附录：

问题一：

function result=F(t,v,Tl,T2,T3,T4)

%计算当前环境温度

% v:移动速度；Ti:第i个不同温区的温度；

tl=25/v; %炉前区域

t2=tl+ (30.5\*5 + 5\*4) /v; % 小温区 1-5

t3=t2+ (5+30.5) /v; % 小温区6

t4=t3+(5+30.5) /v; % 小温区7

t5=t4+ (5\*2 + 30.5\*2) /v; % 小温区8-9

if (t<=tl-(Tl-25)/20)

T=25;

elseif(t>tl- (Tl-25)/20 && t<=tl)

T=175-(tl-t)/(Tl-25)\*20\*150;

elseif (t>tl && t<=t2)

T=T1;

elseif(t>t2 && t<=t2+5/v)

T=(t-t2)\*v/5\*(T2-T1) +T1;

elseif(t>t2+5/v && t<=t3)

T=T2;

elseif (t>t3 && t<=t3 + 5/v)

T= (t-t3)\*v/5\*(T3-T2)+T2;

elseif(t>t3+5/v && t<=t4)

T=T3;

elseif (t>t4 && t<=t4 + 5/v)

T= (t-t4)\*v/5\*(T4-T3) +T3;

elseif(t>t4+5/v && t<=t5)

T=T4;

elseif(t>t5 && t<=t5+20/v)

T= (t-t5)\*v/20\*(25-T4)+T4;

else

T=25;

end

result=T;

end

function [result]=T(RC1,RC2,v,Tl,T2,T3,T4,h)

%求解PCB板中心温度变化曲线函数

% RC1,RC2:两个时间常数；v:移动速度；Ti:第i个不同温区的温度；h:对流换热系数; deltat=0.01;

lenl=floor(339.5/v/deltat);

len0=floor(235.5/v/deltat);

len=floor(435.5/v/deltat);

tn=linspace(0,0,len);

for i=l:len

tn (i)=i\*deltat;

end

T=linspace(25,25,len);

for i=2:lenO

T(i)=T(i-l)+(F(tn(i),v,Tl,T2,T3,T4)-T(i-l))\*(1-exp(-deltat/RCl));

end

for i=lenO+l:lenl

T(i)=T(i-l)+(F(tn(i),v,T1,T2,T3,T4)-T(i-1))\*(1-exp(-deltat/RC2));

end

for i=lenl+l:len

T(i)=T(i-l)+(F(tn(i),v,T1,T2,T3,T4)-T(i-1))\*h\*deltat;

end

result=T;

end

%第一问主函数

clear

clc

[Ts]=x1sread( 'D:\附件.x丄sx‘，1, 'B2:B710');

suml=0;

sum2=0;

minl=inf;

bestl=0;

best2=0;

min2=inf;

best3=0;

deltat=0.01;

v=7/6;

len0=floor(235.5/v/deltat);

lenl=floor(339.5/v/deltat);

len=floor(435.5/v/deltat);

tn=linspace(0,0,len);

for i=l:len

tn (i)=i\*deltat;

end

for j=l:1000

temp=T(0.1\*j,50,7/6,175,195,235,255,0.005);

for i=l:lenO

if (tn (i)>=19 && mod(iz 50)==0)

suml=suml+(temp(i)-Ts((i-1850)/50))A2;

end

end

if (sumKminl)

minl=suml;

bestl=O.1\*j;

end

suml=O;

end

min=inf;

for j=l:1000

temp=T(bestl,0.1\*j,7/6,175,195,235,255,0.005);

for i=len0+l:lenl

if(mod(i,50) ==0) suml=suml+(temp(i)-Ts((i-1850) /50) ) A2;

end

end

if (sumKmin)

min=suml;

best2=0.1\*j;

end

suml=0;

end

for j=l:1000

temp=T(bestl,best2,7/6, 175, 195,235, 255,2e-3+5e-6\*j); for i=lenl+l:len

if(mod(i,50)==0) sum2=sum2+(temp(i)-Ts((i-2100)/50))A2;

end

end

if (sum2<min2)

min2=sum2;

best3=2e-3 + 5e-6\*j ;

end

sum2=0;

end

v=78/60;

len=floor(435.5/v/deltat);

tn=linspace(0,0, len);

for i=l:len

tn (i)=i\*deltat;

end

result=T(bestl,best2,vz173,198,230,257,best3);

plot(tn,result);

问题二：

function result=check(deltat,v,T)

%判断是否符合制程条件

len2=floor(435.5/v/deltat);

len3=floor(339.5/v/deltat);

result=l; %符合条件为1,反之为0

cntl=0;

cnt2=0;

cnt3=0;

cnt4=0;

for i=2:len3

grad=(T (i) -T (i-1) ) /deltat; % 计算导数

if (grad<0 | | grad>3)

result=0;

end

if (T (i)>=150 && T (i-1)<150)

cntl=i;

end

if (T (i)>180 && T (i-1)<=180)

cnt2=i-l;

end

if (T (i)>217 && T (i-1)<=217)

cnt3=i;

end

end

for i=len3+l:len2

grad=(T(i)-T(i-1))/deltat;

if (abs(grad)>3)

result=0;

end

if (T (i)<=217 && T (i-1)>217)

cnt4=i-l;

end

end

%判断在150° C~190° C的时间是否符合

if(deltat\*(cnt2-cntl)<60 || deltat\*(cnt2-cntl)>120) result=0;

end

%判断大于217° C的时间是否符合

if(deltat\*(cnt4-cnt3)<40 || deltat\*(cnt4-cnt3)>90) result=0;

end

%判断峰值是否符合

if (T (len3)<240 | | T(len3)>250)

result=0;

end

end

%第二问主函数

clear

clc

best=65;

%第一次搜素，步长1;

for i=l:100

v=i;

result=T (57.4,43.7,v/60,182,203,237,254, 0.00678);

if(check(0.01,v/60,result)==l)

best=v;

end

end

%第二次搜素，步长0.01;

for i=l:200

v=best-l+0.01\*i;

result=T (57.4,43.7,v/60,182,203,237,254, 0.00 67 8);

if(check(0.01,v/60,result)==l)

best=v;

end

end

问题三：

function [Bestv,BestTl,BestT2,BestT3,BestT4,trace,T\_m]=SAA() %模拟退火算法

vmax=100;

vmin=65;

Tlmax=185;

Tlmin=l65;

T2max=205;

T2min=185;

T3max=245;

T3min=225;

T4max=2 65;

T4min=225;

L=100;

K=0.98;

S=0.08;

T\_m=100;

Yz=lE-6;

P=0;

trace=linspace (0, 0,20000);

f=l;

while(f==l)

Prev=rand\*(vmax-vmin)+vmin;

PreTl=rand\*(Tlmax-Tlmin)+Tlmin;

PreT2=rand\*(T2max-T2min)+T2min;

PreT3=rand\*(T3max-T3min)+T3min;

PreT4=rand\*(T4max-T4min)+T4min;

temp=T(57.4,43.7,Prev/60,PreTl,PreT2,PreT3,PreT4,0.00678);

if(check(0.01,Prev/60,temp)==1)

Prebestv=Prev;

PrebestTl=PreTl;

PrebestT2=PreT2;

PrebestT3=PreT3;

PrebestT4=PreT4;

f=0;

end

end

f=l；

while(f==l)

Prev=rand\*(vmax-vmin)+vmin;

PreTl=rand\*(Tlmax-Tlmin)+Tlmin;

PreT2=rand\*(T2max-T2min)+T2min;

PreT3=rand\*(T3max-T3min)+T3min;

PreT4=rand\*(T4max-T4min)+T4min;

temp=T(57.4,43.7,Prev/60,PreTl,PreT2,PreT3, PreT4z 0.00678);

if(check(0.01,Prev/60,temp)==1)

Bestv=Prev;

BestTl=PreTl;

BestT2=PreT2;

BestT3=PreT3;

BestT4=PreT4;

f=0;

end

end

deta=abs (func(Bestv,BestTl,BestT2,BestT3,BestT4)-func(Prebestv,PrebestT

1,PrebestT2z PrebestT3,PrebestT4));

while(deta>Yz) && (T\_m>0.001) && (P<20000)

T\_m=K\*T\_m;

for i=l:L

P=0;

while p==0

Nextv=rand\*(vmax-vmin)+vmin;

NextTl=rand\*(Tlmax-Tlmin)+Tlmin;

NextT2=rand\*(T2max-T2min)+T2min;

NextT3=rand\*(T3max-T3min)+T3min;

NextT4=rand\*(T4max-T4min)+T4min;

temp=T(57.4,43.7,Nextv/60,NextTl,NextT2,NextT3,NextT4,0.00678);

m=check(0.01,Nextv/60,temp);

if(Nextv>=vmin && Nextv<=vmax && NextTl>=Tlmin && NextTl<=Tlmax

&& NextT2>=T2min && NextT2<=T2max && NextT3>=T3min && NextT3<=T3max && NextT4>=T4min && NextT4<=T4max &&m==l)

p=l；

end

end

if(func(Bestv,BestTl,BestT2,BestT3,BestT4)>func(Nextv,NextTl,NextT2,Nex tT3,NextT4))

Prebestv=Bestv;

PrebestTl=BestTl;

PrebestT2=BestT2;

PrebestT3=BestT3;

PrebestT4=BestT4;

Bestv=Nextv;

BestTl=NextTl;

BestT2=NextT2;

BestT3=NextT3;

BestT4=NextT4;

end

if(func(Prev,PreTl,PreT2,PreT3,PreT4)>func(Nextv,NextTl,NextT2,NextT3,N extT4))

Prev=Nextv;

PreTl=NextTl;

PreT2=NextT2;

PreT3=NextT3;

PreT4=NextT4;

P=P+1;

else

change=-(func(Prev,PreTl,PreT2,PreT3,PreT4)-func(Nextv,NextTl,NextT2,Ne xtT3,NextT4))/T\_m;

pl=exp(change);

if(pl>rand)

Prev=Nextv;

PreTl=NextTl;

PreT2=NextT2;

PreT3=NextT3;

PreT4=NextT4;

P=P+1;

end

end

trace(P)=func (Bestv,BestTl,BestT2z BestT3, BestT4);

end

deta=abs (func(Bestv,BestTl,BestT2,BestT3,BestT4)-func(Prebestv,PrebestT

1,PrebestT2,PrebestT3,PrebestT4));

end

end

function result=func(v,T1,T2,T3Z T4)

%计算面积

Tt=T(57.4, 43.7,v/60z Tl,T2,T3,T4,0.00 678);

maxT=max (Tt);

len5=length(Tt);

cntl=0;

cnt2=0;

sum=0;

for i=2:len5

if(Tt(i-1)<=217 && Tt (i)>217)

cntl=i;

end

if(Tt(i)==maxT)

cnt2=i;

end

end

for i=2:len5

if ( i>=cntl && i<=cnt2-l)

sum=sum+0.01\*(Tt(i)-217);

end

end

result=sum;

end

问题四：

function result=func2(v,Tl,T2,T3,T4)

%计算对称度

Tt=T(57.4,43.7,v/60,Tl,T2,T3,T4,0.00678);

cntl=0;

cnt2=0;

cnt3=0;

maxT=max (Tt);

len=length(Tt);

for i=2:len

if(Tt(i-1)<=217 && Tt (i)>217)

cntl=i;

end

if (Tt(i-1)>217 && Tt(i)<=217)

cnt3=i-l;

end

if(Tt(i)==maxT)

cnt2=i;

end

end

n=floor(((cnt2-cntl)+(cnt3-cnt2))/2);

sum=0;

for i=l:n

sum=sum+(Tt(cnt2-i)-Tt(cnt2 + i) ) A2;

end

result=sum/n;

end

function result=func3 (vz Tl,T2,T3,T4)

%面积与对称度统一数量级赋权值

ml = func (v,Tl,T2,T3,T4);

m2=func2(v,T1,T2,T3,T4);

result=0.1\*ml+m2;

end

第四问的主函数仅需将第三问之中SAA函数中的适应度函数func改成func3即可运行。