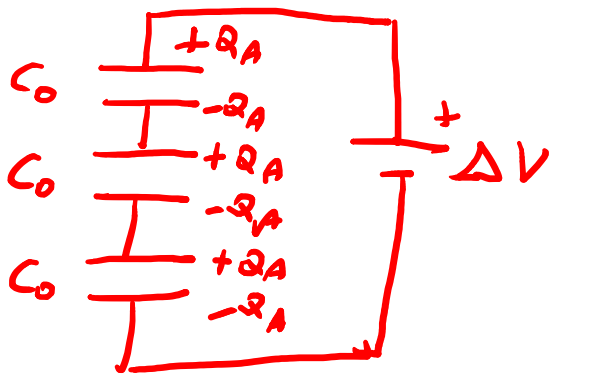
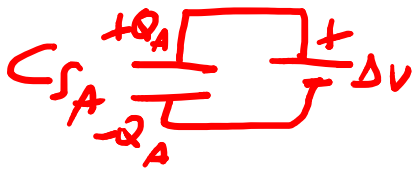
14 - 9 - 2023

CASO A

1)



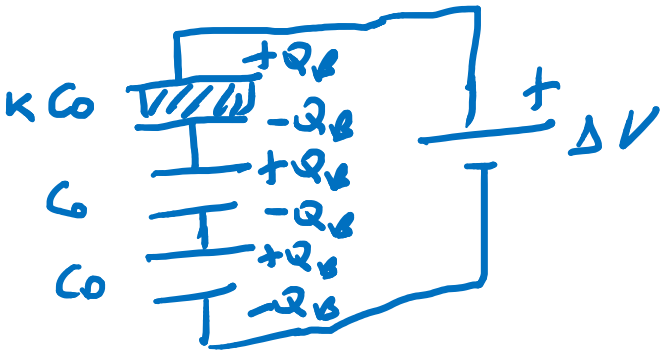


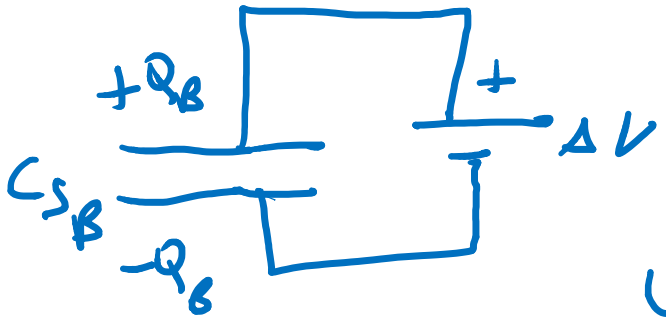
$$C_{S_A} = \frac{1}{\frac{1}{C_0}+\frac{1}{C_0}+\frac{1}{C_0}} = \frac{C_0}{3}$$

$$Q_A = C_{S_A}\,\Delta V = \frac{C_0}{3}\Delta V$$

$$U_A = \frac{1}{2} C_{S_A} \Delta V^2 = \frac{1}{2}\frac{C_0}{3}\Delta V^2$$

CASO B





$$C_{S_B} = \frac{1}{\frac{1}{\kappa C_0}+\frac{1}{C_0}+\frac{1}{C_0}} = \frac{1}{\frac{1+2\kappa}{\kappa C_0}} = \frac{\kappa C_0}{1+2\kappa}$$

$$Q_B = C_{S_B}\,\Delta V = \frac{\kappa C_0 \Delta V}{1+2\kappa}$$

$$U_B = \frac{1}{2} C_{S_B} \Delta V^2 = \frac{1}{2}\frac{\kappa C_0}{1+2\kappa}\Delta V^2 = \frac{\kappa}{3} U_A$$

$$U_B = \frac{1}{2}\frac{kC_0}{1+2k}\Delta V^2 = \frac{k}{3}U_A = \frac{4}{3}\frac{1}{2}\frac{C_0}{3}\Delta V^2$$

$$\frac{4}{1+2k} = \frac{4}{9} \rightarrow 9k = 4 + 8k \rightarrow k = 4$$

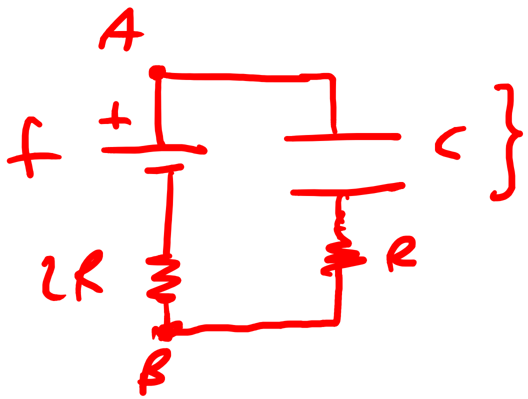
LE CARICHE IN COND. IN SERIE SONO TUTTE UGUALI A $Q_B = \frac{kC_0}{1+2k}\Delta V$

OSSIA CON $k = \frac{1}{4}$ $\quad Q_B = \frac{C_0 4}{1+8}\Delta V = \frac{C_0 4}{9}\Delta V = \frac{C_0}{9}\Delta V$

ENERGIA FORNITA DAL GENERATORE $U_{GEN} = \Delta V (Q_B - Q_A) = C_0 \Delta V^2 \left[\frac{k}{1+2k} - \frac{1}{3}\right] =$

CHE PER $k = \frac{1}{4}$ VIENE $\quad U_{GEN} = C_0 \Delta V^2 \left[\frac{4}{9} - \frac{1}{3}\right] = + C_0 \Delta V^2 \left[\frac{1}{9}\right]$

2) CASO A T APERTO

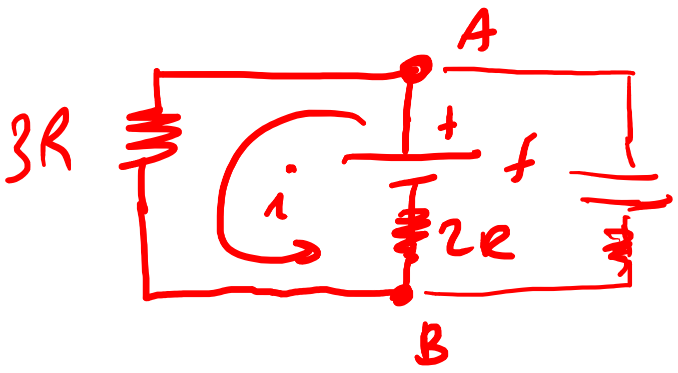


$\} \Delta V_{C_A} = f$

$$\Delta V_{C_A} = f = V_A - V_B$$

$$Q_{C_A} = C\,\Delta V_{C_A} = C f$$

CASO B T CHIUSO DA TEMPO



$$i = \frac{f}{5R}$$

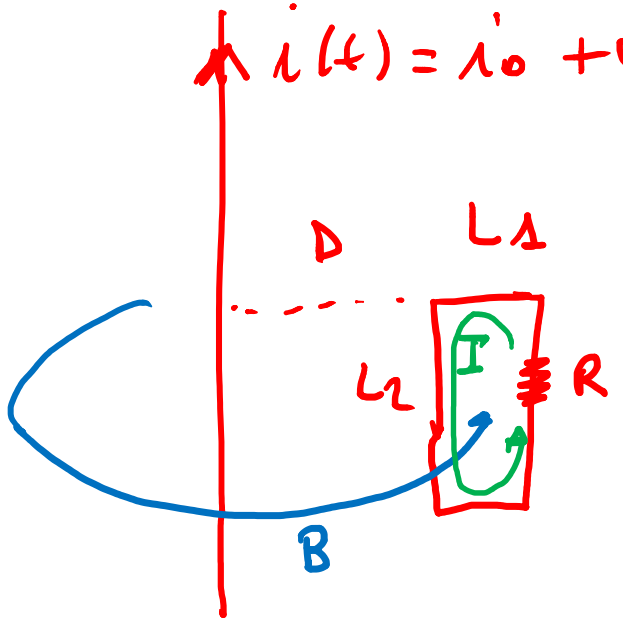
$$\Delta V_{C_B} = V_A - V_B = 3R\,i$$

$$\Delta V_{C_B} = \frac{3R\,f}{5R} = \frac{3}{5} f$$

$$Q_{C_B} = C\,\Delta V_{C_B} = \frac{3}{5} C f$$

$$\Delta U = U_B - U_A = \frac{1}{2} C\,\Delta V_{C_B}^2 - \frac{1}{2} C\,\Delta V_{C_A}^2 = \frac{1}{2} C\left[\frac{9}{25} f^2 - f^2\right] = \frac{1}{2} C f^2\left[\frac{9-25}{25}\right] = -\frac{16}{2} C f^2$$

3)



I corrente indotta

$$B(t,r) = \frac{\mu_0 i(t)}{2\pi r} = \frac{\mu_0 (i_0 + \alpha t)}{2\pi r}$$

$$\phi(B) = L_2 \int_D^{D+L_1} \frac{\mu_0 (i_0 + \alpha t)}{2\pi r} dr =$$

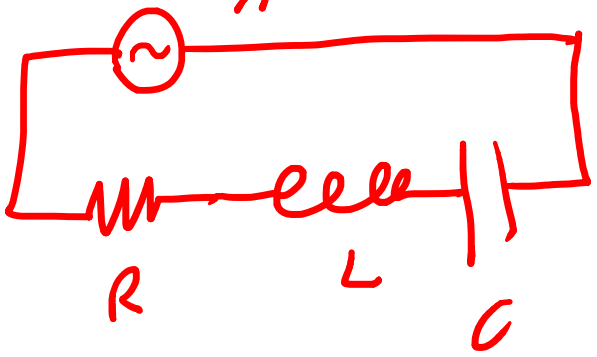
$$= \frac{\mu_0 (i_0 + \alpha t) L_2}{2\pi} \ln\left(\frac{D+L_1}{D}\right)$$

$$f_{em} = -\frac{d\phi}{dt} = -\frac{\alpha \mu_0 L_2}{2\pi} \ln\left(\frac{D+L_1}{D}\right)$$

$$I = \frac{f_{em}}{R} = -\frac{\alpha R \mu_0 L_2}{2\pi} \ln\left(\frac{D+L_1}{D}\right)$$

$$M = \frac{\phi(B)}{i(t)} = \frac{\mu_0 L_2}{2\pi} \ln\left(\frac{D+L_1}{D}\right)$$

4)



$f = 50 Hz$ $\quad \omega = 2\pi f$

$$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$$i_{eff} = \frac{V_{eff}}{Z} \qquad i_{MAX} = \sqrt{2} \cdot i_{eff}$$

$$V_{MAX} = \sqrt{2} \cdot V_{eff}$$

$$V_{MAX_C} = i_{MAX} Z_C \quad \text{con} \quad Z_C = \frac{1}{\omega C}$$

$$P_m = \frac{1}{2} V_{eff} i_{eff} \cos\phi \qquad \cos\phi = \frac{R}{Z} = \frac{R}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$