Scilab Textbook Companion for Fundamentals of Optics by F. A. Jenkins and H. E.white[1]

Created by
Reshma Sunil Konjari
M.Tech
Electrical Engineering
VIT
College Teacher
None
Cross-Checked by
Lavitha

July 11, 2017

[1]Funded by a grant from the National Mission on Education through ICT, http://spoken-tutorial.org/NMEICT-Intro. This Textbook Companion and Scilab codes written in it can be downloaded from the "Textbook Companion Project" section at the website http://scilab.in

Book Description

Title: Fundamentals of Optics

Author: F. A. Jenkins and H. E.white

Publisher: McGraw-Hill

Edition: 3

Year: 1957

ISBN: 0-07-256191-2

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 3

Spherical Surfaces

Scilab code Exa 3.1 Position of image

```
1 //Example 3.1, page 69
2 clc;
3 n1=1.5
4 r=1//in cm
5 n=1//in cm
6 a=4//in cm, air
7 s=.5-(1/a)
8 s1=n1/s
9 printf("\n The image is formed at %d cm",s1)
```

Scilab code Exa 3.2 Primary secondary and final image

```
1 //Example 3.2, page 71
2 clc
3 n=1
4 n1=1.5
5 r=-4//in cm
6 s=10//in cm
```

```
f=(n*r)/(n1-n)
f1=(n1*r)/(n1-n)
s_temp=(1/-8)-(1/s)
s1=n1/s_temp
printf("\n The primary focal length is  %d cm",f)
printf("\n The secondary focal length is formed at
   %d cm",f1)
printf("\n The image distance is %f cm",s1)
```

Scilab code Exa 3.3 Power and position of image

```
//Example 3.3, page 77
clc
n=1
n1=1.5
r=10//in cm
s=40//in cm
p=(n1-n)/.1
v1=n/.4
s1=n1/v1
printf("\n The power of image is  %dD",p)
printf("\n The image distance is  %f m",s1)
```

Scilab code Exa 3.4 Image distance

```
//Example 3.4, page 78
clc
n=1
n1=1.5
r=2//in cm
s=12//in cm
f=r/(n1-n)
printf("\n The focal length is  %d cm",f)
```

Chapter 4

Thin Lenses

Scilab code Exa 4.1 Image formation

```
1 //example 4.1, page 86
2 clc
3 s=6//in cm
4 f=10//in cm
5 s1=(s*f)/(s-f)
6 m=s1/s
7 printf("\n The magnification obtained is %fX",m)
```

Scilab code Exa 4.2 Find the image

```
1 //example 4.2, page 86
2 clc
3 s=12//in cm
4 f=-6//in cm
5 s1=(s*f)/(s-f)
6 m=s1/s
7 printf("\n The magnification obtained is %fX",m)
```

Scilab code Exa 4.3 Radius of curvature

```
1 //Example 4.3, page 89
2 clc
3 n=1.520
4 f=25//in cm
5 r2=-(f*(n-1))
6 printf("\n The radius of curvature is %f cm",r2)
```

Scilab code Exa 4.4 Find power

```
1 //example 4.4, page 92
2 clc
3 n=1.6
4 r1=.080//in cm
5 r2=-0.080
6 P=(n-1)*((1/r1)-(1/r2))
7 printf("\n The power  is %f D",P)
```

Chapter 5

Thick lenses

Scilab code Exa 5.1 Position of final image

```
1 //Example 5.1, page no 101
2 clc
3 n_air=1//refractive index of air
4 n_glass=1.5//refractive index of glass
5 n_water=1.33//refractive index of water
6 s1=n_glass/(((n_glass-n_air)/2)-(n_air/5))
7 s2=n_water/(((n_water-n_glass)/-2)-(n_glass/-28))
8 printf("\n The value of s1 is +%f  cm",s1)
9 printf("\n The value of s2 is +%f  cm",s2)
```

Scilab code Exa 5.2 Principal points

```
1 //Example 5.2, page 107
2 clc
3 r1=1.5//in cm
4 r2=1.5//in cm
5 d=2//in cm
6 n=1//in cm
```

```
n1=1.60//in cm
n11=1.30//in cm
n_by_f1=(n1-n)/r1
n1_by_f21=(n11-n1)/r2
f1=n/n_by_f1
f11=n1/n_by_f1
f21=n1/n1_by_f21
f211=n11/n1_by_f21
disp("Part a")
printf("\n The focal length f1 is +%f cm",f1)
printf("\n The focal length f11 is +%f cm",f11)
printf("\n The focal length f21 is -%f cm",f21)
printf("\n The focal length f211 is -%f cm",f211)
n_by_f=(n1/f11)+(n11/f211)-((d*n11)/(f11*f211))
f=1/n_by_f
f11=n11/n_by_f
A1_f=(-f)*(1-(d/f21))
A2_f211=f11*(1-(d/f11))
disp("Part b")
printf("\n The primary focal length is %f cm",A1_f)
printf("\n The secondary focal length is %f cm",
   A2_f211)
A1_h=f*(d/f21)
A2_h11=-f11*(d/f11)
disp("Part c")
printf("\n The primary point is %f cm",A1_h)
printf("\n The secondary point is %f cm",A2_h11)
```

Scilab code Exa 5.3 Nodal point

```
//Example 5.3, Page 111
clc
n=1
n11=1.3
f11=4.333//in cm
```

```
6 HN=f11*((n11-n)/n11)
7 printf("Nodal length is %f cm",HN)
```

Scilab code Exa 5.4 Power of lenses

```
1 //Example 5.4, page 113
2 clc
3 n1=1.50
4 n2=1.60
5 n_dash=1.33
6 n_doubledash=1
7 p1=((n1-n_doubledash)/.04)+((n_dash-n1)/-0.04)
8 p2=((n2-n_dash)/-.06)+((n_doubledash-n2)/.06)
9 p=p1+p2+(-.015*p1*p2)
10 printf("The power is %f D", p)
11 //Part b
12 f=1/p
13 f_doubledash=1/p
14 printf("\nThe focal length f is %f m",f)
15 printf("\n The focal length f'' is %f m",
     f_doubledash)
16 //Part c
17 A1f=-(1/p)*(1+(.015*14.45))
18 A2H=-(1/p)*((.015*-4.45))
19 A2f11=-(1/p)*(1-(.015*16.67))
20 printf("\nThe focal point A1F is %f m",A1f)
21 printf("\nThe focal point A2H is %f m",A2H)
22 printf("\nThe focal point A2F11 is %f m",A2f11)
23 //Part d
24 A2H11=(1/p)*0.015*16.67
25 printf("\nThe principal point is %f m",A2H11)
```

Chapter 6

Spherical Mirrors

Scilab code Exa 6.1 focal length and position of image and lateral magnification

```
1 //Example 6.1, Page 125
2 clc
3 y=2//in cm
4 s=10//in cm
5 r=-16//in cm
6 //Part a
7 f=-r/2
8 printf("\n The focal length is %f cm",f)
9 s1=1/((1/f)-(1/s))
10 printf("\n The position of image is formed at %f cm"
    ,s1)
11 //part c
12 m=-(s1/s)
13 printf("\n The inveted position of image is formed
    at %f cm",m)
```

Scilab code Exa 6.2 power of mirror and magnification

```
1 //Example 6.2, page 126
2 clc
3 k=1/.5
4 v=1/.2
5 v1=-4-5
6 p=-2*k
7 s1=-(1/v1)
8 m=-(5/v1)
9 printf("The power is %f D", p)
10 printf("\n The position of image is formed at %f m",
     s1)
11 printf("\n The magnification of image is %f cm",m)
```

Scilab code Exa 6.3 Focal length and principal point

```
1 //Example 6.3, page 129
2 clc
3 n1=1.50
4 r1=.5//in m
5 r2=-.5//in m
6 d=.1//in cm
7 r=-0.5//radius in cm
8 p1=(n1-1)*((1/r1)-(1/r2))
9 p2=-2*(1/r2)
10 c=d/1
11 p=(1-(c*2))*(8-.8)
12 f=1/p
13 H1H=(c)/(1-(c*2))
14 printf("The power is %f D", p)
15 printf("\nThe focal length f is %f m",f)
16 printf("\nThe principal point is %f m",H1H)
```

Chapter 8

Ray Tracing

Scilab code Exa 8.1 Convex spherical surface

```
1 //Example 8.1, page 157
2 clc
3 r=5//in cm
4 n=1//in cm
5 n1=1.67200//in cm
6 for h = 1:3          //the calculations for h=0 is 0,
      the textbook ans is wrong
7     sin_ph=h/r
8     sin_ph_1=(sin_ph)*(n/n1)
9     ph=asind(sin_ph)
10    ph_1=asind(sin_ph_1)
11    theta=ph_1-ph
12    angle=sin(theta)       // the textbook ans is
         wrong
13      printf("\n \n")
14    printf("\n For h=%d, sin_ph=%f ",h,sin_ph)
15    printf("\n \n")
16     printf("\n For h=%d, sin_ph1=%f ",h,sin_ph_1)
17         printf("\n \n")
18       printf("\n \n")
19       printf("\n For h=%d, ph=%f ",h,ph)
```

```
20          printf("\n \n")
21        printf("\n For h=%d, ph1=%f ",h,ph_1)
22            printf("\n \n")
23         printf("\n For h=%d, theta=%f ",h,theta)
24             printf("\n \n")
25          printf("\n For h=%d, angle=%f ",h,angle)
26
27 end
```

Scilab code Exa 8.2 Double convex lens

```
1  //Example 8.2
2  clc
3  r1=15//in cm
4  r2=-15 //in cm
5  d=3//in cm
6  n=1//in cm
7  n1=1.62500//in cm
8  n2=1//in cm
9  for h = 2:2:7          //the calculations for h=0 is
       0, the textbook ans is wrong
10     sin_ph=h/r1
11     sin_ph1=(sin_ph)*(n/n1)
12     ph= asind(sin_ph)
13     ph_1=asind(sin_ph1)
14     theta=ph_1-ph
15     angle=r1*(sin_ph/sin(theta))
16     s1=sin_ph/sin(theta)
17     s2=d-s1
18     sin_ph2=(1+(s2/r2))*sin(theta)
19     sin_ph3=(sin_ph2)*(n1/n2)
20     ph_2=asind((1+(s2/r2))*sin(theta))
21     ph_3=asind((sin_ph2)*(n1/n2))
22     theta1=ph_3+theta-ph_2
23     angle1=r2*(sin_ph3/sin(theta))
```

```
24          printf("\n \n")
25        printf("\n For h=%d, sin_ph=%f ",h,sin_ph)
26        printf("\n \n")
27         printf("\n For h=%d, sin_ph1=%f ",h,sin_ph1)
28             printf("\n \n")
29           printf("\n \n")
30          printf("\n For h=%d, ph=%f ",h,ph)
31             printf("\n \n")
32           printf("\n For h=%d, ph_1=%f ",h,ph_1)
33                printf("\n \n")
34            printf("\n For h=%d, theta=%f ",h,theta)
35                printf("\n \n")
36            printf("\n For h=%d, angle=%f ",h,angle)
37            printf("\n \n")
38            printf("\n For h=%d, s2=%f ",h,s2)
39            printf("\n \n")
40                 printf("\n For h=%d, sin_ph2=%f ",h,
                      sin_ph2)
41        printf("\n \n")
42         printf("\n For h=%d, sin_ph3=%f ",h,sin_ph3)
43             printf("\n \n")
44           printf("\n \n")
45          printf("\n For h=%d, ph_2=%f ",h,ph_2)
46             printf("\n \n")
47           printf("\n For h=%d, ph_3=%f ",h,ph_3)
48                printf("\n \n")
49            printf("\n For h=%d, theta1=%f ",h,theta1)
50                printf("\n \n")
51            printf("\n For h=%d, angle1=%f ",h,angle1)
52
53  end
```

Chapter 11

Vibrations and waves

Scilab code Exa 11.1 Energy in vibrations

```
1  clc
2
3  m=4 //kg
4  x=0.180 //m
5  g=9.80 //m/s^2
6
7  //solution a:
8  F=m*g
9  k=F/x
10 disp(k,"the spring constant k in N/m is=")
11
12 //sloution b:
13 T=2*%pi*sqrt(m/k)
14 disp(T,"the period T in sec is=")
15
16 //solution c:
17 v=1/T
18 disp(v,"the frequency v in hz is")
19
20 //solution d:
21 W=0.5*k*x^2
```

```
22 disp(W,"the total energy stored in Nm is=")
```

Scilab code Exa 11.2 Displacement

```
1  clc
2
3  T=5// sec
4  a=3// cm
5  alpha=%pi/3
6  w=(2*%pi/T)
7  //solution a:
8  //for
9  t=0//sec
10 y=a*sin(w*t+alpha)
11 disp(y,"y in cm is=")
12
13 //solution b:
14 //for
15 t=12//sec
16 y=a*sin(w*t+alpha)
17 disp(y,"y in cm is=")
```