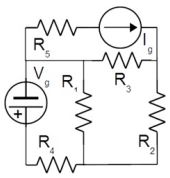
Soluzioni Prova Scritta Elettrotecnica del 6 Luglio 2017 - Compito A

Esercizio n° 1

```
reset();kn:=5;kc:=5
5
5
```



Dato il circuito in figura, determinare lapotenza assorbita dai resistori e la potenza erogata dai generatori ideali V_g el$_{g.}$ Verificate poi il bilancio energetico.

DATI

V_1= k_N [V], I_1= k_C [A], R_1 = 1 [Ω], R_2= 2 [Ω], R_3 = 3 [Ω], R_4 = 4 [Ω], R_5 = 5 [Ω]

```
Vg:=kn:; Ig:=kc:; R1:=1:; R2:=2:; R3:=3:; R4:=4:;R5:=5:;G1:=1/R1:;G2:=1/R2:;G3:=1/R3:;G4:=1/R4:;G5:=1/R5:;
VGen:=matrix([[-Vg],[Ig*R3]]):; MCoeff:=matrix([[R1+R4, -R1],[-R1 ,R1+R2+R3]]):;
```

```
MCoeff;VGen;
```

$$\begin{pmatrix} 5 & -1 \\ -1 & 6 \end{pmatrix}$$

$$\begin{pmatrix} -5 \\ 15 \end{pmatrix}$$

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

$$\begin{pmatrix} -\frac{15}{29} \\ \frac{70}{29} \end{pmatrix}$$

```
IA:=Ig:;IB:=Correnti[1,1]
```

$$-\frac{15}{29}$$

```
IC:=Correnti[2,1]
```

$$\frac{70}{29}$$

```
float(IA);float(IB);float(IC)
```

5.0

−0.5172413793

2.413793103

```
PR1:=((IB-IC)^2*R1);PR1f:=float((IB-IC)^2*R1)
```

$$\frac{7225}{841}$$

8.590963139

```
PR2:=IC^2*R2;float(PR2)
```

$$\frac{9800}{841}$$

11.65279429

```
PR3:=(IA-IC)^2*R3;float(PR3)
```

$$\frac{16875}{841}$$

20.06539834

```
PR4:=(IB)^2*R4;float(PR4)
```

$$\frac{900}{841}$$

1.070154578

```
PR5:=(IA)^2*R5;float(PR5)
```

125

125.0

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

166.3793103

```
Vig:=(IA-IC)*R3+IA*R5; float(Vig)
```

$$\frac{950}{29}$$

32.75862069

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

$$\frac{4750}{29}$$

```
IVg:=-IB
```

$$\frac{15}{29}$$

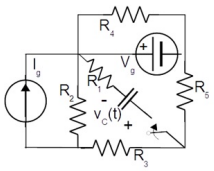
```
PVg:=float(Vg*IVg)
```

2.586206897

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

166.3793103

Esercizio n° 2



Nel circuito in figura l'interruttore è stato aperto per molto tempo. All'istante t=0, l'interruttore viene chiuso. Determinare $\mathbf{v_C(}t\mathbf{)}$ per t > 0, sapendo che all'istante t=0 in cui viene connesso il condensatore C la tensione $\mathbf{v_C(}t\mathbf{=0^-)}$ = ***5*** [V], Rappresentarne poi su un grafico l'andamento temporale.

DATI

V_g = k_N [V], I_g= 2 [A], R_1 =1[Ω], R_2 = 4[Ω], R_3 =2 [Ω], R_4 = 2 [Ω], R_5 =k_C [Ω], C=20 [nF]

```
Vg:=kn:; Ig:=2:; R1:=1:; R2:=4:; R3:=2:; R4:=2:;R5:=kc:; C:=20e-9;
RTh:=R1+((R2+R3)*R5)/(R2+R3+R5);float(RTh)
```

0.00000002

$$\frac{41}{11}$$

3.727272727

```
VTh:=expand(-Vg*(R2+R3)/(R2+R3+R5)-Ig*R2*R5/(R2+R3+R5));float(VTh)
```

$$-\frac{70}{11}$$

−6.363636364

```
IGen:=matrix([[-Ig+Vg/R2],[0]]); MCoeffTh:=matrix([[1/R2+1/R3, -1/R3],[-1/R3 ,1/R5+1/R3]]);
```

$$\begin{pmatrix} -\frac{3}{4} \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} \frac{3}{4} & -\frac{1}{2} \\ -\frac{1}{2} & \frac{7}{10} \end{pmatrix}$$

```
Nodi:=matrix(1/MCoeffTh*IGen)
```

$$\begin{pmatrix} -\frac{21}{11} \\ -\frac{15}{11} \end{pmatrix}$$

```
VTh2:=expand(Nodi[2,1]-Vg);
```

$$-\frac{70}{11}$$

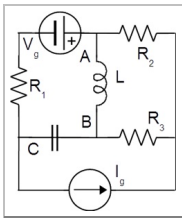
```
simplify(VTh-VTh2);
```

0

```
tau:=RTh*C
```

0.00000007454545455

Esercizio n° 3



Il circuito in figura si trova in regimepermanente sinusoidale.

Determinare: (1) la potenza complessa e la potenza istantanea generata dal generatoredi corrente Ig e rappresentare l'andamento temporale della potenza istantanea;(2) il fattore di potenza del generatore di tensione Vg e la sua potenzaapparente

DATI:V_g= 2cos(ωt)+ k_N sen(ωt) [V], I_g=- k_C cos(ωt)-sen(ωt) [A], R_1 = 2 [Ω], R_2 = 1 [Ω], R_3= 2 [Ω], C =0.0025[F], L= 20[mH], ω=100 [rad/s]

```
assume(kn, Type::PosInt):; assume(kc, Type::PosInt):; Vg:=2-I*kn;Ig:=-kc+I; R1:=2; R2:=1; R3:=2;L:=0.02;C:=0.0025;w:=100;ZL:=I*w*L;ZC:=-I/(w*C);IC:=-Ig;
```

2 – 5 i

– 5 + i

2

1

2

0.02

0.0025

100

2.0 i

– 4.0 i

5 – i

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

$$\begin{pmatrix} -2.0 - 25.0\,i \\ 10 - 2\,i \end{pmatrix}$$

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

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

$$\begin{pmatrix} 3.95 - 3.65\,i \\ 4.9 - 1.3\,i \end{pmatrix}$$

```
IA:=Correnti[1,1];
```

3.95 – 3.65 i

```
IB:=Correnti[2,1]
```

4.9 – 1.3 i

```
VIg:=float((IB-IC)*R3+(IA-IC)*ZC)
```

– 10.8 + 3.6 i

```
SIg:=1/2*VIg*conjugate(Ig)
```

28.8 – 3.6 i

```
SVg:=1/2*Vg*conjugate(IA)
```

13.075 – 6.225 i

```
PVg:=Re(SVg);Papp:=1/2*sqrt(Re(SVg)^2+Im(SVg)^2);
```

13.075

7.240618931

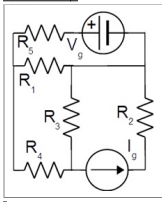
```
FattP:=Pvg/Papp
```

0.1381097403 Pvg

COMPITO B

Soluzioni Prova Scritta Elettrotecnica del 6 LUGLIO 2017 - Compito B

Esercizio n° 1



Dato il circuito in figura, determinare lapotenza assorbita dai resistori e la potenza erogata dai generatori ideali V_g el$_g$. Verificate poi il bilancio energetico.

DATI

V_1= k_N [V], I_1= k_C [A], R_1 = 5 [Ω], R_2= 4 [Ω], R_3 = 3 [Ω], R_4 = 2 [Ω], R_5 = 1 [Ω]

```
Vg:=kn:; Ig:=kc:; R1:=5:; R2:=4:; R3:=3:; R4:=2:;R5:=1:;G1:=1/R1:;G2:=1/R2:;G3:=1/R3:;G4:=1/R4:;G5:=1/R5:;
VGen:=matrix([[-Vg],[-Ig*R3]]):; MCoeff:=matrix([[R1+R5, -R1],[-R1 ,R1+R4+R3]]):;
```

```
MCoeff;VGen;
```

$$\begin{pmatrix} 6 & -5 \\ -5 & 10 \end{pmatrix}$$

$$\begin{pmatrix} -5 \\ -15 \end{pmatrix}$$

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

$$\begin{pmatrix} -\frac{25}{7} \\ -\frac{23}{7} \end{pmatrix}$$

```
IC:=-Ig:;IA:=Correnti[1,1]
```

$$-\frac{25}{7}$$

```
IB:=Correnti[2,1]
```
$-\frac{23}{7}$

```
float(IA);float(IB);float(IC)
```
-3.571428571

-3.285714286

-5.0

```
PR1:=((IB-IA)^2*R1);PR1f:=float(PR1)
```
$\frac{20}{49}$

0.4081632653

```
PR2:=IC^2*R2;float(PR2)
```
100

100.0

```
PR3:=(IB-IC)^2*R3;float(PR3)
```
$\frac{432}{49}$

8.816326531

```
PR4:=(IB)^2*R4;float(PR4)
```
$\frac{1058}{49}$

21.59183673

```
PR5:=(IA)^2*R5;float(PR5)
```
$\frac{625}{49}$

12.75510204

```
Ptot:=float(expand(PR1+PR2+PR3+PR4+PR5))
```
143.5714286

```
Vig:=(IB-IC)*R3-IC*R2; float(Vig)
```
$\frac{176}{7}$

25.14285714

```
PIg:=(Vig*(Ig));float(PIg)
```
$\frac{880}{7}$

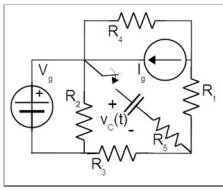
125.7142857

```
IVg:=-IA
```
$\frac{25}{7}$

```
PVg:=float(Vg*IVg)
```
17.85714286

```
PtotGen:=float(float(expand(PVg+PIg)))
```
143.5714286

Esercizio n° 2



Nel circuito in figura l'interruttore è stato aperto per molto tempo. All'istante t=0, l'interruttore viene chiuso. Determinare $\mathbf{v_C(}t\mathbf{)}$ per t > 0, sapendo che all'istante t=0 in cui viene connesso il condensatore C la tensione $\mathbf{v_C(}t\mathbf{)}$ vale $\mathbf{v_C(}t\mathbf{=0^-)} = \mathbf{5}$ [V], Rappresentarne poi su un grafico l'andamento temporale.

DATI

$V_g = \boldsymbol{k_N}$[V], I_g= 1[A], R_1 =2[Ω], R_2= 4[Ω], R_3=5 [Ω], R_4= 4 [Ω], R_5 =$\boldsymbol{k_C}$ [Ω], C=50 [nF]

```
Vg:=kn:; Ig:=1:; R1:=2:; R2:=4:; R3:=5:; R4:=4:;R5:=kc:; C:=50e-9;
RTh:=R5+((R1+R4)*R3)/(R1+R3+R4); float(RTh)
```
0.00000005

$\frac{85}{11}$

7.727272727

```
VTh:=expand(Vg*(R1+R4)/(R1+R3+R4)+Ig*R3*R4/(R1+R3+R4));float(VTh)
```
$\frac{50}{11}$

4.545454545

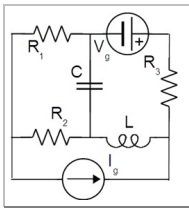
```
IGen:=matrix([[0],[-Ig+Vg/R4]]):; MCoeffTh:=matrix([[1/R1+1/R3, -1/R1],[-1/R1 ,1/R1+1/R4]]):;
Nodi:=matrix(1/MCoeffTh*IGen)
```
$\begin{pmatrix} \frac{5}{11} \\ \frac{2}{11} \end{pmatrix}$

```
VTh2:=expand(Vg-Nodi[1,1]);
```
$\frac{50}{11}$

```
simplify(VTh-VTh2);
```
0

```
tau:=RTh*C
```
0.0000003863636364

Esercizio n° 3



Il circuito in figura si trova in regimepermanente sinusoidale.

Determinare: (1) la potenza complessa e la potenza istantanea generata dal generatoredi corrente Ig e rappresentare l'andamento temporale della potenza istantanea;(2) il fattore di potenza del generatore di tensione Vg e la sua potenzaapparente

$V_g = \boldsymbol{k_N}\cos(\omega t) + 2\,\mathrm{sen}(\omega t)$ [V], $I_g = -\cos(\omega t) - \boldsymbol{k_C}\,\mathrm{sen}(\omega t)$ [A], R_1 = 2 [Ω], R_2 = 1 [Ω], R_3 = 2 [Ω], C =0.0025[F], L= 20[mH], ω=200 [rad/s]

```
assume(kn, Type::PosInt):; assume(kc, Type::PosInt):; Vg:=kn-I*2;Ig:=-1+I*kc; R1:=2; R2:=1; R3:=2;L:=0.02;C:=0.0025;w:=200;ZL:=I*w*L;ZC:=-I/(w*C);
```
$5 - 2\,i$

$-1+5\,i$

2

1

2

0.02

0.0025

200

$4.0\,i$

$-2.0\,i$

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

$1-5\,i$

$$\begin{pmatrix} 1-5\,i \\ 25.0+2.0\,i \end{pmatrix}$$

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

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

$$\begin{pmatrix} 0.54-4.22\,i \\ 4.37-3.91\,i \end{pmatrix}$$

```
IA:=Correnti[1,1];
```

$0.54-4.22\,i$

```
IB:=Correnti[2,1]
```

$4.37-3.91\,i$

```
VIg:=float((IB-IC)*ZL+(IA-IC)*R2)
```

$-4.82+14.26\,i$

```
SIg:=1/2*VIg*conjugate(Ig);float(arg(SIg)*180/PI);abs(SIg)
```

$38.06+4.92\,i$

7.365753502

38.37668563

```
SVg:=1/2*Vg*conjugate(IB)
```

$14.835+5.405\,i$

```
PVg:=Re(SVg);Papp:=1/2*sqrt(Re(SVg)^2+Im(SVg)^2);
```

14.835

7.894479875

```
FattP:=Pvg/Papp
```

0.1266707897 Pvg