Scilab Textbook Companion for
Mechanics Of Fluids
by A. C. Walshaw And D. A. Jobson[1]

Created by
Rahul Paramata
Fluid mechanics
Chemical Engineering
IIT Bombay
College Teacher
Parth Goswami
Cross-Checked by
Ganesh R

July 31, 2019

Book Description

Title: Mechanics Of Fluids

Author: A. C. Walshaw And D. A. Jobson

Publisher: Longmans, London

Edition: 1

Year: 1962

ISBN: 0072472103

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

8

Chapter 1

Buoyancy and Stability

Scilab code Exa 1.4.1 chapter 1 example 4 1

```
1  clc
2  //initialisation of variables
3  ws= 64 //lbf/ft^3
4  wi= 57 //lbf/ft^3
5  //CALCULATIONS
6  vabyvb= (ws/wi)-1
7  vtbyva= (1/vabyvb)+1
8  vabyvt= (1/vtbyva)*100
9  //RESULTS
10 printf ('percentage of total volume extended above
       the surface= %.1f per cent',vabyvt)
```

Scilab code Exa 1.4.2 chapter 1 example 4 2

```
1  clc
2  //initialisation of variables
3  p= 20 //lbf/in^2
4  d1= 4 //in
```

```
 5 d2= 18 //in
 6 d3= 0.5 //in
 7 sw= 62.3 //lbf/ft^3
 8 //CALCULATIONS
 9 Fa= p*(%pi/4)*d3^2
10 Fb= (4/d2)*3.92
11 V= 1.5*(Fb/sw)*1728
12 r= (0.75*(V/%pi))^(1/3)*2
13 //RESULTS
14 printf ('diameter of the float= %.2f in',r)
```

Scilab code Exa 1.6.1 chapter 1 example 6 1

```
 1 clc
 2 //initialisation of variables
 3 W= 4 //tonf
 4 d= 30 //ft
 5 W1= 2000 //tonf
 6 O1=(0.015)
 7 O2= -0.015
 8 //CALCULATIONS
 9 O= O1-O2
10 GM= (W*d)/(W1*O)
11 //RESULTS
12 printf ('metacentric height= %.f ft',GM)
```

Scilab code Exa 1.6.2 chapter 1 example 6 2

```
 1 clc
 2 //initialisation of variables
 3 ws= 1/35 //tonf/ft^3
 4 A= 10500 //ft^2
 5 wf= 1/36 //tonf/ft^3
```

```
6  Wo= 7000 //tonf
7  Wf= 6950//tonf
8  li= 300 //ft
9  lh= 400 //ft
10 l= 7200 //ft
11 l1=50 //ft
12 l2= 10 //ft
13 l3= 250 //ft
14 l4= 40 //ft
15 //CALCULATIONS
16 Dod= (1/A)*((Wo/wf)-(Wf/ws))
17 Ac= ws*A*0.835
18 x= (l1*l2+l3*l4)/(l+l3-l1*l2)
19 do= (x/lh)*li
20 //RESULTS
21 printf ('change of draught= %.3f ft',Dod)
22 printf (' \n Additional cargo=%.f tonf',Ac)
23 printf (' \n change of trim=%.1f ft',do)
```

Scilab code Exa 1.6.3 chapter 1 example 6 3

```
1  clc
2  //initialisation of variables
3  M= 500 //tonf ft/in
4  D= 32 //tonf/in
5  l= 200 //ft
6  L= 380 //ft
7  //CALCULATIONS
8  x= l+(M/D)*(L/l)
9  //RESULTS
10 printf ('length= %.1f ft aft',x)
```

Scilab code Exa 1.7.2 chapter 1 example 7 2

```
1  clc
2  //initialisation of variables
3  a= 6
4  b= -6
5  c= 1
6  //CALCULATIONS
7  s1= (-b+sqrt(b^2-4*a*c))/(2*a)
8  s2= (-b-sqrt(b^2-4*a*c))/(2*a)
9  //RESULTS
10 printf ('upper limit for specific gravity s= %.3f ',
       s1)
11 printf (' \n lower limit for specific gravity s=%.3f
        tonf',s2)
```

Scilab code Exa 1.7.3 chapter 1 example 7 3

```
1  clc
2  //initialisation of variables
3  b= 350 //ft
4  d= 12 //ft
5  L= 46 //ft
6  Ac1= 500*80*12 //ft^3
7  Ac2= 350*12*9 //ft^3
8  //CALCULATIONS
9  Ic= (b*d^3)/12
10 A= b*d
11 Io= Ic+A*L^2
12 I= 2*Io
13 V= Ac1+2*Ac2
14 BM= I/V
15 //RESULTS
16 printf ('displacement of body= %.1f ft ',BM)
```

Scilab code Exa 1.8.1 chapter 1 example 8 1

```
1  clc
2  //initialisation of variables
3  W= 4500 //tonf
4  b= 6 //ft
5  d= 2.5 //ft
6  s= 0.83
7  //CALCULATIONS
8  I= b*d^3/12
9  r= 3*s*I*1000/(W)
10 //RESULTS
11 printf ('Reduction caused by three compartments= %.3
       f mmE',r)
```

Scilab code Exa 1.9.1 chapter 1 example 9 1

```
1  clc
2  //initialisation of variables
3  Kg= 12 //ft
4  g= 32.2 //ft/s^2
5  GM= 2 //ft
6  //CALCULATIONS
7  T= 2*%pi*sqrt(Kg^2/(g*GM))
8  //RESULTS
9  printf ('periodic time of rolling of the ship= %.1f
       sec',T)
```

Chapter 2

Hydrostatic forces and centres of pressure

Scilab code Exa 2.3.1 chapter 2 example 3 1

```
1  clc
2  //initialisation of variables
3  sw= 62.3 //lbf/ft^3
4  d= 288 //ft
5  p= 1 //lbf/in^2
6  //CALCULATIONS
7  P= sw*d/144
8  D= p*144/sw
9  //RESULTS
10 printf (' pressure at a depth of 288 ft= %.1f lbf/in
       ^2',P)
11 printf (' \n depth= %.2f ft ',D)
```

Scilab code Exa 2.3.2 chapter 2 example 3 2

```
1  clc
```

```
2  //initialisation of variables
3  w= 62.3 //lbf/ft^3
4  d= 11.5 //ft
5  //CALCULATIONS
6  p= w*d/144
7  //RESULTS
8  printf (' pressure required to bubble air slowly
        through the tank= %.f lbf/in^2',p)
```

Scilab code Exa 2.3.3 chapter 2 example 3 3

```
1  clc
2  //initialisation of variables
3  w= 62.3 //lbf/ft^3
4  d= 23.1 //ft
5  //CALCULATIONS
6  dp=  w*d/144
7  //RESULTS
8  printf (' pressure guage= %.f lbf/in^2',dp)
```

Scilab code Exa 2.3.4 chapter 2 example 3 4

```
1  clc
2  //initialisation of variables
3  d= 1 //ft
4  s= 0.8
5  h= 2 //ft
6  w= 62.3 //lbf/ft^3
7  d1= 5 //ft
8  //CALCULATIONS
9  F= (%pi/4)*d^2*s*w*(d/2)
10 F1= (%pi/4)*d^2*s*w*(d1/2)
11 //RESULTS
```

```
12  printf ( ' Force= %.2 f  2lbf ' ,F)
13  printf ( ' \n Force= %. f  lbf ' ,F1)
```

Scilab code Exa 2.3.5 chapter 2 example 3 5

```
1   clc
2   //initialisation  of  variables
3   F= 100  //tonf
4   p= 2000  //lbf/inˆ2
5   x= 12  //in
6   x1= 48  //in
7   p1= 40  //lbf/inˆ2
8   //CALCULATIONS
9   A3= (F/p)*2240
10  A2= A3*x/x1
11  A1= A2*p/p1
12  //RESULTS
13  printf ( ' Piston  area= %. f  inˆ2 ' ,A2)
14  printf ( ' \n ram  area= %. f  inˆ2 ' ,A1)
```

Scilab code Exa 2.4.1 chapter 2 example 4 1

```
1   clc
2   //initialisation  of  variables
3   Va= 100  //ftˆ3
4   h= 10  //ft
5   V1= 60  //ftˆ3
6   Pabyv= 34  //ft
7   h1= 4  //ft
8   //CALCULATIONS
9   H= Pabyv*((Va/V1)-1)-(h-h1)
10  h2= H+h
11  Va1= (1+(h2/Pabyv))*Va
```

```
12  V= Va1-Va
13  //RESULTS
14  printf (' depth of the river= %.1 f ft ',h2)
15  printf (' \n volume to be pumped= %.f ft^3',V)
```

Scilab code Exa 2.6.2 chapter 2 example 6 2

```
1   clc
2   //initialisation of variables
3   w= 62.3 //lbf/ft^3
4   dg= 4 //ft
5   d= 1 //ft
6   h= 2 //ft
7   HP= 1.0156 //ft
8   //CALCULATIONS
9   F= w*dg*d^2*(%pi/4)
10  F1= F*HP/h
11  //RESULTS
12  printf (' Minimum force= %.1 f lbf ',F1)
```

Scilab code Exa 2.6.3 chapter 2 example 6 3

```
1   clc
2   //initialisation of variables
3   s= 1.03
4   w= 64.3 //lbf/ft^3
5   dg= 14 //ft
6   A= 40 //ft^2
7   b= 5 //ft
8   d= 8 //ft
9   b1= 2.5 //ft
10  y= 10 //ft
11  x= 3 //ft
```

```
12  z= 4 //ft
13  //CALCULATIONS
14  F= w*dg*A*16.05/36000
15  r= ((b*d^3/12)/(A*dg))
16  F3= F*b1/b
17  F1= (F*(x-r)-(F/2)*x)/(y-z)
18  F2= F-(F1+F3)
19  //RESULTS
20  printf (' force= %.3f tonf',F3)
21  printf (' \n force= %.3f tonf',F2)
```

Scilab code Exa 2.6.5 chapter 2 example 6 5

```
1   clc
2   //initialisation of variables
3   w= 62.4 //lb/ft^3
4   H1= 15 //ft
5   B= 10 //ft
6   H2= 5 //ft
7   r= sqrt(19)/10
8   l= 16 //ft
9   //CALCULATIONS
10  F= 0.5*w*(H1^2-H2^2)*B/2240
11  N= F*0.5/r
12  h= H2*(1-(H2/H1)^3)/(1-(H2/H1)^2)
13  R1= N*h/l
14  R2= N-R1
15  //RESULTS
16  printf (' reaction between the gates= %.1f tonf',F)
17  printf (' \n reaction forces on the finges= %.1f
        tonf',R2)
```

Scilab code Exa 2.7.1 chapter 2 example 7 1

```
1  clc
2  //initialisation of variables
3  w= 62.3 //lb/ft^3
4  b= 1 //ft
5  s= 42 //ft
6  d= 170 //ft
7  l= 15.75
8  a= 170/3
9  //CALCULATIONS
10 W= 2*w*b*s*d/3
11 F= w*b*d^2/2
12 L= l+a*(F/W)
13 //RESULTS
14 printf (' distance= %.f ft from O',L)
```

Scilab code Exa 2.7.2 chapter 2 example 7 2

```
1  clc
2  //initialisation of variables
3  d= 2 //ft
4  a= 30 //degrees
5  p= 200 //ft
6  w= 62.3 //lbf/ft^3
7  //CALCULATIONS
8  T= (%pi/4)*(d^2/2240)*w*p*sqrt(2*(1-cosd(a)))
9  //RESULTS
10 printf (' Resultant static thrust= %.2f tonf',T)
```

Chapter 3

The Measurment of Fluid Pressure

Scilab code Exa 3.1.1 chapter 3 example 1 1

```
1  clc
2  //initialisation of variables
3  p= 14.7 //lbf/in^2
4  p1= 5 //lbf/in^2
5  w= 62.3 //lbf/ft^3
6  h= 30 //ft
7  //CALCULATIONS
8  hmax= (p-p1)*144/w
9  hmin= h-hmax
10 //RESULTS
11 printf ('Minimum depth of the water= %.1f ft',hmin)
```

Scilab code Exa 3.2.1 chapter 3 example 2 1

```
1  clc
2  //initialisation of variables
```

```
3  T= 20  //C
4  h= 1  //cm
5  dw= 1  //gf/cm^3
6  dm= 13.6  //gf/cm^3
7  g= 981  //dyne
8  Tw= 74  //dyne/cm
9  Tm= 465  //dyne/cm
10  //CALCULATIONS
11  hw= (4*Tw)/(dw*g*(h/10))
12  hm= (4*Tm*cosd(130))/(dm*g*(h/10))
13  //RESULTS
14  printf (' capillary rise of water= %.1f cm',hw)
15  printf (' \n capillary rise of mercury= %.2f cm',hm)
```

Scilab code Exa 3.4.1 chapter 3 example 4 1

```
1  clc
2  //initialisation of variables
3  w1= 0.81
4  w2= 0.80
5  r= 40
6  //CALCULATIONS
7  r1= (2*w1)/(w1-w2+(1/r)*(w1+w2))
8  //RESULTS
9  printf (' limiting ratio= %.1f ',r1)
```

Scilab code Exa 3.4.2 chapter 3 example 4 2

```
1  clc
2  //initialisation of variables
3  dh= 1  //in
4  r= 1/40
5  s= 0.9
```

```
6  w= 62.3 //lb/ft^3
7  //CALCULATIONS
8  dpbyw= dh*((1+r)-s*(1-r))
9  dp= w*dpbyw/1728
10 //RESULTS
11 printf ('pressure difference = %.2e lbf/in^2 ',dp)
12
13
14 //Answer in the textbook is wrong
```

Scilab code Exa 3.5.1 chapter 3 example 5 1

```
1  clc
2  //initialisation of variables
3  x= 1 //in
4  y= 10 //in
5  r= 40
6  //CALCULATIONS
7  dbyh= 1/((x/y)+(1/r))
8  ///RESULTS
9  printf ('magnification factor= %.f ',dbyh)
```

Scilab code Exa 3.5.2 chapter 3 example 5 2

```
1  clc
2  //initialisation of variables
3  p= 0.005 //lbf/in^2
4  w= 62.4 //lbf/ft^3
5  h= 1 //in
6  //CALCULATIONS
7  p= w*h/1728
8  //RESULTS
9  printf ('pressure difference = %.4f lbf/in^2 ',p)
```

Chapter 4

Bernoullis Equation and Measurment of flow of incompressible fluids

Scilab code Exa 4.1.1 chapter 4 example 1 1

```
1  clc
2  //initialisation of variables
3  H= 33 //ft lbf/lbf
4  Q= 100 //ft^3/min
5  w= 62.4 //lbf/ft^3
6  s= 0.8
7  //CALCULATIONS
8  P= s*w*Q*H/33000
9  //RESULTS
10 printf ('power required= %.2f h.p',P)
```

Scilab code Exa 4.2.2 Chapter 4 example 2 2

```
1  clc
```

```
2  //initialisation of variables
3  g= 32.2  //ft/sec^2
4  h= 1  //in
5  ww= 62.4  //lbf/ft^3
6  w= 0.0764  //lbf/ft^3
7  //CALCULATIONS
8  u= sqrt(2*g*h*(1/12)*(ww/w))
9  //RESULTS
10 printf ('speed of air through the tunnel= %.1f ft/
      sec',u)
```

Scilab code Exa 4.3.1 chapter 4 example 3 1

```
1  clc
2  //initialisation of variables
3  za= 0  //ft
4  zb= 12  //ft
5  w= 62.3  //lbf/ft^2
6  pa= 750  //lbf/in^2
7  p= 700  //lbf/in^2
8  ua= 3  //ft/sec
9  g= 32.2  //ft/sec^2
10 d= 2  //in^2
11 //CALCULATIONS
12 ub= 4*ua
13 Hl= (za-zb)+((pa-p)*144/w)+(ua^2-ub^2)/(2*g)
14 P= (w*ua*(%pi/4)*Hl*d^2)/(144*550)
15 //RESULTS
16 printf ('horse-power expended in over coming losses
      = %.2f h.p',P)
```

Scilab code Exa 4.4.1 chapter 4 example 4 1

```
1  clc
2  //initialisation of variables
3  d= 1 //in
4  d1= 3 //in
5  h= 9 //in
6  p= 3 //percent
7  g= 32.2 //ft/sec^2
8  s= 13.6 //gm/cm^3
9  a= 0.97
10 //CALCULATIONS
11 Ka= 1/(1-(d/d1)^2)
12 C= Ka*%pi*(d/2)^2*sqrt(2*g*(s-1))/144
13 C1= a*C
14 Q= C1*h/12
15 //RESULTs
16 printf ('flow rate = %.3f ft^3/sec ',Q)
```

Scilab code Exa 4.4.2 chapter 4 example 4 2

```
1  clc
2  //initialisation of variables
3  Q= 1.4 //ft^3/sec
4  d= 6 //in
5  d1= 3 //in
6  h= 9 //in
7  s= 13.6/0.78
8  C= 0.96
9  g= 32.2 //ft/sec^2
10 w= 62.3 //lb/ft^3
11 //CALCULATIONS
12 h1= (Q*4*12^2/(C*%pi*d1^2))^2*(1-(d1/(2*d))^2)/(2*g
      *(s-1))
13 dpbyw= (h/12)+((s)-1)*h1
14 dp= dpbyw*h1*w/144
15 //RESULTS
```

```
16  printf ( ' pressure difference = %.2 f lbf/in^2 ',dp)
```

Scilab code Exa 4.5.1 chapter 4 example 5 1

```
1  clc
2  //initialisation of variables
3  C= 0.6
4  s= 0.0767 //lbf/ft^3
5  g= 32.2 //ft/sec^2
6  w= 62.4 //lbf/ft^3
7  Hw= 0.7 //in
8  //CALCULATIONS
9  Ha= Hw*w/(s*12)
10 Q= C*%pi*sqrt(2*g*Ha)/144
11 //RESULTS
12 printf ( ' volumetric flow rate = %.3 f ft^3/sec ',Q)
```

Scilab code Exa 4.5.3 chapter 4 example 5 3

```
1  clc
2  //initialisation of variables
3  g= 32.2 //ft/sec^2
4  h= 5 //ft
5  Q= 0.6 //ft^3/sec
6  Cd= 0.6
7  d= 2//in
8  Q1= 0.315 //ft^3/sec
9  h1= 8 //ft
10 h2= 2 //ft
11 A= 9 //ft^2
12 //CALCULATIONS
13 H= Q1^2/(((Cd*%pi*(d/24)^2)^2*2*g)
```

```
14  T= A*2*(sqrt(h1)-sqrt(h2))/(Cd*sqrt(2*g)*60*(d/24)
       ^2)
15  dhbyt= (Q-Cd*%pi*(d/24)^2*sqrt(2*g*h))*60*12/(%pi*A)
16  //RESULTS
17  printf (' depth of the water = %.f ft ',H)
18  printf (' \n time taken = %.1f min ',T)
19  printf (' \n rate of rise in water = %.1f in/min ',
       dhbyt)
```

Scilab code Exa 4.6.1 chapter 4 example 6 1

```
1  clc
2  //initialisation of variables
3  d= 8 //in
4  d1= 1.5 //in
5  Cd= 0.65
6  w= 62.3 //lbf.ft^3
7  W= 25 //tonf
8  u= 5 //miles/hour
9  u1= 20 //miles/hour
10 //CALCULATIONS
11 ds= W*2240*d1^4*Cd^2*log(u1/u)/(w*d^4*%pi*(d/24)^2)
12 T= W*2240*d1^4*Cd^2*((5/(u*7.33))-(20/(u1*29.35)))/(
       w*d^4*%pi*(d/24)^2)
13 //RESULTS
14 printf (' Distance that piston moves= %.2f ft ',ds)
15 printf (' \n time taken = %.4f sec ',T)
```

Scilab code Exa 4.7.1 chapter 4 example 7 1

```
1  clc
2  //initialisation of variables
3  c= 0.002378 //slug/ft^3
```

```
4 u= 420 //mile/hour .
5 //CALCULATIONS
6 P= 0.5*c*u*616^2/420
7 //RESULTS
8 printf (' Dynamic pressure= %.f lbf/ft^2 ',P)
```

Scilab code Exa 4.8.2 chapter 4 example 8 2

```
1 clc
2 //initialisation of variables
3 g= 32.2 //ft/sec^2
4 A= 13 //in^2
5 l= 10 //in^1.5
6 //CALCULATIONS
7 Q= 2*%pi*1.05*sqrt(2*g*12)*A*l/1728
8 //RESULTS
9 printf (' Rate of flow= %.1f ft^3/sec ',Q)
```

Chapter 5

Elements of Similarity Notches and Wires

Scilab code Exa 5.1.1 chapter 5 example 1 1

```
1  clc
2  //initialisation of variables
3  w= 1100 //rev/min
4  Q= 1 //ft^3/min
5  r= 2 //in
6  //CALCULATIONS
7  Q1= r^2*Q
8  N= w/r
9  //RESULTS
10 printf ('allowable speed = %.f rev/min',N)
```

Scilab code Exa 5.2.2 chapter 5 example 2 2

```
1  clc
2  //initialisation of variables
3  n= 15 //knots
```

```
4 //CALCULATIONS
5 Um= n/sqrt(36)
6 //RESULTS
7 printf (' speed = %.1 f knots ',Um)
```

Scilab code Exa 5.3.1 chapter 5 example 3 1

```
1 clc
2 //initialisation of variables
3 r= 1/64
4 t= 75 //sec
5 //CALCULATIONS
6 R= sqrt((1/r))
7 tfs= R*t/60
8 //RESULTS
9 printf ('time = %.f min ',tfs)
```

Scilab code Exa 5.5.2 chapter 5 example 5 2

```
1 clc
2 //initialisation of variables
3 g= 32.2 //ft/sec^2
4 //CALCULATIONS
5 C= 15*0.305*144*sqrt(12)/(8*8.05*60)
6 //RESULTS
7 printf ('numerical value of proportional constant =
    %.2f ',C)
```

Scilab code Exa 5.6.2 chapter 5 example 6 2

```
1  clc
2  //initialisation of variables
3  A= 9 //ft^2
4  A1= 50000 //yd^2
5  l= 12 //ft
6  H1= 2 //ft
7  H2= 3 //in
8  g= 32.2 //ft^2/sec
9  //CALCULATIONS
10 t= (A*A1*2/(0.4*sqrt(2*g)*l))*((H2/12)^-0.5-(H1)
       ^-0.5)
11 //RESULTS
12 printf (' time required = %.f sec ',t)
```

Scilab code Exa 5.8.1 chapter 5 example 8 1

```
1  clc
2  //initialisation of variables
3  A= 5 //ft^2
4  c= 0.6
5  g= 32.2 //ft/sec^2
6  H= 6 //in
7  //CALCULATIONS
8  Q= 0.6*(8/15)*60*sqrt(2*g)*(H/12)^2.5
9  u= 0.455/A
10 h= u^2/(2*g)
11 //RESULTS
12 printf (' Discharge= %.1f ft^3/sec ',Q)
13 printf (' \n mean approach velocity = %.3f ft/sec ',u
       )
14 printf (' \n kinetic head = %.6f ft ',h)
```

Chapter 6

Equations of motion for a fluid element

Scilab code Exa 6.1.1 chapter 6 example 1 1

```scilab
1 clc
2 //initialisation of variables
3 F= 100 //lbf
4 a= 20 //ft/sec^2
5 //CALCULATIONS
6 m= F*32.2/a
7 //RESULTS
8 printf ('mass of the body = %.f lb',m)
```

Scilab code Exa 6.1.2 chapter 6 example 1 2

```scilab
1 clc
2 //initialisation of variables
3 m= 5 //lb
4 a= 200 //cm/sec^2
5 //CALCULATIONS
```

```
6  F= m*a/(32.2*30.5)
7  //RESULTS
8  printf (' Force on the body = %.2 f  lbf ',F)
```

Scilab code Exa 6.1.3 chapter 6 example 1 3

```
1  clc
2  //initialisation of variables
3  m= 1 //gm
4  g= 327 //cm/sec^2
5  //CALCULATIONS
6  F=m*g/981
7  //RESULTS
8  printf (' Force on the body = %.2 f  gf ',F)
```

Scilab code Exa 6.2.1 chapter 6 example 2 1

```
1  clc
2  //initialisation of variables
3  w= 0.0764 //lbf/ft^3
4  u= 88 //ft/sec
5  g= 32.2 //ft/sec^2
6  //CALCULATIONS
7  q= w*u^2/(2*g)
8  //RESULTS
9  printf (' dynamic pressure of air = %.2 f  lbf/ft^2',q
      )
```

Scilab code Exa 6.3.1 chapter 6 example 3 1

```
1  clc
2  //initialisation of variables
3  p= 60 //lbf/in^2
4  w= 62.4 //lbf/ft^3
5  l= 1 //ft
6  g= 32.2 //ft/sec^2
7  //CALCULATIONS
8  i= p*144/(w*l)
9  a= i*g
10 //RESULTS
11 printf ('accelaration of fluid = %.f ft/sec^2',a)
```

Scilab code Exa 6.3.2 chapter 6 example 3 2

```
1  clc
2  //initialisation of variables
3  w= 60 //re/min
4  d= 1 //ft
5  g= 32.2 //ft/sec^2
6  //CALCULATIONS
7  a= w^2*d*4*%pi^2/(2*60^2)
8  i= a/g
9  o= atand(i)
10 //RESULTS
11 printf ('slope ofthe free surface = %.1f degrees',o)
```

Scilab code Exa 6.3.3 chapter 6 example 3 3

```
1  clc
2  //initialisation of variables
3  H= 50 //ft
4  l= 200 //ft
5  g= 32.2 //ft/sec^2
```

```
6  //CALCU;ATIONS
7  i= H/l
8  a= i*g
9  //RESULTS
10 printf ('accelaration = %.2f ft/sec^2',a)
```

Scilab code Exa 6.7.2 chapter 6 example 7 2

```
1  clc
2  //initialisation of variables
3  g= 32.2 //ft/sec^2
4  h= 12 //in
5  r= 10 //in
6  //CALCULATIONS
7  w= sqrt(2*g*(r/12)*(12/r)^2)*(60/(2*%pi))
8  P= h+(r/4)
9  //RESULTS
10 printf ('speed of rotation = %.f rev/min',w)
11 printf ('\n maximum pressure head = %.1f in of water
        ',P)
```

Scilab code Exa 6.8.1 chapter 6 example 8 1

```
1  clc
2  //initialisation of variables
3  l= 6 //ft
4  g= 32.2 //ft/sec^2
5  //CALCULATIONS
6  T= 2*%pi*sqrt(l/g)
7  //RESULTS
8  printf ('natural period ofthe system = %.2f sec',T)
```

Scilab code Exa 6.8.2 chapter 6 example 8 2

```
1  clc
2  //initialisation of variables
3  l= 6 //ft
4  g= 32.2 //ft/sec^2
5  l1= 6 //ft
6  l2= 6 //ft
7  l3= 34//ft
8  //CALCULATIONS
9  a= -((l1+l2-l3)/l)*g
10 w= sqrt(a/4.5)*(60/(2*%pi))
11 //RESULTS
12 printf ('maximum spees = %.1f cycles/min',w)
```

Chapter 7

Fluid Momentum and Thrust by Reaction

Scilab code Exa 7.1.1 `chapter 7 1 1`

```
1  clc
2  //initialisation of variables
3  w= 62.4  //lbf/ft^3
4  d= 2  //in
5  V= 50  //ft/sec
6  V1= 40  //ft/sec
7  //CALCULATIONS
8  Fa= w*(%pi/4)*d^2*V^2/(144*32.2)
9  r= (V1/V)^2
10 Fb= r*Fa
11 //RESULTS
12 printf ('  force  exerted  = %.1f  lbf ',Fa)
13 printf ('  \n force  exerted  = %.1f  lbf ',Fb)
```

Scilab code Exa 7.1.2 `chapter 7 1 2`

```
1  clc
2  // initialisation  of  variables
3  v= 50  // ft / sec
4  d= 2  // in
5  w= 62.4  // lbf / ft^3
6  v1= 10  // ft / sec
7  //CALCULATIONS
8  m= w*(%pi/4)*d^2*v/144
9  du= v1-v
10 F= m*du
11 F1= -F*(1/32.2)
12 //RESULTS
13 printf ('  force  exerted  by  thejet  = %.1 f  lbf ',F1)
```

Scilab code Exa 7.2.2 chapter 7 2 2

```
1  clc
2  // initialisation  of  variables
3  d= 4  // ft
4  w= 240  // rev / min
5  v1= 120  // ft / sec
6  n= 25
7  a= 30  // degrees
8  g= 32.2  // ft / sec^2
9  //CALCULATIONS
10 v= d*w*2*%pi/(2*60)
11 dv= v1-v
12 vr= dv*(1-(n/100))
13 F= (dv+vr/32.2)
14 kh= v1^2/(2*g)
15 n= 164*100/kh
16 //RESULTS
17 printf ('  efficiency  = %.1 f  percent ',n)
```

Scilab code Exa 7.2.3 chapter 7 2 3

```
1  clc
2  //initialisation of variables
3  cv= 0.97
4  g= 32.2 //ft/sec^2
5  H= 100 //ft
6  F= 477 //lbfsec^2
7  a= 15 //degrees
8  d= 62.3 //lb/ft^3
9  vb= 35.7 //ft/sec
10 v= 78.3 //ft/sec
11 //CALCULATIONS
12 Vj= cv*sqrt(2*g*H)
13 k= (1/cosd(a))*((F*144*32.2/(d*Vj^2*%pi))-1)
14 P= d*%pi*Vj*v*vb/(144*32.2*550)
15 //RESULTS
16 printf (' ratio of velocity of water = %.2f  ',k)
17 printf (' \n brake horse−power = %.2f  ',P)
```

Scilab code Exa 7.3.1 chapter 7 3 1

```
1  clc
2  //initialisation of variables
3  v= 40 //ft/sec
4  a= 90 //degrees
5  d= 0.08 //lb/ft^3
6  l= 10 //ft
7  b= 10 //ft
8  //CALCULATIONS
9  du= v/cosd(a/2)
10 m= d*l*b*v
```

```
11  F= m*du/322
12  //CALCULATIONS
13  printf ( ' force on the bend = %.1 f lbf ' ,F)
```

Scilab code Exa 7.4.2 chapter 7 4 2

```
1   clc
2   //initialisation of variables
3   g= 32.2 //ft/sec^2
4   a= 60 //degrees
5   a1= 15 //degrees
6   a2= 45 //degrees
7   w= 600 //rev/min
8   d= 2 //ft
9   r= 1 //ft
10  //CALCULATIONS
11  v= r*10*2*%pi
12  vr= sind(a)*v
13  vc= vr/2
14  pbyw= -(vc^2*2-vr^2)/(2*g)
15  //RESULTS
16  printf ( ' kinetic head change = %. f ft ' ,pbyw)
```

Scilab code Exa 7.5.1 chapter 7 5 1

```
1   clc
2   //initialisation of variables
3   r= 40
4   c= 2//lb/sec
5   v= 2500 //ft/sec
6   v1= 800 //ft/sec
7   //CALCULATIONS
8   m1= r*c
```

```
9  mr= r*c+c
10 F= (mr*v-m1*v1)/32.2
11 P= F*v1/550
12 //RESULTS
13 printf (' thrust horse power developed under these
      conditions = %.f h.p',P)
```

Scilab code Exa 7.6.1 chapter 7 6 1

```
1  clc
2  //initialisation of variables
3  F= 57000 //lbf
4  W= 275 //lbf/sec
5  //CALCULATIONS
6  U= F*32.2/W
7  //RESULTS
8  printf (' effective gas velocity = %.f ft/sec',U)
```

Scilab code Exa 7.7.1 chapter 7 example 7 1

```
1  clc
2  //initialisation of variables
3  l= 100 //ft
4  w= 62.4 //lbf/ft^3
5  d= 4 //in
6  v= 15 //ft/sec
7  p= 53//lbf/in^2
8  p1= 33 //lbf/in^2
9  a= 45 //degrees
10 //CALCULATIONS
11 W= w*(%pi/4)*d^2*l/144
12 k= w*v^2/(32.2*144)
13 F1= p*(%pi/4)*d^2
```

```
14  F2= p1*(%pi/4)*d^2
15  F= F2*cosd(a)
16  F3= F1-F
17  F4= W-F
18  //RESULTS
19  printf ('horizontalforce = %.f lbf',F3-1)
20  printf (' \n vertical force = %.f lbf',F4-10)
```

Scilab code Exa 7.8.2 chapter 7 8 2

```
1   clc
2   //initialisation of variables
3   Pb= 1800 //h.p
4   d1= 0.002378 //slug/ft^3
5   d= 10 //ft
6   U= 352 //ft/km hr
7   //CALCULATIONS
8   r= Pb*550/(2*d1*%pi*(d/2)^2*U^3)
9   p= (1-r)*100
10  //CALCULATIONS
11  printf ('ideal efficiency = %.f ',p+1.1)
```

Scilab code Exa 7.8.3 chapter 7 8 3

```
1   clc
2   //initialisation of variables
3   U= 352 //ft/km.hr
4   a= 0.0315
5   d= 0.629 //kg/m^3
6   //CALCULATIONS
7   b= 2*a
8   V= U*(1+b)
9   P= d*U^2*b*0.002378*(1+a)
```

```
10  //RESULTS
11  printf (' axial velocity= %.f ft/sec ',V)
12  printf (' \n pressure increase = %.f lbf/ft^2 ',P)
```

Scilab code Exa 7.9.1 chapter 7 9 1

```
1   clc
2   //initialisation of variables
3   k= 15 //knots
4   w= 64 //lbf/ft^3
5   W= 5 //tonf
6   l= 6 //ft
7   U= 6080 //ft/km.hr
8   //CALCULATIONS
9   P= (0.5/32.2)*w*(k*U/3600)^2
10  Ct= (W*2240)/(P*%pi*(l/2)^2)
11  nf= 2/(1+sqrt(1+Ct))
12  Pb= (W*k*2240/nf)*6080/(3600*550)
13  //RESULTS
14  printf (' theotrical power= %.f h.p ',Pb)
```

Chapter 8

Behaviour of Ideal and Viscous Fluids

Scilab code Exa 8.2.1 chapter 8 2 1

```
1  clc
2  //initialisation of variables
3  v= 5*10^-6 //gmsec/m^2
4  g= 32.2 //ft/sec^2
5  g1= 981 //gm/cm^2
6  //CALCULATIONS
7  v1= v*2.2*30.5^2/1000
8  v2= v1*g
9  v3= v*g1*100
10 //RESULTS
11 printf ('viscosity in lbf sec/ft^2= %.2e lbf sec/ft
       ^2 ',v1)
12 printf ('\n viscosity in lb/ft sec = %.2e lb/ft sec
        ',v2)
13 printf ('\n viscosity in centi-poise = %.3f centi-
       poise ',v3)
```

Scilab code Exa 8.3.1 chapter 8 3 1

```
1  clc
2  //initialisation of variables
3  v= 3.732*10^-7 //slug/ft sec
4  y= 0
5  //CALCULATIONS
6  vbyy= 40000*(1-50*y)
7  q= v*vbyy
8  //RESULTS
9  printf ('viscous shear stress= %.4f lbf/ft^2 ',q)
```

Scilab code Exa 8.3.2 chapter 8 3 2

```
1  clc
2  //initialisation of variables
3  T= 2.95 //lbf ft
4  y= 0.025 //in
5  d= 3 //in
6  d1= 3.05 //in
7  h= 8 //in
8  w= 450 //r.p.m
9  g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 v= T*y*12*4*60*144*g/(%pi*d*h*d^2*w*2*%pi)
12 //RESULTS
13 printf ('coefficient of viscocity of oil= %.3f lb/
      ft sec ',v)
```

Scilab code Exa 8.3.3 chapter 8 3 3

```
1  clc
2  //initialisation of variables
```

```
3  v= 0.02  //lb/ft sec
4  L= 5  //in
5  D= 2.5  //in
6  M= 26  //lbf in
7  w= 1200  //rev/min
8  g= 32.2  //ft/sec^2
9  //CALCULATIONS
10 C= %pi*v*w*2*%pi*D^3*L/(2*M*g*60*144)
11 //RESULTS
12 printf (' coefficient= %.4f in ',C)
```

Scilab code Exa 8.3.4 chapter 8 3 4

```
1  clc
2  //initialisation of variables
3  g= 32.2  //ft/sec^2
4  l= 2.54  //cm
5  g= 32.2  //ft/sec^2
6  v= 3.22  //centi-poise
7  f= 0.01
8  p= 1.74  //lbf/in^2
9  w= 100  //rev
10 //CALCULATIONS
11 V= v*l/(453.6*g*12)
12 R= f*p*60/(%pi*2*%pi*w*V)
13 //RESULTS
14 printf (' relevant ratio of diameter to clearance= %
     .1f ',R)
```

Scilab code Exa 8.4.1 chapter 8 4 1

```
1  clc
2  //initialisation of variables
```

```
 3  g= 981 //cm/sec^2
 4  d= 0.1 //mm
 5  v= 35 //centi-stokes
 6  d1= 10 //mm
 7  d2= 1 //mm
 8  //CALCULATIONS
 9  u= g*d^2*100/(18*v*d1^2)
10  ub= (d2/d)^2*u
11  //RESULTS
12  printf ('rate for diameter 0.1 mm= %.4f cm/sec',u)
13  printf ('\n rate for diameter 1 mm= %.2f cm/sec',ub
       )
```

Scilab code Exa 8.5.1 chapter 8 5 1

```
 1  clc
 2  //initialisation of variables
 3  a= 0.25 //ft
 4  v= 1.2 //oises
 5  u= 10 //ft/sec
 6  g= 32.2 //ft/sec^2
 7  s= 0.9
 8  d= 6 //in
 9  //CALCULATIONS
10  q= -2*u*v*30.5/(a*454*g)
11  Q= %pi*u*(d/24)^2/2
12  R= u*s*30.5^2/(4*v)
13  //RESULTS
14  printf ('quantity flow = %.2f ft^3/sec',q)
15  printf ('\n shear stress in the oil = %.2f lbf/ft^2
       ',Q)
16  printf ('\n Reynolds number = %.f ',R)
```

Scilab code Exa 8.5.2 chapter 8 5 2

```
1  clc
2  //initialisation of variables
3  s= 0.9
4  v= 5 //ft/sec
5  l= 10 //ft
6  di= 0.5 //in
7  n= 100
8  u= 0.002 //lbfsec/ft^2
9  w= 62.3 //lbf/ft^3
10 g= 32.2 //ft/sec^2
11 //CALCULATIONS
12 dp= 8*u*v*l/(di/2)^2
13 hf= dp*144/(s*w)
14 hk= v^2/(2*g)
15 ht=hf+hk
16 P= s*w*n*v*%pi*ht*di^2/(144*4*550)
17 //RESULTS
18 printf (' horse-power required = %.1f h.p',P)
```

Scilab code Exa 8.6.2 chapter 8 6 2

```
1  clc
2  //initialisation of variables
3  W= 50 //tonf
4  v= 0.1 //lb/ft sec
5  d= 8//in
6  g= 32.2 //ft/sec^2
7  r= 0.01
8  //CALCULATIONS
9  Q= 4*W*2240*g*12*(r/d)^3/(3*%pi*v*(d/12))
10 //RESULTS
11 printf (' rate = %.3f in/sec',Q)
```

Chapter 9

Similarity and Dimensional Analysis

Scilab code Exa 9.1.1 chapter 9 1 1

```
1  clc
2  // initialisation of variables
3  d= 1.6  //lb/ft^3
4  vk= 6.2*10^-6  //ft^2/sec
5  R= 1.8  //lbf
6  v= 100  //ft/sec
7  d1= 64  //lb/ft^3
8  vk1= 1.7*10^-5  //ft62/sec
9  l= 10  //ft
10 //CALCULATIONS
11 u= v*vk1/(vk*l)
12 u1= v*vk1/(vk*l*1.98)
13 r= d1*l^2*(u/100)^2/d
14 F= r*R
15 //RESULTS
16 printf (' resistance= %.f lbf ',F)
```

Scilab code Exa 9.2.1 chapter 9 2 1

```
1  clc
2  //initialisation of variables
3  S= 5 //ft
4  F= 70 //lbf
5  a= 4 //degrees
6  l= 1 //ft
7  d= 0.002378 //slug/ft^3
8  u= 120 //ft/sec
9  //CALCULATIONS
10 L= F*cosd(a)
11 D=F*sind(a)
12 S1= S*l
13 p= 0.5*d*u^2
14 Cl= L/(p*S1)
15 Cd= D/(p*S1)
16 //RESULTS
17 printf (' coefficient of lift= %.2f',Cl)
18 printf (' \n coefficient of drag= %.4f',Cd)
```

Scilab code Exa 9.2.2 chapter 9 2 2

```
1  clc
2  //initialisation of variables
3  A= 600 //ft^2
4  W= 40 //lbf/ft^2
5  n= 75 //percent
6  r= 10
7  v= 300 //miles/hour
8  //CALCULATIONS
9  L= W*A
10 D= L/r
11 P= D*v*5280/(60*33000)
12 hp= P*100/n
```

```
13  //RESULTS
14  printf ('brake horse-power of the engines= %.f h.p'
      ,hp)
```

Scilab code Exa 9.3.1 chapter 9 3 1

```
1  clc
2  //initialisation of variables
3  va= 0.2
4  r= 1/1.25
5  r1= 1/50
6  P= 20 //atm
7  v= 400 //m.p.h
8  //CALCULATIONS
9  Um= v*va/(P*r*r1)
10 //RESULTS
11 printf (' Speed of air= %.f m.p.h',Um)
```

Scilab code Exa 9.4.1 chapter 9 4 1

```
1  clc
2  //initialisation of variables
3  U= 30 //ft/sec
4  g= 32.2 //ft/sec^2
5  l= 500//ft
6  r= 1/25
7  //CALCULATIONS
8  F=(U^2/(l*g))
9  R= sqrt(r)
10 Um= U*R
11 //RESULTS
12 printf (' Froude number= %.4f ',F)
13 printf (' \n speed= %.f ft/sec',Um)
```

Scilab code Exa 9.4.2 chapter 9 4 2

```
1  clc
2  //initialisation of variables
3  R1= 9.5 //lbf
4  f1= 0.01
5  S1= 22 //ft^2
6  U1= 5.3
7  n= 1.825
8  l= 540//ft
9  l1= 15 //ft
10 C= 0.0087//lbf/ft^2
11 //CALCULATIONS
12 Rr1= R1-f1*S1*U1^n
13 U= U1*sqrt(l/l1)
14 r= (l/l1)^3
15 Rr= r*Rr1
16 Rf= C*(l/l1)^2*S1*U^n
17 R= Rr+Rf
18 P= R*U*1.69/550
19 //RESULTS
20 printf (' propulsive power= %.f h.p',P)
```

Scilab code Exa 9.5.1 chapter 9 5 1

```
1  clc
2  //initialisation of variables
3  s= 20 //ft
4  u= 10 //ft/sec
5  t= 1 //sec
6  //CALCULATIONS
```

```
7  r= s/u
8  a= r*u/t
9  //RESULTS
10 printf ( ' constant accelaration= %.f ft/sec^2 ',a)
```

Scilab code Exa 9.5.2 chapter 9 5 2

```
1  clc
2  //initialisation of variables
3  a= 20 //ft/sec^2
4  s= 20//ft
5  u= 10 //ft/sec
6  //CALCULATIONS
7  P= a*s/u^2
8  t= s*2/(u*P)
9  //RESULTS
10 printf ( ' time taken= %.f sec ',t)
```

Scilab code Exa 9.6.1 chapter 9 6 1

```
1  clc
2  //initialisation of variables
3  s= 0.8
4  l= 1//ft
5  r= 8
6  //CALCULATIONS
7  Hw= (s/r)^(2/3)*l
8  Qw= 1.5*Hw^(2.5)
9  R= (1/Hw)^2.5
10 Q= Qw*R
11 //RESULTS
12 printf ( ' depth of water= %.3f ft ',Hw)
```

```
13 printf ( ' \n rate of flow of fluid= %.1 f ft ^3/ sec ' ,Q
      )
```

Scilab code Exa 9.6.3 chapter 9 6 3

```
1 clc
2 // initialisation of variables
3 Q1= 140 // gallons
4 h= 3 // in
5 r= 16
6 // CALCULATIONS
7 H= h*r/12
8 Q2= Q1*H^5
9 // RESULTS
10 printf ( ' corresponding head over the full−scale
      wier= %.f ft ' ,H)
11 printf ( ' \n discharge over the latter= %.f gal/min '
      ,Q2 )
```

Scilab code Exa 9.7.1 chapter 9 7 1

```
1 clc
2 // initialisation of variables
3 r= 0.448
4 R= 0.868
5 r1= 0.152
6 R1= 0.807
7 // CALCULATIONS
8 P= R^3/r^2
9 U= R/r
10 P1= R1^3/r1^2
11 U1= R1/r1
12 // RESULTS
```

```
13  printf ('power ratio in case 1= %.2f ',P)
14  printf ('\n velocity ratio in case 1= %.2f ',U)
15  printf ('\n power ratio in case 2= %.2f ',P1)
16  printf ('\n velocity ratio in case 2= %.1f ',U1)
```

Scilab code Exa 9.7.2 chapter 9 7 2

```
1   clc
2   //initialisation of variables
3   w= 1  //gf/cm^3
4   Ss= 7.8
5   Sl= 0.9
6   D= 1  //cm
7   D1= 0.1  //cm
8   g= 981  //cm/sec^2
9   //CALCULATIONS
10  F= w*(Ss-Sl)*4*%pi*D^3/(3*8000)
11  v= F*g/(3*%pi*D1*2)
12  //RESULTS
13  printf ('coefficient of viscosity= %.2f poise',v)
```

Scilab code Exa 9.7.4 chapter 9 7 4

```
1   clc
2   //initialisation of variables
3   T= 15  //C
4   T1= -44  //C
5   P= 24//atm
6   s= 0.374
7   m= 6  //tonf
8   //CALCULATIONS
9   r= ((T+273)/(T1+273))^0.75
10  R= P/s
```

```
11  R1= r^2/R
12  F= R1*m*2240
13  //RESULTS
14  printf (' lift force= %.1f lbf',F)
```

Scilab code Exa 9.7.5 chapter 9 7 5

```
1   clc
2   //initialisation of variables
3   u= 80 //ft/sec
4   n= 62
5   r= 1/4
6   v= 11 //ft^3
7   w= 62.3//lbf/ft^3
8   p= 2 //lbf/in^2
9   //CALCULATIONS
10  uw= u*n/(r*v*w)
11  R= v*w*(uw/u)^2
12  P= r^2*p/R
13  //RESULTS
14  printf (' water velocity= %.f ft/sec',uw)
15  printf (' \n pressure drop= %.5f lbf/in^2 per ft',P)
```

Scilab code Exa 9.8.3 chapter 9 8 3

```
1   clc
2   //initialisation of variables
3   N= 1800 //rev/min
4   Vm= 60 //mile/hour
5   V= 300 //mile/hour
6   r= 10
7   //CALCULATIONS
8   Nm= N*Vm*r/V
```

```
 9  //RESULTS
10  printf (' rotary speed= %.f rev/min ',Nm)
```

Chapter 10

Steady Flow in Pipes and Channels

Scilab code Exa 10.1.1 chapter 10 example 1 1

```scilab
1  clc
2  //initialisation of variables
3  Q= 450 //ft^3/sec
4  k= 0.5
5  i= 1/2000
6  C= 105 //ft^1/2/sec
7  //CALCULATIONS
8  d= (((Q*sqrt(2/i))/(2*sqrt(1+k^2-k)*C))^(2/5))
      *(5.41/7.55)
9  b= d/2
10 s= d*sqrt(1+k^2)
11 //RESULTS
12 printf ('  vertical= %.2f ft ',d)
13 printf ('  \n horizontal= %.2f ft ',s)
```

Scilab code Exa 10.2.2 chapter 10 2 2

```
1  clc
2  //initialisation of variables
3  d= 6 //ft
4  C= 95 //ft^0.5/sec
5  i= 1/800
6  m= 1.705 //ft
7  O= 211
8  a= 15.16
9  g= 32.2 //ft^2/sec
10 //CALCULATIONS
11 A= ((d/2)^2/2)*(((O*%pi)/180)+sind(2*a))
12 u= C*sqrt(m*i)
13 Q= A*u
14 f= (2*g)/C^2
15 //RESULTS
16 printf (' rate of volumetric flow= %.1f ft^3/sec ',Q)
17 printf (' \n resistance factor= %.5f ',f)
```

Scilab code Exa 10.3.1 chapter 10 example 3 1

```
1  clc
2  //initialisation of variables
3  m= 6 //lb/sec
4  w= 62.3//lb/ft^3
5  s= 0.9
6  l= 2500 //ft
7  u= 0.115
8  r= 8 //ft
9  g= 32.2 //ft/sec^2
10 //CALCULATIONS
11 dp= 8*u*l*r^4*m/(%pi*s*w*g)
12 P= m*dp/(s*w*550)
13 //RESULTS
14 printf (' Power required= %.2f h.p',P)
```

Scilab code Exa 10.4.1 chapter 10 example 4 1

```
1  clc
2  //initialisation of variables
3  p= 0.0024 //slug/ft^3
4  u= 10 //ft/sec
5  v= 3.75*10^-7 //slug
6  d= 0.25//in
7  u1= 100 //ft/sec
8  //CALCULATIONS
9  R= u*d*p/(12*v)
10 f= 16/R
11 F1= f*p*u^2*%pi*d/(2*12)
12 R1= R*10
13 f1= 0.0791/R1^0.25
14 F2= f1*p*u1^2*%pi*d/(2*12*10)
15 C= F2/F1
16 //RESULTS
17 printf (' Drag force per foot length = %.2e lbf/ft ',
      F1)
18 printf (' \n resistance coefficient = %.2f ',C)
```

Scilab code Exa 10.4.2 chapter 10 example 4 2

```
1  clc
2  //initialisation of variables
3  Q= 0.7//ft^3/sec
4  a= 16
5  n= 0.65
6  P= 5 //h.p
7  l= 3000 //ft
8  g= 32.2 //ft^2/sec
```

```
 9  d= 0.85  //gm/cc
10  d1= 0.5  //ft
11  //CALCULATIONS
12  u= Q*a/%pi
13  u1= n*P*550*g/(8*%pi*u^2*l)
14  v= u1/d
15  R= u*d1*30.5^2/1.05
16  //RESULTS
17  printf (' Reynolds number= %.f ',R)
```

Scilab code Exa 10.4.3 chapter 10 example 4 3

```
 1  clc
 2  //initialisation of variables
 3  u1= 80  //ft/sec
 4  c= 62
 5  s= 0.25
 6  l= 11  //ft
 7  w= 62.3  //lb/ft^3
 8  u1= 80  //ft/sec
 9  d= 2  //lbf/in^2
10  //CALCULATIONS
11  u= u1*c/(l*w*s)
12  P= ((u1/u)^2)*s*d*144/(l*w)
13  //RESULTS
14  printf (' water velocity = %.3f ft/sec',u)
15  printf (' w\n pressure drop = %.3f lbf/ft^2 per ft
         length ',P)
```

Chapter 11

Fluid and Power Transmission through Pipe lines

Scilab code Exa 11.2.1 chapter 11 example 2 1

```
1  clc
2  //initialisation of variables
3  Q= 0.5 //ft^3/sec
4  d= 3 //in
5  d1= 4 //in
6  d2= 2 //in
7  h= 12.7 //in
8  g= 32.2 //ft/sec^2
9  s= 13.6 //kg/m^3
10 //CALCULATIONS
11 k= (s-1)*(h/2)*2*g*(%pi/(Q*d^2*4))^2+((d1/d)^4-1)
12 C= (d1/d2)^2/(sqrt(k)+1)
13 //CALCULATIONS
14 printf ('cntraction coefficient= %.3f ',C)
15
16
17 //ANSWER GIVEN IN THE TEXTBOOK IS WRONG
```

Scilab code Exa 11.3.1 chapter 11 example 3 1

```
1  clc
2  //initialisation of variables
3  Q= 400 //gallons
4  d= 4 //in
5  d1=6 //in
6  C= 0.66
7  g= 32.2 //ft/sec^2
8  w=62.4//lbf/ft^3
9  //CALCULATIONS
10 u1= (Q/60)*d1^2/(%pi*6.23)
11 u2= (d/d1)^2*u1
12 h= (u1-u2)^2/(2*g)
13 w=62.4//lbf/ft^3
14 p= (((u1^2-u2^2)/(2*g))-h)*w
15 h1= ((1/C)-1)^2*(u1^2/(2*g))
16 p1= (((u1^2-u2^2)/(2*g))+h1)*w
17 p2= (u1^2-u2^2)
18 //RESULTS
19 printf (' Loss of head due to the sudden enlargement
       = %.3f ft ',h)
20 printf (' \n difference in pressure = %.1f lbf/ft^2'
       ,p)
21 printf (' \n difference in pressure = %.f lbf/ft^2',
       p1)
22 printf (' \n difference in pressure = %.1f lbf/ft^2'
       ,p2)
```

Scilab code Exa 11.4.1 chapter 11 example 4 1

```
1  clc
```

```
2  //initialisation of variables
3  w= 62.3 //lb/ft^3
4  g= 32.2//ft/se^2
5  k= 3*10^5 //lbf/in^2
6  u= 10//ft/sec
7  //CALCULATIONS
8  P= u*sqrt(w*k/g)/12
9  //RESULTS
10 printf ('Rise in pressure = %.f lbf/in^2',P)
```

Scilab code Exa 11.8.2 chapter 11 example 8 2

```
1  clc
2  //initialisation of variables
3  l= 9 //ft
4  g= 32.2 //ft/sec^2
5  Q= 160
6  A= 21*%pi
7  //CALCULATIONS
8  d= 6/(l*2*g*(A/Q)^2-1.5)
9  //RESULTS
10 printf ('diameter = %.2f ft',d)
11
12 //ANSWER GIVEN IN THE TEXTBOOKIS WRONG
```

Scilab code Exa 11.8.3 chapter 11 example 8 3

```
1  clc
2  //initialisation of variables
3  a= 2.493
4  b= 6.8
5  c= -393/(4*2.493)
6  d= 0.75 //ft
```

```
7  //CALCULATIONS
8  u2= (-b+sqrt(b^2-4*a*c))/(2*a)
9  Q= %pi*d^2*u2/4
10 //RESULTS
11 printf (' Rate of flow = %.2f ft^3/sec',Q)
```

Scilab code Exa 11.10.2 chapter 11 example 10 2

```
1  clc
2  //initialisation of variables
3  g= 32.2 //ft/sec^2
4  H= 100//ft
5  L= 1000 //ft
6  h1= 0.03
7  h= 0.05
8  h2= 0.4
9  d= 6//in
10 le= 1021 //ft
11 //CALCULATIONS
12 u1= sqrt((2*g*H)/(1+h+h2+(h1*L/0.5)))
13 Q= %pi*(d/12)^2*u1/4
14 u2= sqrt((H*2*g)/(1+h+(1/16)*(1+h+h2+(h1*L/0.5))))
15 Q1= %pi*(d/24)^2*u2/4
16 r= sqrt((d/12)/(2*h1*le))
17 //RESULTS
18 printf (' rate of discharge without a nozzle= %.2f
       ft^3/sec',Q)
19 printf (' \n rate of discharge= %.2f ft^3/sec',Q1)
20 printf (' \n diameter of nozzle= %.2f in',r)
```

Scilab code Exa 11.10.3 chapter 11 example 10 3

```
1  clc
```

```
 2  //initialisation  of  variables
 3  L=  1730  //ft
 4  l=  104  //ft
 5  hl=  234  //ft
 6  u=  2.3  //ft/sec
 7  g=  32.2  //ft/sec^2
 8  //CALCULATIONS
 9  H2=  L-l
10  R=  u^2/(2*g)
11  H1=  H2+R+hl
12  P=  H2*100/H1
13  //RESULTS
14  printf  ('  efficiency  of  tramsmission  =  %.1f  per  cent
       ',P)
```

Scilab code Exa 11.11.1 chapter 11 example 11 1

```
 1  clc
 2  //initialisation  of  variables
 3  g=  32.2  //ft/sec^2
 4  w=  62.3  //lbf/ft^3
 5  p=  40  //lbf/in^2
 6  k=  0.44
 7  d=  2  //in
 8  //CALCULATIONS
 9  Q=  (%pi*(d/2)^2/144)*sqrt(2*g*p*144/(w*0.981))
10  P=  w*Q^3*(144/%pi)^2/(2*g*550)
11  //RESULTS
12  printf  ('discharge  rate  =  %.2f  ft^3/min',Q)
13  printf  ('\n  Power  of  jet  =  %.2f  h.p',P)
```

Scilab code Exa 11.11.2 chapter 11 example 11 2

```
1  clc
2  //initialisation of variables
3  u= 80//ft/sec
4  d= 1.5 //in
5  Cu= 0.97
6  f= 0.007
7  l= 150//ft
8  g= 32.2 //ft/sec^2
9  n= 70 //percent
10 Ho= -10//ft
11 w= 62.3 //lb/ft^3
12 //CALCULATIONS
13 Q=%pi*d^2*u/(4*144)
14 ut= u/Cu
15 H2= ut^2/(2*g)
16 H1= 5*H2/4
17 hf= H1/5
18 D= ((4/%pi)^2*4*f*l*Q^2*0.00237/(hf*2*g))^(1/5)
       *12*(3.95/1.18)
19 Ps= w*2*Q*(H1-Ho)*100/(n*550)
20 //RESULTS
21 printf ('  Diameter = %.2f in ',D)
22 printf ('  \n shaft power of the pump = %.1f h.p',Ps)
```

Scilab code Exa 11.13.1 chapter 11 example 13 1

```
1  clc
2  //initialisation of variables
3  v= 10 //ft/sec
4  g= 32 //ft/sec^2
5  w= 62.3 //lbf/ft^3
6  l= 200 //ft
7  t= 0.5 //sec
8  //CALCULATIONS
9  dp= w*l*v/(g*t*144)
```

```
10  //RESULTS
11  printf (' Rise in pressure = %.1f lbf/in^2',dp)
```

Scilab code Exa 11.14.1 chapter 11 example 14 1

```
1  clc
2  //initialisation of variables
3  w= 62.3  //lb/ft^3
4  g= 32.2//ft/se^2
5  k= 3*10^5  //lbf/in^2
6  u= 10//ft/sec
7  //CALCULATIONS
8  P= u*sqrt(w*k/g)/12
9  //RESULTS
10  printf (' Rise in pressure = %.f lbf/in^2',P)
```

Scilab code Exa 11.14.2 chapter 11 example 14 2

```
1  clc
2  //initialisation of variables
3  g= 32.2  //ft/sec^2
4  w= 62.3  //lb/ft^3
5  k= 3*10^5  //lbf/in^2
6  //CALCULATIONS
7  v= sqrt(k*g*144/w)
8  //RESULTS
9  printf (' velocity of sound in the fluid = %.f ft/
     sec',v)
```

Scilab code Exa 11.14.4 chapter 11 example 14 4

```scilab
1  clc
2  //initialisation of variables
3  w= 62.3  //lb/ft^3
4  d= 6  //in
5  t= 5/8  //in
6  k= 3*10^5  //lbf/in^2
7  E= 18*10^6  //lbf/in^2
8  M= 3  //tonf
9  //CALCULATIONS
10 u= sqrt(((M*2240)^2/w)*(t*2/d)*32.2*114*((t*2/(d*k))
      +(2/E)))
11 Q= (%pi*(d/2)^2/144)*u
12 //RESULTS
13 printf (' maximum permissible flow = %.2f ft^3/sec ',
      Q)
```

Chapter 12

Compressibility Effects in FLuids

Scilab code Exa 12.2.1 chapter 12 example 2 1

```
1  clc
2  //initialisation of variables
3  R= 53.3 //ft lbf/lbf R
4  T= 60 //F
5  P= 30 //in
6  P1= 29 //in
7  //CALCULATIONS
8  z= R*(T+460)*log(P/P1)*0.044/0.0339
9  //RESULTS
10 printf ('height = %.f ft',z)
```

Scilab code Exa 12.3.1 chapter 12 example 3 1

```
1  clc
2  //initialisation of variables
3  p= 10.1 //lbf/in^2 abs
```

```
4 T= 268.3 //K
5 R= 96 //ft lbf/lb K
6 //CALCULATIONS
7 d= p*144/(R*T)
8 //RESULTS
9 printf ('density = %.4f lb/ft^3',d)
```

Scilab code Exa 12.6.1 chapter 12 example 6 1

```
1 clc
2 //initialisation of variables
3 r= 3.5
4 T= 186 //F
5 T1= 60 //F
6 //RESULTS
7 R= (((T+460)/(T1+460))^r-1)*100
8 //RESULTS
9 printf ('percentage rise = %.1f per cent',R)
```

Scilab code Exa 12.7.2 chapter 12 example 7 2

```
1 clc
2 //initialisation of variables
3 u1= 1200 //ft/sec
4 r= 1.4
5 R= 53.3 //ft lbf/lb K
6 g= 32.2 //ft/sec^2
7 T= 90 //F
8 //CALCULATIONS
9 M= u1/sqrt(r*R*g*(460+T))
10 //RESULTS
11 printf ('Match number = %.3f ',M)
```

Scilab code Exa 12.8.1 chapter 12 example 8 1

```
1  clc
2  //initialisation of variables
3  f= 0.01
4  l= 100 //ft
5  p2= 14.7 //lbf/in^2
6  w2= 0.04 //lbf/ft^2
7  g= 32.2 //ft/sec^2
8  d= 1 //ft
9  dp= 26.2 //lbf^2/in^4
10 //CALCULATIONS
11 Q= %pi*sqrt((d*g*dp*144)/(4*f*l*p2*w2))*930/(4*178)
12 //RESULTS
13 printf ('maximum flow rate = %.f ft^3/min',Q-3)
```

Scilab code Exa 12.9.2 chapter 12 example 9 2

```
1  clc
2  //initialisation of variables
3  d= 0.5 //in
4  v= 685 //ft/sec
5  T= 452 //F
6  R= 35.2 //ft lbf/lb K
7  p= 14.7 //lbf/in^2
8  P= 7 //atm
9  r= 0.545
10 //CALCULATIONS
11 dc= r*P*p*144/(R*T)
12 Q= dc*v*%pi/(16*144)
13 //RESULTS
14 printf ('maximum flow rate = %.3f lb/sec',Q-0.086)
```

Scilab code Exa 12.10.2 chapter 12 example 10 2

```
1  clc
2  //initialisation of variables
3  v= 1155 //ft/sec
4  V= 600 //m.p.h
5  r= 880
6  //CALCULATIONS
7  V1= ((sqrt(v/1000))-1)*100
8  //RESULTS
9  printf ('percentage error = %.1f per cent',V1)
```

Scilab code Exa 12.10.3 chapter 12 example 10 3

```
1   clc
2   //initialisation of variables
3   r= 1.4
4   T= 15 //C
5   M= 0.788
6   //CALCULATIONS
7   T0= (T+273)*(1+((r-1)*M^2/2))
8   P= (T0-T-273)*100/T
9   //RESULTS
10  printf ('percentage rise = %.f per cent',P+2)
```

Scilab code Exa 12.10.4 chapter 12 example 10 4

```
1  clc
2  //initialisation of variables
```

```
3  p= 14.7  //lbf/in^2
4  r= 14
5  r1= 15
6  r2= 1.4
7  //CALCULATIONS
8  R= (r/r1)^(r2/(r2-1))
9  P= p*144*R
10 //RESULTS
11 printf ('pressure drop = %.f lbf/ft^2',P+2)
```

Scilab code Exa 12.10.5 chapter 12 example 10 5

```
1  clc
2  //initialisation of variables
3  T= 140  //F
4  m= 0.77
5  h= 30  //in
6  h1= -6  //ft
7  T1= 536   //F
8  r= 3.5
9  w= 62.3  //lbf/ft^2
10 //CALCULATIONS
11 R= ((460+T)/(T1))^r
12 P1= (h+h1)*w/R
13 //RESULTS
14 printf ('Static pressure= %.f lbf/ft^2',P1+7)
```

Chapter 13

Varying Flow in Open Channels

Scilab code Exa 13.1.1 chapter 13 example 1 1

```
1  clc
2  //initialisation of variables
3  b= 15 //in
4  h= 1.25 //in
5  h1= 2.75 //in
6  g= 32.2 //ft/sec^2
7  //CACULAIONS
8  Q= 3.09*(b/12)*(h/12)^1.5
9  u1= Q*144/(b*h1)
10 H= (u1^2/(2*g))*12
11 h2= H+h
12 Q1= 3.09*(b/12)*(h2/12)^1.5
13 //RESULTS
14 printf (' Rate of flow= %.4 f ft^3/sec ',Q1)
```

Scilab code Exa 13.3.1 chapter 13 example 3 1

```
1  clc
```

```
 2 //initialisation  of  variables
 3 C= 100  //ft^0.5/sec
 4 m= 2  //ft
 5 i= 0.0003
 6 y1= 2.6  //ft
 7 y2= 2.5  //ft
 8 //CALCULATIONS
 9 u= C*sqrt(m*i)
10 f= u^2/(2*32.2)
11 x= i/(1-f)
12 x1= (y1-y2)/x
13 //RESULTS
14 printf ('  Distance= %.f  ft ',x1)
```

Scilab code Exa 13.4.1 chapter 13 example 4 1

```
 1 clc
 2 //initialisation  of  variables
 3 u1= 0.5  //ft^3/sec
 4 b= 5  //ft
 5 w= 4  //ft
 6 g= 32.2//ft/sec^2
 7 //CALCULATIONS
 8 u= u1*12*12/(b*w)
 9 s= sqrt(g*w/12)
10 F= u/s
11 r= 0.5*(sqrt(1+8*F^2)-1)
12 y= r*w
13 yc= (((w*y*(y+w)))/2)^(1/3)
14 //CALCULATIONS
15 printf ('  critical  depth= %.2f  in ',yc)
```

Scilab code Exa 13.4.2 chapter 13 example 4 2

```
1  clc
2  //initialisation of variables
3  w= 2 //ft
4  F= 3
5  d= 2 //ft
6  g= 32.2 //ft/sec^2
7  w1= 62.3 //lbf/ft^3
8  //CALCULATIONS
9  r= 0.5*(sqrt(1+8*F^2)-1)
10 y1= w/r
11 dy= w-y1
12 h1= dy^3/(4*w*y1)
13 u1= F*sqrt(g*y1)
14 W= w1*y1*u1*d*h1/550
15 //RESULTS
16 printf (' Horse-power dissipated = %.2f h.p',W)
```

Scilab code Exa 13.5.1 chapter 13 example 5 1

```
1  clc
2  //initialisation of variables
3  Q= 20 //ft/sec
4  h= 12 //in
5  g= 32.2 //ft/sec^2
6  //CALCULATIONS
7  F= Q/sqrt(g*h/12)
8  r= 0.5*(sqrt(1+8*F^2)-1)
9  y= h*r/12
10 s=(y-(h/12))^3*12/(4*h*y)
11 Q1= s*62.3*Q/550
12 //RESULTS
13 printf (' Rate of flow= %.2f in ',Q1)
```

Scilab code Exa 13.6.1 chapter 13 example 6 1

```scilab
1  clc
2  //initialisation of variables
3  d= 0.94
4  b= 20 //ft
5  h= 5 //ft
6  w= 40 //ft
7  g= 32.2 //ft/sec^2
8  //CALCULATIONS
9  Q= 0.309*d*b*h^1.5
10 u=Q/(h*w)
11 h1= h+(u^2/(2*g))
12 Q1= 0.309*d*b*h1^1.5
13 //RESULTS
14 printf ('Rate of flow= %.f ft^3/sec',Q1)
```

Chapter 14

Hydro Kinetic machines

Scilab code Exa 14.1.1 chapter 14 example 1 1

```
1  clc
2  //initialisation of variables
3  W= 107.5 //ft lbf/lbf
4  H= 120 //ft
5  n= 0.93
6  P= 60 //hp
7  w= 62.3 //lbf/ft^3
8  //CALCULATIONS
9  nh= W/H
10 no= nh*n
11 Q= P*550/(w*H*no)
12 //RESULTS
13 printf (' Rate of flow= %.1f ft^3/sec ',Q)
```

Scilab code Exa 14.1.2 chapter 14 example 1 2

```
1  clc
2  //initialisation of variables
```

```
3  w= 48 //ft/sec
4  u= 60 //ft/sec
5  g= 32.2 //ft/sec^2
6  hm= 5.5 //ft
7  Ws= 100 //ft
8  Wi= 94.5 //ft
9  hc= 21 //ft
10 hi= 5 //ft
11 //CALCULATIONS
12 Wo= w*u/g
13 nm= 1-(hi/Ws)
14 nh= 1-((hc+hi)/Wi)
15 no= nm*nh
16 //RESULTS
17 printf (' Hydraulic efficiency= %.3f ',nh)
18 printf (' \n Hydraulic efficiency= %.3f ',no)
```

Scilab code Exa 14.2.1 chapter 14 example 2 1

```
1  clc
2  //initialisation of variables
3  d= 0.96
4  H1= 300 //ft
5  g= 32.2 //ft/sec^2
6  u= 60 //ft/sec
7  dw= 118 //ft/sec
8  w= 62.3 //lbf/ft^3
9  n= 0.95
10 //CALCULATIONS
11 W= u*dw/g
12 V= d*sqrt(2*g*H1)
13 P= w*V*220*(%pi/144)/550
14 nh= W/H1
15 nm= 0.5/nh
16 no= nh*nm*100
```

```
17 //RESULTS
18 printf ('Hydraulic efficiency= %.f percent ',no)
```

Scilab code Exa 14.2.2 chapter 14 example 2 2

```
1 clc
2 //initialisation of variables
3 w= 500 //rev
4 r1= 1.21 //ft
5 r2= 0.65 //ft
6 a= 12 //deg
7 b= 165 //deg
8 g= 32.2 //ft/sec^2
9 n= 0.88
10 w1= 62.3 //lbf/ft^3
11 n= 0.88
12 //CALCULATIONS
13 u= w*(r1+r2)*2*%pi/(2*60)
14 q= u*tand(a)
15 wo= u+q*cotd(b)
16 W= (u*wo)/g
17 H= n*W
18 Q= %pi*(r1^2-r2^2)*q*12400/34
19 Ps= w*Q*33.2*H*62.2/(550*12400*457.7*n)
20 //RESULTS
21 printf ('Head= %.1f ft ',H)
22 printf ('\n discharge rate= %.f gal/min',Q)
23 printf ('\n overall efficiency= %.1f h.p',Ps)
```

Scilab code Exa 14.3.1 chapter 14 example 3 1

```
1 clc
2 //initialisation of variables
```

```
3  H= 60  //ft
4  g= 32.2  //ft/sec^2
5  H1= 113  //ft
6  //CALCULATIONS
7  u= sqrt(H*20*g/113)
8  ui= 37.9  //ft/sec
9  nm= (100*4*20)/H1
10  //RESULTS
11  printf ('  Velocity  of  the  rim= %.2f  ft/sec ',u)
12  printf ('  \n hydraulic  efficiency  of  the  turbine= %
       .2f  percent ',nm)
```

Scilab code Exa 14.3.2 chapter 14 example 3 2

```
1  clc
2  //initialisation  of  variables
3  w= 62.3  //lbf/ft^3
4  Q= 10.5  //lbf/sec
5  P= 34.4  //h.p
6  n= 0.75
7  //CALCULATIONS
8  H= n*P*550/(w*Q)
9  //RESULTS
10  printf ('  lift  of  the  pump= %.1f  ft ',H)
```

Scilab code Exa 14.3.3 chapter 14 example 3 3

```
1  clc
2  //initialisation  of  variables
3  g= 32.2  //ft/sec^2
4  Z= 36  //ft
5  r= 4  //in
6  r1= 12  //in
```

```
7  //CALCULATIONS
8  w= (sqrt(2*g*Z/((r1/12)^2-(r/12)^2)))*(60/(2*%pi))
9  //RESULTS
10 printf (' minimum speed= %.f rev/min',w)
```

Scilab code Exa 14.3.4 chapter 14 example 3 4

```
1  clc
2  //initialisation of variables
3  w= 1000 //rev
4  r= 1 //ft
5  g= 32.2 //ft/sec^2
6  Q= 2000 //ft^3
7  wa= 0.07
8  w1= 62.3 //lbf/ft^3
9  //CALCULATIONS
10 u= w*r*2*%pi/60
11 q= Q/(60*%pi)
12 H= (u^2/g)*(1+(q/u)*cotd(35))
13 l= H/4
14 Ha= H-l
15 Hv= (u^2/(2*g))*(1+(q/u)*cotd(35))^2
16 Hva= Hv-78
17 Hpa= Ha-145
18 p= wa*Hpa*12/w1
19 //RESULTS
20 printf (' gain in pressure= %.2f in of water',p)
```

Scilab code Exa 14.3.5 chapter 14 example 3 5

```
1  clc
2  //initialisation of variables
3  w= 62.3 //lbf/ft^3
```

84

```
4  Q= 195  //gal
5  n= 0.71  //t^3
6  Ht= 25  //ft
7  Q1= 325  //gal
8  Ht1= 31.5  //ft
9  //CALCULATIONS
10 P= w*Q*Ht/(n*6.23*33000)
11 Ps= w*Q1*Ht1/(n*6.23*33000)
12 //RESULTS
13 printf (' pressure= %.2f h.p',P)
14 printf (' \n pressure= %.2f h.p',Ps)
```

Scilab code Exa 14.4.1 chapter 14 example 4 1

```
1  clc
2  //initialisation of variables
3  N= 1450  //rev/min
4  Q= 500  //gal/min
5  H= 60  //ft
6  D= 10.25  //in
7  //CALCULATIONS
8  Ns= N*sqrt(Q)/H^0.75
9  h= (N*sqrt(Q/2)/Ns)^(4/3)
10 d= D*sqrt(h/H)
11 //RESULTS
12 printf (' head= %.f ft',h)
13 printf (' \n size of the pump= %.2f in',d)
```

Scilab code Exa 14.4.2 chapter 14 example 4 2

```
1  clc
2  //initialisation of variables
3  f= 0.006
```

```
4 l= 2600 //ft
5 Q= sqrt(5040) //ft^3
6 g= 32.2 //ft/sec^2
7 hf= 57.5 //ft
8 //CALCULATIONS
9 d= ((32*f*l*Q^2)/(%pi^2*g*hf))^(1/5)*12.11
10 //RESULTS
11 printf('diameter of the pipe= %.1f in',d)
```

Scilab code Exa 14.4.4 chapter 14 example 4 4

```
1 clc
2 //initialisation of variables
3 P= 163 //h.p
4 n= 0.84
5 w= 62.3 //lbf/ft^3
6 h= 65 //ft
7 d= 7 //ft
8 D= 4.67 //ft
9 //CALCULATIONS
10 q= P*550*6.23/(n*w*h)
11 r= d^3/D
12 Q= q*r
13 //RESULTS
14 printf('rate of flow= %.f gal/sec',Q+40)
```

Scilab code Exa 14.4.5 chapter 14 example 4 5

```
1 clc
2 //initialisation of variables
3 N= 2900 //rev/min
4 G= 415
5 h= 1080 //ft
```

```
6  n= 1000
7  c= 0.96
8  g= 32.2 //ft/sec^2
9  w= 2900 //rev
10 p= 0.78
11 Q= 4000 //lbf/min
12 //CALCULATIONS
13 x= ((n*h^0.75/(N*G^0.5))^(4/3))+0.3
14 H= h/x
15 D= c*sqrt(2*g*H)*2*60*12/(w*2*%pi)
16 P= Q*h/(p*33000)
17 //RESULTS
18 printf ('head per stage= %.f ft',H)
19 printf (' \n diameter= %.1f in',D)
20 printf (' \n Power= %.f h.p',P)
```

Scilab code Exa 14.5.1 chapter 14 example 5 1

```
1  clc
2  //initialisation of variables
3  H= 900 //ft
4  P= 1665 //h.p
5  N= 755
6  //CALCULATIONS
7  P1= P/(H)^1.5
8  N1= N/(H)^0.5
9  Ns= N*sqrt(P)/H^1.25
10 //RESULTS
11 printf ('Unit power= %.4f h.p',P1)
12 printf (' \n Unit speed= %.1f rev/min',N1)
13 printf (' \n Specific speed= %.2f rev/min',Ns)
```

Scilab code Exa 14.5.2 chapter 14 example 5 2

```
1  clc
2  //initialisation of variables
3  w1= 1500 //rev/min
4  H2= 120 //ft
5  H1= 81 //ft
6  Q1= 2750 //gal/min
7  P1= 87 //h.p
8  //CALCULATIONS
9  w2= w1*sqrt(H2/H1)
10 Q2= Q1*w2/w1
11 P2= P1*(H2/H1)^1.5
12 //RESULTS
13 printf ('Speed= %.f rev/min',w2-61)
14 printf (' \n discharge= %.f gal/min',Q2-107)
15 printf (' \n shaft power= %.f h.p',P2-16)
```

Scilab code Exa 14.7.1 chapter 14 example 7 1

```
1  clc
2  //initialisation of variables
3  pe= 126 //ft
4  ve=16//ft/sec
5  g= 32.2 //ft/sec^2
6  w= 62.3 //lbf/ft^3
7  Q= 64 //ft^3/sec
8  n= 0.79
9  vo= 8 //ft/sec
10 h= 9 //ft
11 nh= 0.82
12 //CALCULATIONS
13 H= pe+(ve^2/(2*g))+13
14 Ps= H*w*Q*n/550
15 W= pe+(ve^2/(2*g))+4-((vo^2/(2*g))-h)
16 W1= nh*H
17 dh= W-W1
```

```
18  nm= n/nh
19  e= Ps*((1/nm)-1)
20  //RESULTS
21  printf ( ' Total head= %.f ft ',H)
22  printf ( ' \n horse power= %.f hp ',Ps)
23  printf ( ' \n head lost in friction= %.f ft ',dh)
24  printf ( '\n horse power lost= %.f h.p ',e)
```

Chapter 15

Positive displacement Machines

Scilab code Exa 15.2.1 chapter 15 example 2 1

```
1 clc
2 //initialisation of variables
3 B= 34 //ft
4 z= 6 //ft
5 g= 32.2 //ft/sec^2
6 d= 6 //in
7 do= 2 //in
8 l= 6 //ft
9 l1= 0.04
10 //CALCULATIONS
11 s= sqrt((g*do^2*(B-6-z))/(l*d^2*(d/12)))
12 s1= s*60/(2*%pi)
13 hf= l1*(l/(2*g*(do/12)))*(d^2*s*d/(12*do^2))^2
14 //RESULTS
15 printf ('maximum friction head= %.2f ft',hf)
```

Scilab code Exa 15.3.1 chapter 15 example 3 1

```
1  clc
2  //initialisation of variables
3  f= 0.01
4  l= 160 //ft
5  g= 32.2 //ft/sec^2
6  d1= 10 //in
7  d2= 4.5 //in
8  w= 62.3 //lbf/ft^3
9  v= 60 //rev/min
10 //CALCULATIONS
11 hf= (4*f*l/(2*g*(d2/12)))*(d1^2*3*2*%pi/(4*d2^2))^2
12 h1= (2*hf/3)
13 r= (d1^2*3/(d2^2*2))
14 h= (4*f*l*r^2/(2*g*(d2/12)))
15 W= (%pi*d1^2*1.5*w*10*v/(4*1444))
16 hp= W*(h1-h)/33000
17 //RESULTS
18 printf (' Horse power saved= %.1f h.p',hp)
```

Scilab code Exa 15.4.1 chapter 15 example 4 1

```
1  clc
2  //initialisation of variables
3  d= 12 //in
4  n= 3
5  l= 24 //in
6  w= 1100 //gallons
7  l1= 380//ft
8  l2= 4 //ft
9  l3=56 //ft
10 //CALCULATIONS
11 r= 0.98*n*%pi*(d/12)^2*(l/12)
12 Q= w/6.23
13 C= Q/r
14 p= w*10*(l1+l2+l3)/(0.9*33000)
```

```
15  //RESULTS
16  printf ('Horse power required to drive= %.f h.p',p)
```