

Scilab Textbook Companion for  
Operational Amplifiers And Linear Integrated  
Circuits

by R. F. Coughlin And F. F. Driscoll<sup>1</sup>

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# Book Description

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Scilab numbering policy used in this document and the relation to the above book.

**Exa** Example (Solved example)

**Eqn** Equation (Particular equation of the above book)

**AP** Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

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# Chapter 2

## First Experiences with an opamp

Scilab code Exa 2.1 ProbOnOutputvoltage

```
1 //Chapter 2
2 //Example 2-1
3 //ProbOnOutputvoltage
4 //Page 19,figure 2-3
5 clear;clc;
6 //Given
7 Vplus=15;Vminus=-15;Vsatp=13;Vsatm=-13;//All in
   Volts
8 Aol=200000;//gain
9 //Example 2-1(a)
10 Vam=-10*(10^-6);//voltage at minus input
11 Vap=-15*(10^-6);//voltage at plus input
12 Ed1=Vap-Vam;//Differential Input Voltage
13 Vout1=Ed1*Aol;//Output Voltage
14 format(10);
15 if(Vout1>15) then
16     disp("Value of o/p voltage1 = 13.0000V") //
       positive saturation voltage
17 elseif(Vout1<-15) then
```

```

18     disp("Value of o/p voltage1 = -13.0000V")//
        negative saturation voltage
19 else
20     printf("\n\n Value of o/p voltage1 = %.4f V \n\n"
        ,Vout1)
21 end
22
23 //Example 2-1(b)
24 Vbm=-10*(10^-6); //voltage at minus input
25 Vbp=+15*(10^-6); //voltage at plus input
26 Ed2=Vbp-Vbm; //Differential Input Voltage
27 Vout2=Ed2*Aol; //Output Voltage
28 format(10);
29 if(Vout2>15) then
30     disp("Value of o/p voltage2 = 13.0000V")//positive
        saturation voltage
31 elseif(Vout2<-15) then
32     disp("Value of o/p voltage2 = -13.0000V")//
        negative saturation voltage
33 else
34     printf("\n\n Value of o/p voltage2 = %.4f V \n\n"
        ,Vout2)
35 end
36
37 //Example 2-1(c)
38 Vcm=-10*(10^-6); //voltage at minus input
39 Vcp=-5*(10^-6); //voltage at plus input
40 Ed3=Vcp-Vcm; //Differential Input Voltage
41 Vout3=Ed3*Aol; //Output Voltage
42 format(10);
43 if(Vout3>15) then
44     disp("Value of o/p voltage3 = 13.0000V")//positive
        saturation voltage
45 elseif(Vout3<-15) then
46     disp("Value of o/p voltage3 = -13.0000V")//
        negative saturation voltage
47 else
48     printf("\n\n Value of o/p voltage3 = %.4f V \n\n"

```



```

        ,Vout3)
49 end
50
51 //Example 2-1(d)
52 Vdm=+1.000001; //voltage at minus input
53 Vdp=+1.000000; //voltage at plus input
54 Ed4=Vdp-Vdm; //Differential Input Voltage
55 Vout4=Ed4*Ao1; //Output Voltage
56 format(10);
57 if(Vout4>15) then
58     disp("Value of o/p voltage4 = 13.0000V")//positive
        saturation voltage
59 elseif(Vout4<-15) then
60     disp("Value of o/p voltage4 = -13.0000V")//
        negative saturation voltage
61 else
62     printf("\n\n Value of o/p voltage4 = %.4f V \n\n"
        ,Vout4)
63 end
64
65 //Example 2-1(e)
66 Vem=+5*(10^-3); //voltage at minus input
67 Vep=0; //voltage at plus input
68 Ed5=Vep-Vem; //Differential Input Voltage
69 Vout5=Ed5*Ao1; //Output Voltage
70 format(10);
71 if(Vout5>15) then
72     disp("Value of o/p voltage5 = 13.0000V")//positive
        saturation voltage
73 elseif(Vout5<-15) then
74     disp("Value of o/p voltage5 = -13.0000V")//
        negative saturation voltage
75 else
76     printf("\n\n Value of o/p voltage5 = %.4f V \n\n"
        ,Vout5)
77 end
78
79 //Example 2-1(f)

```

```

80 Vfm=0;//voltage at minus input
81 Vfp=+5*(10^-3);//voltage at plus input
82 Ed6=Vfp-Vfm;//Differential Input Voltage
83 Vout6=Ed6*Aol;//Output Voltage
84 format(10);
85 if(Vout6>15) then
86     disp("Value of o/p voltage6 = 13.0000V");//positive
        saturation voltage
87 elseif(Vout6<-15) then
88     disp("Value of o/p voltage6 = -13.0000V");//
        negative saturation voltage
89 else
90     printf("\n\n Value of o/p voltage6 = %.4f V \n\n"
        ,Vout6)
91 end

```

---

### Scilab code Exa 2.2 ProbOnPWM

```

1 //Chapter 2
2 //Example 2-2
3 //ProbOnPWM
4 //Page 34
5 clear;clc;
6 //Given
7 f=50;//in Hz
8 Vtemp=4; //input signal in volts
9 Ecm=10; //maximum peak voltage of sawtooth carrier
    wave in volts
10
11 //Example 2-2(a)
12 T=1/f;
13 Th=(Vtemp*T)/Ecm;//High time in seconds
14 printf("\n\n High Time = %.4f s \n\n",Th)

```

```
15
16 //Example 2-2(b)
17 d=(Th/T)*100;//duty cycle in percentage
18 printf("\n\n Duty cycle = %.4f percent \n\n",d)
```

---

### Scilab code Exa 2.3 ProbOnHighTime

```
1 //Chapter 2
2 //Example 2-3
3 //ProbOnHighTime
4 //Page 34,35,figure 2-16(d)
5 clear;clc;
6 //Given
7 Vtemp=4;//in volts
8 Ecm=5;//maximum peak voltage of a sawtooth carrier
   wave
9 T=0.01;//in seconds
10 //calculate
11 Th=T*(1-(Vtemp/Ecm));//High Time
12 printf("\n\n High Time = %.4f s \n\n",Th)
```

---

# Chapter 3

## Inverting and Noninverting Amplifiers

Scilab code Exa 3.1 ProbOnOpampDescriptions

```
1 //Chapter 3
2 //Example 3-1
3 //ProbOnOpampDescriptions
4 //Page 46,47 figure 3-1
5 clear;clc;
6 //Given
7 Rf=100*(10^3);//Feedback Resistance in ohms
8 Ri=10*(10^3);//Input Resistance in ohms
9 Ei=1;//Input volts
10 //Calculate
11 //Example 3-1(a)
12 I=Ei/Ri;//Equation for current through Rf
13 printf("\n\n Current through Rf = %.4f A \n\n",I)
14 //Example 3-1(b)
15 Vout=- (Rf/Ri)*Ei;//Equation for Output Voltage
16 printf("\n\n Value of output voltage = %.4f V \n\n"
    ,Vout)
17 //Example 3-1(c)
18 Acl=- (Rf/Ri);//Closed loop gain of the amplifier
```

```
19 printf("\n\n Value of closed loop gain = %.4f \n\n",  
    ,Ac1)
```

---

### Scilab code Exa 3.2 ProbOnCurrentinOpamp

```
1 //Chapter 3  
2 //Example 3-2  
3 //ProbOnCurrentinOpamp  
4 //Page 47, figure 3-2  
5 clear;clc;  
6 //Given  
7 Vout=10;//output voltage  
8 I=0.1*(10^-3);//current through Rf in amperes  
9 Rl=25*(10^3);//Load resistance in ohms  
10 //Calculate  
11 //Example 3-1(a)  
12 I1=Vout/Rl;  
13 printf("\n\n Value of load current = %.4f A \n\n",  
    I1)  
14 //Example 3-1(b)  
15 Iout=I+I1;  
16 printf("\n\n Total current into the output pin of  
    the opamp = %.4f A \n\n",Iout)  
17 printf("\n\n The input resistance seen by Ei is Ri.  
    In order to keep input resistance of the circuit  
    high. Ri should be equal to or greater than 10  
    KiloOhm")
```

---

### Scilab code Exa 3.3 ProbOnOpampParameters

```

1 //Chapter 3
2 //Example 3-3
3 //ProbOnOpampParameters
4 //Page 48,49,figure 3-2
5 clear;clc;
6 //Given
7 Rf=250*(10^3); //Feedback Resistance in Ohms
8 Ri=10*(10^3); //Input Resistance in Ohms
9 Ei=0.5; //Input voltage
10 //Calculate
11 //Example 3-3(a)
12 I=Ei/(Ri);
13 printf("\n\n Value of current through Rf = %.6f A \
      n\n",I)
14 //Example 3-3(b)
15 VRf=I*Rf;
16 printf("\n\n Voltage through Rf = %.4f V \n\n",VRf)
17 //Example 3-3(c)
18 Ei1=-0.5;
19 Vout=- (Rf/Ri)*Ei1;
20 printf("\n\n Output Voltage = %.4f V \n\n",Vout)
21 printf("\n\n Thus the magnitude of the output
      voltage does equal the voltage across Rf and Acl
      =-25")

```

---

#### Scilab code Exa 3.4 ProbOnOpampResistance

```

1 //Chapter 3
2 //Example 3-4
3 //ProbOnOpampResistance
4 //Page 49
5 clear;clc;
6 //Given

```

```

7 Vout=12.5; //in volts
8 I1=2*10^-3; //in amperes
9 R1=Vout/I1; //Load resistance in ohm
10 //example 3-4(a)
11 printf("\n\n Value of Load Resistance = %.8f ohm \n
    \n",R1)
12 //example 3-4(b)
13 I=0.05*10^-3;
14 Iout=I+I1;
15 printf("\n\n Value of output current = %.8f amp \n\
    n",Iout)
16 //example 3-4(c)
17 printf("\n\n The circuit input resistance is R1=10
    Kohm")

```

---

### Scilab code Exa 3.5 ProbOnVoltageGain

```

1 //Chapter 3
2 //Example 3-5
3 //ProbOnVoltageGain
4 //Page 50, figure 3-3
5 clear;clc;
6 //Given
7 Rf=20*10^3;
8 Ri=10*10^3;
9 Acl=-(Rf/Ri); //Voltage Gain
10 printf("\n\n Value of Voltage Gain = %.6f \n\n",
    Acl)

```

---

### Scilab code Exa 3.6 ProbonOutputVoltage

```
1 //Chapter 3
2 //Example 3-6
3 //ProbonOutputVoltage
4 //Page 51
5 clear;clc;
6 Ei=-5;//input voltage
7 Acl=-2;//Voltage Gain
8 Vout=Ei*Acl;//output voltage
9 printf("\n\n Value of Output Voltage = %.4f V \n\n"
    ,Vout)
```

---

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

### Scilab code Exa 3.7 ProbOnOutputvoltage

```
1 //Chapter 3
2 //Example 3-7
3 //ProbOnO/Pvoltage
4 //Page 51
5 clear;clc;
6 Ri=10*10^3;//input resistance in ohm
7 Gain= 25;
8 Rf=Gain*Ri;//feedback resistance in ohm
9 printf("\n\n Value of Rf = %.4f ohm \n\n",Rf)
10 xcos('Figure3_7.xcos');
```

---



### Scilab code Exa 3.8 ProbOnOutputvoltage

```
1 //Chapter 3
2 //Example 3-8
3 //ProbOnO/Pvoltage
4 //Page 52, Figure 3-4
5 clear;clc;
6 //Given
7 E1=2;E2=3;E3=1;//input voltage
8 R=10*10^3;//in ohm
9 Vout=-(E1+E2+E3);
10 printf("\n\n Value of o/p voltage = %.4f V \n\n",
    Vout)
```

---

### Scilab code Exa 3.9 ProbOnOutputvoltage

```
1 //Chapter 3
2 //Example 3-9
3 //ProbOnO/Pvoltage
4 //Page 53, Figure 3-4
5 clear;clc;
6 //Given
7 E1=2;E2=3;E3=-1;//input voltage
8 R=10*10^3;//in ohm
9 Vout=-(E1+E2+E3);
10 printf("\n\n Value of o/p voltage = %.4f V \n\n",
    Vout)
```

---

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

### Scilab code Exa 3.10 ProbOnDCVoltage

```
1 //Chapter 3
2 //Example 3-10
3 //ProbOnDCVoltage
4 //Page 53,54
5 clear;clc;
6 xcos('Figure3_10.xcos');
7 //Figure 3-5(b)
8 x=[0 1 2]
9 y=[-5,5,-5]
10 subplot(2,2,1)
11 a=gca()
12 a.thickness = 1;
13 a.x_location = 'middle';
14 plot2d(x,y,style=3,rect=[0,-5,2,5])
15 xtitle("Eac Vs t", "t(ms)", "Eac(V)");
16 subplot(2,2,2)
17 x1=[0 0.5 1 1.5 2]
18 y1=[10 5 0 5 10]
19 a=gca()
20 a.thickness = 1;
21 a.x_location = 'middle';
22 plot2d(x1,y1,style=3,rect=[0,-15,2,15])
23 xtitle("Edc Vs t", "t(ms)", "Edc(V)");
24 y2=[5 0 -5 0 5]
25 y3=[-2.5 -7 -12.5 -7 -2.5]
26 plot2d(x1,y2,style=2)
27 plot2d(x1,y3,style=1)
```

```

28 legend ( " Edc= - 5 V " , " Edc= 0 V " , " Edc= 7 V"
    );
29 xtitle (" Waveshapes of Vo for Edc = 0V, -5V , 7V")
30 //Figure 3-5(c)
31 subplot(2,2,3)
32 x4=[-5 0 5]
33 y4=[10 5 0]
34 y5=[5 0 -5]
35 y6=[-2.5 -7.5 -12.5]
36 a=gca()
37 a.thickness = 1;
38 a.y_location = 'middle';
39 a.x_location = 'middle';
40 plot2d(x4,y4,style=3,rect=[-5,-15,5,15])
41 plot2d(x4,y5,style=2,rect=[-5,-15,5,15])
42 plot2d(x4,y6,style=1,rect=[-5,-15,5,15])
43 legend ( " Edc= - 5 V " , " Edc= 0 V " , " Edc= 7 V"
    );
44 xtitle (" Vo Vs Eac " , " Eac(V)", " Vo ");
45 xtitle (" Output-Input Characteristic")
46 printf("\n\n If Edc = 0 V , Eac appears inverted at
    Vo ( Gain is -1 )")
47 printf("\n\n If Edc = - 5 V , Eac appears at the
    output as a 5 V dc-offset voltage upon which
    rides the inverted Eac ")
48 printf("\n\n If Edc = 7 V , then Eac shifts down by
    7 V ")

```

---

### Scilab code Exa 3.11 ProbonThreeChannelInvertingAmplifier

```

1 //Chapter 3
2 //Example 3-11
3 //ProbonThreeChannelInvertingAmplifier

```

```

4 //Page 56
5 clear;clc;
6 //Channel 1
7 Ri= 10*10^3;//Choosing Input resistance
8 Acl = -10 ;
9 Rf1 = - (Acl * Ri);
10 printf("\n\n Value of Rf1 = %.4 f ohm \n\n",Rf1)
11 //Channel 2
12 Acl1 = -5;
13 Rf2 = - (Acl1 * Ri);
14 printf("\n\n Value of Rf2 = %.4 f ohm \n\n",Rf2)
15 //channel 3
16 Acl2 = -2;
17 Rf3 = - (Acl2 * Ri);
18 printf("\n\n Value of Rf3 = %.4 f ohm \n\n",Rf3)

```

---

### Scilab code Exa 3.12 ProbOnOutputvoltage

```

1 //Chapter 3
2 //Example 3-12
3 //ProbOnOutputvoltage
4 //Page 57
5 clear;clc;
6 //Given
7 R1=100000;R2=100000;R3=100000;R=100000//in ohm
8 Rf=33*10^3;//in ohm
9 E1=5;E2=5;E3=-1;//in volts
10 n=3;//number of inputs
11 Vout=- (E1+E2+E3)/n;//output voltage
12 printf("\n\n Value of output voltage = %.4 f V \n\n"
, Vout)

```

---

### Scilab code Exa 3.13 ProbOnOpampParameters

```
1 //Chapter 3
2 //Example 3-13
3 //ProbOnOpampParameters
4 //Page 58, Figure 3-8
5 clear;clc;
6 //Given
7 Ei=4;//in volts
8 Rl=10*10^3;//in ohm
9 I=0;//in ampere
10 Vout=Ei;//output voltage
11 I1=Vout/Rl;//load current
12 IO=I+I1;//output current
13 printf("\n\n Value of o/p voltage = %.4f V \n\n",
        Vout)
14 printf("\n\n Value of load current = %.4f A \n\n",
        I1)
15 printf("\n\n Value of output current = %.4f A \n\n"
        ,IO)
```

---

### Scilab code Exa 3.14 ProbOnVoltageGain

```
1 //Chapter 3
2 //Example 3-14
3 //ProbOnVoltageGain
4 //Page 62,63, Figure 3-11
5 clear;clc;
```

```

6 //Given
7 Rf = 40*10^3;
8 R1 = 10*10^3;
9 //Example 3-14(a)
10 Ac1 = (Rf + R1)/R1;
11 printf("\n\n Value of Voltage Gain = %.4f \n\n",Ac1
    )
12 //Example 3-14(b)
13 x=[0 2.5 5 7.5 10]
14 y=[-2 0 2 0 -2]
15 subplot(2,2,1)
16 a=gca()
17 a.thickness = 1;
18 a.x_location = 'middle';
19 plot2d(x,y,style=3,rect=[0,-2,10,2])
20 xtitle ( " Ei Vs t " , " t(ms) " , " Ei(V) " );
21 subplot(2,2,2)
22 x1=[0 2.5 5 7.5 10]
23 y1=[-10 0 10 0 -10]
24 x2=[0 2.5 5 7.5 10]
25 y2=[-2 0 2 0 -2]
26 a=gca()
27 a.thickness = 1;
28 a.x_location = 'middle';
29 plot2d(x1,y1,style=3,rect=[0,-15,10,15])
30 plot2d(x2,y2,style=1)
31 xtitle ( " Vo Vs t " , " t(ms) " , " Vo and Ei " );
32 legend ( " Vo Vs t " , " Ei Vs t ");
33 xtitle ( " CRO waveshape of Vo and Ei Vs t ")
34 subplot(2,2,3)
35 //Example 3-14(c)
36 x=[-2 -1 0 1 2]
37 y=[-10 -5 0 5 10]
38 a=gca()
39 a.thickness = 1;
40 a.x_location = 'middle';
41 a.y_location = 'middle';
42 plot2d(x,y,style=3,rect=[-2,-15,2,15])

```

```
43 xtitle ( " Vo Vs Ei " , " Ei(V) " , "Vo(V) " );
44 legend ( " Slope = +5 " );
45 xtitle ( "Input-output characteristic of a
    noninverting Amplifier")
```

---

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

#### Scilab code Exa 3.15 DesignAnAmplifier

```
1 //Chapter 3
2 //Example 3-15
3 //DesignAnAmplifier
4 //Page 64
5 clear;clc;
6 //Given
7 Ac1 = 10;// Gain is positive , so choose noninverting
    amplifier
8 R1 = 10*10^3;
9 Rf = (Ac1*R1)-R1;
10 printf("\n\n Value of Rf = %.4f ohm \n\n",Rf)
11 xcos('Figure3_15.xcos')//Design will be as shown in
    the figure
```

---

#### Scilab code Exa 3.16 ProbOnServoAmplifier

```
1 //Chapter 3
2 //Example 3-16
3 //ProbOnServoAmplifier
```

```

4 //Page 72
5 clear;clc;
6 //Given
7 Ei=2;//in volts
8 Vf=Ei;//feedback voltage
9 Vout=2*Vf;//output voltage
10 Vr=-Vout;//Reference voltage
11 Vcap=3*Ei;//capacitor voltage
12 printf("\n\n Value of feedback voltage = %.4f V \n\n",Vf)
13 printf("\n\n Value of output voltage = %.4f V \n\n",Vout)
14 printf("\n\n Value of reference voltage = %.4f V \n\n",Vr)
15 printf("\n\n Value of capacitor voltage = %.4f V \n\n",Vcap)

```

---

### Scilab code Exa 3.17 ProbOnEquilibriumVoltage

```

1 //Chapter 3
2 //Example 3-17
3 //ProbOnEquilibriumVoltage
4 //Page 72
5 clear;clc;
6 //Given
7 Ei=4;//in volts
8 Vf=Ei;//feedback voltage
9 Vout=2*Vf;//output voltage
10 Vr=-Vout;//Reference voltage
11 Vcap=3*Ei;//capacitor voltage
12 printf("\n\n Value of feedback voltage = %.4f V \n\n",Vf)
13 printf("\n\n Value of output voltage = %.4f V \n\n",Vout)

```



```
    ,Vout)
14 printf("\n\n Value of reference voltage = %.4f V \n
    \n",Vr)
15 printf("\n\n Value of capacitor voltage = %.4f V \n
    \n",Vcap)
```

---

### Scilab code Exa 3.18 ProbOnEquilibriumTime

```
1 //Chapter 3
2 //Example 3-18
3 //ProbOnEquilibriumTime
4 //Page 73, Figure 3-17
5 clear;clc;
6 //Given
7 Ri=10^5;//in ohm
8 C=10^-6;//in farad
9 T=3*Ri*C;//Time constant
10 ETime=5*T;//equilibrium time
11 printf("\n\n Value of Equilibrium Time = %.4f s \n\
    n",ETime)
```

---

# Chapter 4

## Comparators and Controls

Scilab code Exa 4.1 ProbOnThresholdVoltage

```
1 //Chapter 4
2 //Example 4-1
3 //ProbOnThresholdVoltage
4 //Page 90
5 clear;clc;
6 //Given
7 Vsat = 14;//Saturation Voltage
8 R1 = 1000; R2 = 100 ; //Load resistances
9 Vut = (R2/(R1*R2))*Vsat;
10 printf("\n\n Value of Upper Threshold Voltage = %.6
    f V \n\n",Vut)
```

---

Scilab code Exa 4.2 ProbOnLowerThresholdVoltage

```
1 //Chapter 4
2 //Example 4-2
3 //ProbOnLowerThresholdVoltage
```

```

4 //Page 91
5 clear;clc;
6 //Given
7 Vsat = -13;//Saturation Voltage
8 R1 = 1000; R2 = 100 ; //Load resistances
9 Vlt = (R2/(R1*R2))*Vsat;
10 printf("\n\n Value of Lower Threshold Voltage = %.6
        f V \n\n",Vlt)

```

---

#### Scilab code Exa 4.3 ProbOnOutputvoltage

```

1 //Chapter 4
2 //Example 4-3
3 //ProbOnOutputVoltage
4 //Page 91, Figure 4-4
5 clear;clc;
6 printf ("\n\n The dashed lines drawn on Ei in thew
        figure locate Vut and Vlt.\n\n At time t=0, Ei is
        below Vlt, so Vo is at +Vsat. When Ei goes above
        Vut, at times (a) and (c), Vo switches quickly
        to -Vsat. \n\nWhen Ei again goes below Vlt, at
        times (b) and (d), Vo switches quickly to +Vsat.
        \n\nObserve how positive feedback has eliminated
        the false crossings ")

```

---

#### Scilab code Exa 4.4 DesignUsingVutAndVlt

```

1 //Chapter 4
2 //Example 4-4

```

```

3 //DesignUsingVutAndVlt
4 //Page 96
5 clear;clc;
6 //Given
7 Vut = 12 ; Vlt = 8 ; //Upper and Lower Threshold
    Voltages
8 Vsatp = 15 ; Vsatm = -15 ;// Saturation Voltages
9 R = 10*10^3 ;//Choosing R
10 //Design
11 Vh = Vut - Vlt ; // Hysteresis Voltage
12 Vctr = (Vut + Vlt)/2;//Center Voltage
13 n = (Vsatp - Vsatm)/Vh ; // Resistor Factor
14 Vref = Vctr / (1 + (1/n)); //Reference Voltage
15 Resistance = n * R;
16 printf ( "\n\n Hysteresis Voltage = %.4f V \n\n", Vh
    )
17 printf ( "\n\n Center Voltage = %.4f V \n\n", Vctr )
18 printf ( "\n\n Resistor Factor = %.4f \n\n" , n )
19 printf ( "\n\n Reference Voltage = %.4f \n\n", Vref)
20 printf ( "\n\n Feedback resistor = %.4f \n\n",
    Resistance)

```

---

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

#### Scilab code Exa 4.5 designInvertingVoltageDetector

```

1 //Chapter 4
2 //Example 4-5
3 //designInvertingVoltageDetector
4 //Page 97
5 clear;clc;
6 //Given

```

```

7 Vsatp = 15 ; Vsatm = -15 ;// Saturation Voltages
8 Vh = 4 ; //Hysteresis Voltage
9 Vctr = 10 ; //Center voltage
10 n = ((Vsatp - Vsatm)/Vh)-1 ;
11 R = 10*10^3 ;//Input Resistance
12 Vref = ((n + 1)*(Vctr))/n ; // Reference Voltage
13 Resistance = n * R // Feedback Resistance
14 printf (” \n\n Resistance Factor = %.4f ”, n)
15 printf (” \n\n Reference Voltage = %.4f ”, Vref)
16 printf (” \n\n Feedback Resistance = %.4f ”,
Resistance)
17 xcos(’Figure4_5.xcos’);

```

---

#### Scilab code Exa 4.6 DesignOnInvertingVoltageLevelDetector

```

1 //Chapter 4
2 //Example 4-6
3 //DesignOnInvertingVoltageLevelDetector
4 //Page 100
5 clear;clc;
6 //Given
7 Vut = 13.5 ; Vlt = 10.5 ; //Upper and Lower
Threshold Voltages
8 Vref = -15 ; // Reference Voltage
9 Vsatp = 13 ; Vsatm = -13; //Saturation Voltages
10 R = 10*10^3 ; // Input Resistance
11 Vctr = (Vut + Vlt)/2;
12 Vh = Vut - Vlt ;
13 m = -(Vref / Vctr);
14 Resistance = m * R ;
15 n = (Vsatp-Vsatm)/Vh ;
16 Resistance1 = n * R ;
17 printf (” \n\n Hysteresis Voltage = %.4f ”, Vh )

```

```
18 printf ( " \n\n Center Voltage = %.4f ", Vctr )
19 printf ( " \n\n Resistor mR = %.4f ", Resistance)
20 printf ( " \n\n Resistor nR = %.4f ", Resistance1)
```

---

# Chapter 5

## Selected Applications of Opamp

Scilab code Exa 5.1 ProbOnMeterCurrent

```
1 //Chapter 5
2 //Example 5-1
3 //ProbOnMeterCurrent
4 //Page 121,122, Figure 5-1
5 clear;clc;
6 //Given
7 Ei = 0.5;//Input voltage
8 Ri = 1*10^3;//Input resistance in ohm
9 Im = Ei / Ri ;//Meter Current
10 printf (” \n\n Meter Current = %.4f ”, Im )
```

---

Scilab code Exa 5.2 ProbOnInputResistance

```
1 //Chapter 5
2 //Example 5-2
3 //ProbOnInputResistance
4 //Page 121,122, Figure 5-1
```

```

5 clear;clc;
6 //Given
7 Efs = 5 ;//Full scale Voltage
8 Ifs = 50*10^-6;//Full scale Meter Current
9 Ri = Efs / Ifs ;// Input Resistance
10 printf ( "\n\n Input Resistance = %.4f ", Ri )

```

---

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

### Scilab code Exa 5.3 DesignASimpleSwitchArrangement

```

1 //Chapter 5
2 //Example 5-3
3 //DesignASimpleSwitchArrangement
4 //Page 124
5 clear;clc;
6 //Given
7 Edc = 5 ; Erms = 5 ; Epeak = 5 ; Eptop = 5 ;//
   Voltages of meters
8 Ifs = 50*10^-6 ; // Full scale Meter Current
9 Ri1 = Edc / Ifs ; // DC Voltmeter
10 Ri2 = 0.90 * (Erms / Ifs );// Rms ac voltmeter (
   Sine wave only )
11 Ri3 = 0.636 * (Epeak / Ifs );//Peak Reading
   Voltmeter ( Sine wave only )
12 Ri4 = 0.318 * (Eptop / Ifs );//Peak-to-Peak ac
   Voltmeter(sine wave only)
13 printf ( "\n\n Ri1 = %.4f ohm", Ri1 )
14 printf ( "\n\n Ri2 = %.4f ohm", Ri2 )
15 printf ( "\n\n Ri3 = %.4f ohm", Ri3 )
16 printf ( "\n\n Ri4 = %.4f ohm", Ri4 )
17 xcos ( 'Figure5_3.xcos ' )

```



---

**Scilab code Exa 5.4 ProbOnZenerCurrentAndVoltage**

```
1 //Chapter 5
2 //Example 5-4
3 //ProbOnZenerCurrentAndVoltage
4 //Page 125,126, Figure 5-3(a)
5 clear;clc;
6 //Given
7 Vo = 10.3 ; //Voltage across the load resistor
8 Ei = 5 ; //Input voltage
9 Ri = 1*10^3 ; //Input Resistance
10 //Example 5-4(a)
11 I = Ei / Ri ; //Zener Current
12 printf ( "\n\n Zener Current = %.4f A", I )
13 //Example 5-4(b)
14 Vt = Vo - Ei ; //Zener Voltage
15 printf ( "\n\n Zener Voltage = %.4f V", Vt )
```

---

**Scilab code Exa 5.5 ProbOnOpampParameters**

```
1 //Chapter 5
2 //Example 5-5
3 //ProbOnOpampParameters
4 //Page 126, Figure 5-3(b)
5 clear;clc;
6 //Given
7 Ei = 1 ; //Reference voltage
```

```

8 Ri = 1*10^3 ; //Input Resistance
9 Vo = 0.6 ; //Output Voltage
10 //example 5-5(a)
11 I = Ei / Ri ; //Diode Current
12 printf ( "\n\n Diode Current = %.4f A " , I )
13 //example 5-5(b)
14 Vdiode = Vo ;
15 printf ( "\n\n Voltage drop across the diode = %.4f
    V " , Vdiode )

```

---

#### Scilab code Exa 5.6 ProbOnOpampParameters

```

1 //Chapter 5
2 //Example 5-6
3 //ProbOnOpampParameters
4 //Page 128,129, Figure 5-5
5 clear;clc;
6 //Given
7 R = 10*10^3 ; //Resistance
8 E2 = 0 ; //Source across negative terminal
9 R1 = 5*10^3 ; // Load Resistance
10 E1 = 5 ; // source across positive terminal
11 //example 5-6(a)
12 I1 = (E1 - E2)/R ; //Load Current
13 printf ( "\n\n Load current across R1 = %.4f A " , I1
    )
14 //example 5-6(b)
15 V1 = I1 * R1 ; // Voltage across R1
16 printf ( "\n\n Voltage across load resistance = %.4f
    V " , V1 )
17 //example 5-6(c)
18 Vo = (2*V1)-E2 ; //Output voltage
19 printf ( "\n\n Output Voltage = %.4f V " , Vo )

```

---

Scilab code Exa 5.7 ProbOnOpampParameters

```
1 //Chapter 5
2 //Example 5-7
3 //ProbOnOpampParameters
4 //Page 128,129, Figure 5-5
5 clear;clc;
6 //Given
7 R = 10*10^3 ; //Resistance
8 E2 = 5 ; //Source across negative terminal
9 R1 = 5*10^3 ; // Load Resistance
10 E1 = 0 ; // source across positive terminal
11 //example 5-6(a)
12 I1 = (E1 - E2)/R ; //Load Current
13 printf ("\n\n Load current across R1 = %.4f A " , I1
14 )
15 //example 5-6(b)
16 V1 = I1 * R1 ; // Voltage across R1
17 printf ("\n\n Voltage across load resistance = %.4f
18 V " , V1 )
19 //example 5-6(c)
20 Vo = (2*V1)-E2 ; //Output voltage
21 printf ( "\n\n Output Voltage = %.4f V " , Vo )
22 printf ( "\n\n V1 and I1 are reversed in polarity
23 and direction respectively from example 5-6. If
24 the polarity of E2 is reversed , I1 and V1 change
25 sign but not magnitude ")
```

---

### Scilab code Exa 5.8 ProbOnShortCircuitCurrent

```
1 //Chapter 5
2 //Example 5-8
3 //ProbOnShortCircuitCurrent
4 //Page 133,134, Figure 5-8(c)
5 clear;clc;
6 //Given
7 Vo = 5 ;//Output Voltage
8 Rf = 100*10^3 ; //Feedback Resistance
9 Isc = Vo / Rf ; //Short Circuit Current
10 printf ( "\n\n Short Circuit Current = %.7f A " ,
        Isc )
```

---

### Scilab code Exa 5.9 ProbOnPhotoDetectors

```
1 //Chapter 5
2 //Example 5-9
3 //ProbOnPhotoDetectors
4 //Page 134,135, Figure 5-9
5 clear;clc;
6 //Given
7 Rf = 10*10^3 ;//Feedback Resistance
8 I = 10*10^-6 ; //Current through Photo Detector
9 //example 5-9(a)
10 Vo = Rf * I ;//Vo for Dark Condition
11 printf ( "\n\n Output Voltage for dark Condition = %
        .4f V " , Vo )
12 //example 5-9(b)
13 I1 = 1*10^-3 ; //Current in presence of sunlight
14 Vo1 = Rf * I1 ; //output voltage in light condition
15 printf ( "\n\n Output voltage in light condition = %
        .4f V " , Vo1 )
```

---

**Scilab code Exa 5.10 ProbOnPhotoDetector**

```
1 //Chapter 5
2 //Example 5-10
3 //ProbOnPhotoDetector
4 //Page 134,135, Figure 5-9
5 clear;clc;
6 //Given
7 Rf = 100*10^3 ;//Feedback Resistance
8 //example 5-10(a)
9 I11 = 1*10^-6 ; //Load current 1
10 Vo1 = Rf * I11 ; //Output voltage in photo detector
11 printf ( "\n\n Output Voltage in photo detector for
           I11 = %.4f V ",Vo1 )
12 //example 5-10(b)
13 I12 = 50*10^-6 ; // Load current 2
14 Vo2 = Rf * I12 ; //Output Voltage in photo detector
15 printf ( "\n\n Output Voltage in photo detector for
           I12 = %.4f V ",Vo2 )
```

---

**Scilab code Exa 5.11 ProbOnOpticalCoupler**

```
1 //Chapter 5
2 //Example 5-11
3 //ProbOnOpticalCoupler
4 //Page 136, Figure 5-10
5 clear;clc;
```

```

6 //Given
7 R = 1*10^3;
8 R1 = 99*10^3 ;
9 m = R1 / R ; //multiplier
10 Isc = 10*10^-6; //Current on short-circuit condition
11 I1 = (1 + m)*Isc ;
12 printf ( "\n\n Load current = %.4f A ", I1)

```

---

#### Scilab code Exa 5.12 ProbonCurrentDivider

```

1 //Chapter 5
2 //Example 5-12
3 //ProbonCurrentDivider
4 //Page 138, Figure 5-12
5 clear;clc;
6 //Given
7 Im = 100*10^-6; //Meter current
8 Isc = 0.5; // Current in short-circuit condition
9 Rf = 20 ; // Feedback resistance
10 Rm = 0.8*10^3 ; //Meter resistance
11 d = Isc / Im ; //Current divider
12 R1 = d * Rf ;
13 Rscale = R1 - Rm ;
14 printf ( "\n\n Resistance dRf = %.4f ohm ", R1 )
15 printf ( "\n\n Rscale = %.4f ohm ", Rscale )

```

---

#### Scilab code Exa 5.13 ProbOnPhaseShifter

```

1 //Chapter 5

```

```

2 //Example 5-13
3 //ProbOnPhaseShifter
4 //Page 140, Figure 5-13(b)
5 clear;clc;
6 //Given
7 f = 10^3 ; //Frequency of Ei in Hz
8 Ci = 0.01*10^-6 ;
9 m = tan(%pi/4);
10 Ri = m / (2*%pi*f*Ci);
11 printf ("\n\n Value of Ri = %.4f ohm ", Ri )

```

---

#### Scilab code Exa 5.14 ProbOnPhaseAngle

```

1 //Chapter 5
2 //Example 5-14
3 //ProbOnPhaseAngle
4 //Page 140, Figure 5-13(b)
5 clear;clc;
6 //Given
7 f = 10^3 ;
8 Ri = 100*10^3 ;
9 Ci = 0.01*10^-6;
10 phaseangle = 2*atan(2*%pi*f*Ri*Ci);
11 printf ("\n\n Phase angle = %.4f radians ",
    phaseangle)

```

---

# Chapter 6

## Signal Generators

Scilab code Exa 6.1 ProbOnThresholdVoltage

```
1 //Chapter 6
2 //Example 6-1
3 //ProbOnThresholdVoltage
4 //Page 149,151, Figure 6-1
5 clear;clc;
6 //Given
7 R1 = 100*10^3 ;
8 R2 = 86*10^3 ;
9 Vsatp = 15 ; Vsatm = -15 ;//Saturation voltages
10 Vut = (R2 * Vsatp)/(R1 + R2);
11 Vlt = (R2 * Vsatm)/(R1 + R2);
12 printf ( "\n\n Upper Threshold Voltage = %.4f V ",
           Vut )
13 printf ( "\n\n Lower Threshold Voltage = %.4f V ",
           Vlt )
```

---

Scilab code Exa 6.2 ProbOnMultivibrator



```

1 //Chapter 6
2 //Example 6-2
3 //ProbOnMultivibrator
4 //Page 151
5 clear;clc;
6 //Given
7 Rf = 100*10^3; //Feedback Resistance
8 C = 0.1*10^-6 ;
9 T = 2 * Rf * C;
10 printf ( "\n\n Period = %.4f sec ", T )

```

---

#### Scilab code Exa 6.3 ProbOnFrequency

```

1 //Chapter 6
2 //Example 6-3
3 //ProbOnFrequency
4 //Page 151
5 clear;clc;
6 //Given
7 T = 20*10^-3; //Period
8 f = 1 / T;
9 printf ( "\n\n Frequency = %.4f Hz ", f )

```

---

#### Scilab code Exa 6.5 ProbOnDurationOfOutputPulse

```

1 //Chapter 6
2 //Example 6-5
3 //ProbOnDurationOfOutputPulse
4 //Page 155

```

```

5 clear;clc;
6 //Given
7 Rf = 100*10^3 ;//Feedback Resistance
8 C = 0.1*10^-6 ;
9 t = (Rf * C)/ 5 ;
10 printf ( "\n\n Duration of output pulse of one-shot
           = %.4f sec ", t )

```

---

#### Scilab code Exa 6.6 ProbonTriangularGenerator

```

1 //Chapter 6
2 //Example 6-6
3 //ProbonTriangularGenerator
4 //Page 157,158, Figure 6-6
5 clear;clc;
6 //Given
7 Vsatm = -13.8 ;
8 Vut = 5 ; //Upper Threshold Voltage
9 R = 10*10^3 ;
10 f = 1000; //Frequency
11 C = 0.05*10^-6 ;
12 p = -Vsatm / Vut ;
13 p1 = p * R ;
14 Ri = p / (4*f*C);
15 printf ( "\n\n Value of p = %.4f ", p )
16 printf ( "\n\n Value of p1 = %.4f ", p1 )
17 printf ( "\n\n Value of Ri = %.4f ", Ri )

```

---

#### Scilab code Exa 6.7 ProbOnUnipolarTriangularWaveGenerator

```

1 //Chapter 6
2 //Example 6-7
3 //ProbOnUnipolarTriangularWaveGenerator
4 //Page 159
5 clear;clc;
6 //Given
7 p = 2.8 ;
8 Vsatm = -13.8 ;
9 Ri = 28*10^3 ;
10 C = 0.05*10^-6;
11 Vut = - ((Vsatm+0.6)/p);
12 f = p / (2*Ri*C);
13 printf ( "\n\n Peak Voltage = %.4f V ", Vut )
14 printf ( "\n\n frequency = %.4f Hz ", f )

```

---

This code can be downloaded from the website [www.scilab.in](http://www.scilab.in)

#### Scilab code Exa 6.8 DesignOnSawtoothWaveGenerator

```

1 //Chapter 6
2 //Example 6-8
3 //DesignOnSawtoothWaveGenerator
4 //Page 163
5 clear;clc;
6 //Design a voltage divider to give voltage reference
   10 V
7 //Here Ri = 10 KiloOhm and C = 0.1microfarad
8 //The Circuit will be as shown below
9 xcos( 'Figure6_8.xcos' );
10 //Checking Frequency value
11 Ri = 10*10^3 ;
12 Ci = 0.1*10^-6 ;

```

```
13 Ei = 1 ;
14 Vref = 10 ;
15 f = Ei / (Ri*Ci*Vref) ;
16 printf ( "\n\n Frequency is %.4f Hz ", f )
```

---

#### Scilab code Exa 6.9 ProbOnFrequency

```
1 //Chapter 6
2 //Example 6-9
3 //ProbOnFrequency
4 //Page 164
5 clear;clc;
6 //Given
7 Ri = 10*10^3 ;
8 Ci = 0.1*10^-6 ;
9 Ei = 2 ;
10 Vref = 10 ;
11 f = Ei / (Ri*Ci*Vref) ;
12 printf ( "\n\n Frequency is %.4f Hz ", f )
```

---

#### Scilab code Exa 6.10 ProbOnFrequency

```
1 //Chapter 6
2 //Example 6-10
3 //ProbOnFrequency
4 //Page 164
5 clear;clc;
6 //Given
7 Ri = 10*10^3 ;
```

```

8 Ci = 0.1*10^-6 ;
9 Ei = 2 ;
10 Vref = 2 ;
11 f = Ei / (Ri*Ci*Vref) ;
12 printf ( "\n\n Frequency is %.4f Hz ", f )

```

---

### Scilab code Exa 6.12 ProbOnAD639A

```

1 //Chapter 6
2 //Example 6-12
3 //ProbOnAD639A
4 //Page 170,171, Figure 6-11
5 clear;clc;
6 //Given
7 Ei = 1 ;
8 t1 = 45 ; t2 = 90 ; t3 = 225 ; t4 = 405;
9 Vang1 = (20*10^-3)*t1 ;//example 6-12(a)
10 Vang2 = (20*10^-3)*t2 ;//example 6-12(b)
11 Vang3 = (20*10^-3)*t3 ;//example 6-12(c)
12 Vang4 = (20*10^-3)*t4 ;//example 6-12(d)
13 Vo1 = Ei*sin(t1);//example 6-12(a)
14 Vo2 = Ei*sin(t2);//example 6-12(b)
15 Vo3 = Ei*sin(t3);//example 6-12(c)
16 Vo4 = Ei*sin(t4);//example 6-12(d)
17 printf ( "\n\n Input Voltages are %.4f,%.4f,%.4f,%.4
    f V", Vang1,Vang2,Vang3,Vang4 )
18 printf ( "\n\n Output Voltages are %.4f,%.4f,%.4f,%
    .4f V ", Vo1,Vo2,Vo3,Vo4 )
19 printf ( "\n\n Angles are in radians " )

```

---

### Scilab code Exa 6.13 ProbOnFrequency

```
1 //Chapter 6
2 //Example 6-13
3 //ProbOnFrequency
4 //Page 173,174, Figure 6-12(a)
5 clear;clc;
6 //Given
7 R1 = 10*10^3 ;
8 R2 = 100*10^3 ;
9 C = 0.025*10^-6;
10 f1 = 1 / (4*R1*C) ;
11 f2 = 1 / (4*R2*C) ;
12 printf ( "\n\n Frequency when Ri is 10KiloOhm is %.4
    f Hz " , f1 )
13 printf ( "\n\n Frequency when Ri is 100KiloOhm is %
    .4 f Hz " , f2 )
```

---

# Chapter 7

## OpAmps With Diodes

Scilab code Exa 7.1 ProbOnDeadZoneCircuit

```
1 //Chapter 7
2 //Example 7-1
3 //ProbOnDeadZoneCircuit
4 //Page 201,202, Figure 7-15
5 clear;clc;
6 V = 15 ;
7 mR = 30*10^3 ;
8 R = 10*10^3 ;
9 Ei = -10 ;
10 Vref = V / 3 ;
11 Voa = -Ei-Vref ;
12 Vob = Ei / 2 ;
13 printf ( "\n\n Values of Voa and Vob are %.4f V , %
    .4f V" , Voa, Vob)
```

---

# Chapter 8

## Differential Instrumentation and Bridge Amplifiers

Scilab code Exa 8.1 ProbOnOutputVoltage

```
1 //Chapter 8
2 //Example 8-1
3 //ProbOnOutputVoltage
4 //Page 216, Figure 8-1
5 clear;clc;
6 //Given
7 m = 100 ; //Differential Gain
8 E1 = 10*10^-3; E2 = 10*10^-3;//input voltages
9 E3 = 0*10^-3; E4 = -20*10^-3;//input voltages
10 Vout1 = (m*E1)-(m*E2);//example 8-1(a)
11 Vout2 = (m*E1)-(m*E3);//example 8-1(b)
12 Vout3 = (m*E1)-(m*E4);//example 8-1(c)
13 printf ( "\n\n Output Voltages are %.4f V, %.4f V, %
    .4f V ", Vout1,Vout2,Vout3)
```

---



### Scilab code Exa 8.2 ProbOnDifferentialAmplifier

```
1 //Chapter 8
2 //Example 8-2
3 //ProbOnDifferentialAmplifier
4 //Page 220,221, Figure 8-5(b)
5 clear;clc;
6 //Given
7 a = 2/9 ; //Differential Gain
8 E1 = 10*10^-3; E2 = 5*10^-3; //Input Voltages
9 Vout = (E1 - E2)*(1+(2/a));
10 printf ( "\n\n output voltage = %.4f V ", Vout )
```

---

### Scilab code Exa 8.3 ProbOnVoltageGain

```
1 //Chapter 8
2 //Example 8-3
3 //ProbOnVoltageGain
4 //Page 223
5 clear;clc;
6 R = 25*10^3 ;
7 aR = 50 ;
8 a = aR / R ;
9 Gain = 1 + (2/a) ;
10 printf ( "\n\n Voltage Gain = %.4f " , Gain )
```

---

### Scilab code Exa 8.4 ProbOnVoltageGain

```
1 //Chapter 8
```

```

2 //Example 8-4
3 //ProbOnVoltageGain
4 //Page 223
5 clear;clc;
6 a = %i; //Infinity
7 Gain = 1+(2/a) ;
8 printf ( "\n\n Voltage Gain = %.4f ", Gain )

```

---

#### Scilab code Exa 8.5 ProbOnInstrumentationAmplifier

```

1 //Chapter 8
2 //Example 8-5
3 //ProbOnInstrumentationAmplifier
4 //Page 222,223, Figure 8-6
5 clear;clc;
6 m = 1001 ;//Gain
7 E1 = 5.001 ; E2 = 5.002 ; //example 8-5(a)
8 E3 = 5.001 ; E4 = 5.000 ; //example 8-5(b)
9 E5 = -1.001 ; E6 = -1.002 ; //example 8-5(c)
10 Vout1 = m*(E1-E2); Vout2 = m*(E3-E4); Vout3 = m*(E5-
    E6);
11 printf ( "\n\n Output Voltages are %.4f V , %.4f V,
    %.4f V ", Vout1,Vout2,Vout3)

```

---

#### Scilab code Exa 8.6 ProbOnCollectorVoltage

```

1 //Chapter 8
2 //Example 8-6
3 //ProbOnCollectorVoltage

```

```

4 //Page 226,227, Figure 8-9(b)
5 clear;clc;
6 //Given
7 Vout = 5 ; //Output Voltage
8 Vce = Vout ;
9 printf ( "\n\n Collector Voltage = %.4f V ", Vce )

```

---

#### Scilab code Exa 8.7 ProbOnVoltages

```

1 //Chapter 8
2 //Example 8-7
3 //ProbOnVoltages
4 //Page 226,227, Figure 8-9
5 clear;clc;
6 //Given
7 Vre = 1.2 ; Re = 1*10^3 ;Vce = 5 ;Vcc = 15; //
   Voltages in the circuit
8 Ie = Vre / Re ;
9 Vcol = Vce + Vre ;
10 Vrl = Vcc - Vcol ;
11 printf ( "\n\n Collector Voltage = %.4f V ", Vcol )
12 printf ( "\n\n Voltage across Rl = %.4f V ", Vrl )

```

---

#### Scilab code Exa 8.8 ProbOnVtoIConverter

```

1 //Chapter 8
2 //Example 8-8
3 //ProbOnVtoIConverter
4 //Page 228, Figure 8-10

```

```

5 clear;clc;
6 Rs = 1*10^3 ; E1 = 100*10^-3 ;
7 E2 = 0 ; Rl = 5*10^3 ;
8 Gain = 10 ;
9 I1 = 10*((E1-E2)/Rs);
10 Vr = I1 * Rs ;
11 Vref = I1 * Rl ;
12 V9 = Vref + Gain*(E1 - E2);
13 printf ( "\n\n Current across Load Resistor = %.4f A
      ", I1 )
14 printf ( "\n\n Voltage across R = %.4f V ", Vr)
15 printf ( "\n\n Reference Voltage = %.4f V ", Vref )
16 printf ( "\n\n Voltage at terminal 9 = %.4f V ", V9
      )

```

---

#### Scilab code Exa 8.9 ProbOnStrainGage

```

1 //Chapter 8
2 //Example 8-9
3 //ProbOnStrainGage
4 //Page 230,231
5 clear;clc;
6 //Given
7 GF = 2 ;//Gage factor
8 DR = 0.001 ;
9 R = 120 ;
10 L = DR /(R*GF) ;
11 printf ( "\n\n Change in length is %.9f inches per
      inch ", L )

```

---

### Scilab code Exa 8.10 ProbOnWheatstoneBridge

```
1 //Chapter 8
2 //Example 8-10
3 //ProbOnWheatstoneBridge
4 //Page 232, Figure 8-12
5 clear;clc;
6 E = 1 ;
7 DR = 0.001 ; R = 120 ; //Resistance in Ohm
8 Vout = (E*DR)/(4*R) ;
9 printf ( "\n\n Output of the Bridge = %.9f V ", Vout
        )
```

---

### Scilab code Exa 8.11 ProbOnAD620

```
1 //Chapter 8
2 //Example 8-11
3 //ProbOnAD620
4 //Page 237,238, Figure 8-17
5 clear;clc;
6 //Given
7 Vout = 100*10^-3 ; E = 5 ; R = 120 ;
8 Gain = 1000 ;
9 E1 = 30 *10^6 ;
10 Gf = 2 ;//Gage factor
11 Vbridge = Vout / Gain ;
12 DL = 20*10^-6 ;
13 DR = (R * Vbridge)/E ;
```

```
14 Rratio = DR / R ;//Change in Resistance
15 Strain = DL / Gf ;//Change in Length
16 Stress = E1 * Strain ;
17 printf ( "\n\n Change in Resistance = %.4f ohm ", DR
    )
18 printf ( "\n\n Ratio of Resistance = %.9f ohm per
    ohm ", Rratio )
19 printf ( "\n\n Strain value = %.9f ", Strain )
20 printf ( "\n\n Stress value = %.9f psi ", Stress )
```

---