۱-۱ مدار فیدبک اول

کد:

```
***************part 1 lab 5
***************SOURCES
Vcc   100   0     10
***************AC SOURCES AND RESISTOR
Vs    1     0     ac=1
Vo    9     0     ac=1
Rs    1     2     1K
***************ELEMENTS
R2    100   3     470K
R3    100   4     1K
R4    5     0     470
R5    100   6     470k
R6    100   7     1K
R7    8     0     470
R8    9     5     10K
C1    2     3     1u
C2    4     6     1u
C3    8     0     1u
C4    7     9     1u
***************MODELS
.model      mynpn npn   bf=100      Va=100
Q1    4     3     5     mynpn
Q2    7     6     8     mynpn
***************ANALYSIS
.op
.ac   lin   20    1k    1000k
.print ac gain =par('v(9)/v(1)')
.print ac Rin  =par('v(2)/i(Rs)')
.print ac Ro   =par('v(9)/i(C4)')
.end
```

نتیجه شبیه سازی برای بهره و مقاومت ورودی:

بهره ذکر شده متناسب با فیدبک است.

```
 ***************************************************************
 ******  option summary
 ******
 runlvl  = 3         bypass  = 2
1****** HSPICE -- D-2010.03-SP1 32-BIT (May 26 2010) winnt ******
 ******
 ***************part 1 lab 5


  ******  operating point information tnom=  25.000 temp=  25.000 *****
 ***** operating point status is all       simulation time is     0.
    node    =voltage      node    =voltage      node    =voltage

 +0:1       =   0.      0:2       =   0.      0:3       =   1.6778
 +0:4       =   8.1153  0:5       = 894.1122m 0:6       =   1.6778
 +0:7       =   8.1153  0:8       = 894.1122m 0:9       = 894.1122m
 +0:100     =  10.0000


 ****  voltage sources

 subckt
 element  0:vcc      0:vs
  volts     10.0000     0.
  current   -3.8047m    0.
  power     38.0473m    0.

     total voltage source power dissipation=   38.0473m       watts
```

**** resistors

subckt						
element	0:rs	0:r2	0:r3	0:r4	0:r5	0:r6
r value	1.0000k	470.0000k	1.0000k	470.0000	470.0000k	1.0000k
v drop	0.	8.3222	1.8847	894.1122m	8.3222	1.8847
current	0.	17.7067u	1.8847m	1.9024m	17.7067u	1.8847m
power	0.	147.3581u	3.5519m	1.7009m	147.3581u	3.5519m

subckt		
element	0:r7	0:r8
r value	470.0000	10.0000k
v drop	894.1122m	0.
current	1.9024m	0.
power	1.7009m	0.

**** bipolar junction transistors

subckt		
element	0:q1	0:q2
model	0:mynpn	0:mynpn
ib	17.7067u	17.7067u
ic	1.8847m	1.8847m
vbe	783.7288m	783.7288m
vce	7.2212	7.2212
vbc	-6.4375	-6.4375
vs	-8.1153	-8.1153
power	13.6234m	13.6234m
betad	106.4375	106.4375
gm	73.3386m	73.3386m
rpi	1.4510k	1.4510k
rx	0.	0.

ro	56.4757k	56.4757k
cpi	0.	0.
cmu	0.	0.
cbx	0.	0.
ccs	0.	0.
betaac	106.4118	106.4118
ft	1.167e+13	1.167e+13

******

**********part 1 lab 5

****** ac analysis tnom= 25.000 temp= 25.000 *****

x

freq	gain
1.00000k	8.9070
53.57895k	17.4554
106.15789k	17.4626
158.73684k	17.4639
211.31579k	17.4644
263.89474k	17.4646
316.47368k	17.4648
369.05263k	17.4648
421.63158k	17.4649
474.21053k	17.4649
526.78947k	17.4649
579.36842k	17.4650
631.94737k	17.4650
684.52632k	17.4650
737.10526k	17.4650
789.68421k	17.4650
842.26316k	17.4650
894.84211k	17.4650

```
  947.42105k     17.4650
    1.00000x     17.4650
y
x

        freq        rin

    1.00000k     56.8975k
   53.57895k    151.4290k
  106.15789k    151.9350k
  158.73684k    152.0313k
  211.31579k    152.0652k
  263.89474k    152.0810k
  316.47368k    152.0897k
  369.05263k    152.0949k
  421.63158k    152.0982k
  474.21053k    152.1006k
  526.78947k    152.1022k
  579.36842k    152.1034k
  631.94737k    152.1044k
  684.52632k    152.1051k
  737.10526k    152.1057k
  789.68421k    152.1061k
  842.26316k    152.1065k
  894.84211k    152.1068k
  947.42105k    152.1071k
    1.00000x    152.1073k
y

          ***** job concluded
```

نتیجه شبیه سازی برای مقاومت خروجی:

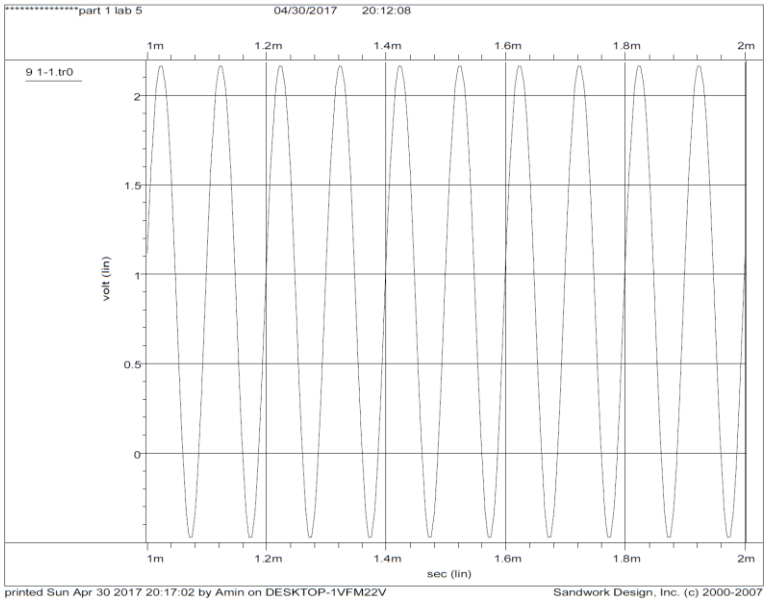
```
 ****************************************************************
 ******  option summary
 ******
```

```
 runlvl  = 3         bypass  = 2
1****** HSPICE -- D-2010.03-SP1 32-BIT (May 26 2010) winnt ******
 ******
 ***************part 1 lab 5


  ******  operating point information tnom=  25.000 temp=  25.000 *****
 ***** operating point status is all       simulation time is     0.
    node    =voltage      node    =voltage      node    =voltage

 +0:1       =   0.      0:2       =   0.      0:3       =   1.6417
 +0:4       =   8.1067  0:5       = 857.8990m 0:6       =   1.6778
 +0:7       =   8.1153  0:8       = 894.1122m 0:9       =   0.
 +0:100     =  10.0000



 ****  voltage sources

 subckt
 element  0:vcc      0:vs       0:vo
  volts     10.0000     0.          0.
  current   -3.8135m    0.         85.7899u
  power     38.1347m    0.          0.

     total voltage source power dissipation=   38.1347m       watts



 **** resistors

 subckt
 element  0:rs       0:r2       0:r3       0:r4       0:r5       0:r6
  r value    1.0000k  470.0000k    1.0000k  470.0000   470.0000k    1.0000k
  v drop     0.          8.3583     1.8933   857.8990m    8.3222     1.8847
  current    0.         17.7835u    1.8933m    1.8253m   17.7067u    1.8847m
  power      0.        148.6394u    3.5847m    1.5659m  147.3581u    3.5519m
```

```
subckt
element  0:r7       0:r8
 r value  470.0000    10.0000k
 v drop   894.1122m -857.8990m
 current    1.9024m  -85.7899u
 power      1.7009m   73.5991u


**** bipolar junction transistors


subckt
element  0:q1       0:q2
model    0:mynpn    0:mynpn
 ib        17.7835u   17.7067u
 ic         1.8933m    1.8847m
 vbe      783.8401m  783.7288m
 vce        7.2488     7.2212
 vbc       -6.4649    -6.4375
 vs        -8.1067    -8.1153
 power     13.7382m   13.6234m
 betad    106.4649   106.4375
 gm        73.6758m   73.3386m
 rpi        1.4447k    1.4510k
 rx         0.         0.
 ro        56.2318k   56.4757k
 cpi        0.         0.
 cmu        0.         0.
 cbx        0.         0.
 ccs        0.         0.
 betaac   106.4392   106.4118
 ft       1.172e+13  1.167e+13
```

```
 ******
 ***************part 1 lab 5


  ******  ac analysis tnom=  25.000 temp=  25.000 *****
x

        freq        ro

    1.00000k    744.9574
   53.57895k    197.6757
  106.15789k    196.3701
  158.73684k    196.1223
  211.31579k    196.0348
  263.89474k    195.9942
  316.47368k    195.9720
  369.05263k    195.9586
  421.63158k    195.9499
  474.21053k    195.9440
  526.78947k    195.9397
  579.36842k    195.9365
  631.94737k    195.9341
  684.52632k    195.9323
  737.10526k    195.9308
  789.68421k    195.9296
  842.26316k    195.9286
  894.84211k    195.9278
  947.42105k    195.9271
    1.00000x    195.9265
y

          ***** job concluded
```

تغییرات ولتاژ خروجی:



۱-۲ مدار فیدبک دوم

کد:

```
***************part 2 lab 5
***************SOURCES
Vcc     100     0       10
***************AC SOURCES AND RESISTOR
Vs      1       0       ac=1    *sin    0       80m     10k
Vo      9       0       ac=1
R1      1       2       1K
***************ELEMENTS
R2      100     3       470K
R3      100     4       1K
R4      5       0       470
R5      100     6       470k
R6      100     7       1K
R7      8       0       470
R8      10      8       10K
C1      2       3       10u
C2      4       6       10u
C3      5       0       10u
C4      3       10      10u
C5      7       9       10u
```

```
***************MODELS
.model mynpn  npn    bf=100 Va=100
Q1     4      3      5      mynpn
Q2     7      6      8      mynpn
***************ANALYSIS
.op
.tran  0.01u  2m     start=1ms
.ac    lin    20     1k     1000k
.print ac gain =par('i(R6)/i(R1)')
.print ac Rin  =par('v(2)/i(R1)')
.print ac Ro   =par('v(9)/i(C5)')
.end
```

نتیجه شبیه سازی برای بهره و مقاومت ورودی:

بهره ذکر شده متناسب با فیدبک است.

```
*****************************************************************
 ******  option summary
 ******
 runlvl  = 3         bypass  = 2
1****** HSPICE -- D-2010.03-SP1 32-BIT (May 26 2010) winnt ******
 ******
 ***************part 2 lab 5

  ******  operating point information tnom=  25.000 temp=  25.000 *****
 ***** operating point status is all       simulation time is     0.
    node    =voltage      node    =voltage      node    =voltage

 +0:1       =   0.      0:2       =   0.      0:3       =   1.6778
 +0:4       =   8.1153  0:5       = 894.1122m 0:6       =   1.6778
 +0:7       =   8.1153  0:8       = 894.1122m 0:9       =   0.
 +0:10      = 894.1122m 0:100     =  10.0000


 ****  voltage sources

 subckt
```

```
element  0:vcc      0:vs
 volts     10.0000     0.
 current   -3.8047m    0.
 power     38.0473m    0.

    total voltage source power dissipation=   38.0473m       watts



**** resistors

subckt
element  0:r1       0:r2       0:r3       0:r4       0:r5       0:r6
 r value    1.0000k  470.0000k    1.0000k  470.0000   470.0000k    1.0000k
 v drop     0.          8.3222     1.8847   894.1122m    8.3222     1.8847
 current    0.         17.7067u    1.8847m    1.9024m   17.7067u    1.8847m
 power      0.        147.3581u    3.5519m    1.7009m  147.3581u    3.5519m

subckt
element  0:r7       0:r8
 r value  470.0000    10.0000k
 v drop   894.1122m    0.
 current    1.9024m    0.
 power      1.7009m    0.


**** bipolar junction transistors


subckt
element  0:q1       0:q2
model    0:mynpn    0:mynpn
 ib         17.7067u   17.7067u
 ic          1.8847m    1.8847m
 vbe      783.7288m  783.7288m
 vce         7.2212     7.2212
 vbc        -6.4375    -6.4375
```

vs	-8.1153	-8.1153
power	13.6234m	13.6234m
betad	106.4375	106.4375
gm	73.3386m	73.3386m
rpi	1.4510k	1.4510k
rx	0.	0.
ro	56.4757k	56.4757k
cpi	0.	0.
cmu	0.	0.
cbx	0.	0.
ccs	0.	0.
betaac	106.4118	106.4118
ft	1.167e+13	1.167e+13

******

**********part 2 lab 5

****** ac analysis tnom= 25.000 temp= 25.000 *****

x

freq	gain
1.00000k	19.7761
53.57895k	19.7882
106.15789k	19.7882
158.73684k	19.7882
211.31579k	19.7882
263.89474k	19.7882
316.47368k	19.7882
369.05263k	19.7882
421.63158k	19.7882
474.21053k	19.7882
526.78947k	19.7882
579.36842k	19.7882
631.94737k	19.7882

684.52632k	19.7882
737.10526k	19.7882
789.68421k	19.7882
842.26316k	19.7882
894.84211k	19.7882
947.42105k	19.7882
1.00000x	19.7882

y

x

freq	rin
1.00000k	215.7190
53.57895k	131.1224
106.15789k	131.0933
158.73684k	131.0877
211.31579k	131.0858
263.89474k	131.0849
316.47368k	131.0844
369.05263k	131.0841
421.63158k	131.0839
474.21053k	131.0838
526.78947k	131.0837
579.36842k	131.0836
631.94737k	131.0836
684.52632k	131.0835
737.10526k	131.0835
789.68421k	131.0835
842.26316k	131.0835
894.84211k	131.0834
947.42105k	131.0834
1.00000x	131.0834

y

***** job concluded

نتیجه شبیه سازی برای مقاومت خروجی:

```
**************************************************************
 ******  option summary
 ******
 runlvl  = 3         bypass  = 2
1****** HSPICE -- D-2010.03-SP1 32-BIT (May 26 2010) winnt ******
 ******
 ***************part 2 lab 5


  ******  operating point information tnom=  25.000 temp=  25.000 *****
 ***** operating point status is all       simulation time is     0.
    node    =voltage      node    =voltage      node    =voltage

 +0:1       =   0.      0:2       =   0.      0:3       =   1.6778
 +0:4       =   8.1153  0:5       = 894.1122m 0:6       =   1.6778
 +0:7       =   8.1153  0:8       = 894.1122m 0:9       =   0.
 +0:10      = 894.1122m 0:100     =  10.0000



 ****  voltage sources

 subckt
 element  0:vcc      0:vs       0:vo
  volts     10.0000     0.         0.
  current   -3.8047m    0.         0.
  power     38.0473m    0.         0.

     total voltage source power dissipation=   38.0473m       watts



 **** resistors
```

```
subckt
element  0:r1       0:r2       0:r3       0:r4       0:r5       0:r6
 r value    1.0000k  470.0000k    1.0000k  470.0000   470.0000k    1.0000k
 v drop     0.         8.3222     1.8847   894.1122m    8.3222     1.8847
 current    0.        17.7067u    1.8847m    1.9024m   17.7067u    1.8847m
 power      0.       147.3581u    3.5519m    1.7009m  147.3581u    3.5519m

subckt
element  0:r7       0:r8
 r value  470.0000    10.0000k
 v drop   894.1122m    0.
 current    1.9024m    0.
 power      1.7009m    0.


**** bipolar junction transistors


subckt
element  0:q1       0:q2
model    0:mynpn    0:mynpn
 ib        17.7067u   17.7067u
 ic         1.8847m    1.8847m
 vbe      783.7288m  783.7288m
 vce        7.2212     7.2212
 vbc       -6.4375    -6.4375
 vs        -8.1153    -8.1153
 power     13.6234m   13.6234m
 betad    106.4375   106.4375
 gm        73.3386m   73.3386m
 rpi        1.4510k    1.4510k
 rx         0.         0.
 ro        56.4757k   56.4757k
 cpi        0.         0.
 cmu        0.         0.
 cbx        0.         0.
```

```
  ccs         0.          0.
  betaac    106.4118    106.4118
  ft        1.167e+13   1.167e+13




 ******
 ***************part 2 lab 5


  ******  ac analysis tnom=  25.000 temp=  25.000 *****
x


        freq        ro


    1.00000k    999.7685
   53.57895k    999.6611
  106.15789k    999.6611
  158.73684k    999.6611
  211.31579k    999.6611
  263.89474k    999.6611
  316.47368k    999.6611
  369.05263k    999.6611
  421.63158k    999.6611
  474.21053k    999.6611
  526.78947k    999.6611
  579.36842k    999.6611
  631.94737k    999.6611
  684.52632k    999.6611
  737.10526k    999.6611
  789.68421k    999.6611
  842.26316k    999.6611
  894.84211k    999.6611
  947.42105k    999.6611
    1.00000x    999.6611
y
```

```
***** job concluded
```

تغییرات ولتاژ خروجی:

به علت وجود مشکل در نشان دادن خود خروجی، خروجی از قبل خازن کوپلاژ گرفته شد و تنها تفاوت در داشتن مقدار آفست است.