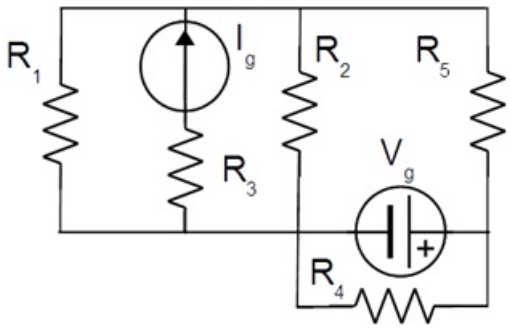
Soluzioni Prova Scritta Elettrotecnica del 20 Luglio 2017 - Compito A

Esercizio n° 1

```
reset();kn:=9;kc:=6
```
9
6



Dato il circuito in figura, determinare lapotenza assorbita dai resistori e

la potenza erogata dai generatori ideali V_g eI_g.

Verificate poi il bilancio energetico.

DATI

V_g= $\boldsymbol{k_N}$[V], I_g= $\boldsymbol{k_C}$ [A], R_1 = 3 [Ω],

R_2= 5 [Ω], R_3=4 [Ω], R_4 = 2[Ω], R_5 =1 [Ω]

```
Vg:=kn:; Ig:=kc:; R1:=3:; R2:=5:; R3:=4:; R4:=2:;R5:=1:;
G1:=1/R1:;G2:=1/R2:;G3:=1/R3:;G4:=1/R4:;G5:=1/R5:;
Ea:=(Vg/R5+Ig)/(1/R5+1/R2+1/R1);
Eb:=-Ig*R3;
```
$\frac{225}{23}$

-24

```
float(Ea);float(Eb)
```
9.782608696

−24.0

```
PR1:=(Ea^2/R1);float(PR1)
```
$\frac{16875}{529}$

31.89981096

```
PR2:=Ea^2/R2;float(PR2)
```

$\frac{10125}{529}$

19.13988658

```
PR3:=(Eb)^2/R3;float(PR3)
```

144

144.0

```
PR4:=(Vg)^2/R4;float(PR4)
```

$\frac{81}{2}$

40.5

```
PR5:=(Ea-Vg)^2/R5;float(PR5)
```

$\frac{324}{529}$

0.6124763705

```
Ptot:=float(expand(PR1+PR2+PR3+PR4+PR5))
```

236.1521739

```
 Vig:=(Ea-Eb); float(Vig)
```

$\frac{777}{23}$

33.7826087

```
PIg:=(Vig*(Ig))
```

$\frac{4662}{23}$

```
IVg:=(Vg-Ea)/R5+Vg/R4;
```

$\frac{171}{46}$

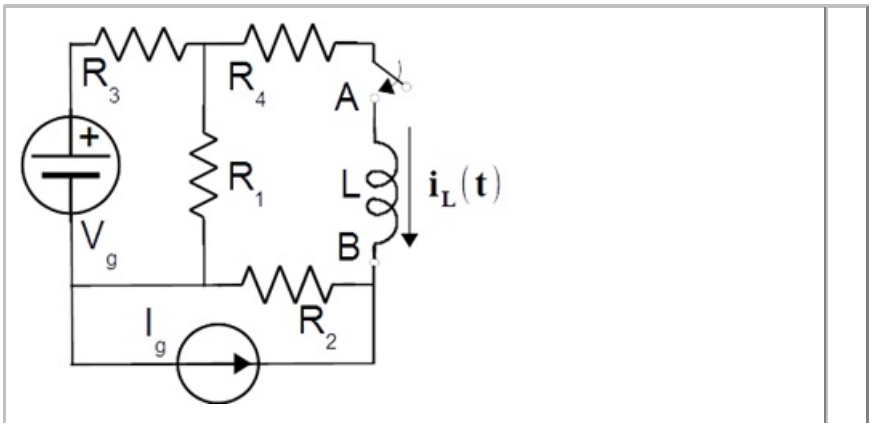
```
PVg:=float(Vg*IVg)
```

33.45652174

```
PtotGen:=float(float(expand(PVg+PIg)))
```

236.1521739

Esercizio n° 2



Nel circuito in figura l'interruttore è statoaperto per molto tempo.

All'istante t=0, l'interruttore viene chiuso. Determinare$i_L(t)$ pert > 0,

sapendo che all'istante t=0 in cui viene connesso l'induttore L

la corrente $i_L(t)$vale $i_L(t=0^-) = 5$[V], Rappresentarne poi su un grafico l'andamento temporale.

DATI

$V_g = k_C$ [V], I_g= 2 [A], R_1 =2[Ω], R_2 = 4[Ω], R_3 =5 [Ω], $R_4 = k_N$ [Ω], L=40 [μH]

```
Vg:=kc:; Ig:=2:; R1:=2:; R2:=4:; R3:=5:; R4:=kn:;
L:=40e-6;I0:=5;
RTh:=R2+(R1*R3)/(R1+R3)+R4;
float(RTh)
```

0.00004

5

$\frac{101}{7}$

14.42857143

```
VGen:=matrix([[Vg],[-Ig*R2]]); MCoeff:=matrix([[R1+R3, -R1],[-R1 ,R1+R2+
```

$\begin{pmatrix} 6 \\ -8 \end{pmatrix}$

$\begin{pmatrix} 7 & -2 \\ -2 & 15 \end{pmatrix}$

```
Correnti:=matrix(1/MCoeff*VGen)
```

$\begin{pmatrix} \frac{74}{101} \\ -\frac{44}{101} \end{pmatrix}$

```
In:=expand(Correnti[2,1]);
```

$-\frac{44}{101}$

```
float(In);VTh:=In*RTh
```

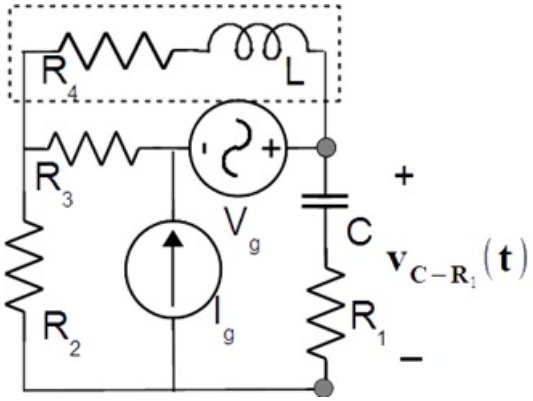
−0.4356435644

$-\frac{44}{7}$

```
tau:=L/RTh
```

0.000002772277228

Esercizio n° 3



Il circuito in figura si trova in regimepermanente sinusoidale.

Determinare: (1) la potenza complessa e la potenza istantanea del bipolo R4-L

racchiuso nel rettangolo tratteggiato erappresentare l'andamento temporale della potenzaistantanea;

(2) la tensione V_C_R1(t) ai capi del bipolo C-R1

DATI:

V_g= *5Cos(wt-36.87°)* [V], I_g= k_C cos(ωt)- k_N sen(ωt) [A], R_1 = 1 [Ω], R_2 = 2 [Ω], R_3 = 2 [Ω],

R_4 = 1 [Ω],C =0.00125[F], L= 10 [mH], ω=200 [rad/s]

```
assume(kn, Type::PosInt):; assume(kc, Type::PosInt):;
Vg:=round(5*(cos(-36.87*PI/180)+I*sin(-36.87*PI/180)));Ig:=kc+I*kn;
R1:=1; R2:=2; R3:=2;R4:=1;L:=0.01;C:=0.00125;w:=200;
ZL:=I*w*L;ZC:=-I/(w*C);
```

$4 - 3\,i$

$6 + 9\,i$

1

2

2

1

0.01

0.00125

200

$$2.0\,i$$

$$-4.0\,i$$

```
VGen:=matrix([[-Vg],[Vg-Ig*(R1+ZC)]]); MCoeff:=matrix([[R3+R4+ZL, -R3],[
```

$$\begin{pmatrix} -4+3\,i \\ -38.0+12.0\,i \end{pmatrix}$$

$$\begin{pmatrix} 3.0+2.0\,i & -2 \\ -2 & 5.0-4.0\,i \end{pmatrix}$$

```
Correnti:=matrix(1/MCoeff*VGen)
```

$$\begin{pmatrix} -4.673972603+2.402739726\,i \\ -7.41369863-2.569863014\,i \end{pmatrix}$$

```
IA:=Correnti[1,1];float(IA)
```

$$-4.673972603+2.402739726\,i$$

$$-4.673972603+2.402739726\,i$$

```
IB:=Correnti[2,1];float(IB)
```

$$-7.41369863-2.569863014\,i$$

$$-7.41369863-2.569863014\,i$$

```
IC:=IB+Ig;float(IC)
```

$$-1.41369863+6.430136986\,i$$

$$-1.41369863+6.430136986\,i$$

```
S_R4_L:=1/2*abs(IA)^2*(R4+ZL);
V_R4_L:=IA*(R4+ZL);
v_R4_L:=abs(V_R4_L)*cos(w*t+arg(IA));
p_R4_L:=Re(S_R4_L)+Re(S_R4_L)*cos(2*w*t+2*arg(IA))-Im(S_R4_L)*sin(2*w*t+
```

$$13.80958904+27.61917808\,i$$

$$-9.479452055-6.945205479\,i$$

$$11.75142078\cos(200\,t+2.666754092)$$

$$13.80958904\cos(400\,t+5.333508184)-27.61917808\sin(400\,t+5.333508184)+13.80958904$$

```
S_R1_C:=1/2*abs(IC)^2*(R1+ZC);
V_R1_C:=IC*(R1+ZC);
v_R1_C:=abs(V_R1_C)*cos(w*t+arg(IC));
p_R1_C:=Re(S_R1_C)+Re(S_R1_C)*cos(2*w*t+2*arg(IC))-Im(S_R1_C)*sin(2*w*t+
```

$$21.67260274-86.69041096\,i$$

$$24.30684932+12.08493151\,i$$

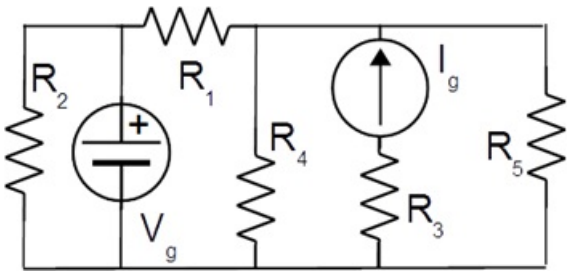
$$27.14532175\cos(200\,t+1.78720845)$$

$$21.67260274\cos(400\,t+3.574416899)+86.69041096\sin(400\,t+3.574416899)+21.67260274$$

Soluzioni Prova Scritta Elettrotecnica del 20 LUGLIO 2017 - Compito_B

Esercizio n° 1

Esercizio n° 1



Dato il circuito in figura, determinare la potenza assorbita dai resistori

e la potenza erogata dai generatori ideali V_g e I_g.

Verificate poi il bilancio energetico.

DATI

$V_g = \boldsymbol{k_N}$ [V], $I_g = \boldsymbol{k_C}$ [A], $R_1 = 1$ [Ω], $R_2 = 2$ [Ω], $R_3 = 4$ [Ω], $R_4 = 5$ [Ω], $R_5 = 3$ [Ω]

```
Vg:=kn:; Ig:=kc:; R1:=1:; R2:=2:; R3:=4:; R4:=5:;R5:=3:;G1:=1/R1:;
G2:=1/R2:;G3:=1/R3:;G4:=1/R4:;G5:=1/R5:;
Ea:=(Vg/R1+Ig)/(1/R5+1/R4+1/R1);Eb:=-Ig*R3;
```

$$\frac{225}{23}$$

$$-24$$

```
float(Ea);float(Eb)
```

$$9.782608696$$

$$-24.0$$

```
PR1:=((Ea-Vg)^2/R1);float(PR1)
```

$$\frac{324}{529}$$

$$0.6124763705$$

```
PR2:=Vg^2/R2;float(PR2)
```

$$\frac{81}{2}$$

$$40.5$$

```
PR3:=(Eb)^2/R3;float(PR3)
```

144

144.0

```
PR4:=(Ea)^2/R4;float(PR4)
```

$\frac{10125}{529}$

19.13988658

```
PR5:=(Ea)^2/R5;float(PR5)
```

$\frac{16875}{529}$

31.89981096

```
Ptot:=float(expand(PR1+PR2+PR3+PR4+PR5))
```

236.1521739

```
 Vig:=(Ea-Eb);  float(Vig)
```

$\frac{777}{23}$

33.7826087

```
PIg:=(Vig*(Ig))
```

$\frac{4662}{23}$

```
IVg:=(Vg-Ea)/R1+Vg/R2;
```

$\frac{171}{46}$

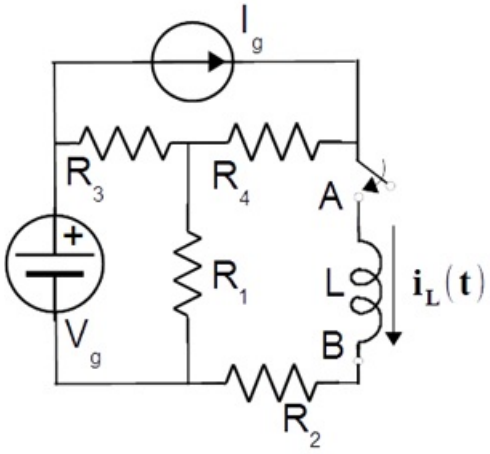
```
PVg:=float(Vg*IVg)
```

33.45652174

```
PtotGen:=float(float(expand(PVg+PIg)))
```

236.1521739

Esercizio n° 2



Nel circuito in figura l'interruttore è statoaperto per molto tempo. All'istante t=0, l'interruttore viene chiuso.

Determinare $i_L(t)$ pert > 0, sapendo che all'istante t=0 in cui viene connesso l'induttore L lacorrente $i_L(t)$ vale $i_L(t=0^-)$ = 10[V],

Rappresentarne poi su un grafico l'andamento temporale.

DATI

$V_g = k_N$ [V], I_g= 2 [A], R_1 =2[Ω], R_2 = 4[Ω], R_3 =5 [Ω], $R_4 = k_C$ [Ω], L=50 [μH]

```
Vg:=kn:; Ig:=2:; R1:=2:; R2:=4:; R3:=5:; R4:=kc:; L:=50e-6;I0:=10;
RTh:=R2+(R1*R3)/(R1+R3)+R4;float(RTh)
```

0.00005

10

$\frac{80}{7}$

11.42857143

```
VGen:=matrix([[Vg+Ig*R3],[Ig*R4]]); MCoeff:=matrix([[R1+R3, -R1],[-R1 ,R
```

$\begin{pmatrix} 19 \\ 12 \end{pmatrix}$

$\begin{pmatrix} 7 & -2 \\ -2 & 12 \end{pmatrix}$

```
Correnti:=matrix(1/MCoeff*VGen)
```

$\begin{pmatrix} \frac{63}{20} \\ \frac{61}{40} \end{pmatrix}$

```
In:=expand(Correnti[2,1]);
```

$\frac{61}{40}$

```
float(In);VTh:=float(In*RTh)
```

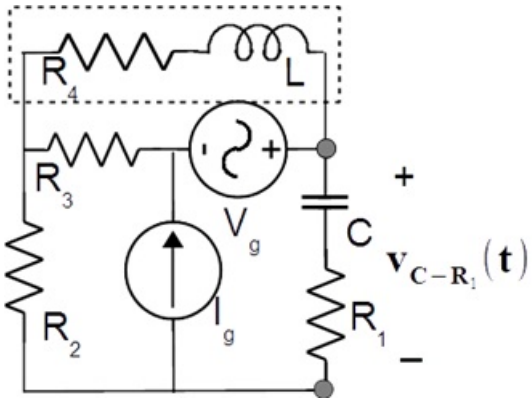
1.525

17.42857143

```
tau:=L/RTh
```

0.000004375

Esercizio n° 3



Il circuito in figura si trova in regimepermanente sinusoidale.

Determinare: (1) la potenza complessa e la potenza istantanea del bipolo R4-L racchiuso

nel rettangolo tratteggiato e rappresentare l'andamento temporale della potenzaistantanea;

(2) la tensione $V_{C\text{-}R1}(t)$ ai capi del bipolo C-R1

DATI:

V_g= *5Cos(wt+36.87°)* [V], I_g= ***kn*** cos(ωt)+ $\boldsymbol{k_c}$ sen(ωt) [A], R_1 = 1 [Ω], R_2 = 2 [Ω], R_3 = 2 [Ω],

R_4 = 1 [Ω],C =0.00125[F], L= 10 [mH], ω=400 [rad/s]

```
assume(kn, Type::PosInt):; assume(kc, Type::PosInt):; Vg:=round(5*(cos(3
ZL:=I*w*L;ZC:=-I/(w*C);
```

$4 + 3\,i$

$9 - 6\,i$

1

2

2

1

0.01

0.00125

400

$4.0\,i$

$-2.0\,i$

```
VGen:=matrix([[-Vg],[Vg-Ig*(R1+ZC)]]); MCoeff:=matrix([[R3+R4+ZL, -R3],[
```

$$\begin{pmatrix} -4-3\,i \\ 7.0+27.0\,i \end{pmatrix}$$

$$\begin{pmatrix} 3.0+4.0\,i & -2 \\ -2 & 5.0-2.0\,i \end{pmatrix}$$

```
Correnti:=matrix(1/MCoeff*VGen)
```

$$\begin{pmatrix} 0.7719928187+1.904847397\,i \\ -0.6517055655+5.901256732\,i \end{pmatrix}$$

```
IA:=Correnti[1,1];float(IA)
```

$$0.7719928187+1.904847397\,i$$

$$0.7719928187+1.904847397\,i$$

```
IB:=Correnti[2,1];float(IB)
```

$$-0.6517055655+5.901256732\,i$$

$$-0.6517055655+5.901256732\,i$$

```
IC:=IB+Ig;float(IC)
```

$$8.348294434-0.0987432675\,i$$

$$8.348294434-0.0987432675\,i$$

```
S_R4_L:=1/2*abs(IA)^2*(R4+ZL);
V_R4_L:=IA*(R4+ZL);
v_R4_L:=abs(V_R4_L)*cos(w*t+arg(IA));
p_R4_L:=Re(S_R4_L)+Re(S_R4_L)*cos(2*w*t+2*arg(IA))-Im(S_R4_L)*sin(2*w*t+
```

$$2.112208259+8.448833034\,i$$

$$-6.847396768+4.992818671\,i$$

$$8.4743779\cos(400\,t+1.185748213)$$

$$2.112208259\cos(800\,t+2.371496426)-8.448833034\sin(800\,t+2.371496426)+2.112208259$$

```
S_R1_C:=1/2*abs(IC)^2*(R1+ZC);
V_R1_C:=IC*(R1+ZC);
v_R1_C:=abs(V_R1_C)*cos(w*t+arg(IC));
p_R1_C:=Re(S_R1_C)+Re(S_R1_C)*cos(2*w*t+2*arg(IC))-Im(S_R1_C)*sin(2*w*t+
```

$$34.8518851-69.7037702\,i$$

$$8.150807899-16.79533214\,i$$

$$18.66865959\cos(400\,t-0.01182740546)$$

$$34.8518851\cos(800\,t-0.02365481091)+69.7037702\sin(800\,t-0.02365481091)+34.8518851$$