Chapter1_1_1

```
clear
I(1)=0.095310

for n=1:10
   I(n+1)=1/n-10*I(n);
end
```

Chapter1_1_2

```
clear
I(7)=0.011932

for n=7:-1:2
   I(n-1)=1/10*(1/n-I(n));
end
I0=1/10*(1/1-I(1))
```

Chapter2_1_1

```
clear
n=1;
h=1e-6;
x(n)=-4;
x(n+1)=1+h;

y(n)=x(n)^3+4*x(n)^2-10;
y(n+1)=x(n+1)^3+4*x(n+1)^2-10;
z=y(n)*y(n+1);

 while z>0

  y(n)=x(n)^3+4*x(n)^2-10;
  y(n+1)=x(n+1)^3+4*x(n+1)^2-10;
  z=y(n)*y(n+1);
  n=n+1;
  x(n+1)=x(n)+h;

 end
disp('根的区间：');
x(n-1)
x(n)

%  % 函数定义
% f = @(x) x.^3 + 4*x.^2 - 10;
%
% % 设置查找区间
% x_start = -4; % 起始点
% x_end = 2; % 结束点
% step = 1; % 步长
%
% % 初始化存放根的区间
% root_intervals = [];
%
% % 逐步计算函数值并寻找符号变化
% x = x_start:step:x_end;
% for i = 1:length(x)-1
%     f_value1 = f(x(i));
%     f_value2 = f(x(i+1));
%
%     if f_value1 * f_value2 < 0  % 符号变化
%         root_intervals = [root_intervals; x(i) x(i+1)]; % 记录区间
```

```
%     end
% end
%
% % 显示结果
% disp('根的区间：');
% disp(root_intervals);
```

Chapter2_1_2

```
clear
a=1; b=2;
epsilon=abs(a-b);
n=0;
while epsilon>0.5*10^(-6)
      n=n+1;
      x=(a+b)/2;
      ya=a^3+4*a^2-10;
      yb=b^3+4*b^2-10;
      yx=x^3+4*x^2-10;
      fprintf('%d\t%.6f\t%.6f\t%.6f\t%.6f\n', n, a, b, x, yx);
      if ya*yx<0
         b=x;
      elseif yb*yx<0
         a=x;
      end
      epsilon=abs(a-b);

end
```

Chapter2_2_1

```
% 调用函数计算前 20 项
N = 25;
%x_values = compute_recursive_sequence(N);

% 可视化结果
% figure;
% plot(0:N, x_values, '-o', 'LineWidth', 1.5);
% xlabel('n');
% ylabel('x(n)');
% title('递推序列 x(n+1) = sqrt(10/(4+x(n))) 的收敛情况');
% grid on;
```

```
%function x_sequence = compute_recursive_sequence(N)
    % 初始化数组存储序列
    x = zeros(1, N+1);  % 包含 x(0)到 x(N)

    % 设置初始条件 x(0) = 1.5
    x1(1) = 1.5;
    x2(1) = 1.5;
    x3(1) = 1.5;
    x4(1) = 1.5;  % MATLAB 索引从 1 开始，x(1)对应 x(0)

    % 递推计算 x(1)到 x(N)
    for n = 1:N
        x1(n+1)=x1(n)-x1(n)^3-4*x(n)^2+10;
        x2(n+1)=sqrt(10/x2(n)-4*x2(n));
        x3(n+1)=1/2*sqrt(10-x3(n)^3);
        x4(n+1) = sqrt(10 / (4 + x4(n)));

    end

    % 输出结果（可选：显示前 20 项）
    % if N <= 20
    %     disp('递推序列结果:');
    %     for k = 0:N
    %         fprintf('x1(%d) = %.8f x2(%d) = %.8f x3(%d) = %.8f x(%d) = %.8f\n', k, x1(k+1),k, x2(k+1),k, x3(k+1),k, x(k+1));
    %     end
    %
    % else
    %     fprintf('x(%d) = %.8f\n', N, x(N+1));
    % end

    % 返回序列
    %x_sequence = x;
%end
table(x1',x2',x3',x4')
```

Chapter2_3_1

```
%松弛法计算 x^3+4x^2-10=0
clear
clc
n=1
x(1)=1.5;

for n=1:8
```

```
    fai(n)=(10/(4+x(n)))^(1/2);
    w(n) =1/(1+sqrt(10)/2*(4+x(n))^(-3/2));
    x(n+1)=(1-w(n))*x(n)+w(n)*fai(n);
end

% n=1
% x(1)=1.5;
%
% while true
%    fai(n)=(10/(4+x(n)))^(1/2);
%    w(n) =1/(1+sqrt(10)/2*(4+x(n))^(-3/2));
%    x(n+1)=(1-w(n))*x(n)+w(n)*fai(n);
%    if abs(x(n+1)-fai(n))<1e-6
%        break
%    end
%    n=n+1;
% end
```

Chapter2_3_2

```
%松弛法计算 x^3+4x^2-10=0
clear
clc
n=1
x(1)=1.5;

% for n=1:10
%     x1(n+1)=(10/(4+x(n)))^(1/2);
%     x2(n+1)=(10/(4+x1(n+1)))^(1/2);
%     x(n+1)=x2(n+1)-(x2(n+1)-x1(n+1))^2/(x2(n+1)-
2*x1(n+1)+x(n));
%     if abs(x(n+1)-x(n))<10^-6
%         break;
%     end
% end

while true
    x1(n+1)=(10/(4+x(n)))^(1/2);
    x2(n+1)=(10/(4+x1(n+1)))^(1/2);
    x(n+1)=x2(n+1)-(x2(n+1)-x1(n+1))^2/(x2(n+1)-
2*x1(n+1)+x(n));

    if abs(x(n+1)-x(n))<10^-6
        break;
    end
```

```
    n=n+1;
end
```

Chapter2_4_1

```
clear
clc
% n=1
% x(1)=1.5;
%
% for n=1:3
%    x(n+1) = x(n)-(x(n)^3+4*x(n)^2-10)/(3*x(n)^2+8*x(n));
% end


% while true
%    x(n+1) = x(n)-(x(n)^3+4*x(n)^2-10)/(3*x(n)^2+8*x(n));
%    if abs(x(n+1)-x(n))<1e-6
%        break;
%    end
%    n=n+1;
%
% end

syms y;

f=y^3+4*y^2-10;
df=diff(f,y);
n=1;
x(1)=1.5;
while true
    fx=subs(f,y,x(n));
    dfx=subs(df,y,x(n));
    x(n+1) = x(n)-fx/dfx;
    fprintf('%d \t %.8f \t \n', n, x(n));
    if abs(vpa(x(n+1)-x(n)))<1e-6
        fprintf('\n 收敛到解： x=%.8f\n',x(n))
        break;
    end
    %x(n) = x1;
    n=n+1;

end
```

```
% f=@(x)x^3+4*x^2-10;
% df=@(x)3*x.^2+8*x;
% n=1;
% x(1)=1.5
% while true
%     fx=f(x(n));
%     dfx=df(x(n));
%
%     x(n+1) = x(n)-fx/dfx;
%     fprintf('%d \t %.8f \t \n', n, x(n));
%     if abs(x(n+1)-x(n))<1e-6
%         break;
%     end
%
%     n=n+1;
%
% end
```

Chapter2_4_2

```
%用牛顿二阶导数法求解 x^3+4x^2-10=0;
clear

n=1
x(1)=1.5;

while true
    f(n)=x(n)^3+4*x(n)^2-10;
    f1(n)=3*x(n)^2+8*x(n);
    f2(n)=6*x(n)+8;
    x(n+1)=x(n)-2*f(n)*f1(n)/(2*f1(n)^2-f2(n)*f(n));
    if abs(x(n+1)-x(n))<1e-6
        break;
    end
    n=n+1;

end
```

Chapter2_5_1

```
%用双点割线法求方程 x^3 - 3x +1=0 在 0.5 附近的根;
clear
% n=2
%
% x(1)=0.5;
% x(2)=0.2;
% while true
%     %f(n)=x(n)^3 -3*x(n)+1;
%     x(n+1) = x(n)-(x(n)^3-3*x(n)+1)/(x(n)^3-3*x(n)-x(n-1)^3+3*x(n-1))*(x(n)-x(n-1));
%     if abs(x(n+1)-x(n))<1e-6
%         break;
%     end
%     n=n+1;
%
% end

% while true
%      f(n) = x(n)^3 - 3*x(n) + 1;
%      f(n-1) = x(n-1)^3 - 3*x(n-1) + 1;
%      x(n+1) = x(n) - f(n)/(f(n)-f(n-1))*(x(n) - x(n-1));
%      if abs(x(n+1)-x(n))<1e-6
%          break;
%      end
%      n=n+1;
% end
```

Chapter3_8_1

```
clear
x1(1)=0,x2(1)=0,x3(1)=0;


% for k=1:13
%     x1(k+1) =0.1 *x2(k) +0.2*x3(k) +0.72;
%     x2(k+1) =0.1*x1(k)+0.2*x3(k)+0.83;
%     x3(k+1) =0.2*x1(k)+0.2*x2(k)+0.84;
% end
clear
x1(1)=0,x2(1)=0,x3(1)=0;
k=1
epsilon=1e-5
```

```
while true
    x1(k+1) =0.1 *x2(k) +0.2*x3(k) +0.72;
    x2(k+1) =0.1*x1(k)+0.2*x3(k)+0.83;
    x3(k+1) =0.2*x1(k)+0.2*x2(k)+0.84;
    if abs(x1(k+1)-x1(k))<epsilon
        break
    end
    k=k+1;
end
```

Chapter3_8_2

```
clear
x1(1)=0,x2(1)=0,x3(1)=0;

k=1
epsilon=1e-5
while true
    x1(k+1) =0.1 *x2(k) +0.2*x3(k) +0.72;
    x2(k+1) =0.1*x1(k+1)+0.2*x3(k)+0.83;
    x3(k+1) =0.2*x1(k+1)+0.2*x2(k+1)+0.84;
    if abs(x1(k+1)-x1(k))<epsilon
        break
    end
    k=k+1;
end
```

Chapter3_9_1

```
clear
w=1.055
k=1;
x1(1)=0;
x2(1)=0;
x3(1)=0;
while true

    x1(k+1)=x1(k)+w*1/10*(7.2-10*x1(k)+x2(k)+2*x3(k));
    x2(k+1)=x2(k)+w*1/10*(8.3 + x1(k+1)-10*x2(k)+2*x3(k));
    x3(k+1)=x3(k)+w*1/5*(4.2+ x1(k+1)+x2(k+1)-5*x3(k));

    if abs(x1(k+1)-x1(k)) <=1e-5 & abs(x2(k+1)-x2(k)) <=1e-5 &
abs(x3(k+1)-x3(k)) <=1e-5
    %if abs(x1(k+1)-1.1) <=1e-5
```

```
        break;
    end
    k=k+1;
end
```

Chapter4_1_1

```
clear
x0=[1,1,1]

A=[2 -1 0
    -1 2 -1
    0 -1 2]
k=1
epsilon=1e-3

x(1,:)=x0;
while true
    y(k+1,:)=A*x(k,:)';
    yk=y(k+1,:);
    [~,idx]=max(abs(y(k+1,:)));
    m(k+1)=yk(idx);
    x(k+1,:)=y(k+1,:)/m(k+1);
    if max(abs(x(k+1,:)-x(k,:)))<epsilon
        break
    end
    k=k+1;
end

table=table[y,m',x]
```

Chapter4_1_2

```
%94 页例 3.
clear

A=[2 -1 0 0
    -1 2 -1 0
    0 -1 2 -1
    0 0 -1 2]
k=1
x(1,:)=[1,1,1,1]
epsilon=1e-3
```

```
while true
    y(k+1,:)= inv(A-0.4*eye(4))*x(k,:)';
    yk=y(k+1,:);
    [~,idx]=max(abs(yk));

    m(k+1)=yk(idx);
    x(k+1,:)=y(k+1,:)/m(k+1);
    if max(abs(x(k+1,:)-x(k,:)))<epsilon
        break
    end
    k=k+1;

end
1./m+0.4
```

Chapter4_1_3

```
%94 页，例 3 使用 93 的算法求解。
clear

A=[2 -1 0 0
-1 2 -1 0
0 -1 2 -1
0 0 -1 2]

% A=[2 0 0
%     2 3 2
%     1 2 3]

n=length(A)
x1=ones(n,1)

N=7
y=cell(1,N)
x=cell(1,N)
x={}
y={}

for k=1:N
  y1=inv(A)*x1;
  y{k}=y1;
  maxIndex=find(abs(y1)==max(abs(y1)));
  m(k)=y1(maxIndex(1));
  x1=y1/m(k);
  x{k}=x1;
```

```
end

lamda=1./m
```

Chapter4_2_1

```
%99 页算例。利用雅克比方法计算。
clear
A=[2 -1 0
-1 2 -1
0 -1 2]
A1={};
P1={};

maxA=1;
difference=maxA-10^-4

k=1
while difference>0.001
   B=A;

   baA=B(~eye(size(A)));
   maxbaA=max(max(baA));
   minbaA=(min(baA));

   if abs(maxbaA)>=abs(minbaA)
      maxA=maxbaA
   else
      maxA=minbaA
   end
      difference=abs(maxA-10^-4);
      [row,col]=find(A == maxA)
      n=size(A);
      P=eye(n);
      i=row(1),j=col(1);

     if A(i,i) == A(j,j)
         theda = pi/4;
         sintheda=sin(theda);
         costheda=cos(theda);
     else
         tan2=2*A(i,j)/(A(i,i)-A(j,j));
         sintheda=sqrt((1-sqrt(1/(1+tan2^2)))/2);
         costheda=sqrt(1-sintheda^2);
     end
```

```
     P=eye(n);
     P(i,i)=costheda;
     P(i,j)=-sintheda;
     P(j,i)=sintheda;
     P(j,j)=costheda;
     P1{k}=P;

    A1{k}=P1{k}'*A*P1{k};
    A=A1{k};
    k=k+1;
end

P2=eye(n)

for h=1:k-1
   P2=P2*P1{h}
end
```

Chapter4_3_1

```
%102 页算例
clear

A=[3 2 4
    2 0 2
    4 2 3]

B={}
[m,n]=size(A);
I=eye(n);

for k=1:n
    if k==1
        B{1}=A;
        p(1)=trace(A)
    else
       B{k}=A*(B{k-1}-p(k-1)*I)
       p(k)=1/k*trace(B{k})
    end
end

for i=1:n+1
    if i==1;
        coeffs(i)=1;
    else
```

```
        coeffs(i)=-p(i-1);
    end
end
lamda=roots(coeffs)
invA=1/p(n)*(B{n-1}-p(n-1)*I)
```

Chapter4_4_1

```
%112 页算例。
clear
a=[5 -2 -5 -1
1 0 -3 2
0 2 2 -3
0 0 1 -2]


for k=1:20
    [q,r]=qr(a);
    Q(:,:,k)=q;
    R(:,:,k)=r;
    A(:,:,k+1)=R(:,:,k)*Q(:,:,k);
    a=A(:,:,k+1);

end
```

Chapter5_2_1

```
%119 页例 1
clear

x=[4,9]

n=length(x)

x0=7
L=0
for i=1:n
   l(i)=1;
   for j=1:n
      if i~=j
         l(i)=l(i)*(x0-x(j))/(x(i)-x(j));
      end
   end
```

```
   L=L+sqrt(x(i))*l(i);
end
```

Chapter5_2_3

```
clear
%P121,抛物插值
x=[2,2.5,4]

n=length(x)

x0=3
L=0
for i=1:n
   l(i)=1;
   for j=1:n
      if i~=j
         l(i)=l(i)*(x0-x(j))/(x(i)-x(j));
      end
   end
   L=L+1/x(i)*l(i);
end
```

Chapter5_2_4

```
%122 页例 4
clear

x=[0.32,0.34]

n=length(x)

x0=0.33
L=0;
for i=1:n
   l(i)=1;
   for j=1:n
      if i~=j
         l(i)=l(i)*(x0-x(j))/(x(i)-x(j));
      end
   end
   L=L+sin(x(i))*l(i);
end
L
```

Chapter5_3_1

```
%124 页，例 1，差商表。

clear
x=[1 3 4 7]
fx=[0 2 15 12]
n=length(x)

f(:,1)=fx'

for j=2:n
   for i=j:n
       f(i,j)=(f(i,j-1)-f(i-1,j-1))/(x(i)-x(i-j+1))
   end
end
```

Chapter5_3_4

```
%差商表
%计算插值。

clear

% x=[1 3 4 7]
% fx=[0 2 15 12]

%126 页，例 4
x=[0.4 0.55 0.65 0.80 0.9 1.05]
fx=[0.41075 0.57815 0.69675 0.88811 1.02652 1.25386]



n=length(x)

f(:,1)=fx'

for j=2:n
   for i=j:n
       f(i,j)=(f(i,j-1)-f(i-1,j-1))/(x(i)-x(i-j+1))
   end
end

%n=4
Nx=fx(1)
```

```
x0=0.596;
for i=2:n
    wn=1;
    for j=1:i-1
        wn=wn*(x0-x(j));
    end
    Nx=Nx+f(i,i)*wn;
end
Nx


% x=[1 3 4 7]
% fx=[0 2 15 12]
% n1=length(x)
% for t=1:n1
%     if t==1
%     else
%        x(:,1)=[]
%        fx(:,1)=[];
%     end
%     n=length(x);
%     di=zeros(1,n);
%     for k=1:n
%         L=0
%         for i=1:k
%             l(i)=1;
%             for j=1:k
%                 if i~=j
%                     l(i)=l(i)/(x(i)-x(j));
%                 end
%             end
%             L=L+fx(i)*l(i);
%         end
%         di(k)=L;
%     end
%     d{t}=di;
% end
```

Chapter5_3_5

```
%129 页例 5
clear
x=[1 1.5 2 2.5 3]
fx=exp(x)
x0=1.2
t=(x0-x(1))/(x(2)-x(1))

y0=fx(1)


    for m=2:length(x)
       product=1;
       for n=1:m-1
           product=product.*(t-n+1)/n;
       end
       diffx=diff(fx,m-1)
       y0=y0+diffx(1).*product
    end
```

Chapter5_4_1

```
%133 页例子

clear
syms x
f=sqrt(x)
df=diff(f,x)

x0=121
x1=144

m0=subs(df,x,x0)
m1=subs(df,x,x1)

x=125

l0=(x-x1)/(x0-x1);
l1=(x-x0)/(x1-x0)

y0=sqrt(x0);
y1=sqrt(x1);

alpha0=(1+2*l1)*l0^2
```

```
alpha1=(1+2*l0)*l1^2
beta0=(x-x0)*l0^2
beta1=(x-x1)*l1^2

H=y0*alpha0+y1*alpha1+m0*beta0+m1*beta1
vpa(H)
```

Chapter5_7_1

```
clear
%P146,拉格朗日差值法，反插值，使用原来的程序，x 和 y 交换。所以如下
x，y 和书上反过来。
x=[3 7 11 17]
y=[10 15 17 20]


n=length(x)
%x0 即为当求 x=x0 时对应的 y 值，
x0=10
L=0
for i=1:n
   l(i)=1;
   for j=1:n
      if i~=j
         l(i)=l(i)*(x0-x(j))/(x(i)-x(j));
      end
   end
   L=L+y(i)*l(i);
end
```

Chapter5_7_2

```
%差商表
%计算反插值。

clear
%P146,由于是反插值，所以 x 和 y 倒过来，如下数据 x 和 y 倒过来。计算差商
表。
x=[0.10653 0.02695 -0.05119 -0.12795 -0.20341]
fx=[0.5 0.55 0.6 0.65 0.7]

n=length(x)

f(:,1)=fx'
```

```
for j=2:n
   for i=j:n
       f(i,j)=(f(i,j-1)-f(i-1,j-1))/(x(i)-x(i-j+1));
   end
end
%差商表
table(x',f)

Nx=fx(1)
x0=0;
%x0 是实际上当 f(x)=0 时求 x 的值，由于是反插值法，所以，实际上对程序仍然是求 x0 时 y 的值。
for i=2:n
    wn=1;
    for j=1:i-1
        wn=wn*(x0-x(j));
    end
    Nx=Nx+f(i,i)*wn;
end

Nx

%{
% x=[1 3 4 7]
% fx=[0 2 15 12]
n1=length(x)
for t=1:n1
    if t==1
    else
       x(:,1)=[]
       fx(:,1)=[];
    end
    n=length(x);
    di=zeros(1,n);
    for k=1:n
        L=0
        for i=1:k
            l(i)=1;
            for j=1:k
                if i~=j
                    l(i)=l(i)/(x(i)-x(j));
                end
```

```
            end
            L=L+fx(i)*l(i);
        end
        di(k)=L;
    end
    d{t}=di;
end
%}
```

Chapter6_1_1

```
clear
%P151 页,
x=[19.1,25,30.1,36,40,45.1,50]
y=[76.3,77.8,79.25,80.8,82.35,83.9,85.1]

plot(x,y,'ro')

%表 6.2
table(x',y',(x.^2)',(x.*y)')

table6_2=[x',y',(x.^2)',(x.*y)']
sum_table6_2=sum(table6_2)

m=length(x)
A=[m sum(x)
    sum(x) sum(x.^2)]

b=[sum(y)
    sum(x.*y)]

v=inv(A)*b


scatter(x,y,'filled')
p=polyfit(x,y,1)
%plot(x, y, 'o', 'MarkerSize', 8, 'MarkerFaceColor', 'b'); % 数据点
hold on;
plot(x, polyval(p, x), '-', 'LineWidth', 2, 'Color', 'r')

fprintf('斜率: %f\n', p(1));
```

```
fprintf('截距: %f\n', p(2))

legend('数据点', '线性拟合','fontname','宋体');
xlabel('x');
ylabel('y');

hold off
```

Chapter6_1_2

```
x=[1 3 4 5 6 7 8 9 10]
y=[10 5 4 2 1 1 2 3 4]

table_6_4=table(x',y',(x.^2)',(x.^3)',(x.^4)',(x.*y)',(x.^2.*y
)')
[table_6_4
sum(table_6_4)]

sum1=sum([x',y',(x.^2)',(x.^3)',(x.^4)',(x.*y)',(x.^2.*y)'])

A=[length(x) sum1(1) sum1(3)
    sum1(1) sum1(3) sum1(4)
    sum1(3) sum1(4) sum1(5)]

b=[sum1(2)
    sum1(6)
    sum1(7)]

v=inv(A)*b

v=A\b

p=polyfit(x,y,2)

x_fit=linspace(min(x),max(x),100)
y_fit=polyval(p,x_fit)

figure;
plot(x,y,'bo','MarkerSize',8,'LineWidth',1.5)

hold on
plot(x_fit,y_fit,'r-','LineWidth',2)
%title('二次多项式最小二乘拟合')
xlabel('x')
```

```
ylabel('y')
legend('原始数据','拟合曲线','Location','Northwest')
grid on
```

Chapter6_3_1

```
%P160，拟合函数

x=[0 0.1 0.2 0.3 0.4 0.5 0.6]
y=[2 2.20254 2.40715 2.61592 2.83096 3.05448 3.28876]

polyfit(x,y,1)

f0=1
f1=exp(x)
f2=exp(-x)

G=[x.^0' f1' f2']

a1=inv(G'*G)*(G'*y')

a2=G'*G\(G'*y')
a3=G\y'
```

Chapter6_3_2

```
%P161,

t=[0.2 0.3 0.4 0.5 0.6 0.7 0.8]
I=[3.16 2.38 1.75 1.34 1 0.74 0.56]

y=log(I)


m=length(t)
A=[m sum(t)
    sum(t) sum(t.^2)]

b=[sum(log(I))
    sum(t.*y)]

v=inv(A)*b

%或者用如下 matlab 拟合函数
p=polyfit(t,y,1)
```