代码

Q3 中 2)的程序（计算数值解，比较数值解与解析解的误差）

```
clc
clear all
close all

%% parameter set up
afa=0.06;
deltx=0.02;
deltt=0.002;
T0=50;
endt=10;endx=1;
numberx=endx/deltx+1;numbert=endt/deltt+1;
A=zeros(numbert,numberx);


%% solve the question
%initial    condition set up
k=1;
for x=0:deltx:endx
                    T=T0*sin(pi*x);A(1,k)=T;k=k+1;
end

if A(1,k-1)~=0
       A(1,k-1)=0;
end

%solve
for n=2:1:numbert
   for i=2:1:numberx-1
         Tin=A(n-1,i)+afa*deltt/(deltx)^2*(A(n-1,i+1)-2*A(n-1,i)+A(n-1,i-
1));A(n,i)=Tin;%calculate    inner value
   end
   A(n,1)=0;A(n,numberx)=0;%boundary condition set up
end

%% post-processing
%calculate the exact value
B1=A(numbert,:);
B2=zeros(1,numberx);
p=1;
for x=0:deltx:endx
```

```
      T=T0*sin(pi*x)*exp((-afa*(pi)^2)*endt);B2(1,p)=T;p=p+1;
end
%calculate the variance
B=B2-B1;
Var=var(B)

%figure
x=0:deltx:endx;
scatter(x,B1)
hold on
plot(x,B2,'-r*')
legend('数值解','解析解')
xlabel('位置 x','fontsize',14)
ylabel('温度 T','fontsize',14)
title('t=10 时， T 的数值解与解析解','fontsize',16)
```

Q3 中 3)的程序（设置函数计算数值解，从而能够实现多次调用）

函数：

```
function Vart=change(afa,deltx,deltt,T0,endt,endx)
format long
numberx=endx/deltx+1;numbert=endt/deltt+1;
A=zeros(numbert,numberx);

%% solve the question
%initial    condition set up
k=1;
for x=0:deltx:endx
                    T=T0*sin(pi*x);A(1,k)=T;k=k+1;
end

if A(1,k-1)~=0
      A(1,k-1)=0;
end

%solve
for n=2:1:numbert
   for i=2:1:numberx-1
         Tin=A(n-1,i)+afa*deltt/(deltx)^2*(A(n-1,i+1)-2*A(n-1,i)+A(n-1,i-
1));A(n,i)=Tin;%calculate    inner value
   end
   A(n,1)=0;A(n,numberx)=0;%boundary condition set up
end
```

```
%% post-processing
%calculate the exact value
B1=A(numbert,:);
B2=zeros(1,numberx);
p=1;
for x=0:deltx:endx
      T=T0*sin(pi*x)*exp((-afa*(pi)^2)*endt);B2(1,p)=T;p=p+1;
end
%calculate the variance
B=B2-B1;
Var=var(B);Vart=Var
end
```

调用

```
clc
clear all
close all

%% parameter set up
format long
afa=0.06;
deltx=0.02;
T0=50;
endt=10;endx=1;
A=zeros(1,4);
deltt=[0.0001,0.001,0.002,0.0025];

%% calculate
for p=1:4
Vart=change(afa,deltx,deltt(1,p),T0,endt,endx);A(1,p)=Vart;
end
plot(deltt,A,'-*');
xlabel('间隔时间 deltt','fontsize',14)
ylabel('解析解与数值解的误差方差','fontsize',14)
title('T 的数值解与解析解的误差方差','fontsize',16)
```