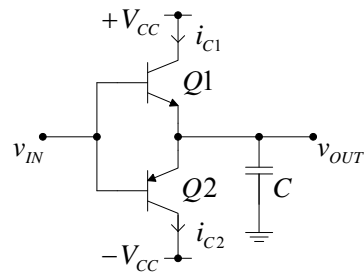


2. Na slici 2 je prikazan pojačavač snage kod koga je  $V_{CC} = 10 \text{ V}$ ,  $C = 20 \mu\text{F}$ , tranzistori su sa  $|V_{BE}| = 0.7 \text{ V}$  i  $\beta_F \rightarrow \infty$ , izlazni napon je  $v_{OUT} = 5 \text{ V} \sin(1 \text{ (krad/s)}t)$ .

- [6] Nacrtati vremenske dijagrame  $i_{C1}$  i  $i_{C2}$  i dijagrame  $i_{C1}(v_{CE1})$  i  $i_{C2}(v_{CE2})$ .
- [2] Nacrtati vremenski dijagram ulaznog napona  $v_{IN}$  ne zanemarujući crossover izobličenje.
- [2] Nacrtati vremenski dijagram trenutne snage koju izvori za napajanje ulažu u kolo.
- [2] Odrediti srednju snagu koju izvori za napajanje daju kolu.
- [6] Odrediti maksimalnu trenutnu snagu i srednju snagu disipacije na tranzistoru Q1.
- [2] Dodavanjem jednog operacionog pojačavača i dva otpornika sa  $R = 10 \text{ k}\Omega$  modifikovati pojačavač sa slike 2 tako da se dobije pojačanje  $A = 2$  i izbegne crossover izobličenje. Nacrtati šemu.



Slika 2

Rešenje:

Savremen pristup:

```

npoint=720;
i=1:npoint;
wt=2*pi*(i-0.5)/npoint;
deg=wt*180/pi;
s=sin(wt);
c=cos(wt);
q1=c>0;
q2=c<0;

```

```

Vcc=10;
Vm=5;
Im=0.1;
Vbe=0.7;

```

```

vout=Vm*s;
vce1=Vcc-vout;
vce2=-Vcc-vout;
iout=Im*c;
ic1=iout.*q1;
ic2=-iout.*q2;
vin=vout+Vbe*(q1-q2);

```

```

pcc=Vcc*(ic1+ic2);
Pcc=mean(pcc)

```

```

pd1=vce1.*ic1;
Pdlmax=max(pd1)
Pdl=mean(pd1)

```

```

figure(1)
subplot(3,2,1)

```

```

plot(deg,ic1)
xlabel('wt [deg]')
ylabel('i_C_1 [A]')
axis([0 360 -0.05 0.15])
set(gca,'xtick',[0 60 120 180 240 300 360])
subplot(3,2,2)
plot(deg,ic2)
xlabel('wt [deg]')
ylabel('i_C_2 [A]')
axis([0 360 -0.05 0.15])
set(gca,'xtick',[0 60 120 180 240 300 360])
subplot(3,2,3)
plot(deg,vce1)
xlabel('wt [deg]')
ylabel('v_C_E_1 [V]')
axis([0 360 0 20])
set(gca,'xtick',[0 60 120 180 240 300 360])
subplot(3,2,4)
plot(deg,vce2)
xlabel('wt [deg]')
ylabel('v_C_E_2 [V]')
axis([0 360 -20 0])
set(gca,'xtick',[0 60 120 180 240 300 360])
subplot(3,2,5)
plot(vce1,ic1)
xlabel('v_C_E_1 [V]')
ylabel('i_C_1 [A]')
axis([0 20 -0.05 0.15])
subplot(3,2,6)
plot(vce2,ic2)
xlabel('v_C_E_2 [V]')
ylabel('i_C_2 [A]')
axis([-20 0 -0.05 0.15])

```

```

figure(2)
plot(deg,vin)
xlabel('wt [deg]')
ylabel('v_I_N [V]')
axis([0 360 -6 6])
set(gca,'xtick',[0 60 120 180 240 300 360])

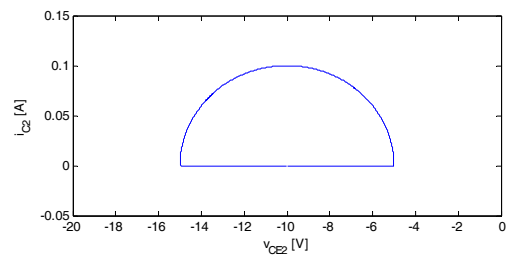
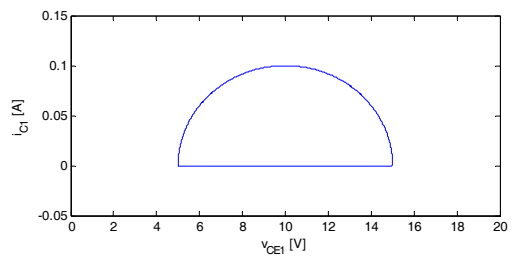
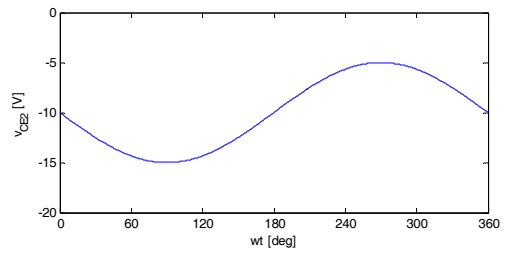
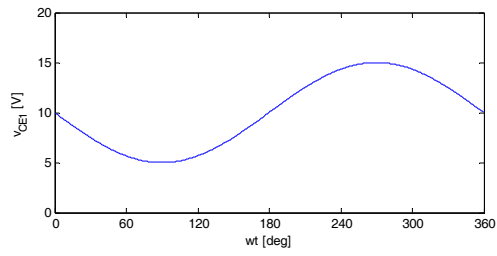
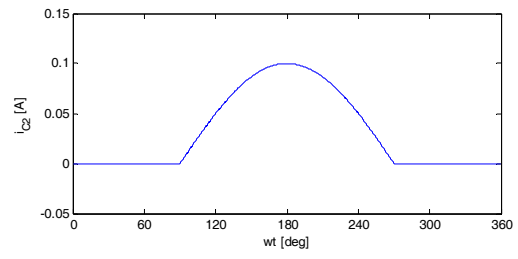
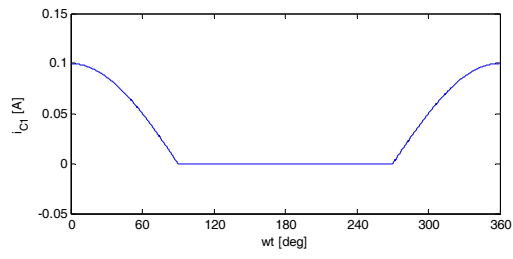
```

```

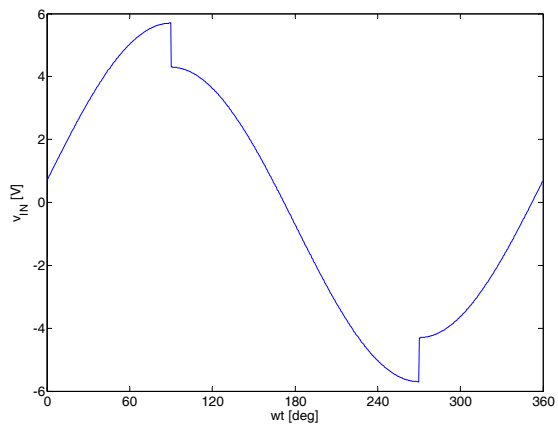
figure(3)
plot(deg,pcc)
xlabel('wt [deg]')
ylabel('p_C_C [W]')
axis([0 360 -0.5 1.5])
set(gca,'xtick',[0 60 120 180 240 300 360])

```

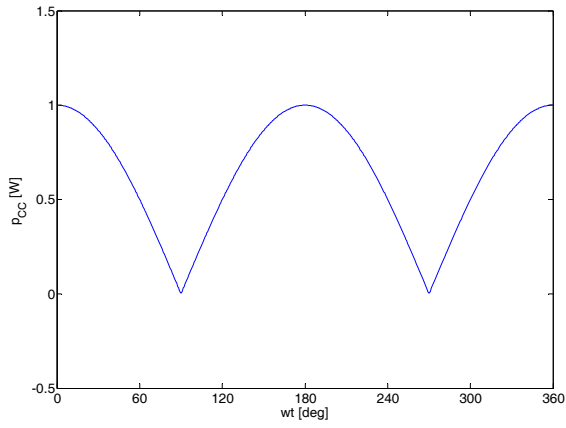
a)



b)



c)



d)

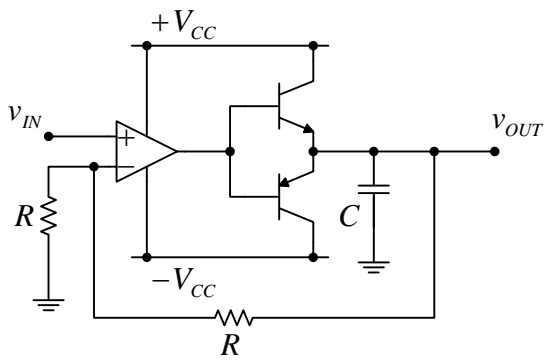
$$P_{cc} = 0.6366 \text{ W}$$

e)

$$P_{d1max} = 1.1009 \text{ W}$$

$$P_{d1} = 0.3183 \text{ W}$$

f)



Klasičan pristup:

a)

$$v_{OUT} = V_m \sin(\omega t) = 5 \text{ V} \sin(\omega t)$$

$$i_{OUT} = \omega C V_m \cos(\omega t) = 0.1 \text{ A} \cos(\omega t)$$

$$i_{C1} = i_{OUT} h(i_{OUT})$$

$$i_{C2} = -i_{OUT} h(-i_{OUT})$$

$$v_{CE1} = V_{CC} - v_{OUT}$$

$$v_{CE2} = -V_{CC} - v_{OUT}$$

b)

$$v_{IN} = v_{OUT} + V_{BE} \operatorname{sgn}(i_{OUT})$$

c)

$$P_{CC} = V_{CC} (i_{C1} + i_{C2})$$

d)

$$P_{CC} = \frac{2}{\pi} V_{CC} \omega C V_m = 0.637 \text{ W}$$

e)

$$p_{D1} = v_{CE1} i_{C1} = 1 \text{ W} \left( \cos(\omega t) - \frac{1}{2} \cos(\omega t) \sin(\omega t) \right)$$

$$\frac{d p_{D1}}{d(\omega t)} = 0 \dots \sin(\omega t) = \frac{1 - \sqrt{3}}{2} \dots \cos(\omega t) = \frac{\sqrt[4]{12}}{2} \dots p_{D1\max} = \frac{1}{8} (\sqrt{2} \sqrt[4]{27} + 3 \sqrt[4]{12}) \approx 1.1 \text{ W}$$

$$P_{D1} = \frac{1}{2} P_{CC} = 0.318 \text{ W}$$

f)

