Scilab Textbook Companion for Oscillations and Waves by S. Prakesh[1]

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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.

Contents

List of Scilab Codes

Chapter 1

Free Oscillations in One Dimension Simle Harmonic Oscillator

Scilab code Exa 1.1 frequency and time period

```
//Example 1 //  FREQUENCY AND TIME PERIOD
clc;
clear;
close;
format('v',6)
//ph=50*x^2+100 in joule/kg
m=10;//mass in kg
f=10^3/m;//joule/kg
w=sqrt(f);//oscillations
fr=w/(2*%pi);//oscillations/sec
tp=1/fr;//seconds
disp(fr,"frequency of oscillation is ,(oscillations/
    seconds)=")
disp(tp,"time period is,(seconds)=")
```

Scilab code Exa 1.3 total energy

```
//Example 3 // ENERGY
clc;
clear;
close;
ke=5;//joule
pe=5;//joule
rep=10;//joule
eo=rep+ke+pe;//joule
disp(eo,"energy of the oscillator is,(joule)=")
```

Scilab code Exa 1.4 velocity and acceleration

```
//Example 4 //  peroid ,maximum velocity and
    acceleration
clc;
clear;
close;
a=3;//cm
b=4;//cm
A=sqrt(a^2+b^2);//cm
w=2;//sec^-1
T=(2*%pi)/w;//seconds
um=w*A;//cm/s
am=w^2*A;//cm/s^2
disp(T,"time period is ,(seconds)=")
disp(um,"maximum velocity is,(cm/s)=")
disp(am,"maximum acceleration is,(cm/s^2)=")
```

Scilab code Exa 1.5 velocity and acceleration

```
//Example 5 // maximum velocity and acceleration
```

```
clc;
clear;
close;
A=5;//cm
T=31.4//seconds
w=(2*%pi)/T;//sec^-1
um=w*A;//cm/s
am=w^2*A;//cm/s^2
disp(um,"maximum velocity is,(cm/s)=")
disp(am,"maximum acceleration is,(cm/s^2)=")
```

Scilab code Exa 1.6 period

```
//Example 6 //  Period
clc;
clear;
close;
//given data :
g=9.8;// constant
l=1;// in m
theta_m1=60;// in degree
theta_m=%pi/3;// in radians
T0=round(2*%pi*sqrt(l/g));
disp(T0,"(a). Time period for small displacement,T0(
    seconds) = ")
T=T0*(1+(theta_m^2/16));
disp(T,"(b).Time period,T(seconds) = ")
```

Scilab code Exa 1.7 energy

```
//Example 7 // ENERGY
clc;
clear;
```

```
close;
es=1;//joule
l=2;//metre
am=3;//cm
am1=5;//cm
e1=(am1^2/am^2)*es;//joules
l2=1;//meter
e2=(l/l2)*es;//joules
disp(e1,"energy in first case is,(joules)=")
disp(e2,"energy in second case is,(joules)= ")
```

Scilab code Exa 1.8 period of motion

```
//Example 8 //  Period of motion
clc;
clear;
close;
//given data :
x=0.16;// in m
m1=4;// in kg
g=9.8;
K=m1*g/x;
m=0.50;// in kg
T=2*%pi*sqrt(m/K);//
disp(T,"The period of motion ,T(seconds) = ")
// answer is wrong in textbook
```

Scilab code Exa 1.9 force constant period of oscillation amlitude and energy

```
//Example 9 //foce constant,displacement ,
   acceleration and energy
clc;
clear;
```

```
close;
//given data :
x1=.10;// in m
F1=4;// in N
K=F1/x1;
x2=0.12;// in m
disp(K,"(a). The force constant,K(N/m) = ")
F=-K*x2;
disp(F,"(b). The force,F(N) = ")
m=1.6;// in kg
T=2*%pi*sqrt(m/K);
disp(T,"(c). Period of pscillation,T(s) = ")
A=x2;
disp(A,"(d). Amplitude of motion,A(m) = ")
alfa=A*K/m;
disp(alfa,"(e). Maximum acceleration, alfa(m/s^2) = ")
x=A/2;// in m
w=sqrt(K/m);
v=w*sqrt(A^2-x^2);
a=w^2*x;// in m/s^2
KE=(1/2)*m*v^2;// in J
PE=(1/2)*K*x^2;// in J
TE=KE+PE;
disp(v,"(f) velocity is,(m/s) ")
disp(a,"(f). acceleration,(m/s^2) = ")
disp(KE,"(f) Kinetic energy is ,(J)=")
disp(PE,"(f) Potential energy is ,(J)=")
disp(TE,"(g). Total energy of the oscillating system,TE(J) = ")
// in textbook part f is inculded in the part e so their is the numbeing error in parts
```

Scilab code Exa 1.10 `velocity`

```
//Example 10 // ENERGY
clc;
clear;
close;
t=8/3;//seconds
v=-10*%pi*sin((35*%pi)/6)//cm
disp(v,"velocity is,(cm)=")
```

Scilab code Exa 1.11 frequency energy and velocity

```
//Example 11 //
clc;
clear;
close;
//given data :
K1=3;// in N/m
K2=2;// in N/m
m=0.050;// in kg
w=sqrt((K1+K2)/m);
n=w/(2*%pi);
disp(n,"(i). The frequency,n(oscillations/sec) = ")
A=0.004;// in m
E=(1/2)*A^2*(K1+K2);
disp(E,"(ii). The energy,E(J) = ")
v=sqrt(2*E/m);
disp(v,"(iii). The velocity,v(m/s) = ")
```

Scilab code Exa 1.12 rotational inertia

```
//Example 12 // Rotational inertia
clc;
clear;
close;
```

```
//given data :
M=0.1;// in m
l=0.1;// in m
I1=M*l^2/12;// in kg-m^2
T1=2;// in s
T2=6;// in s
I2=(I1*T2^2)/T1^2;
disp(I2,"Rotational inertia ,I2(kg.m^2) = ")
```

Scilab code Exa 1.13 `period`

```
//Example 13 // Time period
clc;
clear;
close;
//given data :
M=4;// in kg
R=0.10;// in m
I=(2/5)*M*R^2;// in kg.m^2
C=4*10^-3;// in Nm/radian
T=2*%pi*sqrt(I/C);
disp(T,"Time period ,T(s) = ")
// answer is wrong in textbook
```

Scilab code Exa 1.15 `frequency and energy`

```
//Example 15 // Energy
clc;
clear;
close;
//given data :
L=10*10^-3;// in H
C=20*10^-6;// in F
```

```
n=1/(2*%pi*sqrt(L*C));
V=10;//in V
U=(1/2)*C*V^2;
disp(n,"Frequency,n(cycles/s) = ")
disp(U,"Energy of oscillations,U(J) = ")
//answer of frequency is calculated wrong in textbook
```

Scilab code Exa 1.16 `distance binding energy and force constant`

```
//Example 16 // distance,binding energy and force constant
clc;
clear;
close;
disp("equilibrium inter−nuclear distance correspondes to lowest potential enegy is ro= 2* ")
pet=0;//eV
peb=-4;//eV
be=pet-peb;//eV
x1=-2;//eV
x2=-4;//eV
V=x1-x2;//eV
e=1.6*10^-19;//electronic charge
x=0.5;//armstrong
K=((2*V)/x^2);//eV/ ^2
k1=(K*e)/(10^-10)^2;//joule/m^2
disp(be,"binding energy is ,(eV)=")
disp(k1,"force constant is ,(newton/metre)=")
```

Scilab code Exa 1.17 `possible values of r and energy`

```
//Example 17 // possible values and energy
clc;
clear;
close;
r1=2;//from graph
r2=4.5;//units from graph
disp("possible values of r are "+string(r1)+" units
    and "+string(r2)+" units")
osc=1-(-2.5);//units
disp("maximum energy of oscillations for r=2 units
    is "+string(osc)+" units ")
osc1=0.5-(-1);//units
disp("maximum energy of oscillations for r=4.5 units
     is "+string(osc1)+" units ")
t=1;//from graph
v=0;//from graph
e=t+v;//
disp(e,"total energy is,(unit)=")
disp("at infinity V = "+string(v)+" therefore T = "+
    string(t)+" unit ")
```

Scilab code Exa 1.19 `frequency and moment of inertia`

```
//Example 19 // Frequency
clc;
clear;
close;
//given data :
m1=10;// in g
m2=90;// in g
K=10^3;// in N/m
mu=m1*m2*10^-3/(m1+m2);
n=round(sqrt(K/mu)/(2*%pi));
disp(n," The frequency,n(oscillations/sec) = ")
x1=0;//
```

```
x2=10; //cm
xb=((m1*x1+m2*x2)/(m1+m2)); //cm
mo=(m1*10^-3)*(xb*10^-2)^2+(m2*10^-3)*(1*10^-2)^2; //
disp(mo,"moment of inertia is ,(kg-m^2)=")
```

Scilab code Exa 1.20 frequency and amlitude

```
//Example 20 // frequency and amplitude
clc;
clear;
close;
c=10^-4; //N-m
m1=9; //gm
m2=1; //gm
mu=((m1*m2)/(m1+m2))*10^-3; //kg
r=20; //cm
I=mu*(r*10^-2)^2; //kg-m^2
fr=((1/(2*%pi))*sqrt(c/I)); //vibrations/sec
disp(fr,"frequency of vibration is ,(vibrations/s)="
   )
e=10^-2; //joule
thmax=sqrt((2*e)/c); //radians
disp(thmax,"amplitude is ,(radians)=")
```

Scilab code Exa 1.21 frequency energy and velocity

```
//Example 21 // frequency ,energy and maximum
   velocity
clc;
clear;
close;
c=1; //N-m
m1=6; //gm
```

```
m2=2;//gm
mu=((m1*m2)/(m1+m2))*10^-3;//kg
fr=((1/(2*%pi))*sqrt(c/mu));//vibrations/sec
disp(fr,"frequency of oscillations is ,(vibrations/s)=")
td= 1+(1/3);//cm
e=((1/2)*c*(td*10^-2)^2);//joule
disp(e,"energy is ,(joule)=")
y=((1/2)*m2*10^-3)+((1/2)*(1/3)^2*m1*10^-3);//
v1=sqrt((e/y));//m/sec
disp(v1,"maximum velocity of smaller mass is ,(m/seconds)=")
//velocity is calculated wrong in the book
```

Scilab code Exa 1.22 frequency

```
//Example 22 // frequency
clc;
clear;
close;
k=100;//N/m
m=100;//gm
n1=((1/(2*%pi))*sqrt(k/(m*10^-3)));//sec^-1
m1=100;//gm
m2=200;//gm
mu=((m1*m2)/(m1+m2))*10^-3;//kg
fr=((1/(2*%pi))*sqrt(k/mu));//sec^-1
disp(n1,"in first case frequency is ,(sec^-1)=")
disp(fr,"in second case frequency is ,(sec^-1)=")
```

Scilab code Exa 1.23 force constant and work done

```
//Example 23 // force constant and work done
```

```
clc;
clear;
close;
m1=1;//assume
m2=19;//assume
mh=1.66*10^-27;//kg
mu=((m1*m2)/(m1+m2))*mh;//kg
w=7.55*10^14;//radians/sec
k=mu*(w)^2;//N/m
disp(k,"force constant is ,(N/m)=")
x=0.5;//arngstrom
wh=((1/2)*k*(x*10^-10)^2);//joule
disp(wh,"work done is ,(joule)=")
```

Scilab code Exa 1.24 frequency

```
//Example 24 // frequency
clc;
clear;
close;
m1=1;//a.m.u
m2=35;//a.m.u
mu1=((m1*m2)/(m1+m2));//a.m.u
m3=2;//
mu2=((m3*m2)/(m3+m2));//a.m.u
n1=8.99*10^13;//cycle/sec
n2=(sqrt(mu1/mu2))*n1;//c/s
disp(n2,"frequecy of vibrations is ,(c/s)=")
```

Chapter 2

Damped Harmonic Oscillator

Scilab code Exa 2.3 `time damping force total distance`

```
//Example 3 // relaxation time ,damping force ,time
   and total distance
clc;
clear;
close;
v=10;//cm/s
vo=100;//cm/s
t=23;//sec
x=-(log(v/vo))/t;//
t=(1/x)*1;//seconds
disp(round(t),"relaxation time is ,(seconds)=")
m=40;//gm
vx=50;//cm/sec
fd=((-x*m*10^-3*vx*10^-2));//newton
disp(fd,"damping force is ,(newton)=")
tx=5*(log(10));//
disp(tx,"time in which kinetic energy will reduce to
    1/10th of its value is ,(seconds)=")
xx=v*1;//
disp(xx,"distance travelled is ,(m)=")
```

Scilab code Exa 2.4 period

```
//Example 4 // period
clc;
clear;
close;
//given data :
m=2;// in g
k=30;// in dynes/cm
b=5;// in dynes/cm-sec^-1
r=b/(2*m);
w0=sqrt(k/m);
T=2*%pi/sqrt(w0^2-r^2);
disp(T,"The time period ,T(s) = ")
```

Scilab code Exa 2.5 time period

```
//Example 5 // time
clc;
clear;
close;
tr=50;//seconds
r=(1/(2*tr));//s^-1
t=1/r;//seconds
disp(t,"time in which amplitude falls to 1/e times
   the initial value is ,(seconds)=")
t2=tr;//
disp(t2,"time in which system falls to 1/e times the
    initial value is ,(seconds)=")
t3=2*(1/r);//
disp(t3,"time in which energy falls to 1/e^4 of the
   initial value is ,(seconds)=")
```

Scilab code Exa 2.6 `relaxation time frequency energy and rate of loss`

```
//Example 6 // relaxation time ,frequency ,energy ,time ,rate and number of vibrations
clc;
clear;
close;
k=20;//N/m
m=5//N-s/m
wo=sqrt(k/m);//
v1=2;//m/s
to=m/v1;//seconds
disp(to,"relaxation time is ,(seconds)=")
w=wo*(1-(1/(2*wo*to))^2);//
lf=w/(2*%pi);//vibration/s
disp(lf,"linear frequency is ,(vibration/s)=")
a=1;//
e=((1/2)*m*a^2*wo^2);//joule
disp(e,"energy is ,(joule)=")
tm=v1*to;//seconds
disp(tm,"time taken in fall of amlitude to 1/e value is ,(seconds)=")
disp(tm,"time taken in fall of velocity amplitude to 1/2 value is ,(seconds)=")
tr=to;//
disp(tr,"time taken in fall of energy to 1/e value is ,(seconds)=")
eng=(1/2)*m*a*v1^2*(2/tm);//
disp("rate of loss of energy at t=0 seconds is "+string(eng)+" J/s and at any time is "+string(eng)+"e^-2*t/"+string(tm)+" J/s ")
rel=((eng*2*%pi)/wo);//J/s
disp("rate of loss of energy per cycle at t=0 seconds is "+string(rel)+" J/s and at any time is
```

```
    "+string(rel)+"e^-2*t/"+string(tm)+" J/s ")
nv=tm/((2*%pi)/wo);//
disp(nv,"number of vibratios made are,=")
```

Scilab code Exa 2.7 time and distance

```
//Example 7 // time and distance
clc;
clear;
close;
b=5;//N-s/m
v=10;//m/s
to=b/v;//second
disp(to,"time in which velocity falls to 1/e times
    the initial value is ,(second)=")
t2=b*to;//
disp(t2,"time in which velocit falls to half the
    initial value is,(second)=")
disp("diatnce traversed by the particle before the
    velocity falls to half the initial value is "+
    string(b)+"*(1-e^-(log)"+string((2*to)/to)+")")
x=b;//m
disp(x,"distance traversed by the particle it comes
    to rest is,(m)=")
```

Scilab code Exa 2.8 time interval

```
//Example 8// time interval
clc;
clear;
close;
q=5*10^4;//quality factor
x=1/10;//
```

```
fr=300;//second^-1
to=q/(2*%pi*fr);//second
xm=((to*log(10)));//seconds
disp(xm,"time interval is,(seconds)=")
```

Scilab code Exa 2.9 time

```
//Example 9 // Time
clc;
clear;
close;
//given data :
n=240;// in sec^-1
w=2*%pi*n;
Q=2*10^3;
tau=Q/w;
t=4*tau;
disp(t,"Time,t(s) = ")
```

Scilab code Exa 2.10 logarithmic decrement

```
//Example 10 // Logarithmic decrement
clc;
clear;
close;
//given data :
a=100;
l1=20;// in cm
l2=2;// in cm
l=l1/l2;
lamda=(1/100)*log(l);
disp(lamda," Logarithmic decrement, = ")
```

Scilab code Exa 2.12 frequency

```
//Example 12 // Frequency
clc;
clear;
close;
//given data :
C=10^-6;// in F
L=0.2;// in H
R=800;// in ohm
Rm=2*sqrt(L/C);
n=sqrt((1/(L*C))-(R^2/(4*L^2)))/(2*%pi);
disp(n,"The frequency ,n(cycles/s) = ")
```

Scilab code Exa 2.13 resistance

```
//Example 13 // Resistance
clc;
clear;
close;
//given data :
C=0.0012*10^-6;// in F
L=0.2;// in H
Rm=2*sqrt(L/C);
disp(Rm,"The maximum value of resistance ,Rm(ohms) =
    ")
```

Scilab code Exa 2.14 frequency and quality factor

```
//Example 14 // Q factor
clc;
clear;
close;
//given data :
C=5*10^-6;// in F
L=2*10^-3;// in H
R=0.2;// in ohm
w=round(sqrt((1/(L*C))-(R^2/(4*L^2))));
f=w/(2*%pi);
Q=w*L/R;
disp(f,"frequency is ,(Hz)=")
disp(Q,"Quality factor ,Q = ")
```

Chapter 3

Forced Harmonic Oscillator and Resonance

Scilab code Exa 3.1 amlitude and phase displacement

```
//Example 1 // Phase shift
clc;
clear;
close;
//given data :
F0=25;// in N
m=1;
f0=F0/m;
K=1*10^3;// in N/m
w0=sqrt(K/m);
b=0.05;// in N-s/m
r=b/(2*m);// in s^-1
A=f0*10^3/sqrt(9*w0^4+(16*r^2*(w0)^2));
disp(A,"The amplitude,A(mm) = ")
p=2*w0;
fi=atand(2*r*p/(w0^2-p^2));
disp("phase shift is "+string(fi)+" degree or "+string(fi*(%pi/180))+" radian")
//phase shift is converted wrong into radians
```

Scilab code Exa 3.2 cosntant

```
//Example 2 // A/Amax
clc;
clear;
close;
x1=[0.99;0.98;0.97];//
wt=50;//
wo=1;//assume
fo=1;//assume
for i=1:3
    a(i)=((fo/((wo^2)*((1-x1(i)^2)^2+((1/wt^2)*x1(i)
       ^2))^(1/2))));//
    am(i)=fo/((wo^2)*(1/wt^2)^(1/2));//
    z(i)=a(i)/am(i);//
    disp("for p/wo "+string(x1(i))+" value of A/Amax
        is "+string(z(i))+"")
end
```

Scilab code Exa 3.3 reactance and impedance

```
//Example 3 // Reactance and impedence
clc;
clear;
close;
//given data :
n=50;// in cycles
w=2*%pi*n;// in rad/sec
L=1/%pi;// in H
XL=w*L;
disp(XL,"The reactance,XL(ohm) = ")
```

```
R=100;// in ohm
Z=sqrt(R^2+XL^2);
disp(Z,"The impedence ,Z(ohm) = ")
```

Scilab code Exa 3.4 current and capacitance

```
//Example 4 // Current and Capacity
clc;
clear;
close;
//given data :
E=110;// in V
R=10;// in ohm
L=1*10^-3;// in H
C=1*10^-6;// in F
n=10000;// in Hz
w=2*%pi*n;
I=E/sqrt(R^2+((w*L)-(1/(w*C)))^2);
disp(I,"The current ,I(A) = ")
L1=1/(w^2*C);
disp(L1,"The value of capacity ,L1(F) = ")
//Capacitance is calculated wrong in the textbook
```

Scilab code Exa 3.5 resonant frequency separation and sharpness

```
//Example 5 // Resonent frequency and Separation
clc;
clear;
close;
//given data :
L=1*10^-3;// in H
C=0.1*10^-6;// in F
w0=1/sqrt(L*C);
```

```
disp(w0,"Resonant frequency,w0(rad/s)  = ")
R=10;// in ohm
w2_w1=R/L;
disp(w2_w1,"the separation,(rad/s) = ")
S=w0/w2_w1;
disp(S,"The sharpness is = ")
```

Chapter 4

Coupled Oscillator

Scilab code Exa 4.2 `ratio of frequency`

```
//Example 2 // ratio of  Frequency
clc;
clear;
close;
k=1;//assume
m1=16;//a.m.u
m2=12;//a.m.u
m3=m1;//
rt=((m2+2*m1)/m2)^(1/2);//
disp(rt,"ratio of frequency is,=")
```

Chapter 5

Wave Motion and Speed of Waves in Gaes

Scilab code Exa 5.1 `wavelength`

```
//Example 1 // wavelength
clc;
clear;
close;
//given data :
v=960;// in m/s
n=3600/60;// in per sec
lamda=v/n;
disp(lamda,"The wavelength,lamda(m) = ")
```

Scilab code Exa 5.2 `frequency`

```
//Example 2 // Frequency
clc;
clear;
close;
```

```
//given data :
c=3*10^8;// in m/s
lamda=300;// in m
n=c*10^-6/lamda;
disp(n,"The frequency ,n(MHz) = ")
```

Scilab code Exa 5.3 velocity and direction

```
//Example 3 // velocity and direction
clc;
clear;
close;
//y=1.2*sin(3.5*t+0.5*x);//equation
w=3.5;//from equation
k=0.5;//from equation
v=w/k;//m/s
disp("wave velocity is "+string(v)+" m/s and
   direction of the wave is along negative X-axis")
```

Scilab code Exa 5.4 wave equation

```
//Example 4 //equation of wave propogation
clc;
clear;
close;
amp=0.02;//m
fr=110;//Hz
v=330;//m/s
w=2*%pi*fr;//s^-1
k=w/v;//constant
//y=a*sin(w*t-k*x);//refrence equation
disp("equation of wave is "+string(amp)+"*sin("+
   string(w)+"*t-"+string(k)+"*x)")
```

Scilab code Exa 5.5 path difference

```
//Example 5 //path difference
clc;
clear;
close;
v=360; //m/s
fr=500; //Hz
h=v/fr; //wavelength in metre
ang=60; //degree
angr=ang*(%pi/180); //radian
pth=(h)/(2*%pi); //metre
disp(pth,"path difference is ,(m)=")
```

Scilab code Exa 5.6 wavelength

```
//Example 6 //path difference
clc;
clear;
close;
pth=15; //cm
pd=(2*%pi)/3; //radians
h=(pth*2*%pi)/pd; //cm
disp(h,"wavelength is ,(cm)=")
```

Scilab code Exa 5.8 displacement velocity and acceleration

```
//Example 8 //displacement ,particle velocity and
    acceleration
```

```
clc;
clear;
close;
//y=a*sin*((2*%pi)/h)*(vt-x);//
v=1000;//cm/s
n=25;//vibrations
h=v/n;//cm
a=3;//cm
t=2;//seconds
x1=200;//cm
y=3*sind(((2*360)/h)*(v*t-x1));//
vl=2*%pi*a*n;//cm/s
acc=0;//
disp(y,"displacement is,(cm)=")
disp(vl,"velocity is,(cm/s)=")
disp(acc,"acceleration is,(cm/s^2)=")
```

Scilab code Exa 5.9 `amplitude frequency velocity and wavelength`

```
//Example 9 //amplitude,frequency,velocity ,
   wavelength and speed
clc;
clear;
close;
//y=5*sin*(4t-0.02x);//given
a=5;//cm
h=(2*%pi)/0.02;//
v=0.02*10000;//cm/s
n=v/h;//cycles/seconds
disp(a,"amplitude is,(cm)=")
disp(n,"frequency is,(cycles/s)=")
disp(v,"velocity is,(cm/s)=")
disp(h,"wavelength is,(cm)=")
ma1x=a*4;//cm/s
disp(ma1x,"maximum speed is,(cm/s)=")
```

Scilab code Exa 5.10 wave intensity

```
//Example 10 //wave intensity
clc;
clear;
close;
nt=1;//watt source
r=1;//n
is=(nt/(4*%pi*r^2));// joule/sec-m^2
disp(is,"intensity on the surface is ,(joule/sec-m
    ^2)=")
```

Scilab code Exa 5.14 energy flux

```
//Example 14 // Energy flux
clc;
clear;
close;
//given data :
A=.10;// in m
w=4;// in per sec
k=0.1;// in per cm
p=1.25*10^3;// in kg/m^3
v=w*10^-2/k;// in m/s
n=w/(2*%pi);
Ef=2*%pi^2*n^2*A^2*p*v;
disp(Ef,"Energy flux of the wave,Ef(W/m^2) = ")
```

Scilab code Exa 5.15 energy

```
//Example 15 // Energy radiated and energy current
clc;
clear;
close;
//given data :
p=1.29;// in kg/m^3
a=.15*10^-2;// in m/s
n=76;// in Hz
E=2*%pi^2*n^2*a^2*p;
disp(E,"(a). Energy radiated ,E(J/m^3) = ")
v=332;// in m/s
Ev=E*v;
disp(Ev,"(b). The energy  current ,Ev(W/s) = ")
// energy current is calculated wrong in the
   textbook
```

Scilab code Exa 5.16 `pressure amplitude energy density and energy flux`

```
//Example 16 // Pressure amplitude, Energy density
   and energy flux
clc;
clear;
close;
//given data :
a=10^-5;// in m
n=500;// in per sec
p=1.29;// in kg/m^3
v=340;// in m/s
Pa=2*%pi*a*n*v*p;
disp(Pa,"(i).Pressure amplitude ,Pa(N/m^2) = ")
Ed=2*%pi^2*a^2*n^2*p;
disp(Ed,"(ii). Energy density ,Ed(J/m^3) = ")
Ef=2*%pi^2*a^2*n^2*p*v;
disp(Ef,"(iii). The energy flux ,Ef(J/m^2-s) = ")
```

Scilab code Exa 5.17 pressure

```
//Example 17 // Pressure
clc;
clear;
close;
//given data :
gama=1.4;
u=10^-3;// in m/s
v=340;// in m/s
P=10^5;// in N/m^2
p=gama*P*u/v;
disp(p,"The pressure ,p(N/m^2) = ")
```

Scilab code Exa 5.18 speed of sound

```
//Example 18 //speed
clc;
clear;
close;
sa=332;//m/s
pa=16;//density of air
ph=1;//density of hydrogen
vn=sa*sqrt(pa/ph);//m/s
t1=0;//degree celsius
t2=546;//degree celsius
t1k=0+273;//kelvin
t2k=t2+273;//kelvin
v2=vn*sqrt(t2k/t1k);//m/s
disp(vn,"speed of sound in first case is ,(m/s)=")
disp(v2,"speed of sound in second case is ,(m/s)=")
```

Scilab code Exa 5.19 temperature

```
//Example 19 //temperature
clc;
clear;
close;
t1=0;//degree celsius
t1k=t1+273;//kelvin
rt=2;//
tk=rt^2*t1k;//Kelvin
t=tk-273;//degree celsius
disp(t,"temperature is ,(degree-celsius)=")
```

Scilab code Exa 5.20 temperature

```
//Example 20 //temperature
clc;
clear;
close;
rtd=16/14;//ratio of densities
tk=15+273;//degree celsius
x=(tk*rtd)-273;//degree celsius
disp(x,"temperature is ,(degree-celsius)=")
```

Scilab code Exa 5.21 speed of sound in nitrogen

```
//Example 21 //speed
clc;
clear;
```

```
close;
rt=4/1;//
ss=332;//m/s
rd=32/28;//ratio of densities
rt1=((1+(1/rt)*rd)/(1+(1/rt)));//
v1=ss*sqrt(rt1);//m/s
disp(v1,"speed of sound in nitrogen is,(m/s)=")
```

Scilab code Exa 5.22 `RMS velocity`

```
//Example 22 //speed
clc;
clear;
close;
gm=1.41;//
vs=330;//m/s
vrms=sqrt(3/gm)*vs;//m/s
disp(vrms,"root mean square velocity of molecules of
    a gas is ,(m/s)=")
```

Chapter 7

Superposition of Harmonic Waves Interference Beats Stationary Waves Phase and Group Velocities

Scilab code Exa 7.1 ratio

```
//Example 1 //  ratio
clc;
clear;
close;
ri=9/16;//ratio of intensities
ra=sqrt(ri);//ratio of amplitude
a1=1;//assume
a2=ra*a1;//
rim=(a1+a2)^2/(a1-a2)^2;//
disp("ratio of  maximum intensity and minimum
   intensity in fringe system is "+string(rim)+":"+
   string(a1)+"")
```

Scilab code Exa 7.2 intensity

```
//Example 2 //  intensity
clc;
clear;
close;
I=1;//assume
a1=1*I;//
a2=4*I;//
ph1=0;//degree
i1=(a1+a2)+a2*cosd(ph1);//
disp("intensity where phase difference is zero is "+
    string(i1)+"*I")
ph2=90;//degree
i2=(a1+a2)+a2*cosd(ph2);//
disp("intensity where phase difference is pi/2 is "+
    string(i2)+"*I")
ph3=180;//degree
i3=(a1+a2)+a2*cosd(ph3);//
disp("intensity where phase difference is pi is "+
    string(i3)+"*I")
```

Scilab code Exa 7.3 wavelength and frequency

```
//Example 3 //  Wavelength and frequency
clc;
clear;
close;
//given data :
d=30;// in cm
lamda=2*d*10^-2;
v=330;// in m/s
disp(lamda,"The wavelength,(m) = ")
n=v/lamda;
disp(n,"The frequency,n(vibrations/s) = ")
```

Scilab code Exa 7.4 time interval

```
//Example 4 //  number of beats and time interval
clc;
clear;
close;
n1=300;//Hz
n2=303;//Hz
bfs=n2-n1;//
disp(bfs,"beat frequency per second is,=")
ti=1/bfs;//second
disp(ti,"time interval is,(second)=")
```

Scilab code Exa 7.5 frequency

```
//Example 5 //  Frequency
clc;
clear;
close;
//given data :
n1=256;// in Hz
x=4;// in beats per sec
n2a=n1+x;
n2b=n1-x;
disp(n2a,"The frequency,n2a(Hz) = ")
disp(n2b,"The frequency,n2b(Hz) = ")
```

Scilab code Exa 7.6 frequency

```
//Example 6 //  Frequency
clc;
clear;
close;
//given data :
nA=256;// in Hz
x=5;// in beats per sec
nB=nA+x;
disp(nB,"The frequency ,nB(Hz) = ")
```

Scilab code Exa 7.7 frequency

```
//Example 7 //  Frequency
clc;
clear;
close;
//given data :
nB=512;// in Hz
x=5;// in beats per sec
nA=nB+x;
disp(nA,"The frequency of A,nA(Hz) = ")
```

Scilab code Exa 7.8 velocity

```
//Example 8 //  Velocity of sound
clc;
clear;
close;
//given data :
lamda1=1;// in m
lamda2=1.01;// in m
a=10/3;// in beats/sec
v=a/((lamda2-lamda1)/(lamda1*lamda2));
```

```
disp(v,"The velocity of sound,v(m/s) = ")
```

Scilab code Exa 7.9 frequency

```
//Example 9 //  Frequency
clc;
clear;
close;
n=273;//
b1=4;//beats per second
b2=b1-1;//
t1=15;//degree celsius
t2=10;//degree celsius
v1510=sqrt((n+t1)/(n+t2));//
n=((b2*v1510-b1)/(1-v1510));//
disp(n,"frequency is,(Hz)=")
```

Scilab code Exa 7.10 frequency

```
//Example 10 //  Frequency
clc;
clear;
close
b1=10;//beats per second
f1=300;//Hz
b2=15;//beats per second
f2=325;//Hz
n1=f1-b1;//Hz
n2=f1+b1;//Hz
n3=f2-b2;//Hz
n4=f2+b2;//Hz
disp(n2,"frequency is,(Hz)=")
```

Scilab code Exa 7.11 velocity

```
//Example 11 //  Velocity of sound
clc;
clear;
close;
//given data :
lamda1=5;// in m
lamda2=5.5;// in m
a=6;// beats/sec
v=a/((lamda2-lamda1)/(lamda1*lamda2));
disp(v,"The velocity of sound,v(m/s) = ")
```

Scilab code Exa 7.12 frequency

```
//Example 12 //  Frequency
clc;
clear;
close
b1=5;//beats per second
fr=384;//Hz
fo=fr-b1;//Hz
disp(fo,"frequency is ,(Hz)=")
```

Scilab code Exa 7.13 frequency

```
//Example 13 //  Frequency
clc;
clear;
```

```
close
b1=4;//beats per second
fr=256;//Hz
fo=fr+b1;//Hz
disp(fo,"frequency is ,(Hz)=")
```

Scilab code Exa 7.18 frequency wavelength velocity and amlitude

```
//Example 18 //Frequency ,wavelength , velocity and amplitude
clc;
clear;
close;
//given data :
a=6;// in cm
lamda=10;// in cm
T=1/10;// in sec
disp(lamda,"Wavelength of progressive wave,(cm) = ")
n=1/T;
disp(n,"Frequency of progressive wave,n(per sec)")
v=n*lamda;
disp(v,"The velocity ,v(cm/s) = ")
disp(a,"The amplitude ,a(cm) = ")
```

Scilab code Exa 7.24 group velocity

```
//Example 24 //Velocity
clc;
clear;
close;
//given data :
c=3*10^8;// in m/s
lamda1=4000;// in Angustrom
```

```
lamda2=5000;// in Aungustrom
mu1=1.540;
mu2=1.530;
vg=c*((mu1*lamda1)-(mu2*lamda2))/(mu1*mu2*(lamda1-
    lamda2));
disp(vg,"The velocity,vg(m/s) = ")
```

Scilab code Exa 7.25 group velocity

```
//Example 25 //Velocity
clc;
clear;
close;
//given data :
v=1.8*10^8;// in m/s
lamda=3.6*10^-7;// in m
dv_dlamda=3.8*10^13;// in per sec
vg=v-(lamda*dv_dlamda);
disp(vg,"The group velocity,vg(m/s) = ")
```

Chapter 8

Vibrations of Strings and Membranes

Scilab code Exa 8.1 speed

```
//Example 1 // Speed
clc;
clear;
close;
//given data :
m1=0.1;// in kg
g=9.81;// in m/s^2
T=m1*g;// N
A=10^-6;// in m^2
p=9.81*10^3;// in kg/m^3
m=A*p;// in kg/m
v=sqrt(T/m);
disp(v,"The speed of transverse waves,v(m/s) = ")
```

Scilab code Exa 8.2 tensile stress

```
//Example 2 // tensile stress
clc;
clear;
close;
//given data :
p=8000;// in kg/m^3
v=340;// in m/s
TbyA=v^2*p*10^-2;
disp(TbyA,"Tensile stress,(N/m^2) = ")
```

Scilab code Exa 8.3 tension

```
//Example 3 // Tension
clc;
clear;
close;
//given data :
M=2*10^-3;// in kg
l=35*10^-2;// in m
n=500;// in Hz
m=M/l;// in kg/m
T=4*n^2*l^2*m;
disp(T,"Tension,T(N) = ")
```

Scilab code Exa 8.4 frequency

```
//Example 4 // Frequency
clc;
clear;
close;
//given data :
T=625;// in N
T1=100;// in N
```

```
l=1/2;
n=240;// in Hz
n1=1/l*(sqrt(T1/T))*n;
disp(n1,"The frequency,n1(Hz) = ")
```

Scilab code Exa 8.5 initial tension

```
//Example 5 // initial tension
clc;
clear;
close;
rt=2/3;//ratio
mi=5;//kg wt
M=((1/rt)^2)-1;//
mo=mi/M;//kg wt
disp(mo,"initial tension in string is ,(kg-wt)=")
```

Scilab code Exa 8.6 speed stress and percentage change

```
//Example 6// speed,stress and change in frequency
clc;
clear;
close;
n=175;//Hz
l=1.5;//m
v=2*n*l;//m/s
d=7.8*10^3;//kg/m^3
st=v^2*d;//N/m^2
per=3;//% increament
T=1;//assume
td=(1+per/100)*T;//
x=(((1/2)*(per/100)));//
td=x*100;//
```

```
disp(v,"velocity is,(m/s)=")
disp(st,"stress is,(N/m^2)=")
disp(td,"percentage change in frequency is,(%)=")
```

Scilab code Exa 8.7 `frequency`

```
//Example 7 // Frequency
clc;
clear;
close;
//given data :
l=.50;// in m
m1=25;// in kg
m2=1.44*10^-3;// in kg
g=9.81;// in m/s^2
T=m1*g;
m=m2/l;
p=2;
n=(p/(2*l))*sqrt(T/m);
disp(n,"The frequency,n = ")
```

Scilab code Exa 8.8 `frequency`

```
//Example 8// frequency
clc;
clear;
close;
l1=90;//cm
d1=0.05;//cm
d2=0.0625;//cm
l2=60;//cm
n1=200;//Hz
n2=((l1*d1*n1)/(l2*d2));//Hz
```

```
disp(n2,"frequency is ,(Hz)=")
```

Scilab code Exa 8.9 `tension`

```
//Example 9// tension
clc;
clear;
close;
n21=3/2;//
r21=3/4;//
t1=2.048;//kg. wt
t2=(n21*r21)^2*t1;//kg weight
n31=9/4;//
r31=2/4;//
t3=(n31*r31)^2*t1;//kg-weight
n41=27/8;//
r41=1/4;//
t4=(n41*r41)^2*t1;//kg-weight
disp(t2,"tension (T2) is ,(kg weight)=")
disp(t3,"tension (T3) is ,(kg weight)=")
disp(t4,"tension (T4) is ,(kg weight)=")
```

Scilab code Exa 8.10 `velocity`

```
//Example 10// velocity
clc;
clear;
close;
l1=20;//cm
v1=600;//cm^-1
n1=v1/4;//
v1=2*n1*l1*10^-2;//m/sec
v2=sqrt(2)*v1;//m/s
```

```
disp(v1,"velocity of the waves is,(m/s)=")
disp(round(v2),"velocity of waves when tension of
    the string is doubled is,(m/s)=")
```

Scilab code Exa 8.11 `frequency`

```
//Example 11// frequency
clc;
clear;
close;
nb=6;//beats
l1=20;//cm
l2=21;//cm
x=l2/l1;//
n=(x*nb+nb)/(x-1);//
disp(n,"frequency is,(Hz)=")
```

Scilab code Exa 8.12 `frequency`

```
//Example 12// frequency
clc;
clear;
close;
nb=4;//beats
l1=70;//cm
l2=70-1;//cm
x=l2/l1;//
n=(x*nb)/(1-x);//
disp(n,"frequency is,(Hz)=")
```

Scilab code Exa 8.13 `length`

```
//Example 13// length
clc;
clear;
close;
n123=1/3/15;//
tl=105;//cm
l123=15/5/1;//
k=tl/21;//
l1=15*k;//cm
l2=5*k;//cm
l3=k;//cm
disp(l1,"l1 length is,(cm)=")
disp(l2,"l2 length is,(cm)=")
disp(l3,"l3 length is,(cm)=")
//length l2 is calculated wrong in the textbook
```

Scilab code Exa 8.14 `wavelength`

```
//Example 14// wave-length
clc;
clear;
close;
//y=ym*sin*2*%pi(nt-(x/h));//given
disp("wavelength is (%pi*ym)/2")
```

Scilab code Exa 8.15 `FREQUENCY`

```
//Example 15// frequency
clc;
clear;
close;
```

```
l=2.5;//m
m1=0.001;//kg
tn=4;//N
m=m1/l;//kg/m
n=((1/(2*l))*sqrt(tn/m));//Hz
disp(n,"frequency is ,(Hz)=")
disp("frequencies stopped are "+string(5*n)+" Hz,"+
    string(10*n)+" Hz,"+string(15*n)+" Hz")
```

Scilab code Exa 8.16 `frequency and relative amplitude`

```
//Example 16// frequency
clc;
clear;
close;
l=1;//m
m1=0.5;//kg
tn=200;//N
m=m1/l;//kg/m
n=((1/(2*l))*sqrt(tn/m));//Hz
disp(n,"frequency is ,(Hz)=")
w=2*%pi*n;//
disp("ratio of three frequencies is "+string(w)+" :
    "+string(2*w)+" : "+string(3*w)+"")
```

Chapter 9

Longitudinal Acoustic Waves in Air

Scilab code Exa 9.1 pressure amplitude energy density and energy lux

```
//Example 1 // Pressure amplitude, Energy density
    and Energy flux
clc;
clear;
close;
//given data :
A=1*10^-5;// in m
n=500;// in per sec
v=340;// in m/s
p=1.29;// in kg/m^3
Pa=2*%pi*n*v*p*A;
disp(Pa,"Pressure amplitude,Pa(N/m^2) = ")
Ed=2*%pi^2*n^2*p*A^2;
disp(Ed,"Energy density,Ed(J/m^3) = ")
Ev=Ed*v;
disp(Ev,"Energy flux,Ev(J/m^2-s) = ")
```

Scilab code Exa 9.2 pressure

```
//Example 2// Pressure
clc;
clear;
close;
//given data :
gama=1.4;
u=10^-3;// in m/s
v=340;// in m/s
P=10^5;// in N/m^2
p=gama*P*u/v;
disp(p,"The pressure,p(N/m^2) = ")
```

Scilab code Exa 9.3 amplitude

```
//Example 3// The amplitude
clc;
clear;
close;
//given data :
n=350;// in Hz
v=330;// in m/s
p=1.293;// in kg/m^3
I=1*10^-6;// in W/m^2
A=sqrt(I/(2*%pi*n^2*p*v));
disp(A,"The amplitude of wave,A(m) = ")
```

Scilab code Exa 9.4 velocity wavelength and amplitude

```
//Example 4// Velocity, Amplitude of pressure and
   particle velocity amplitude
clc;
```

```
clear;
close;
//given data :
gama=1.4;
P=1.013*10^5;
p1=1.29;// in kg/m^3
A=2.5*10^-7;// in m
v=sqrt(gama*P/p1);
disp(v,"The velocity,v(m/s) = ")
n=1000;// in Hz
lamda=v/n;
disp(lamda,"Wavelength,lamda(m) = ")
p=p1*v*2*%pi*n*A;
disp(p,"Amplitude of pressure,p(N/m^2) = ")
u=2*%pi*n*A;
disp(u,"Particle velocity amplitude,u(m/s) = ")
```

Scilab code Exa 9.5 BULK MODULUS AMPLITUDE AND PRESSURE VARIATION

```
//Example 5// Amplitude
clc;
clear;
close;
//given data :
v=(1/3)*10^3;// in m/s
p=1.25;// in kg/m^3
E=v^2*p;
n=10^4;// in rad/sec
disp(E,"Bulk modulus of medium,E(N/m^2) = ")
I=10^-12;// in W/m^2
A=sqrt(I/(2*%pi^2*n^2*p*v));
disp(A,"Amplitude of wave,A(m ) = ")
P=sqrt(2*I*p*v);
disp(P,"Pressure amplitude,P(N/m^2) = ")
// answer A and E is wrong in textbook
```

Scilab code Exa 9.6 velocity

```
//Example 6// Root mean squre velocity
clc;
clear;
close;
//given data :
vs=330;// in m/s
gama=1.41;
c=round(sqrt(3/gama)*vs);
disp(c,"The root mean square velocity of modulus,c(m
   /s) = ")
```

Scilab code Exa 9.7 power

```
//Example 7// Acoustic power entering
clc;
clear;
close;
//given data :
A=1*2;// in m^2
a=80;// in dB
I0=10^-12;// in W/m^2
IbyI0=10^(80/10);
I=I0*IbyI0;
Ape=I*A;
disp(Ape,"Acoustic power entering the room,(Watt) =
   ")
```

Scilab code Exa 9.8 `intensity level`

```
//Example 8// Acoustic intensity level
clc;
clear;
close;
//given data :
Pr=3;// in W
r=15;// in m
I=Pr/(4*%pi*r^2);// in W/m^2
I0=10^-12;// in W/m^2
L=round(10*log10(I/I0));
disp(L,"Acoustic intensity level ,L(dB) = ")
```

Scilab code Exa 9.9 `frequency`

```
//Example 9// frequency
clc;
clear;
close;
n2=200;//second^-1
l21=2;//
f=l21*n2;//
disp(f,"frequency is ,(second^-1)=")
```

Scilab code Exa 9.10 `length`

```
//Example 10// length
clc;
clear;
close;
l1=66;//cm
v=330;//m/s
```

```
nbs=5;//beats/sec
x=(2*(v-(nbs*2*l1*10^-2))/(v*2*l1*10^-2));//
l2=1/x;//cm
disp(l2*100,"length is,(cm)=")
```

Scilab code Exa 9.11 `fundamental frequency and length`

```
//Example 11// length
clc;
clear;
close;
f=110;//Hz
v=330;//m/s
l=v/(2*f);//m
disp(f,"fundamental frequency is,(Hz)=")
disp(l,"length is ,(m)=")
```

Scilab code Exa 9.12 `wave equation frequency amplitude wavelength and distance`

```
//Example 12// equation,frequency,amplitude ,
   wavelength and distance
clc;
clear;
close;
//y=6*(sin(2*%pi*x)/6)*cos(160*%pi*t);//given
   equation
a=3;//cm
T=(2*%pi)/(160*%pi);//sec
h=((2*%pi*6)/(2*%pi));//cm
disp("wave equation is 3*sin((160*%pi*t)+(2*%pi*x)
   /6)")
disp(a,"amplitude is ,(cm)=")
disp(1/T,"frequency is ,(Hz)=")
```

```
disp(h,"wavelength is,(cm)=")
db=h/2;//
disp(db,"distance between consecutive antinodes is,(
   cm)=")
```

Scilab code Exa 9.13 `length pressure amplitude`

```
//Example 13// length,amlitude,pressure
clc;
clear;
close;
f=440;//Hz
v=330;//m/s
l=((5*v)/(4*f))*100;//cm
disp(l,"length (L) is ,(cm)=")
ang=cos((2*%pi)/8);//
disp("maximum pressure variation is at node = Po *"
   +string(ang)+" and minimum at antinode =0")
pmax=0;//
pmin=0;//
disp("at antinode pressure variation is Pmax= "+
   string(pmax)+" and Pmin= "+string(pmin)+"")
```

Chapter 10

Waves in SolidsWaves in Solids

Scilab code Exa 10.1 youngs modulus

```
//Example 1 // Young's modulus of steel
clc;
clear;
close;
//given data :
p=7.8*10^3;// in kg/m^3
v=5200;// m/s
Y=p*v^2;
disp(Y,"Young modulus of steel,Y(N/m^2) = ")
```

Scilab code Exa 10.2 wavelength and velocity

```
//Example 2 // Velocity and wavelength
clc;
clear;
close;
//given data :
Y=8*10^10;// in N/m^2
```

```
p=5000;// in kg/m^3
v=sqrt(Y/p);
disp(v,"(1). The velocity,v(m/s) = ")
f=400;// in vibration/sec
lamda=v/f;
disp(lamda,"(2). The wavelength,(m) = ")
```

Scilab code Exa 10.3 `velocity and wavelength`

```
//Example 3 // Velocity and wavelength
clc;
clear;
close;
//given data :
Y=7*10^10;// in N/m^2
p=2.8*10^3;// in kg/m^3
v=sqrt(Y/p);
disp(v,"(1). The velocity,v(m/s) = ")
f=500;// in vibration/sec
lamda=v/f;
disp(lamda,"(2). The wavelength,(m/s) = ")
```

Scilab code Exa 10.4 `youngs modulus`

```
//Example 4 // Young's modulus
clc;
clear;
close;
//given data :
l=3;// in m
n=600;// in Hz
p=8.3*10^3;// in kg/m^3
Y=p*n^2*(2*l)^2;
```

```
disp(Y,"Youngs modulus,Y(N/m^2) = ")
```

Scilab code Exa 10.5 frequency

```
//Example 5 // Frequency
clc;
clear;
close;
//given data :
Y=2*10^11;// in N/m^2
p=8*10^3;// in kg/m^3
l=0.25;// in m
n=sqrt(Y/p)/(2*l);
disp(n,"The frequency,n(vibrations/s) = ")
```

Scilab code Exa 10.6 AREA

```
//Example 6 // Area of cross section
clc;
clear;
close;
//given data :
n1BYn2=20;
T=20*9.8;// in N
Y=19.6*10^10;// in N/m^2
alfa=n1BYn2^2*T/Y;
disp(alfa,"Area of cross section,alfa(m^2) = ")
```

Scilab code Exa 10.7 velocity

```
//Example 7 // Velocity and Young modulus
clc;
clear;
close;
//given data :
n=2600;// in Hz
l=1;// in m
p=7.8*10^3;// kg/m^3
v=2*n*l;
disp(v,"The velocity ,v(m/s) = ")
Y=v^2*p;
disp(Y,"Youngs modulus ,Y(N/m^2) = ")
```

Scilab code Exa 10.8 `frequency`

```
//Example 8 // Frequencies
clc;
clear;
close;
//given data :
Y=7.1*10^10;// in N/m^2
p=2700;//in kg/m^3
l=1.5;// in m
r1=1;
r2=3;
r3=5;
n1=(r1/(4*l))*sqrt(Y/p);
n2=(r2/(4*l))*sqrt(Y/p);
n3=(r3/(4*l))*sqrt(Y/p);
disp(n1,"frequency of first harmonic ,n1(Hz) = ")
disp(n2,"frequency of first harmonic ,n1(Hz) = ")
disp(n3,"frequency of first harmonic ,n1(Hz) = ")
```

Scilab code Exa 10.9 `frequency`

```
//Example 9 // Frequency
clc;
clear;
close;
//given data :
l=1.2;// in m
v=5150;// in m/s
d=0.006;// in m
k=d/sqrt(12);
v1=%pi*v*k*3.011^2/(8*l^2);
disp(v1,"The frequency,v1(Hz) = ")
```

Scilab code Exa 10.10 `frequency`

```
//Example 10 // Frequencies
clc;
clear;
close;
//given data :
l=2;// in m
v=3560;// in m/s
r=0.004;// in m
k=r/2;
v1=%pi*v*k*3.011^2/(8*l^2);
disp(v1,"The frequency,v1(Hz) = ")
v2=%pi*v*k*5^2/(8*l^2);
disp(v2,"The frequency of first overtone,v2(Hz) = ")
v3=%pi*v*k*7^2/(8*l^2);
disp(v3,"The frequency of second overtone,v3(Hz) = "
    )
```

Scilab code Exa 10.11 `frequency`

```
//Example 11 // Frequency
clc;
clear;
close;
//given data :
Y=7.1*10^10;// in N/m^2
p=2.7*10^3;// in kg/m^3
r=0.005;// in m
vu=sqrt(Y/p);
k=r/2;
v=vu/(2*%pi*k);
disp(v," The frequency ,v(Hz) = ")
```

Chapter 11

Lissajous Figures

Scilab code Exa 11.1 `frequency`

```
//Example 1// Frequencies
clc;
clear;
close;
//given data :
t=2;// in sec
n1=100;// in vibrations/sec
n2a=n1+(1/t);
n2b=n1-(1/t);
disp(n2a,"frequency,n2a= ")
disp(n2b,"frequency,n2b = ")
```

Scilab code Exa 11.2 `frequency`

```
//Example 2// Frequencies
clc;
clear;
close;
```

```
//given data :
t1=15;// in sec
t2=10;// in sec
n2=400;// in vibrations/sec
n1a=n2+(1/t1);
n1b=n2-(1/t1);
disp(n1a,"frequency ,n1a(Hz) = ")
disp(n1b,"frequency ,n1b(Hz) = ")
n_1a=n2+(1/t2);
n_1b=n2-(1/t2);
disp(n_1a,"frequency ,n_1a(Hz) = ")
disp(n_1b,"frequency ,n_1b(Hz) = ")
```

Scilab code Exa 11.3 frequency

```
//Example 3// Frequencies
clc;
clear;
close;
//given data :
t1=15;// in sec
t2=10;// in sec
n2=256;// in vibrations/sec
n1a=(2*n2)+(1/t1);
n1b=(2*n2)-(1/t1);
disp(n1a,"frequency ,n1a(Hz) = ")
disp(n1b,"frequency ,n1b(Hz) = ")
n_1a=(2*n2)+(1/t2);
n_1b=(2*n2)-(1/t2);
disp(n_1a,"frequency ,n_1a(Hz) = ")
disp(n_1b,"frequency ,n_1b(Hz) = ")
```

Chapter 12

Dopplers Effect

Scilab code Exa 12.1 speed

```
//Example 1// Speed
clc;
clear;
close;
//given data :
vl=166;//m/s
v=(2*vl);//m/s
disp(v,"speed is ,(m/s)")
```

Scilab code Exa 12.2 frequency

```
//Example 2// frequency
clc;
clear;
close;
//given data :
f1=90;//vibrations/second
f2=(1+(1/10))*f1;//vibrations/s
disp(f2,"frequency is ,(vibrations/s)=")
```

Scilab code Exa 12.3 `frequency`

```
//Example 3// frequency
clc;
clear;
close;
//given data :
N=400;//hZ
V=340;//M/S
VS=60;//M/S
N2=((V/(V-VS))*N);//Hz
disp(round(N2),"frequency when engine is approaching
    to the listner is,(Hz)=")
N3=((V/(V+VS))*N);//Hz
disp(N3,"frequency when engine is moving away from
   the listner is,(Hz)=")
```

Scilab code Exa 12.4 `wavelength`

```
//Example 4//WAVELENGTH
clc;
clear;
close;
x=1/5;//
h=60;//cm
h1=((1-x)*h);//cm
h2=((1+x)*h);//cm
disp(h1,"wavelength of waves in north-direction is,(
   cm)=")
disp(h2,"wavelength of waves in south-direction is,(
   cm)=")
```

Scilab code Exa 12.5 `frequency`

```
//Example 5//frequency
clc;
clear;
close;
v=340;//m/s
n=600;//Hz
vs=36;//km h^-1
vs1=vs*(1000/3600);//m/s
apf=((v)/(v-vs1))*n;//Hz
vs2=54;//km h^-1
vs3=vs2*(1000/3600);//m/s
apf1=((v)/(v+vs3))*n;//Hz
disp("two apparent frequencies are "+string(apf)+"
    Hz and "+string(apf1)+" Hz")
df=apf-apf1;//Hz
disp(df,"difference in frequencies is ,(Hz)=")
//second apparent frequency and difference is
    calculated wrong in the textbook
```

Scilab code Exa 12.6 `frequency`

```
//Example 6//frequency
clc;
clear;
close;
v=330;//m/s
n=500;//Hz
vs=30;//km h^-1
vs1=vs*(1000/3600);//m/s
n3=((v+vs1)/(v-vs1))*n;//Hz
```

```
disp(round(n3),"frequency when cars are approaching
   is ,(Hz)=")
n1=((v-vs1)/(v+vs1))*n;//Hz
disp(round(n1),"frequency when cars have crossed  is
   ,(Hz)=")
```

Scilab code Exa 12.7 frequency

```
//Example 7//frequency
clc;
clear;
close;
v=330;//m/s
n=600;//Hz
vs=20;//m/s
apf=((v)/(v+vs))*n;//Hz
disp(round(apf),"frequency when source is moving
   away from the observer is ,(Hz)=")
apf1=((v)/(v-vs))*n;//Hz
disp(round(apf1),"frequency when siren reaching at
   the cliff is ,(Hz)=")
bf=apf1-apf;//Hz
disp(round(bf),"beat frequency is ,(Hz)=")
```

Scilab code Exa 12.8 frequency

```
//Example 8//frequency
clc;
clear;
close;
r=3;//m
w=10;//s^-1
vs=r*w;//m/s
```

```
A=6;//m
fd=5/%pi;//s^-1
vmax=A*2*%pi*fd;//m/s
v=330;//m/s
n=340;//Hz
nmax=((v+vmax)/(v-vs))*n;//Hz
nmin=((v-vmax)/(v+vs))*n;//Hz
disp(nmax,"maximum frequency is,(Hz)=")
disp(nmin,"minimum frequency is ,(Hz)=")
```

Scilab code Exa 12.9 speed

```
//Example 9//speed
clc;
clear;
close;
n12=3;//
n=340;//Hz
v=340;//m/s
vs=((n12*v)/(2*n));//m/s
disp(vs,"speed is ,(m/s)=")
```

Scilab code Exa 12.10 frequency

```
//Example 10//frequency
clc;
clear;
close;
sa=1.5;//km
oa=1;//km
so=sqrt(oa^2+sa^2);//km
csd=sa/so;//
v=0.33;//km/s
```

```
n=400; //Hz
vlov=120*(1000/3600); //m/s
vs1=(1/30)*csd; //km/s
nd=((v)/(v-vs1))*n; //vibrations/sec
disp(round(nd),"apparent frequency is ,(vibrations/
    second)=")
```

Scilab code Exa 12.11 `frequency and distance`

```
//Example 11//frequency
clc;
clear;
close;
v=1200; //km/h
w=40; //km/h
vs=40; //km/h
n=580; //Hz
nd=((v+vs)/((v+vs)-vs))*n; //Hz
disp(nd,"frequency of the whistle as heared by an
    observer on the hill is ,(Hz)=")
x=29/30; //km
disp(x*1000,"distance is ,(m)=")
ndd=((v-w)+vs)/((v-w))*nd; //Hz
disp(ndd,"frequency heared by driver is ,(Hz)=")
//distance is calculated wrong in the textbook
```

Scilab code Exa 12.12 `Doppler shift and velocity`

```
//Example 12//doppler shift and velocity
clc;
clear;
close;
h1=6010; //
```

```
h2=6000;//
ds=h1-h2;//
disp(ds,"doppler shift is ,(   )=")
c=3*10^8;//m/s
v=((ds/h2)*c);//m/s
disp(v,"speed is ,(m/s)=")
```

Scilab code Exa 12.13 velocity

```
//Example 13//doppler shift and velocity
clc;
clear;
close;
h1=3737;//
h2=3700;//
ds=h1-h2;//
disp(ds,"doppler shift is ,(   )=")
c=3*10^8;//m/s
v=((ds/h2)*c);//m/s
disp(v,"speed is ,(m/s)=")
//speed is  calculated wrong in the textbook
```

Scilab code Exa 12.14 speed

```
//Example 14//speed
clc;
clear;
close;
dv=10^3;//Hz
v=5*10^9;//Hz
c=3*10^8;//m/s
v=((dv)/(2*v))*c;//m/s
disp(v,"velocity is ,(m/s)=")
```

Chapter 13

Elementary Theory of Filters

Scilab code Exa 13.1 `inductance and capacitance`

```
//Example 1 //  design loss pass constant K-filter
clc;
clear;
close;
k=600;//ohms
fc=2500;//Hz
l=(k/(%pi*fc));//H
c=((1/(%pi*fc*k)));//farad
disp(l*10^3,"inductance is ,(mH)=")
disp(c*10^6,"capacitance is ,(micro-F)=")
```

Scilab code Exa 13.2 `inductance and capacitance`

```
//Example 2 //  T-type band pass filter
clc;
clear;
close;
//given data :
```

```
K=500;// in ohm
f1=4;// in kHz
f2=1;// in kHz
L1=K/(%pi*(f1-f2));
Ls=L1/2;
disp(Ls,"Inductance in each series arm,Ls(mH) = ")
C1=(f1-f2)*10^3/(4*%pi*K*f1*f2);
Cs=2*C1;
disp(Cs,"Capacity in each series arm,Cs(micro-F) = "
    )
L2=((f1-f2)*K)/(4*%pi*f1*f2);
disp(L2,"Shunt arm inductance,L2(mH) = ")
Csh=1*10^6/(%pi*(f1-f2)*10^3*K);
disp(Csh,"Capacity in shunt arm,Csh(micro-F) = ")
```

Chapter 14

Ultrasonics

Scilab code Exa 14.1 frequency

```
//Example 1 // Fundamental frequency
clc;
clear;
close;
//given data :
t=1.6*10^-3;// in m
lamda=2*t;// in m
v=5760;// in m/s
n1=v*10^-6/lamda;
disp(n1,"Fundamental frequency,n1(MHz) = ")
```

Scilab code Exa 14.2 Length

```
//Example 2 //  distance
clc;
clear;
close;
//given data :
```

```
th=40;//cm
t1=30;//micro-seconds
t2=80;//micro seconds
x=((2*th*10^-2*t1*10^-6)/(2*t2*10^-6))*100;//cm
disp(x,"distance is ,(cm)=")
```

Scilab code Exa 14.3 thickness

```
//Example 3 // Thickness
clc;
clear;
close;
//given data :
v=5000;// in m/s
N=50000;// in Hz
t=v/(2*N);
disp(t,"Thickness of steel plate,t(m) = ")
```

Scilab code Exa 14.4 capacitance

```
//Example 4 //  Capacitance
clc;
clear;
close;
//given data :
L=1;// in H
n=10^6;// in Hz
C=1*10^12/(4*%pi^2*n^2*L);
disp(C,"The capacitance,C(micro-F) = ")
```

Chapter 15

Musical Sound and Acoustic of Bulidings

Scilab code Exa 15.1 levels by which intensity will decrease

```
//Example 1 // decibles
clc;
clear;
close;
//given data :
i1=4;//assume
i2=4*i1;//
dl=10*log10(i2/i1);//db
disp(dl,"decibles by which intensity level will
    decrease is ,(db)=")
```

Scilab code Exa 15.2 ratio of amplitudes

```
//Example 2 // ratio of amlitudes
clc;
clear;
```

```
close;
//given data :
l1=10;//db
l2=40;//db
dl=l2-l1;//db
x=(10^(dl/10));//
x1=sqrt(x);//
disp(x1,"ratio of amplitudes is ,=")
```

Scilab code Exa 15.3 `frequency`

```
//Example 3 // frequency
clc;
clear;
close;
//given data :
x=264;//key note
g=x*(3/2);//
disp(g,"frequency of note G is ,=")
cd1=x*2;//
disp(cd1,"frequency of note C is ,=")
```

Chapter 17

Electromagnetic Waves

Scilab code Exa 17.1 poynting vector

```
//Example 1 // magnitude
clc;
clear;
close;
//given data :
R=7*10^8;// in m
P=3.8*10^26;// in Watt
S=P/(4*%pi*R^2);
disp(S,"Magnitude of poynting vector,S(W/m^2) = ")
```

Scilab code Exa 17.2 poynting vector

```
//Example 2 // Poynting vector
clc;
clear;
close;
//given data :
R=1.5*10^11;// in m
```

```
P=3.8*10^26;// in Watt
S=P/(4*%pi*R^2);// in W/m^2
Se=round(S*60/(4.2*10^4));
disp(Se,"Poynting vector,Se(cal/cm^2 -min) = ")
```

Scilab code Exa 17.3 amplitudes of electric and magnetic field radiation

```
//Example 3 // Amplitude and magnetic field
clc;
clear;
close;
//given data :
S=2;// in cal/cm^2- min
EH=S*4.2*10^4/60;// joule/m^2 sec
mu0=4*%pi*10^-7;
epsilon0=8.85*10^-12;
EbyH=sqrt(mu0/epsilon0);
E=sqrt(EH*EbyH);
H=EH/E;
E0=E*sqrt(2);
H0=H*sqrt(2);
disp(E,"E is ,(V/m)=")
disp(H,"H is ,(Amp-turn/m)=")
disp(E0,"Amplitude of electric fields of radiation,
   E0(V/m) = ")
disp(H0,"Magnetice field of radition ,H0(Amp-turn/m)
    = ")
```

Scilab code Exa 17.4 amplitudes of electric and magnetic field radiation

```
//Example 4 // electric and magnetic field
clc;
clear;
```

```
close;
//given data :
r=2;// in m
mu0=4*%pi*10^-7;
epsilon0=8.85*10^-12;
EbyH=sqrt(mu0/epsilon0);
EH=1000/(4*r^2*%pi^2);// in W/m^2
E=sqrt(EH*EbyH);
H=(EH/E);
disp(E,"Intensities of electric ,E(V/m) = ")
disp(H,"Magnetic field of radiation ,H(Amp-turn/m) =
  ")
```

Scilab code Exa 17.5 polarisation degree

```
//Example 5 // Degree of polarization
clc;
clear;
close;
//given data :
thetai=45;// in degree
n=1.5;/// index
thetar=asind(sind(thetai)/n);
Rl=sind(thetai-thetar)^2/sind(thetai+thetar)^2;
Rp=tand(thetai-thetar)^2/tand(thetai+thetar)^2;
D=((Rl-Rp)/(Rl+Rp))*100;
disp(D,"Degree of polarization ,D(%) = ")
// answer is wrong in the textbook
```

Scilab code Exa 17.6 frequency

```
//Example 6 // Frequency
clc;
```

```
clear;
close;
//given data :
del=1;// in m
mu=4*%pi*10^-7;// in H/m
sigma=4;// in siemen/m
v=1*10^-3/(%pi*del^2*mu*sigma);
disp(v,"Frequency ,v(kHz) = ")
```