Complementi di fisica generale

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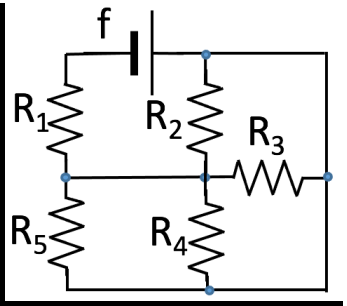
circuiti elettrici

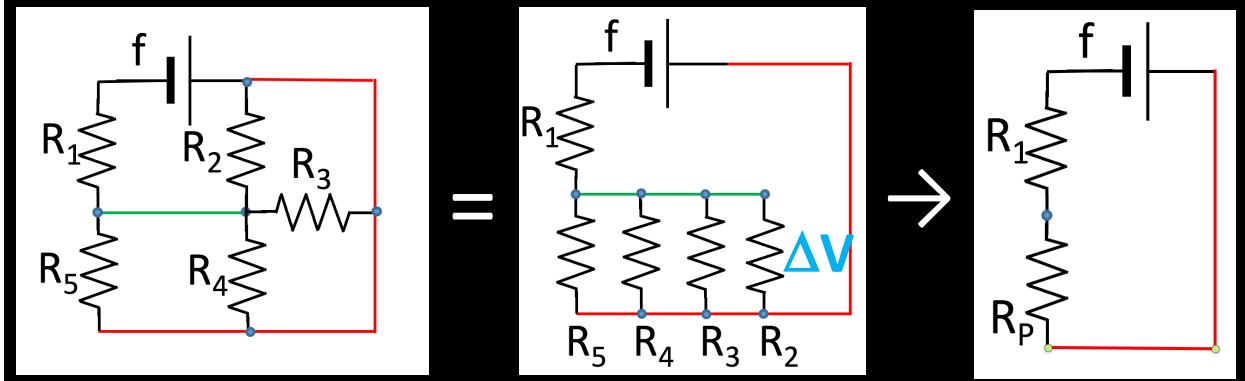
esercitazione su:

elementi circuitali

considerazioni energetiche

5) Calcolare la potenza erogata dal generatore e quella dissipata in R_1.
[dati: f = 10 V; R_1 = 2,4 Ω; R_2 = 10 Ω; R_3 = 40 Ω; R_4 = 2,5 Ω; R_5 = 10 Ω]
>>> soluzione: 25 W; 15 W





IDENTITA' TOPOLOGICA

RIDUZIONE

RIDUZIONE

$R_S = R_1 + R_P = 2,4 + 1,6 = 4\ \Omega$

$I = f/R_S = 10\ V/4\ \Omega = 2,5\ A$

$P_{GEN} = f\ I = 10\ V \times 2,5\ A = 25\ W$

$P_{R1} = R_1\ I^2 = 10\ V \times (2,5\ A)^2 = 6,25\ W$

$$\frac{1}{R_P} = \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} = \frac{1}{10} + \frac{1}{40} + \frac{1}{2,5} + \frac{1}{10} = \frac{1}{1,6\ \Omega}$$

$I_{R4} = \Delta V/R_4 = 1,6\ A$

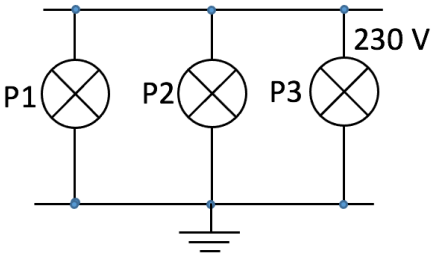
$I_{R5} = I_{R2}$

$I_{R3} = \Delta V/R_3 = 0,1\ A$

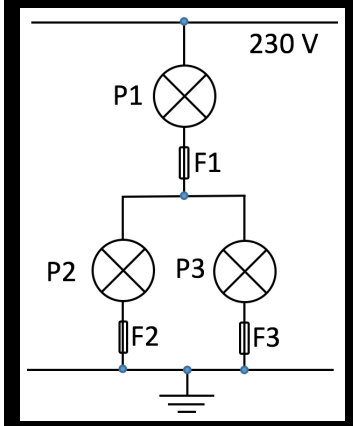
$I_{R2} = \Delta V/R_2 = 0,4\ A$

I_{R2} = ? f - R_1 I = ΔV = 10 V - 2,4 Ω x 2,5 A = 4 V

6) Tre apparecchiature schematizzabili come altrettante resistenze sono state progettate per dissipare, quando sono alimentate a 230 V, rispettivamente: P_1 = 2,3 kW, P_2 = 1,15 kW e P_3 = 460 W.



Vengono inserite nel circuito in figura in cui sono protette con fusibili tarati per intervenire (interrompere il circuito) se attraversati da correnti superiori a: F1 = 4,3 A; F2 = 3,2 A e F3 = 0,9 A. Verificare che F2 fonde



$$R_1 = \frac{\Delta V^2}{P_1} = \frac{230^2}{2300} = 23\ \Omega$$

$$R_2 = \frac{\Delta V^2}{P_2} = \frac{230^2}{1150} = 46\ \Omega$$

$$R_3 = \frac{\Delta V^2}{P_3} = \frac{230^2}{460} = 115\ \Omega$$

$$R_P = \frac{R_2 \times R_3}{R_2 + R_3} = 33\ \Omega$$

$$R_S = R_1 + R_P = 56\ \Omega$$

$$I_{R1} = I_P = \frac{\Delta V}{R_S} = 4{,}1\ \text{A} < \text{F1}$$

$$I_{R2} = I_{R1}\frac{R_3}{R_2 + R_3} = 2{,}9\ \text{A} < \text{F2}$$

$$I_{R3} = I_{R1}\frac{R_2}{R_2 + R_3} = \mathbf{1{,}2\ A > F3}$$

$$R'_P = \frac{R_2 \times \infty}{R_2 + \infty} = 46\ \Omega$$

$$R'_S = R_1 + R_2 = 69\ \Omega$$

$$I'_{R1} = \frac{\Delta V}{R'_S} = 3{,}3\ \text{A} < \text{F1}$$

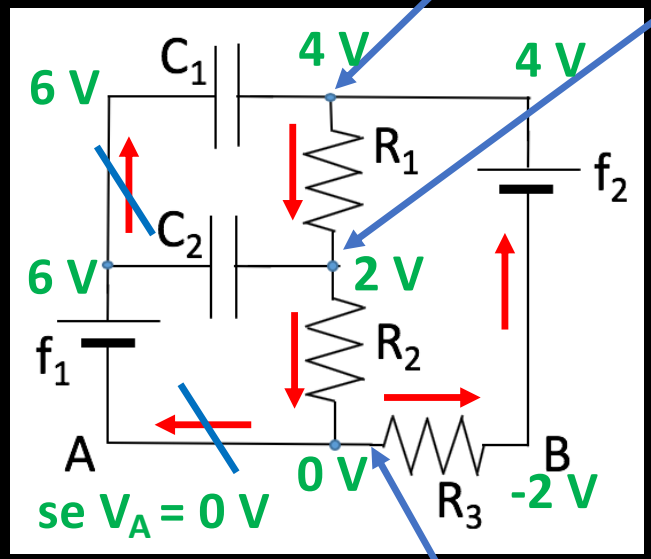
$$= I'_{R2} = \mathbf{3{,}3\ A > F2}$$

$$P = RI^2 = R\left(\frac{\Delta V}{R}\right)^2 = \frac{\Delta V^2}{R}$$

8) Determinare il valore della differenza di potenziale $V_B - V_A$ e delle cariche sulle armature positive dei due condensatori.

Dati: $C_1 = C_2 = 10$ nF; $R_1 = R_2 = R_3 = 10\ \Omega$; $f_1 = f_2 = 6$ V

>>> soluzione: -2 V; 20 nC; 40 nC



$\Delta V_{C1} = (V_A + f_1) - (V_A - R_3 I + f_2) = 2$ V

$Q_1 = C_1 \Delta V_{C1} = 10$ nF x 2 V = 20 nC

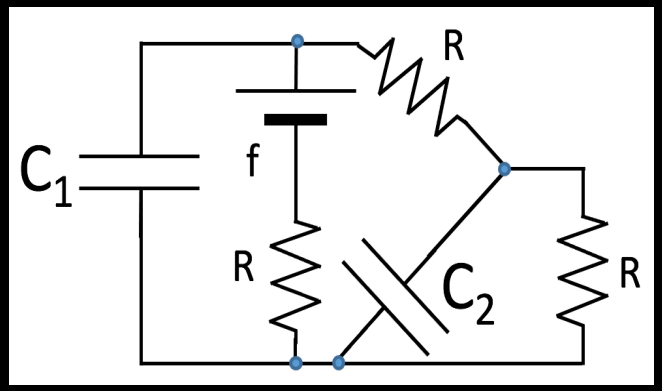
$\Delta V_{C2} = (V_A + f_1) - (V_A - R_3 I + f_2 - R_1 I) = 4$ V

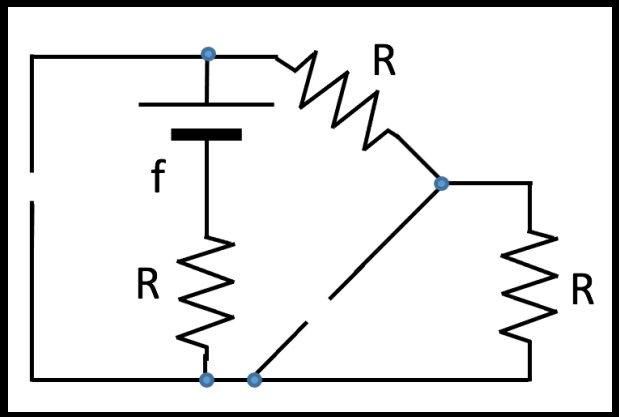
$Q_2 = C_2 \Delta V_{C2} = 10$ nF x 4 V = 40 nC

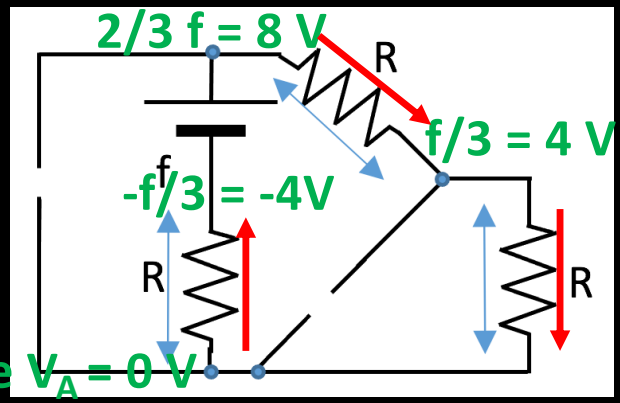
$V_B = V_A - R_3 I \rightarrow V_B - V_A = - R_3 I = - 10\ \Omega$ x 0,2 A = - 2 V

$(V_A - R_3 I + f_2 - R_1 I) - R_2 I = V_A \rightarrow f_2 = (R_1 + R_2 + R_3) I \rightarrow I = 6$ V $/ 30\ \Omega = 0{,}2$ A

9) Ricavare il valore delle cariche Q_1 e Q_2 dei condensatori
(C_1 = 20 nF, C_2 = 40 nF, R = 10 Ω, f = 12 V)
>>> soluzione: 160 nC; 160 nC







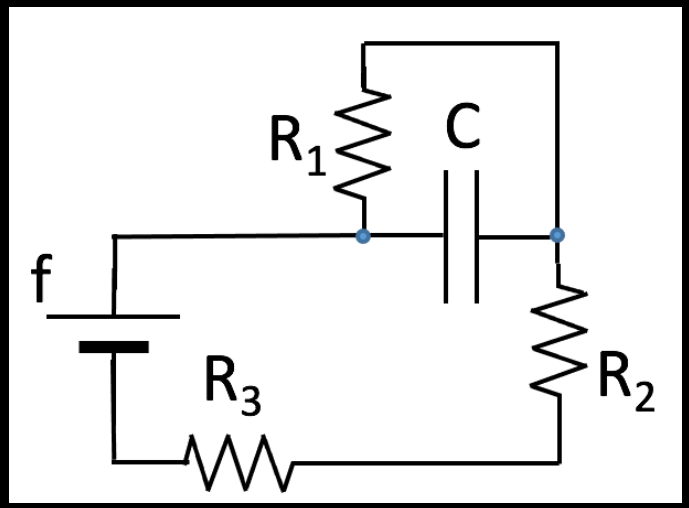
$\Delta V_R = f/3 = 4$ V

$I = f/(3R) = 12$ V/30 Ω = 0,4 A

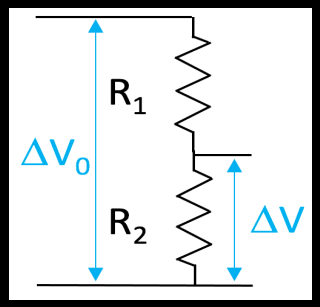
$Q_1 = C_1 \Delta V_{C1} = 20$ nF x 8 V = 160 nC

$Q_2 = C_2 \Delta V_{C2} = 40$ nF x 4 V = 160 nC

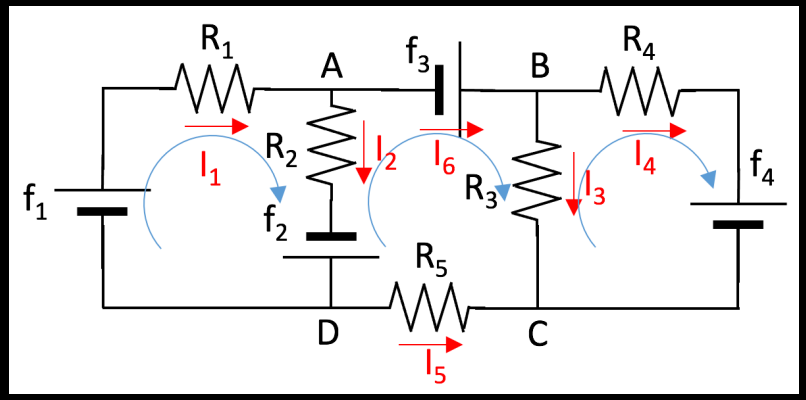
7) Ricavare l'espressione dell'energia accumulata e della potenza dissipata
Dati: $R_1 = R$; $R_2 = 2R$; $R_3 = 3R$ con R= 100 Ω; f = 12V; C = 30 nF]
>>> soluzione: $Cf^2/72$; $f^2/(6R)$

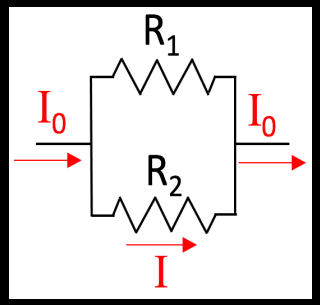


$$\Delta V_C = \Delta V_{R1} = f\,\frac{R_1}{R_1 + R_2 + R_3} = f/6$$



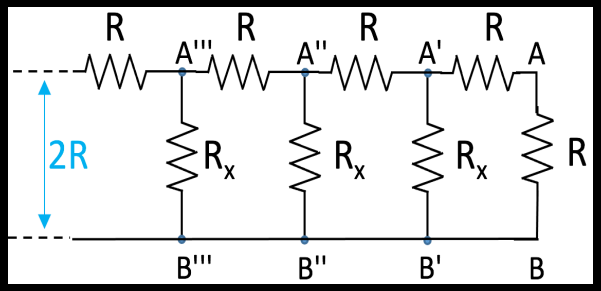
$$\Delta V = \Delta V_0 \frac{R_2}{R_1 + R_2}$$





$$I = I_0 \frac{R_1}{R_1 + R_2}$$

$$I_0 \frac{R_1 \times R_2}{R_1 + R_2} = I\, R_2$$



$$R_x = 2\, R$$

ESONERO...

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VENERDÌ 16 APRILE ORE 8:30-10:00

elementi circuitali (induttanza)
considerazioni energetiche
correnti lentamente variabili