Scilab Textbook Companion for Elements Of Chemical Reaction Engineering(copy) by H. S. Fogler[1]

Created by
Santosh Kumar
B.Tech. + M.Tech
Chemical Engineering
IIT Bombay
College Teacher
Prof. Arun Sadashio Moharir
Cross-Checked by
Prof. Arun Sadashio Moharir

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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

Mole Balances

check Appendix AP 9 for dependency:

`10_3.sci`

Scilab code Exa 1.3 clear

```
//clear//
clc
clear
exec("1.3data.sci");

//CA = 0.1*CA0;
V = (v0/k)*log(1/0.1);
disp("V =")
disp(V)
disp ("dm^3")
```

Chapter 2

Conversion and Reactor Sizing

check Appendix AP 47 for dependency:

2_1.sci

Scilab code Exa 2.1 clear

```
//clear//
clc
clear
exec("2.1data.sci");
CA0=(yA0*P0)/(R*T0);
FA0 = CA0*v0;
disp("CA0 =")
disp(CA0)
disp ("mol/dm^3")
disp("FA0 =")
disp(FA0)
disp("mol/s")
```

check Appendix AP 46 for dependency:

2_2.sci

Scilab code Exa 2.2 clear

```
//clear//
clc
clear
exec("2.2data.sci");
CA0=(yA0*P0)/(R*T0);
FA0 = CA0*v0;
V = FA0*X*(1/-rA)

disp("FA0 =")
disp(FA0)
disp("mol/s")
disp("V =")
disp(V)
disp ("dm^3")
```

check Appendix AP 45 for dependency:

`2_3.sci`

Scilab code Exa 2.3 clear

```
//clear//
clc
clear
exec("2.3data.sci");
CA0=(yA0*P0)/(R*T0);
FA0 = CA0*v0;
//V = FA0*X*(1/-rA)

V = FA0*inttrap(X,p)
disp("FA0 =")
disp(FA0)
disp("mol/s")
disp("V =")
```

```
disp(V)
disp ("dm^3")
disp("Answer is slightly differennt from the book because inttrap command of SCILAB uses trapezoidal integration, while in book it has been calculated using five point formulae.")
```

check Appendix AP 44 for dependency:

`2_4.sci`

Scilab code Exa 2.4 clear

```
//clear//
clc
clear
exec("2.4data.sci");


VCSTR = FA0*X(7)*(1/-rAat);
VPFR = FA0*inttrap(X,p)
disp("VCSTR =")
disp(VCSTR)
disp("dm^3")
disp("VPFR =")
disp(VPFR)
disp ("dm^3")
```

check Appendix AP 43 for dependency:

`2_5.sci`

Scilab code Exa 2.5 clear

```
//clear//
clc
clear
exec("2.5data.sci");


V1 = FA0*X1*(1/-rA);
V2 = FA0*(X2-X1)*(1/-rA2);
V = FA0*X*(1/-rA2);
disp("V1 =")
disp(V1)
disp("dm^3")
disp("V2 =")
disp(V2)
disp ("dm^3")
disp("V =")
disp(V)
disp ("dm^3")
```

check Appendix AP 42 for dependency:

`2_6.sce`

Scilab code Exa 2.6 clear

```
//clear//
clc
clear all
exec("2.6data.sci");


X1 = X(1:5);
p1 = p(1:5);
V1 = FA0*inttrap(X1,p1)
X2 = X(5:9);
p2 = p(5:9);
```

```
V2 = FA0*inttrap(X2,p2)
V=V1+V2;
disp("V1 =")
disp(V1)
disp("dm^3")
disp("V2 =")
disp(V2)
disp ("dm^3")
disp("V =")
disp(V)
disp ("dm^3")
```

check Appendix AP 41 for dependency:

2_7.sci

Scilab code Exa 2.7 clear

```
//clear//
clc
clear
exec("2.7data.sci");


X = X(1:6);
p = p(1:6);
V1 = FA0*inttrap(X,p);
V2 = FA0*(X2-X1)*(1/-rA2);
V=V1+V2;
disp("V1 =")
disp(V1)
disp("dm^3")
disp("V2 =")
disp(V2)
disp ("dm^3")
disp("V =")
```

```
disp(V)
disp ("dm^3")
```

Chapter 3

Rate Laws and Stoichiometry

check Appendix AP 40 for dependency:

`3_5.sci`

Scilab code Exa 3.5 clear

```
//clear//
clc
clear
exec("3.5data.sci");
CD=CA0*(X/3);
CB=CA0*((CB0/CA0)-(X/3));
CD1=CA0*(X1/3);
CB1=CA0*((CB0/CA0)-(X1/3));
disp("For 20% conversion")
disp("CD =")
disp(CD)
disp ("mol/dm^3")
disp("CB =")
disp(CB)
disp("mol/dm^3")
disp("For 90% conversion")
disp("CD =")
```

```
disp(CD1)
disp ("mol/dm^3")
disp("CB =")
disp(CB1)
disp("mol/dm^3")
```

Chapter 4

Isothermal Reactor Design

check Appendix AP 39 for dependency:

4_1.sci

Scilab code Exa 4.1 clear

```
//clear//
clc
clear
exec("4.1data.sci");

x=t;
y =((CA0-CC)/CA0);

yi=interpln([x;y],x);
plot2d(x,y,logflag='nl');

k = log(y(9)/y(2))/(t(9)-t(2));


disp("k =")
disp(k)
disp ("min^-1")
```

check Appendix AP 36 for dependency:

`4_2.sci`

Scilab code Exa 4.2 clear

```
//clear//
clc
clear
exec("4.2data.sci");

 FA0 = FC/X;
 vA0 = FA0/CA01;
 vB0 = vA0;
 v0 = vA0+vB0;
 V = v0*X/(k*(1-X));

 // CSTR in parallel
 V1 = 800/7.48;

 Tau =V1/(v0/2);
 Da= Tau*k;
 Xparallel = Da/(1+Da)

 // CSTR in series
 Tau =V1/v0;
 n=2;
 Xseries = 1- (1/(1+Tau*k)^n);

disp("Reactor volume")
disp(V)
disp ("ft^3")
disp("CSTR in parallel X =")
disp(Xparallel)
disp("CSTR in series X =")
```

```
disp(Xseries)
```

check Appendix AP 35 for dependency:

4_4.sci

Scilab code Exa 4.4 clear

```
//clear//
clc
clear
exec("4.4data.sci");

 FA0 = FB/X;
 CA0 = yA0*P0/(R*T0);
 R = 1.987;
 k2 = k1*exp((E/R)*((1/T1)-(1/T2)));
 V =( FA0/(k2*CA0))*((1+e)*log(1/(1-X))-e*X);

disp("Reactor volume")
disp(V)
disp("ft^3")
```

check Appendix AP 34 for dependency:

4_5.sci

Scilab code Exa 4.5 clear

```
//clear//
clc
clear
exec("4.5data.sci");

```

```
G = m/Ac;
bita0 = (G*(1-phi)/(gc*rho*Dp*phi^3))*((150*(1-phi)*
    mu/Dp)+1.75*G);
bita0 = bita0/(144*14.7);//atm/ft
P = ((1-(2*bita0*L/P0))^.5)*P0;
deltaP = P0 - P;

disp("deltaP")
disp(deltaP)
disp("atm")
```

check Appendix AP 33 for dependency:

`4_6.sci`

Scilab code Exa 4.6 clear

```
//clear//
clc
clear
exec("4.6data.sci");

FT0 = FA0+FB0+FI;
yA0 = FA0/FT0;
e = yA0*(1-.5-1);
PA0 = yA0*P0;
kdes = k*PA0*(1/2)^(2/3);
alpha = 2*bita0/(Ac*(1-phi)*rhoc*P0);
W = (1 - (1-(3*alpha*FA0/(2*kdes))*((1+e)*log(1/(1-X
    ))-e*X))^(2/3))/alpha;


disp("W")
disp(W)
disp("lb of catalyst per tube")
```

check Appendix AP 32 for dependency:

4_7.sci

Scilab code Exa 4.7 clear

```
//clear//
clc
clear
exec("4.7data.sci");
 W = 0:1:60;
function w=f(W,Y)

w=zeros(2,1);
w(1)= (kprime/FA0)*((1-Y(1))/(1+e*Y(1)))*Y(2);
w(2) = -alpha*(1+e*Y(1))/(2*Y(2));
endfunction


x=ode([0;1],W0,W,f);
for i= 1:61
  F(i) = (1+e*x(1,i))/x(2,i);
end
F= F';
for i= 1:61
  rate(i) = (kprime)*((1-x(1,i))/(1+e*x(1,i)))*x(2,i
      );
end
rate =rate';

scf(1)
plot2d(W,rate);
xtitle( 'Figure E4-7.1 Reaction rate porfile down
   the PBR', 'w', 'rate' ) ;
scf(2)

```

```
l1=x(1,: )'
l2=x(2,: )'
l3=F'
plot2d(W',[l1 l2 l3]);

xtitle( 'Figure E4-7.2', 'w', 'x,y,z' ) ;
legend(['x';'y';'f']);
```

check Appendix AP 31 for dependency:

`4_8.sci`

Scilab code Exa 4.8 clear

```
//clear//
clc
clear
exec("4.8data.sci");
Z = 0:1:12;
function w=f(Z,Y)

 w=zeros(2,1);
 Ac= 3.14*((R^2)-(Z-L)^2);
 Ca = Ca0*(1-Y(1))*Y(2)/(1+Y(1));
 ra =kprime*Ca*rhocat*(1-phi);
 G= m/Ac;
 V =3.14*(Z*(R^2)-(1.3*(Z-L)^3)-(1/3)*L^3)
 bita = (98.87*G+25630*G^2)*0.01;
 W=rhocat*(1-phi)*V
w(1)= -ra*Ac/FA0
w(2) = -bita/P0/(Y(2)*(1+Y(1)));
endfunction


x=ode([0;1],Z0,Z,f);
for i= 1:length(Z)
```

```
  V(1,i) =3.14*Z(1,i)*((R^2)-(Z(1,i)-L)^2)
   W1(1,i)=rhocat*(1-phi)*V(1,i)
end

l1=x(1,: )'
l2=x(2,: )'

plot2d(W1',[l1 l2]);

xtitle( 'Figure E4-8.2', 'w', 'x,y' ) ;
legend(['x';'y']);
```

check Appendix AP 30 for dependency:

4_9.sci

Scilab code Exa 4.9 clear

```
//clear//
clc
clear
exec("4.9data.sci");
 V = 0:1:100;
function w=f(V,fa)

 w=zeros(1,1);
 ft =2*(fa0-fa(1))
 Ca = Ct0*fa(1)/ft;
 fb = 2*(fa0-fa(1));
 Cb = Ct0*fb/ft;
w(1)= -ka*(Ca-(Cb^2)/kc)

endfunction


x=ode([9.99],V0,V,f);
```

```

for i= 1:101
   fb(1,i) = 2*(fa0-x(1,i));
end
l1=x';
l2=fb';

plot2d(V',[l1 l2]);

xtitle( 'Figure E4-9.1 Molar flow rate profiles', 'V', 'fa,fb' ) ;
legend(['fa';'fb']);
```

check Appendix AP 38 for dependency:

`4__10.sci`

Scilab code Exa 4.10 clear

```
//clear//
clc
clear
exec("4__10.sci");
 V = 0:1:500;
function w=f(V,F)

 w=zeros(3,1);

 Ft=F(1)+F(2)+F(3);
 ra = -k*Ct0*((F(1)/Ft)-(Ct0/kc)*(F(2)/Ft)*(F(3)/Ft));
 w(1)= ra;
 w(2) = -ra-kc*Ct0*(F(2)/Ft)
 w(3) = -ra;

endfunction
```

```
x=ode([10;0;0],V0,V,f);

l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'
plot2d(V',[l1 l2 l3]);

xtitle( 'Figure E4-10.2', 'V', 'Fa,Fb,Fc' ) ;
legend(['Fa';'Fb';'Fc']);
```

check Appendix AP 37 for dependency:

`4__11.sci`

Scilab code Exa 4.11 clear

```
//clear//
clc
clear
exec("4__11.sci");
 t = 0:1:500;
function w=f(t,C)

 w =zeros(4,1);

 v = v0+v00*t;
 w(1)= -k*C(1)*C(2)-v00*C(1)/v;
 w(2) = -k*C(1)*C(2)+v00*(Cb0-C(2))/v;
 w(3) = k*C(1)*C(2)-v00*C(3)/v;
 w(4) = k*C(1)*C(2)-v00*C(4)/v;

endfunction
```

```
x=ode([.049;0;0;0],t0,t,f);
l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'
for i = 1:length(t)
  rate(1,i)=k*x(1,i )*x(2,i)
  end
scf(1)
plot2d(t',[l1 l2 l3]);

xtitle( 'Figure E4-11.1 Concentration-time
   trajectories', 't', 'Ca,Cb,Cc' ) ;
legend(['Ca';'Cb';'Cc']);
scf(2)
plot2d(t,rate)
xtitle( 'Figure E4-11.2 Reaction rate-time
   trajectories', 't', 'Reaction Rate(mols dm^3)' )
   ;




'V
```

Chapter 5

Collection and Analysis of Rate Data

Scilab code Exa 5.1 clear

```
//clear//
p = [ 1.44 .95 .74]';
dt = 2.5
t = [0 2.5 5]';
dp(1) =( 3*p(1)+4p(2)-p(3))/(2*dt);
for i=2:n1
 dp p(i+3
```

check Appendix AP 29 for dependency:

5_2.sci

Scilab code Exa 5.2 clear

```
//clear//
clc
clear
```

```
exec("5.2data.sci");
 for i =1:length(t)
g(i) =log(2*P0/(3*P0-P(i)));
end
plot2d(t,g);

xtitle( 'Figure E4-11.2 Plot of processed data', 't
   (min)', '2PTo/3PTo-PT' ) ;
```

check Appendix AP 28 for dependency:

5_3.sci

Scilab code Exa 5.3 clear

```
//Clear//
clc
clear
exec("5.3data.sci");

x=log(CHCl);
y=log(-rHCl);
plot2d(x,y);

xtitle( 'Figure E5-3.2 ', 'CHCl (g mol/ liter)', '
   rHCl0 (g mol / cm^2.s)' ) ;
```

check Appendix AP 26 for dependency:

4__4.sci

check Appendix AP 27 for dependency:

5_4.sci

Scilab code Exa 5.4 clear

```
//Clear//
clc
clear
exec("5.4data.sci");

rCH4 = (v0/W)*CCH4;x
x=log(PCO);
y = log(rCH4)
alpha= (y(3)-y(2))/(x(3)-x(2));
//plot2d(x,y)
disp("alpha")
disp(alpha)
```

Chapter 6

Multiple Reactions

check Appendix AP 25 for dependency:

`6_6.sci`

Scilab code Exa 6.6 clear

```
//Clear//
clc
clear
exec("6.6data.sci");
 t = 0:.01:.5;
function w=f(t,c)

 w =zeros(3,1);

r1 = -k1*c(2)*c(1)^.5;
r2 = -k2*c(3)*c(1)^.5;
 w(1)= r1+r2;
 w(2) = r1;
 w(3) = -r1+r2;

endfunction

```

```
x=ode([.021;.0105;0],t0,t,f);

l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'

plot2d(t',[l1 l2 l3]);

xtitle( 'Figure E6-6.1', 'Tau (hr)', 'Concentration
   (lb mol/ft^3' ) ;
legend(['CH';'CM';'CX']);
```

---

check Appendix AP 24 for dependency:

`6_8.sci`

Scilab code Exa 6.8 clear

```
//clear//
clc
clear
exec("6.8data.sci");
 v = 0:.1:10;
function w =FF(v,f)

 w =zeros(6,1);
 ft = f(1)+f(2)+f(2)+f(4)+f(5)+f(6);
 r1a = -5*8*(f(1)/ft)*(f(2)/ft)^2;
 r2a = -2*4*(f(1)/ft)*(f(2)/ft);
 r4c = -5*3.175*(f(3)/ft)*(f(1)/ft)^(2/3);
 r3b = -10*8*((f(3)/ft)^2)*(f(2)/ft);
 Ca =2*f(1)/ft;
 Cb =2*f(2)/ft;
 Cc =2*f(3)/ft;
 Cd =2*f(4)/ft;
 Ce =2*f(5)/ft;
```

```
 Cf =2*f(6)/ft;
w(1)= 1.25*r1a+.75*r2a+r3b;
 w(2) = r1a+r2a+2*r4c/3;
 w(3) = -r1a+2*r3b+r4c;
 w(4) =-1.5*r1a-1.5*r2a-r4c;
 w(5) =.5*r2a-5*r4c/6;
 w(6) = -2*r3b;

endfunction

x=ode([9;9;0;0;0;0],v0,v,FF);

plot2d(v,x(1,:)/10,rect=[1,0,10,1.5]); //B
plot2d(v,x(2,:)/10,rect=[1,0,10,1.5]); //A
plot2d(v,x(3,:)/10,rect=[1,0,10,1.5]); //C
plot2d(v,x(4,:)/10,rect=[1,0,10,1.5]);
plot2d(v,x(5,:)/10,rect=[1,0,10,1.5]);
plot2d(v,x(6,:)/10,rect=[1,0,10,1.5]);
xtitle('FigureE');
legend (['B';'A';'C';'D';'E';'F']);
```

Chapter 7

Nonelementary Reaction Kinetics

check Appendix AP 23 for dependency:

```
7_7.sci
```

Scilab code Exa 7.7 clear

```
//clear//
clc
clear
exec("7.7data.sci");
for i=1:length(Curea)
x(i)= 1/Curea(i);
y(i) = 1/(-rurea(i));
end
 slope = (y(5)-y(1))/(x(5)-x(1));
 plot2d(x,y)

 xtitle( 'Figure E7-7.1', '1/Curea', '1/-rurea' ) ;

 disp("(Km/Vma = slope")
 disp(slope)
```

check Appendix AP 22 for dependency:

7_8.sci

Scilab code Exa 7.8 clear

```
//clear//
clc
clear
exec("7.8data.sci");
Vmax = (Et2/Et1)*Vmax1
t = (Km/Vmax)*log(1/(1-X))+Curea0*X/Vmax;
disp("t")
disp(t)
disp("s")
```

check Appendix AP 21 for dependency:

7_9.sci

Scilab code Exa 7.9 clear

```
//clear//
clc
clear
exec("7.9data.sci");
 t = 0:.1:12;
function w=f(t,c)

 w =zeros(3,1);

rd = c(1)*.01;
rsm = m/c(1);
```

```
kobs= (umax*(1-c(3)/93)^.52);
rg= kobs*c(1)*c(2)/(ks+c(2));
//r2 = -k2*c(3)*c(1)^.5;
 w(1)= rg-rd;
 w(2) = ysc*(-rg)-rsm;
 w(3) = rg*ypc;

endfunction

x=ode([1;250;0],t0,t,f);

l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'

plot2d(t',[l1 l2 l3]);

xtitle( 'Figure E7-9.1 concentrations as a function
    of time', 't (hr)', 'C (g/dm^3)' ) ;
legend(['Cc';'Cs';'Cp']);
```

Chapter 8

Steady State Nonisothermal Reactor Design

check Appendix AP 18 for dependency:

`8_3.sci`

Scilab code Exa 8.3 clear

```
//clear//
clc
clear
exec("8.3data.sci");
deltaHRx0 = 2*H0NH3-3*H0H2-HN2;
deltaCp = 2*CpNH3-3*CpH2-CpN2;
deltaHRx = deltaHRx0+deltaCp*(T-TR);
disp("The heat of reaction on the basis on the moles
    of H2 reacted is =")
disp((1/3)*deltaHRx*4.184)
disp("J at 423 K")
```

---

check Appendix AP 17 for dependency:

`8_4.sci`

Scilab code Exa 8.4 clear

```
//clear//
clc
clear
exec("8.4data.sci");
HRx0 = H0C-H0B-H0A;
deltaCp = CpC-CpB-CpA;
deltaHRx0 = HRx0+deltaCp*(TR-TR);
v0 = vA0+vB0+VM0;
tau = V/v0;
CA0 = FA0/v0;
phiM0 = FM0/FA0;
phiB0 = FB0/FA0;
Cpi = CpA+phiB0*CpB+phiM0*CpM;

for i =1:length(T)
XEB(i) = -Cpi*(T(i)-Ti0)/(deltaHRx0+deltaCp*(T(i)-TR
    ));
XMB(i) = tau*A*exp(-E/(R*T(i)))/(1+tau*A*exp(-E/(R*T
    (i))));
end



plot2d(T',[XEB XMB]);

xtitle( 'Figure E8-4.2', 'T(oR)', 'Conversion, X' )
    ;
legend(['XEB';'XMB']);
```

check Appendix AP 16 for dependency:

`8_6.sci`

Scilab code Exa 8.6 clear

```
//clear//
clc
clear
exec("8.6data.sci");
 V = 0:.1:3.6;
function w=f(V,X)

 w =zeros(1,1);
T =330+43.3*X;
k=31.1*exp(7906*(T-360)/(T*360));
Kc = 3.03*exp(-830.3*((T-360)/(T*360)));
Xe = Kc/(1+Kc);
ra = -k*Ca0*(1-(1+(1/Kc))*X);
 w(1)= -ra/Fa0;
 rate = -ra;
endfunction

x=ode([0],V0,V,f);

for i =1:length(x)
  T(1,i) =330+43.3*x(1,i)

  k(1,i)=31.1*exp(7906*(T(1,i)-360)/(T(1,i)*360));
  Kc(1,i) = 3.03*exp(-830.3*((T(1,i)-360)/(T(1,i)
     *360)));

  ra(1,i) = k(1,i)*Ca0*(1-(1+(1/Kc(1,i)))*x(1,i));
end
scf(1)
plot2d(V,x(1,:));

xtitle( 'Figure E8-6.1a', 'V(m^3)', 'X' ) ;
```

```
scf(2)
plot2d(V,T(1,:));

xtitle( 'Figure E8-6.1b', 'V(m^3)', 'T (K)' ) ;

scf(3)
plot2d(V,ra);

xtitle( 'Figure E8-6.1c', 'V(m^3)', '-ra (kmol/m^3hr
    )' ) ;
```

check Appendix AP 15 for dependency:

`8_8.sci`

Scilab code Exa 8.7 clear

```
//clear//
clc
clear
exec("8.8data.sci");
for i = 1:length(T)
  Xe(i) = 100000*exp(-33.78*(T(i)-298)/(T(i)))/(1+
     100000*exp(-33.78*(T(i)-298)/T(i)));
  XEB(i) = (2.5e-3)*(T(i)-300);
end
plot2d(T,[Xe XEB])

xtitle( 'Figure E8-8.1', 'T', 'X' ) ;
legend(['Xe';'XEB']);
```

Scilab code Exa 8.9 clear

```
//clear//
clc
clear
//eY(2)ec("8.6data.sci");
W = 0:1:28.58;
W0=0;
function w=f(W,Y)
  w =zeros(3,1);


fao=.188
visc=.090
Ta=1264.67
deltah=-42471-1.563*(Y(3)-1260)+.00136*(Y(3)**2-1260**2)-(2.459*10**(-7))*(Y(3)**3-1260**3);
summ= 57.23+.014 * Y(3)-1.94 *10**(-6.)*Y(3)**2
dcp=-1.5625+2.72*10**(-3)*Y(3)-7.38*10**(-7)*Y(3)**2
k=360D*exp(-176008/Y(3)-(110.1*log(Y(3)))+912.8)
thetaso=0;
Po=2
Pao=.22
thetao=.91
eps=-.055
R=1.987;
Kp=exp(42311/R/Y(3)-11.24);
if(Y(2)<=.05)

  ra=(-k*(.848-.012/(Kp**2)));
else
  ra=(-k*(1-Y(2))/(thetaso+Y(2)))**.5*(Y(1)/Po*Pao*((thetao-.5*Y(2))/((1+eps*Y(2)))-((thetaso+Y(2))/(1-Y(2)))**2/(Kp**2)));
end

w(1)=(-1.12*10**(-8)*(1-.055*Y(2))*Y(3))*(5500*visc+2288)/Y(1) ;
w(2)=-(ra)/fao ;
w(3)=(5.11*(Ta-Y(3))+(-ra)*(-deltah) )/(fao*(summ+Y
```

```
(2)*dcp))
endfunction

X=ode([2;0;1400],W0,W,f);

plot2d(W,X(1,:));
plot2d(W,X(3,:));
```

Scilab code Exa 8.10 clear

```
//clear//
clc
clear
//eY(2)ec("8.6data.sci");
W = 0:1:28.58;
W0=0;
function w=f(W,Y)
  w =zeros(3,1);


fao=.188
visc=.090
Ta=1264.67
deltah=-42471-1.563*(Y(3)-1260)+.00136*(Y(3)**2-1260**2)-(2.459*10**(-7))*(Y(3)**3-1260**3);
summ= 57.23+.014 * Y(3)-1.94 *10**(-6.)*Y(3)**2
dcp=-1.5625+2.72*10**(-3)*Y(3)-7.38*10**(-7)*Y(3)**2
k=360D*exp(-176008/Y(3)-(110.1*log(Y(3)))+912.8)
thetaso=0;
Po=2
Pao=.22
thetao=.91
eps=-.055
R=1.987;
Kp=exp(42311/R/Y(3)-11.24);
```

```
if(Y(2)< =.05)

  ra=(-k*(.848-.012/(Kp**2)));
else
  ra=(-k*(1-Y(2))/(thetaso+Y(2)))**.5*(Y(1)/Po*Pao*((thetao-.5*Y(2))/((1+eps*Y(2)))-((thetaso+Y(2))/(1-Y(2)))**2/(Kp**2)));
end

w(1)=(-1.12*10**(-8)*(1-.055*Y(2))*Y(3))*(5500*visc+2288)/Y(1) ;
w(2)=-(ra)/fao ;
w(3)=(5.11*(Ta-Y(3))+(-ra)*(-deltah) )/(fao*(summ+Y(2)*dcp))
endfunction

X=ode([2;0;1400],W0,W,f);

plot2d(W,X(1,:));
plot2d(W,X(3,:));
```

check Appendix AP 20 for dependency:

8__11.sci

Scilab code Exa 8.11 clear

```
//clear//
clc
clear
exec("8__11.sci");
V = 0:.01:1;

function w=f(V,Y)

 w =zeros(4,1);
```

```

k1a=10*exp(4000*((1/300)-(1/Y(4))));
k2a=.09*exp(9000*((1/300)-(1/Y(4))))

Ft=Y(1)+Y(2)+Y(3);

Ca=Cto*(Y(1)/Ft)*(To/Y(4))
Cb=Cto*(Y(2)/Ft)*(To/Y(4))
Cc=Cto*(Y(3)/Ft)*(To/Y(4))
r1a=-k1a*Ca;
r2a=-k2a*Ca^2;

w(1)=r1a+r2a;
w(2)=-r1a;

w(3)=-r2a/2;
w(4)=(4000*(373-Y(4))+(-r1a)*20000+(-r2a)*60000)
    /(90*Y(1)+90*Y(2)+180*Y(3));
endfunction

x=ode([100;0;0;423],V0,V,f);

scf(1)
plot2d(V,x(4,:));

xtitle( 'Figure E8-11.1', 'V', 'T' ) ;

scf(2)

l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'
plot2d(V',[l1 l2 l3]);

xtitle( 'Figure E8-11.2', 'V', 'Fa,Fb,Fc' ) ;
legend(['Fa';'Fb';'Fc']);
```

check Appendix AP 19 for dependency:

8_12.sci

Scilab code Exa 8.12 clear

```
//clear//
clc
clear
exec("8.12data.sci");
t=1:10:250;
for i=1:length(t)
T(i)=2*t(i)+283;

k2(i)=4.58*exp((E2/1.987)*((1/500)-(1/T(i))))
k1(i)=3.3*exp((E1/1.987)*((1/300)-(1/T(i))))
Ca(i)=Cao/(1+tau*k1(i))
kappa=UA/(vo*Cao)/Cp
G(i)=-(tau*k1(i)/(1+k1(i)*tau))*DH1-(k1(i)*tau*k2(i)
   *tau*DH2/((1+tau*k1(i)) *(1+tau*k2(i))));
Tc=(To+kappa*Ta)/(1+kappa);
Cb(i)=tau*k1(i)*Ca(i)/(1+k2(i)*tau);
R(i)=Cp*(1+kappa)*(T(i)-Tc);
Cc=Cao-Ca(i)-Cb(i);
F(i)=G(i)-R(i);
end
plot(T',[G R])

xtitle( 'Figure E8-12.1', 'T (K)', 'G(T),R(T)' ) ;
legend(['G(T)';'R(T)']);
```

Chapter 9

Unsteady State Nonisothermal Reactor Design

check Appendix AP 14 for dependency:

```
9_1.sci
```

Scilab code Exa 9.1 clear

```
//clear//
clc
clear
exec("9.1data.sci");
 t = 0:10:1500;
function w=f(t,x)

 w =zeros(1,1);

t1=535+90.45*x
k= .000273*exp(16306*((1/535)-(1/t1)));
w(1)=k*(1-x)
endfunction

X=ode([0],t0,t,f);
```

```
T=535+90.45*X;
scf(1)
plot2d(t,T);

xtitle( 'Figure E9−1.1', 't (Seconds)', 'T (oR)' ) ;

scf(2)
plot2d(t,X);

xtitle( 'Figure E9−1.1', 't (Seconds)', 'X' ) ;
```

check Appendix AP 13 for dependency:

9_2.sci

Scilab code Exa 9.2 clear

```
//clear//
clc
clear
//this code is only for Part C
exec("9.2data.sci");
 t = 55:1:121;
function w=f(t,Y)

 w =zeros(2,1);



k=.00017*exp(11273/(1.987)*(1/461-1/Y(1)))
Qr=UA*(Y(1) -298)
Theata=Nbo/Nao
ra=-k*(Nao**2)*(1-Y(2))*(Theata-2*Y(2))/(U**2)
rate=-ra
Qg=ra*U*(dH)
w(1)=(Qg-Qr)/NCp
```

```
w(2)=(-ra)*U/Nao
endfunction

x=ode([467.992;0.0423],t0,t,f);


plot2d(t,x(1,:));

xtitle( 'Figure E9-2.2', 't ', 'T (oC)' ) ;
```

check Appendix AP 12 for dependency:

9_3.sci

Scilab code Exa 9.3 clear

```
//clear//
clc
clear
exec("9.3data.sci");
t = 0:1:360;

function w=f(t,Y)

 w =zeros(5,1);

k=.39175*exp(5472.7*((1/273)-(1/Y(4))));
Cd=Y(3);

Kc=10^(3885.44/Y(4))
V=Vi+v0*t;
Fb0=Cb0*v0;
ra=-k*((Y(1)*Y(2))-((Y(3)*Cd)/Kc));
Na=V*Y(1)
Nb=V*Y(2)
Nc=V*Y(3)
```

```
rb=ra
rc=-ra
Nd=V*Cd
rate=-ra
NCp=cp*(Nb+Nc+Nd+Y(5))+cpa*Na;
w(1)=ra-(v0*Y(1))/V;
w(2) =rb+(v0*(Cb0-Y(2))/V);
w(3) =rc- (Y(3)*v0)/V;
w(4)= (UA*(Ta-Y(4))-Fb0*cp*(1+55)*(Y(4)-T0)+ra*V*dh)
    /NCp
w(5) =v0*Cw0
endfunction

x=ode([5;0.0001;00.0001;300;6.14],t0,t,f);
scf(1)
plot2d(t,x(4,:));

xtitle( 'Figure E9-3.1', 't', 'T' ) ;

scf(2)
l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'
plot2d(t',[l1 l2 l3]);

xtitle( 'Figure E9-3.2', 't', 'Ca,Cb,Cc' ) ;
legend(['Ca';'Cb';'Cc']);
```

check Appendix AP 11 for dependency:

9_4.sci

Scilab code Exa 9.4 clear

```
//clear//
clc
```

```
clear
//exec("9.3data.sci");
t = 0:.0001:4;
t0=0;
function w=f(t,Y)

 w =zeros(5,1);

Fa0=80;
T0=75;
V=(1/7.484)*500;
UA=16000;
Ta1=60;
k=16.96e12*exp(-32400/1.987/(Y(5)+460));
Fb0=1000;
Fm0=100;
mc=1000;
ra=-k*Y(1);
rb=-k*Y(1);
rc=k*Y(1) ;
Nm=Y(4)*V;
Na=Y(1)*V;
Nb=Y(2)*V;
Nc=Y(3)*V;
ThetaCp=35+(Fb0/Fa0)*18+(Fm0/Fa0)*19.5;
v0=(Fa0/0.923)+(Fb0/3.45)+(Fm0/1.54);
Ta2=Y(5)- (Y(5)-Ta1)*exp (-UA/(18*mc));
Ca0=Fa0/v0
Cb0=Fb0/v0
Cm0=Fm0/v0
Q=mc*18*(Ta1-Ta2);
tau=V/v0;
NCp=Na*35+Nb*18+Nc*46+Nm*13.5;
w(1)=(1/tau)*(Ca0-Y(1))+ra;
w(2)=(1/tau)*(Cb0-Y(2))+rb;
w(3)=(1/tau)*(-Y(3))+rc;
w(4) =(1/tau)*(Cm0-Y(4));
w(5) = (Q-Fa0*ThetaCp*(Y(5)-T0)+(-36000)*ra*V)/NCp;
```

```
endfunction

x=ode([0;3.45;0;0;75],t0,t,f);
scf(1)
plot2d(t,x(1,:));

xtitle( 'Figure E9-4.1', 't', 'Ca' ) ;

scf(2)
plot2d(t,x(5,:));

xtitle( 'Figure E9-4.2', 't', 'T' ) ;
scf(3)
plot2d(x(5,:),x(1,:));

xtitle( 'Figure E9-4.3', 'T', 'Ca' ) ;
```

check Appendix AP 10 for dependency:

`9_8.sci`

Scilab code Exa 9.8 clear

```
//clear//
clc
clear
exec("9.8data.sci");
t = 0:.01:1.5;

function w=f(t,Y)

 w =zeros(4,1);

k1a=1.25*exp((9500/1.987)*((1/320)-(1/Y(4))));
k2b=0.08*exp((7000/1.987)*((1/290)-(1/Y(4))));
ra=-k1a*Y(1);
```

```
V=100+vo*t;
rc=3*k2b*Y(2);
rb=k1a*(Y(1)/2)-k2b*Y(2);
w(1)=ra+(Cao-Y(1))*vo/V;
w(2)=rb-Y(2)*vo/V;
w(3)=rc-Y(3)*vo/V; w(4)=(35000*(298-Y(4))-Cao*vo
    *30*(Y(4)-305)+((-6500)*(-k1a*Y(1))+(8000)*(-k2b*
    Y(2)))*V)/((Y(1)*30+Y(2)*60+Y(3)*20)*V+100*35);
endfunction

x=ode([1;0;0;290],t0,t,f);


scf(1)
l1=x(1,: )'
l2=x(2,: )'
l3=x(3,: )'
plot2d(t',[l1 l2 l3]);

xtitle( 'Figure E9-8.1', 't', 'Ca,Cb,Cc' ) ;
legend(['Ca';'Cb';'Cc']);

scf(2)
plot2d(t,x(4,:));

xtitle( 'Figure E9-8.2', 't', 'T' ) ;
```

Chapter 10

Catalysis and Catalytic Reactors

check Appendix AP 9 for dependency:

`10_3.sci`

Scilab code Exa 10.3 clear

```
//clear//
clc
clear
exec("10.3data.sci");
w = 0:10:10000;

function W=f(w,x)

 W =zeros(1,1);

pt0=.3*Po;
y=(1-alpha*w)^.5;
ph=pt0*(1.5-x)*y;
pt=pt0*(1-x)*y;
pb=2*pt0*x*y;
```

```
rt=-k*kt*ph*pt/(1+kb*pb+kt*pt);
rate=-rt;
W(1)=-rt/ft0;
endfunction
pt0=.3*Po;
X=ode([0],w0,w,f);


for i =1:length(X)
  y(1,i)=(1-alpha*w(1,i))^.5;
ph(1,i)=pt0*(1.5-X(1,i))*y(1,i);
pt(1,i)=pt0*(1-X(1,i))*y(1,i);
pb(1,i)=2*pt0*X(1,i)*y(1,i)
end

m1 = X';
m2=y';
scf(1)
plot2d(w',[m1 m2]);

xtitle( 'Figure E10-3.1', 'w', 'x,y' ) ;
legend(['x';'y']);

scf(2)
l1=ph'
l2=pt'
l3=pb'
plot2d(w',[l1 l2 l3]);

xtitle( 'Figure E10-3.2', 'w', 'ph,pt,pb' ) ;
legend(['ph';'pt';'pb']);
```

check Appendix AP 8 for dependency:

10_5.sci

Scilab code Exa 10.5 clear

```
//clear//
clc
clear
exec("10.5data.sci");
t = 0:.01:.5;

function w=f(t,Y)

 w =zeros(2,1);


ya0=Ca0/Ct0;
X=1-(1+ya0)/(1+Y(2)/Ct0)*Y(2)/Ca0;
w(1)=-kd*Y(1)*Y(2);
w(2) = (Ca0/tau)-((1+ya0)/(1+(Y(2)/Ct0))+tau*Y(1)*k)*Y(2)/tau;
endfunction

x=ode([1;.8],t0,t,f);
Ca0=.8;
Ct0=1
ya0=Ca0/Ct0;
for i=1:length(t)
  X1(i)=1-(1+ya0)/(1+x(2,i)/Ct0)*x(2,i)/Ca0;
  end


l1=x(1,: )'
l2=x(2,: )'
l3=X1;
plot2d(t',[l1 l2 l3]);

xtitle( 'Figure E10-5.1', 't', 'a,Ca,X' ) ;
legend(['a';'Ca';'X']);
```

check Appendix AP 7 for dependency:

10_7.sci

Scilab code Exa 10.7 clear

```
//clear//
clc
clear
exec("10.7data.sci");
z = 0:.1:10;
z0=0;
function w=f(z,X)

 w =zeros(1,1);


U=Uo*(1+eps*X)
Pa=Pao*(1-X)/(1+eps*X)
Pb=Pao*X/(1+eps*X)
vo=Uo*3.1416*D*D/4
Ca0=Pao/R/T
Kca=Ka*R*T
Pc=Pb
a=1/(1+A*(z/U)**0.5)
raprime=a*(-kprime*Pa/(1+ Ka*Pa+Kb*Pb+Kc*Pc))
ra=rho*raprime;
w(1)=-ra/U/Ca0
endfunction

x=ode([0],z0,z,f);
for i=1:length(z)
U(1,i)=Uo*(1+eps*x(1,i))
a(1,i)=1/(1+A*(z(1,i)/U(1,i))**0.5)
end


```

```
l1=x(1,:)'
l2=a(1,:)'

plot2d(z',[l1 l2]);

xtitle('Figure E10-7.1','z','X,a');
legend(['X';'a']);
```

Scilab code Exa 13.8 clear

```
k=0.1
cao=8;
z0=0;
```

Chapter 11

External Diffusion Effects on Hetrogeneous Reactions

check Appendix AP 6 for dependency:

`11_1.sci`

Scilab code Exa 11.1 clear

```
//clear//
clc
clear
exec("11.1data.sci");
WAZ1=DAB*CT0*(yAb-yAs)/s;
WAZ2=c*DAB*CT0*log((1-yAs)/(1-yAb))/s;
disp(WAZ1)
disp(WAZ2)
```

---

check Appendix AP 5 for dependency:

`11_3.sci`

Scilab code Exa 11.3 clear

```
//clear//
clc
clear
exec("11.3data.sci");
//this is only Part A of the problem.
dp=(6*(D^2)*L/4)^(1/3);
disp("Particle diameter dp =")
disp(dp)
disp("m")
ac=6*(1-phi)*(1/dp);
disp("Surface area pervolume of bed =")
disp(ac)
disp("m^2/m^3")
Re =dp*U/v;
Y=(2*r*Lp+2*r^2)/dp^2;
Reprime=Re/((1-phi)*Y);
DAB=DAB0*(T/T0)^(1.75);
Sc=v/DAB;
Shprime=((Reprime)^.5)*Sc^(1/3);
kc=DAB*(1-phi)*Y*(Shprime)/(dp*phi);
X=1-exp(-kc*ac*z/U);
disp("X =")
disp(X)
```

check Appendix AP 4 for dependency:

`11_4.sci`

Scilab code Exa 11.4 clear

```
//clear//
clc
clear
exec("11.4data.sci")
```

```
X2=1-(1/exp((log(1/(1-X1)))*(1/2)*((2)^.5)));
disp("X2 =")
disp(X2)
```

check Appendix AP 3 for dependency:

11_5.sci

Scilab code Exa 11.5 clear

```
//clear//
clc
clear
exec("11.5data.sci")
X2=1-(1/exp((log(1/(1-X1)))*((T2/T1)^(5/12))));
disp("X2 =")
disp(X2)
```

Chapter 13

Distributions of Residence Times for Chemical Reactions

check Appendix AP 2 for dependency:

```
13_8.sci
```

Scilab code Exa 13.8 clear

```
//clear//
clc
clear
exec("13__8.sci");
z = 0:1:200;

function w=f(z,x)

 w =zeros(1,1);

lam=200-z;
ca=cao*(1-x)
E1=4.44658e-10*(lam^4)-1.1802e-7*(lam^3)+1.35358e
   -5*(lam^2)-.00086
5652*lam+.028004;
```

```
E2=-2.64e-9*(lam^3)+1.3618e-6*(lam^2)-.00024069*lam
    +.015011
F1=4.44658e-10/5*(lam^5)-1.1802e-7/4*lam^4+1.35358e
    -5/3*lam^3-.000865652/2*lam^2+.028004*lam;
F2=-(-9.3076e-8*lam^3+5.02846e-5*lam^2-.00941*lam
    +.61823-1)
ra=-k*ca^2;
if lam< =70
  E=E1
else
  E=(E2)
  end
  if(lam< =70)
    F=F1
  else
    F=F2
    end
    EF=E/(1-F)
    w(1)=-(ra/cao+E/(1-F)*x)
endfunction

X=ode([0],z0,z,f);

plot2d(z,X);
```

check Appendix AP 1 for dependency:

13_9.sci

Scilab code Exa 13.9 clear

```
//clear//
clc
clear
exec("13.9data.sci");
t = 0:.1:2.52;
```

```
function w=f(t,Y)

 w =zeros(10,1);

E1=-2.104*t^4+4.167*t^3-1.596*t^2+0.353*t-.004
E2=-2.104*t^4+17.037*t^3-50.247*t^2+62.964*t-27.402
rc=k1*Y(1)*Y(2)
re=k3*Y(2)*Y(4)
ra=-k1*Y(1)*Y(2)-k2*Y(1)
rb=-k1*Y(1)*Y(2)-k3*Y(2)*Y(4)
if t< =1.26
  E=E1
else
  E=E2
  end
  rd=k2*Y(1)-k3*Y(2)*Y(4)

  w(1)=ra
w(2) =rb
w(3) =rc
w(6)=Y(1)*E
w(7)=Y(2)*E
w(8)=Y(3)*E
w(4)=rd
w(5) =re
w(9)=Y(4)*E
w(10)=Y(5)*E
endfunction

X=ode([1;1;0;0;0;0;0;0;0;0],t0,t,f);

plot2d(t,X(1,:));
```

Chapter 14

Models for Nonideal Reactors

Scilab code Exa 14.3 clear

```
//clear//
clc
clear

t = 0:10:200;

function w=f(t,Y)

 w =zeros(2,1);

CTe1=2000-59.6*t+.64*t^2-0.00146*t^3-1.047*10^(-5)*t
    ^4
Beta=.1
CTe2=921-17.3*t+.129*t^2-0.000438*t^3+5.6*10^(-7)*t
    ^4
alpha=.8
tau=40
if(t<80)
  CTe=CTe1
else
  CTe=CTe2
```

```
end

w(1)=(Beta*Y(2)-(1+Beta)*Y(1))/alpha/tau
w(2)=(Beta*Y(1)-Beta*Y(2))/(1-alpha)/tau
endfunction

X=ode([2000;0],t0,t,f);

t=t';
for i =1:length(t)
CTe1(i)=2000-59.6*t(i)+.64*(t(i)^2)-0.00146*(t(i)^3)-1.047*(10^(-5))*t(i)^4;
CTe2(i)=921-17.3*t(i)+.129*t(i)^2-0.000438*t(i)^3+5.6*10^(-7)*t(i)^4
if(t(i)<80)
  CTe(i)=CTe1(i)
else
  CTe(i)=CTe2(i)
end
end


l1=X(1,: )';
l2=CTe;

plot2d(t,[l1 l2]);

xtitle( 'Figure E14-3.1', 't', 'CT1,CTe' ) ;
legend(['CT1';'CTe']);
```

Appendix

Scilab code AP 1 data

```
k1=1;
k2=1;
k3=1;
t0=0;
```

Scilab code AP 2 data

```
k=0.1
cao=8;
z0=0;
```

Scilab code AP 3 data

```
X1=.865;
T1=673;
T2=773;
```

Scilab code AP 4 data

```
X1=.865;
```

Scilab code AP 5 data

```
D=.0025; //m
L=.005;  //m
phi=.3;
```

```
U=15; //m/s;
v=4.5e-4; //m^2/s
r=.0025/2;
Lp=.005;
DAB0=.69e-4;
T=750;
T0=298;
z=.05; //m
```

Scilab code AP 6 data

```
DAB =1e-6;
CT0=.1; //kmol/m^3
yAb=.9;
yAs=.2;
s=1e-6;
c=.1;
```

Scilab code AP 7 data

```
Ka=0.05;
Kb=.15;
Pao=12;
eps=1;
A=7.6;
R=0.082;
T=400+273;
Kc=.1;
rho=80;
kprime=0.0014;
D=1.5;
Uo=2.5;
```

Scilab code AP 8 data

```
kd=9;
Ca0=.8;
```

```
tau=.02
k=45;
Ct0=1;
t0=0
```

Scilab code AP 9 data

```
ft0=50
k=.0000000145*1000*60;
kt=1.038;
kb=1.39;
alpha=0.000098;
Po=40;
w0=0;
```

Scilab code AP 10 data

```
Cao=4;
vo=240;
t0=0;
```

Scilab code AP 11 data

```
Fa0=80;
T0=75;
V=(1/7.484)*500;
UA=16000;
Ta1=60;
Fb0=1000;
Fm0=100;
mc=1000;
t0=0;
```

Scilab code AP 12 data

```
v0=.004;
Cb0=1;
```

```
UA=3000;
Ta=290;
cp=75240;
T0=300;
dh=-7.9076e7;
Cw0=55;
cpa=170700;
Vi=.2;
t0=0;
```

Scilab code AP 13 data

```
NCp=2504;
U=3.265+1.854;
Nao=9.0448;
UA=35.83;
dH=-590000;
Nbo=33;
t0=55;
```

Scilab code AP 14 data

```
t0=0;
```

Scilab code AP 15 data

```
T = [300:10:600]';
```

Scilab code AP 16 data

```
Fa0 = .9*163;
Ca0 = 9.3;
V0 = 0;
```

Scilab code AP 17 data

```
T =[535 550 565 575 585 595 605 615 625]';
```

```
H0C= -226000;
H0B = -123000;
H0A = -66600;
CpC = 46;
CpB = 18;
CpA = 35;
CpM = 19.5;
TR = 528;
Ti0 = 535;
vA0 = 46.62;
vB0 = 46.62;
VM0 = 233.1;
V = 40.1;
FA0 =43.04;
FM0 = 71.87;;
FB0 = 802.8;
A = 16.96e12;
E = 32400;
R = 1.987;
```

Scilab code AP 18 data

```
H0NH3 = -11020; // cal/moleN2
H0H2 = 0;
HN2 = 0;
CpNH3 = 8.92;// cal/moleH2.K
CpH2 = 6.992;// cal/moleN2.K
CpN2 =6.984;// cal/moleNH3.K
T = 423; //K
TR = 298; //K
```

Scilab code AP 19 data

```
Cp=200
Cao=0.3
To=283
tau=.01;
DH1=-55000;
```

```
DH2=-71500;
vo=1000;
E2=27000;
E1=9900;
UA=40000;
Ta=330;
```

Scilab code AP 20 data

```
V0=0;
Cto=0.1;
To=423;
```

Scilab code AP 21 data

```
ysc=1/.08;
ypc = 5.6;
ks = 1.7;
m = 0.03;
umax = .33;
t0 = 0;
```

Scilab code AP 22 data

```
Km = 0.0266;
Vmax1 = 1.33;
Et2 = 0.001;
Et1 = 5;
X = .8;
Curea0 = .1;
```

Scilab code AP 23 data

```
Curea = [.2 .02 .01 .005 .002]';
rurea = -[1.08 .55 .38 .2 .09]';
```

Scilab code AP 24 data

```
v0 =0;
```

Scilab code AP 25 data

```
k1= 55.2;
k2=30.2;
t0=0;
```

Scilab code AP 26 data

```
CCH4 = [2.44 4.44 10 1.65 2.47 1.75]'*1e-4;
PCO= [1 1.8 4.08 1 1 1]';
v0 =300;
W= 10;
```

Scilab code AP 27 data

```
CCH4 = [2.44 4.44 10 1.65 2.47 1.75]'*1e-4;
PCO= [1 1.8 4.08 1 1 1]';
v0 =300;
W= 10;
```

Scilab code AP 28 data

```
CHCl= [1 4 2 .1 .5];
rHCl = [1.2 2 1.36 .36 .74]*1e7;
```

Scilab code AP 29 data

```
t = [0 2.5 5 10 15 20]';
P = [7.5 10.5 12.5 15.8 17.9 19.4]';
P0 = 7.5;
```

Scilab code AP 30 data

```
ka = 2.7;
kc = 1.2;
```

```
Ct0 = .1;
fa0 =10;
V0 = 0;
```

Scilab code AP 31 data

```
FA0 = 440;
P0 = 2000;
Ca0 = .32;
R = 30;
phi = .4;
kprime = 0.02; //lb.mol/atm.lb cat.h
L = 27;
rhocat = 2.6;
m=44;

alpha = 0.0166;
e = -0.15;
Z0 = 0;
```

Scilab code AP 32 data

```
kprime = 0.0266; //lb.mol/atm.lb cat.h
alpha = 0.0166;
e = -0.15;
W0 = 0;
FA0=1;
```

Scilab code AP 33 data

```
k = 0.0141; //lb.mol/atm.lb cat.h
FA0 = 1.08; //lb.mol/h
FB0 = 0.54; // lb.mol/h
FI = 2.03; // lb.mol/h
bita0 = 0.0775; // atm/ft
Ac = 0.01414; // ft^2
phi = 0.45;
```

```
rhoc = 120; // lb cat/ft^3
P0 = 10; // atm
X = 0.6;
```

Scilab code AP 34 data

```
Ac = 0.01414; // ft^2
m = 104.4; // lbm/h
mu = 0.0673; // lbm/ft.h
Dp = 0.0208; //ft
gc = 4.17e8; // lbm.ft/lbf.h^2
phi = 0.45;
rho = 0.413; // lbm/ft^3
P0 = 10; // atm
L = 60; // ft
```

Scilab code AP 35 data

```
k1 = 0.072; // s^-1;
yA0 = 1;
P0= 6;//atm
R = 0.73; // atm/lb.mol.oR
T0 = 1980; //oR
T1 = 1000; //K
T2 = 1100; // K
e=1;
E = 82000; // cal/g.mol
FB= 0.34; //lb.mol/s
X = 0.8;
```

Scilab code AP 36 data

```
k = 0.311; // min^-1;
FC= 6.137; //lb.mol/min
X = 0.8;
CA01= 1; //mol/dm^3
```

Scilab code AP 37 data

```
k= 2.2;
v00 = .05;
Cb0 = .025;
v0 = 5;
Ca0 = .05;
t0 = 0;
```

Scilab code AP 38 data

```
kc = 0.2;
Ct0 = .2;
k = .7;
V0= 0;
```

Scilab code AP 39 data

```
t = [0 0.5 1 1.5 2 3 4  6 10];
CC = [0 0.145 .27 .376 .467 .61 .715 .848 .957];
CA0 = 1;
```

Scilab code AP 40 data

```
CA0 = 10;
CB0 = 2;
X = 0.2;
X1=0.9
```

Scilab code AP 41 data

```
FA0 = 0.867; // mol/s
X1 = 0.5;
X2 = 0.8;
rA2 = -(1/800);
X = [0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8]';
p = [189 192 200 222 250 303 400 556 800];//1/-rA =
    800//dm^3.s/mols
```

Scilab code AP 42 data

```

clc
clear
exec("2.6data.sci");


X1 = X(1:5);
p1 = p(1:5);
V1 = FA0*inttrap(X1,p1)
X2 = X(5:9);
p2 = p(5:9);
V2 = FA0*inttrap(X2,p2)
V=V1+V2;
disp("V1 =")
disp(V1)
disp("dm^3")
disp("V2 =")
disp(V2)
disp ("dm^3")
disp("V =")
disp(V)
disp ("dm^3")
```

Scilab code AP 43 data

```
FA0 = 0.867; // mol/s
rA = -(1/250);
rA2 = -(1/800);
X = 0.8;
X1 = 0.4;
X2 = 0.8
```

Scilab code AP 44 data

```
FA0 = 5; // mol/s
rAat=-(1/400);
```

```
X = [0 0.1 0.2 0.3 0.4 0.5 0.6]';
p = [189 192 200 222 250 303 400];//1/-rA = 800//dm^3.s/mols
```

Scilab code AP 45 data

```
P0 = 10; //atm
yA0 = 0.5;
T0 = 422.2;//K
R = 0.082;// dm^3.atm/mol.K
v0 = 6;//dm^3/s
X = [0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8]';
p = [189 192 200 222 250 303 400 556 800];//1/-rA = 800//dm^3.s/mols
```

Scilab code AP 46 data

```
P0 = 10; //atm
yA0 = 0.5;
T0 = 422.2;//K
R = 0.082;// dm^3.atm/mol.K
v0 = 6;//dm^3/s
X = 0.8;
rA = -1/800;//1/-rA = 800//dm^3.s/mol
```

Scilab code AP 47 data

```
P0 = 10; //atm
yA0 = 0.5;
T0 = 422.2;//K
R = 0.082;// dm^3.atm/mol.K
v0 = 6;//dm^3/s
```