Complementi di fisica generale

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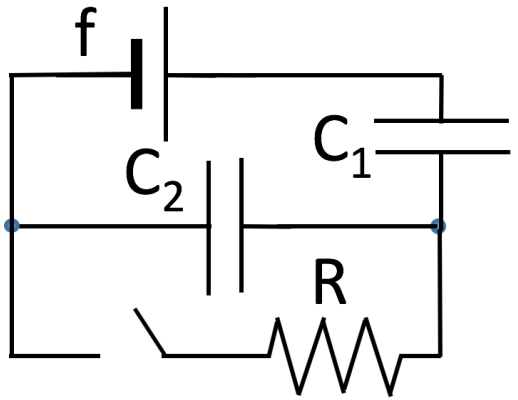
circuiti elettrici

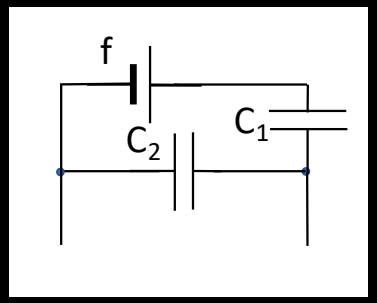
esercitazione su:

circuiti in condizioni stazionarie

1) I due condensatori in figura hanno la stessa capacità C.
Calcolare l'energia immagazzinata nel circuito nelle due configurazioni:
A) interruttore aperto B) interruttore chiuso
>>> soluzione: 1/4 Cf^2; 1/2 Cf^2



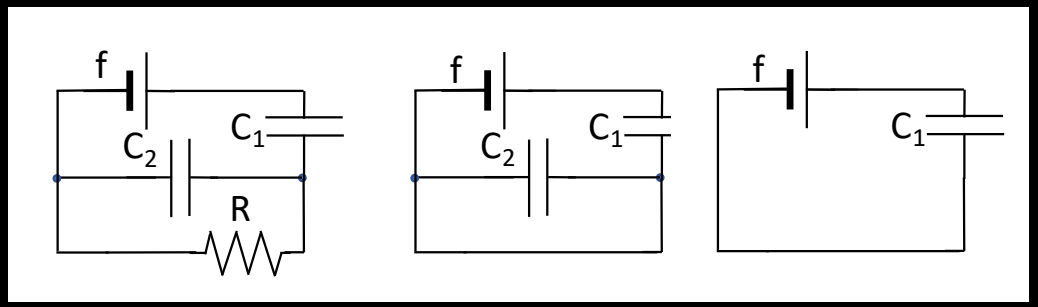
A) interruttore aperto



$C_S = C_1C_2/(C_1+C_2) = C^2/2C = C/2$

$U = ½\ C/2\ f^2$

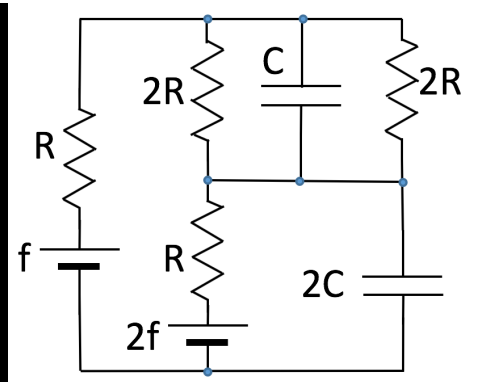
B) interruttore chiuso



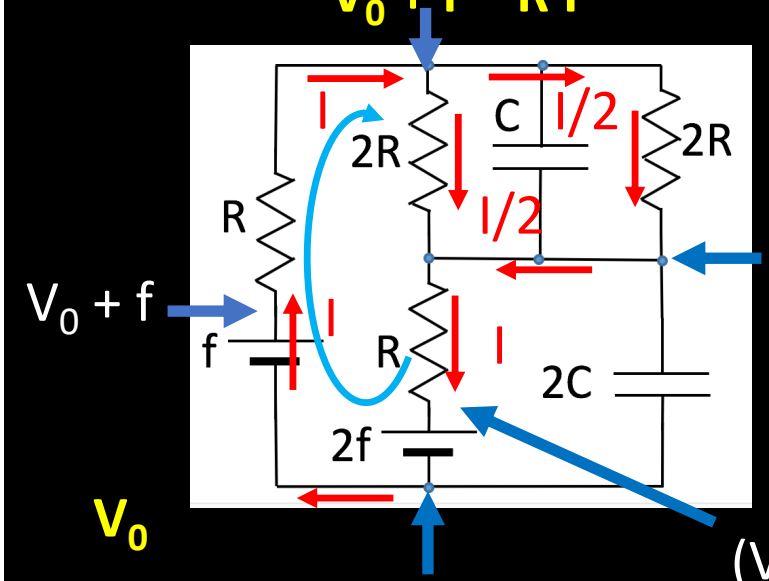
$C_1 = C$ $U = ½\ C\ f^2$

$\Delta V_R = 0$ $\Delta V_{C2} = 0$

4) Calcolare quanta energia è accumulata e quanta potenza viene dissipata nel circuito in figura in cui f = 10 V, R = 100 Ω, C = 100 nF
>>> soluzione: 85/3 μJ; 1/3 W



$P_{DISS} = (R+2R//2R+R)\, I^2$



$(V_0 + f - R\, I) - 2R\, I/2$

oppure → $\mathbf{V_0 + f - 2\, R\, I}$

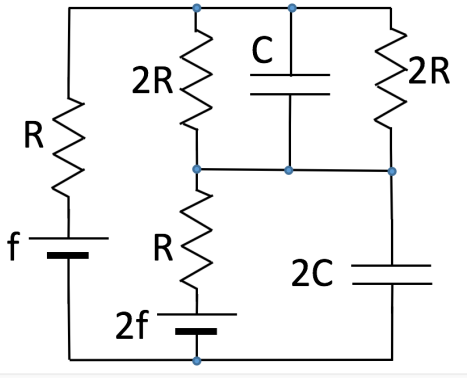
$(V_0 + f - R\, I) - R_P I_P = V_0 + f - R\, I - R\, I$

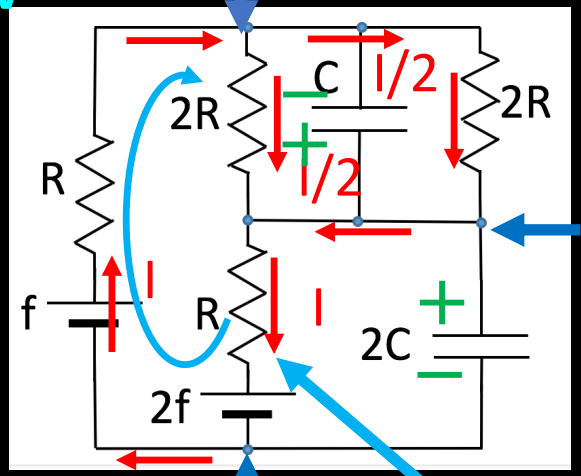
$2R//2R = (2R \times 2R)/(2R + 2R) = 4R^2/4R = R$

$(V_0 + f - 2\, R\, I) - R\, I$

$(V_0 + f - 3\, R\, I) - 2\, f = V_0$ → $\mathbf{I = -\, f/3R}$

4) Calcolare quanta energia è accumulata e quanta potenza viene dissipata nel circuito in figura in cui f = 10 V, R = 100 Ω, C = 100 nF
>>> soluzione: 85/3 μJ; 1/3 W





$V_0 + f - R\,I$

13,3 V

16,7 V

$V_0 + f - 2\,R\,I$

10 V

0 V

$I = -f/3R = -33$ mA

20 V

V_0

ponendo **$V_0 = 0$ V**

$\Delta V_C = (V_0 + f - R\,I) - (V_0 + f - 2R\,I) = R\,I$
$= -R\,f/3R = -f/3$

$U_C = \frac{1}{2}\,C\,f^2/9$

$\Delta V_{2C} = (V_0 + f - 2\,R\,I) - (V_0) = f - 2\,R\,I$
$= f + 2\,R\,f/3R = (1+2/3)\,f = 5/3\,f$

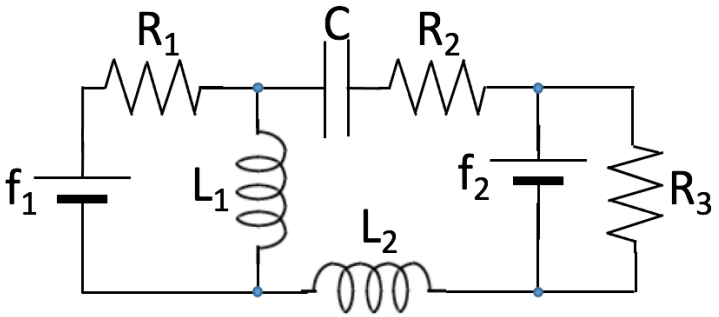
$U_{2C} = \frac{1}{2}\,2C\,f^2\,25/9$

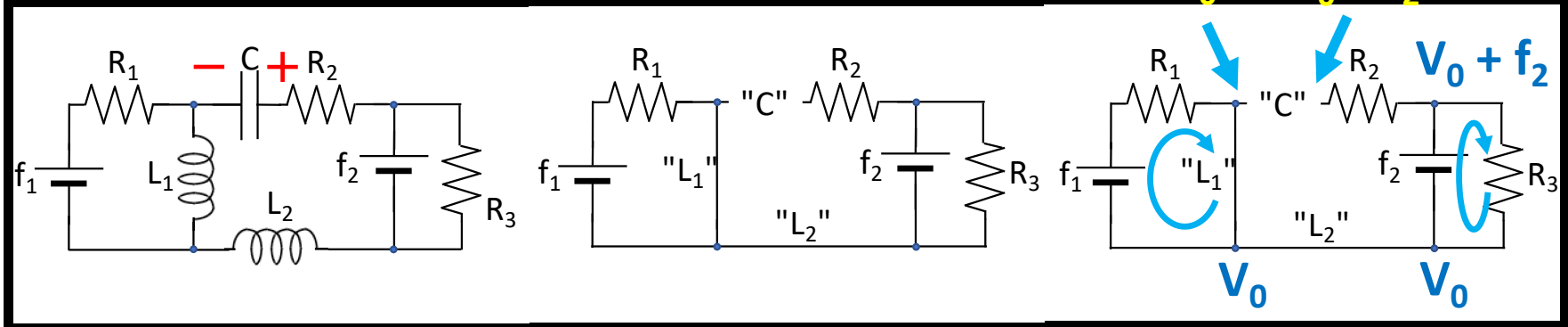
$P_{DISS} = (R+2R//2R+R)\,I^2$
$= 3\,R\,(-f/3R)^2 = f^2/3R$

8) Determinare l'intensità delle correnti che scorrono nelle resistenze e la carica del condensatore.

Dati: $f_1 = 5$ V; $f_2 = 8$ V; $R_1 = 100\ \Omega$; $R_2 = 150\ \Omega$; $R_3 = 200\ \Omega$, $C = 25$ nF

>>> soluzione: $I_{R1} = 50$ mA, $I_{R2} = 0$, $I_{R3} = 40$ mA, $Q = 0{,}2\ \mu$C





$\Delta V_C = f_2 \rightarrow Q = C\, f_2 = 25$ nF x 8 V = 200 nC

$I_{R1} = f_1/R_1 = 5$ V/100 Ω = 0,05 A

$I_{R2} = 0$

$I_{R3} = f_2/R_3 = 8$ V/200 Ω = 0,04 A

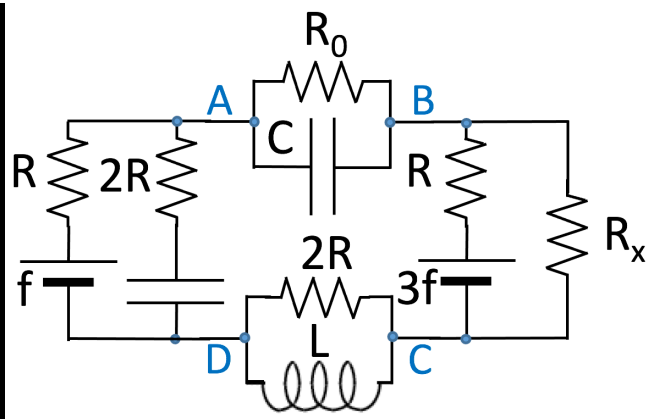
9) Tra i punti A e B non scorre corrente. Determinare:

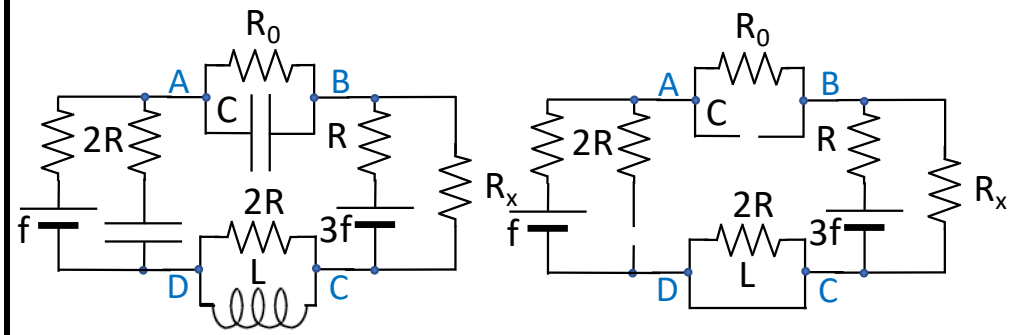
a) l'intensità della corrente che scorre tra i punti C e D

b) la differenza di potenziale fra i punti A e B e fra i punti C e D

c) il valore di R_x

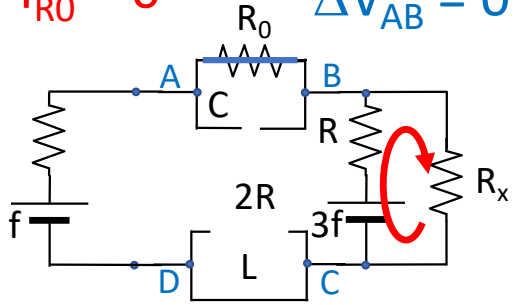
>>> soluzione: 0, 0, 0, R/2

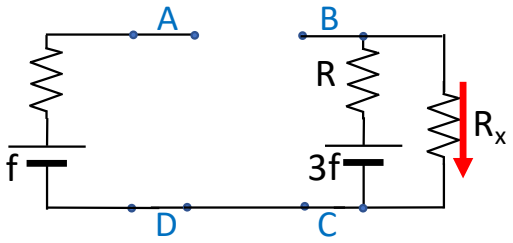




$I_{R0} = 0 \rightarrow \Delta V_{AB} = 0$

$V_A = V_B$





$I_{CD} = 0$

$V_A = V_D + f - R\,0 = V_D + f$

$V_C + 3\,f - R\,I - R_x\,I = V_C \rightarrow I = 3\,f\,/(\,R + R_x)$

$V_B = V_C + R_x\,I = V_C + R_x \times 3\,f/(\,R + R_x)$

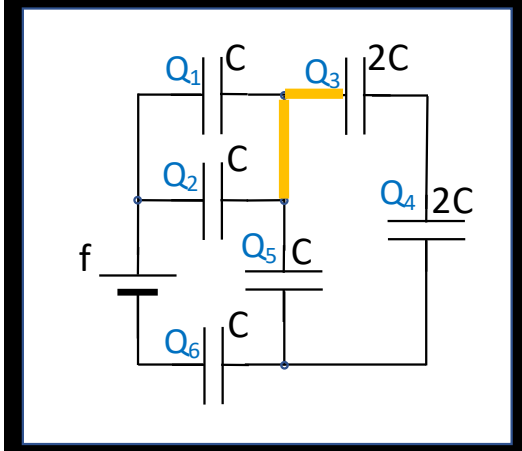
$V_D + f = V_C + R_x \times 3\,f/(\,R + R_x)$

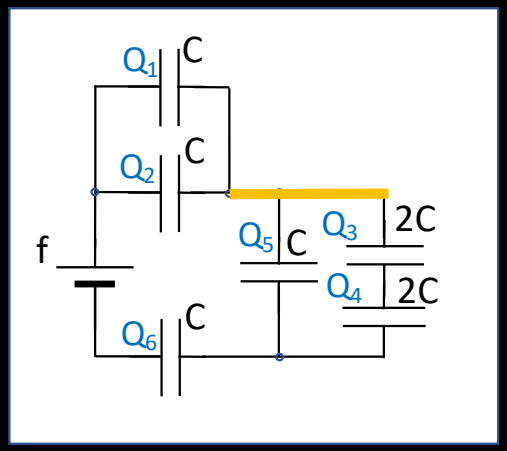
$f\,(\,R + R_x) = 3\,f\,R_x$

$R = 2\,R_x$

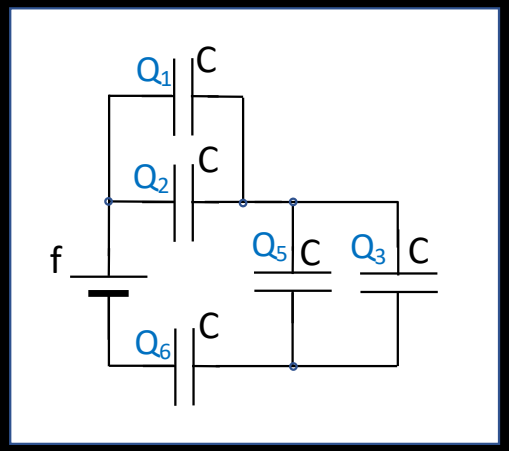
$1/C_{TOT} = 1/2C + 1/2C + 1/C = (1+1+2)/2C = 2/C$

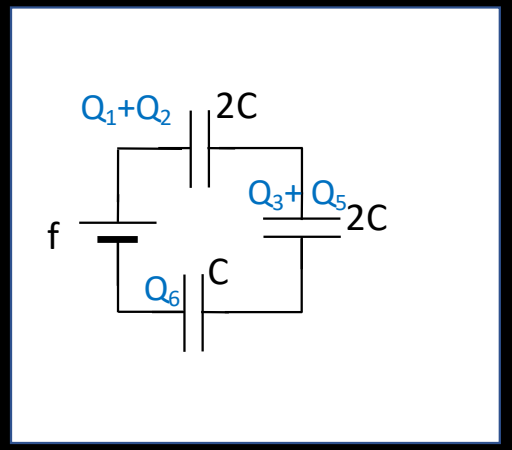
$C_{TOT} = 2C//2C//C = (2C//2C)//C = C//C = C/2$





serie: $Q_3 = Q_4$





serie: $Q_1 + Q_2 = Q_3 + Q_5 = -Q_6$

stessa ΔV: $Q_5 = Q_3$

stessa ΔV: $Q_1 = Q_2$

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ESONERO...

VENERDÌ 23 APRILE ORE 8:30-10:00

correnti lentamente variabili