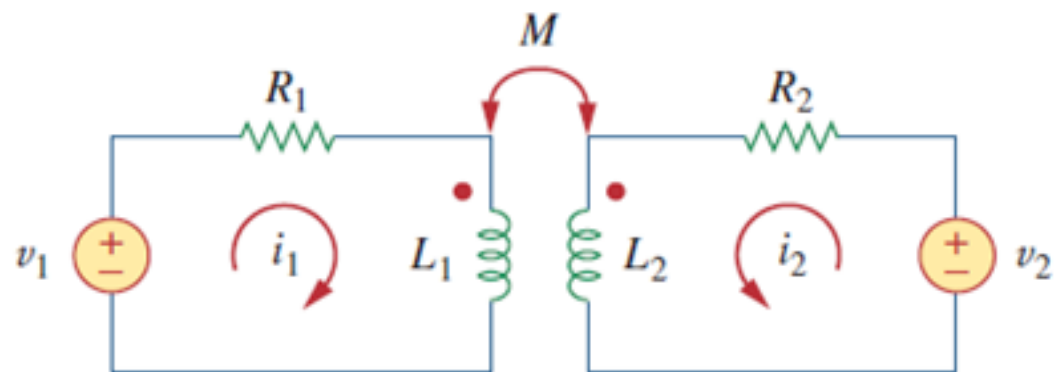
(ب)



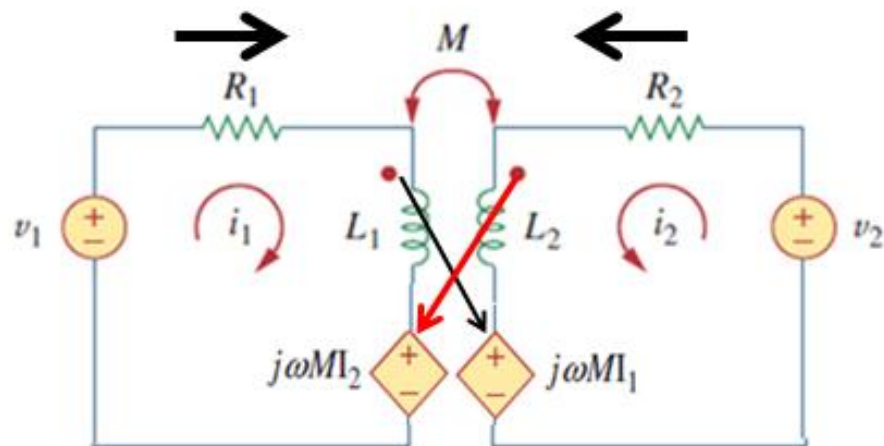
(الف)

مثال:



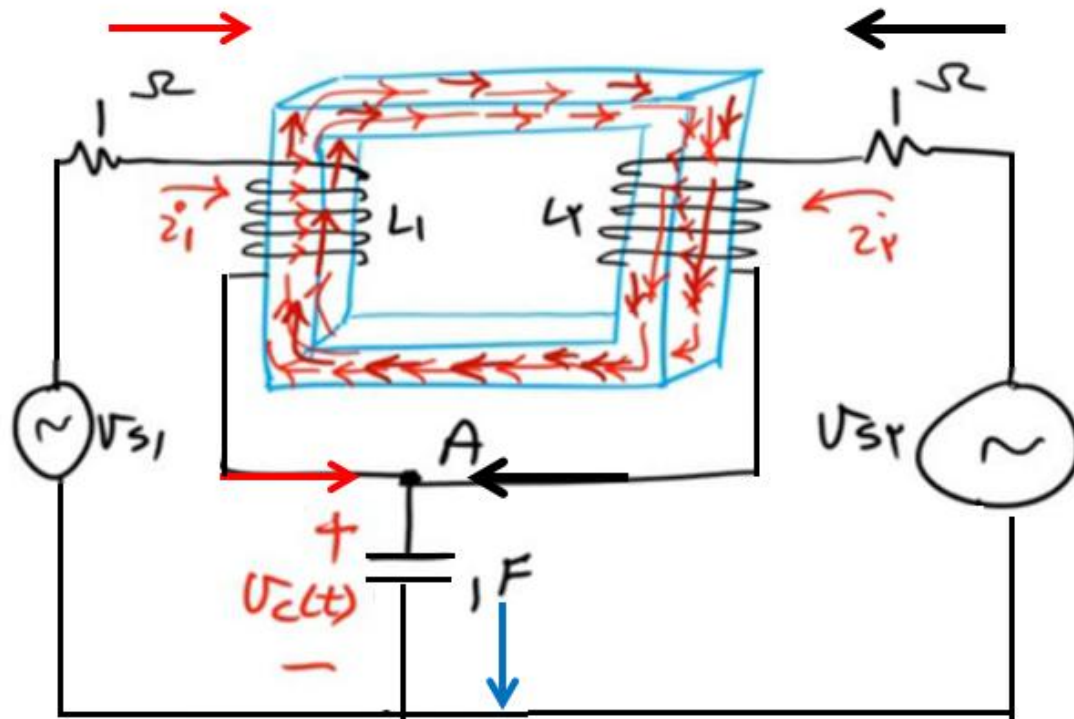


مثال:

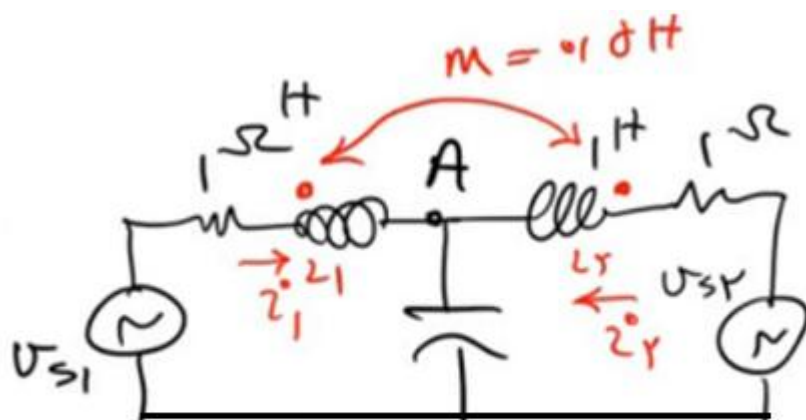
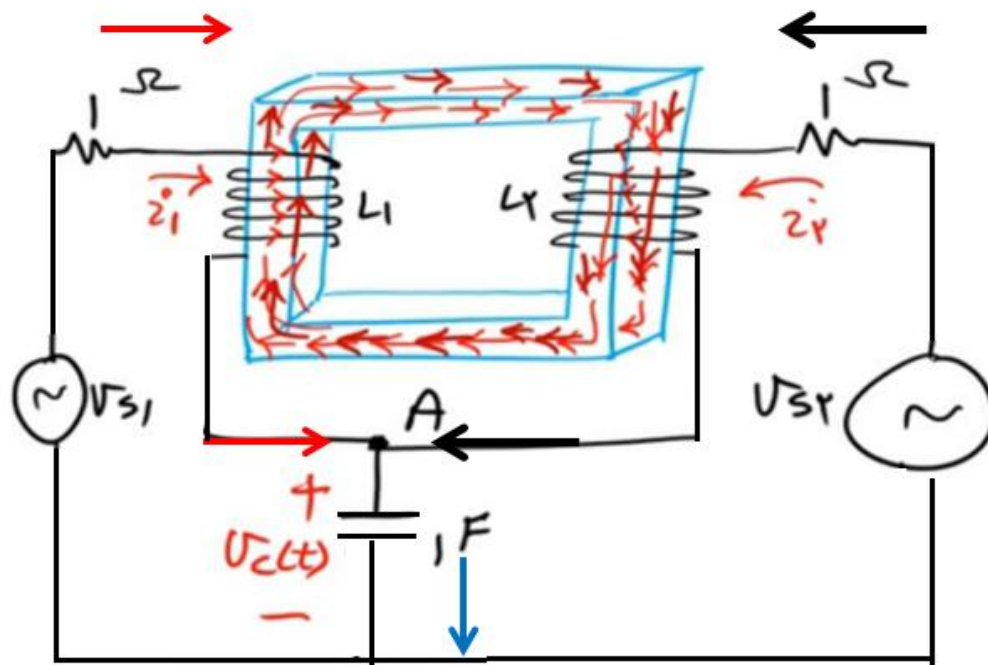


$$\left\{ \begin{array}{ll} \mathbf{V}_1 = (R_1 + j\omega L_1)\mathbf{I}_1 + j\omega M\mathbf{I}_2 & \text{(٢١-الف)} \\ \mathbf{V}_2 = j\omega M\mathbf{I}_1 + (R_2 + j\omega L_2)\mathbf{I}_2 & \text{(٢١-ب)} \end{array} \right.$$

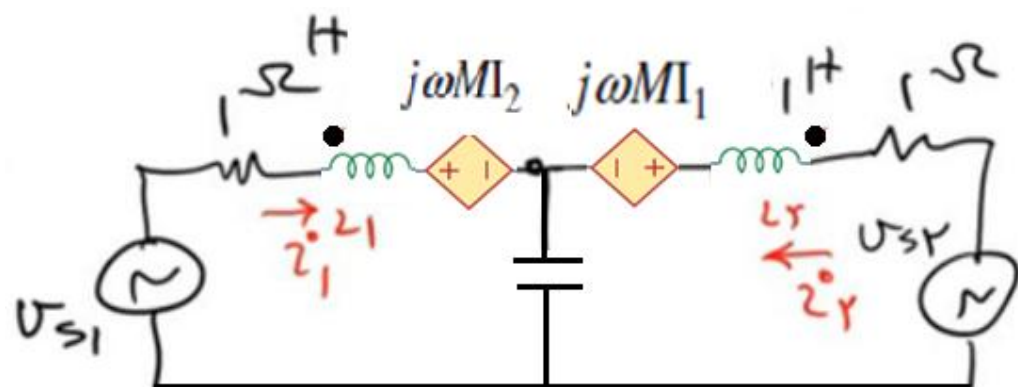
مثال ۲:



$$\begin{cases} V_{s1} = 10 \cos t \\ V_{s2} = 10 \sin t \\ L_1 = L_2 = 1 \text{ H} \\ M = 0.5 \text{ H} \end{cases}$$



$$\begin{cases} u_{s1} = 10 \cos t \\ u_{s2} = 10 \sin t \\ L_1 = L_2 = 1 \text{ H} \\ M = 0.1 \text{ H} \end{cases}$$



$$\begin{cases} 10 = z_1 + j z_1 + 0.1 j z_2 + (-j)(z_1 + z_2) \\ -10j = z_2 + j z_2 + 0.1 j z_1 - j(z_1 + z_2) \end{cases}$$

$$\begin{bmatrix} +1 & -0.1\delta j \\ -0.1\delta j & +1 \end{bmatrix} \begin{bmatrix} z_i \\ z_r \end{bmatrix} = \begin{bmatrix} 1_0 \\ -1_0 j \end{bmatrix}$$

$$\begin{bmatrix} z_i \\ z_r \end{bmatrix} = \frac{1}{1 \times 1 - (-0.1\delta j)^2} \begin{bmatrix} +1 & +0.1\delta j \\ 0.1\delta j & +1 \end{bmatrix} \begin{bmatrix} 1_0 \\ -1_0 j \end{bmatrix}$$