Billet temperature simulation Codes (2D)

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function
[Tb1,Tbhave,TaSh,FHub,FWNub,FWSub,FWNlub,FWSlub,Fdwub,Fcub,FHdb,FWNdb,FWSdb,F
WNldb,FWSldb,Fdwdb,Fcdb,FWNbuf,FWSbuf,FbdWbuf,FfdWbuf]=ip(i,t,tp,Tb1, WF, df,
dTaz, NN, Pt, P, Wb, Wbd, Wbth, Wfd, Wfth, CL, dTax, Lzc, Lz, Tw, zo, hgb,
Asx, cac, Acx, Sds, Sac, Sus, Asy, Scs, hbh, Th,
Shs,ac,Wu,cxp,cxm,cyp,cym,ae,zot,xo,yo,LB,St,Hu,Lu,Hc,Hb,LF,Hbw,Hfw,TaN,TaS,T
aM,CLm,TT,Ds,V,L,asa,asb,Embr,erbr,SBC)


TaSh=TaS-((WF-df-L)/2)*repmat(dTaz', [1 NN]);

%The zone where billet/bloom i is during t
j=Pt(i,t);

%Distance from the nearest wall in direction of upstream to billet surface
Wbrd=(P(i,St(t))-Wb/2)*CL(j)-Wbd(j)-Wbth(j)/2;
%Distance from the nearest wall in direction of downstream to billet surface
Wfrd=Wfd(j)-Wfth(j)/2-(P(i,St(t))+Wb/2)*CL(j);

%Atmoshpere temperature which billet/bloom i experiences
Taxz=dTax(j)*(P(i,St(t))-Wbd(j)-Lzc(j)/2)+Tw(j,t)+dTaz(j).*zo;

%Transmitted heat through heat transfer from gas to billets/blooms
qtrandst=hgb*(Taxz-Tb1).*(Asx*Sds.*cac+Acx*Sds.*Sac)*10^(-6);
qtranust=hgb*(Taxz-Tb1).*(Asx*Sus.*cac+Acx*Sus.*Sac)*10^(-6);
qtranuf=hgb*(Taxz-Tb1).*(Asy*Scs.*cac)*10^(-6);

%Finding spot where billet/bloom i is on right now
besp=P(i,St(t))/400+1;
besp(besp>=70)=70;
besp(besp<1)=1;

%Transmitted heat by contact heat transfer through hearth
qtranhf=hbh*(Th(besp)-Tb1).*(Asy*Shs.*cac)*10^(-6);

qtrantotal=(qtrandst+qtranust+qtranuf+qtranhf);
%qtrantotalcum=qtrantotalcum+qtrantotal;

%Thermal conductivity
aca=ac(i,1);
acb=ac(i,2);
acc=ac(i,3);
acd=ac(i,4);

%Incoming heat conduction
Tbxp=circshift(Tb1,[1 0 0]);
qcondxp=(Tbxp-
Tb1).*(aca*((Tbxp+Tb1)/2).^3+acb*((Tbxp+Tb1)/2).^2+acc*(Tbxp+Tb1)/2+acd)*Asx/
Wu.*cxp*10^(-3);
Tbxm=circshift(Tb1,[-1 0 0]);
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qcondxm=(Tbxm-
Tb1).*(aca*((Tbxm+Tb1)/2).^3+acb*((Tbxm+Tb1)/2).^2+acc*(Tbxm+Tb1)/2+acd)*Asx/
Wu.*cxm*10^(-3);
Tbyp=circshift(Tb1,[0 1 0]);
qcondyp=(Tbyp-
Tb1).*(aca*((Tbyp+Tb1)/2).^3+acb*((Tbyp+Tb1)/2).^2+acc*(Tbyp+Tb1)/2+acd)*Asy/
Hu.*cyp*10^(-3);
Tbym=circshift(Tb1,[0 -1 0]);
qcondym=(Tbym-
Tb1).*(aca*((Tbym+Tb1)/2).^3+acb*((Tbym+Tb1)/2).^2+acc*(Tbym+Tb1)/2+acd)*Asy/
Hu.*cym*10^(-3);

qcondtotal=(qcondxp+qcondxm+qcondyp+qcondym);

%qcondtotalwz=(qcondxp+qcondxm+qcondyp+qcondym)+qcondtotalwz;

 %Emissivity of billet/bloom
 aea=ae(i,1);
 aeb=ae(i,2);
 aec=ae(i,3);
 aed=ae(i,4);
 erb=0;



%View factor
%View factor between billet/bloom surface at upstream side and furnace
FubH=(1/(3.14159*2))*(atan(zot./yo)+atan(zo./yo))-
(yo./(2*3.14159*(yo.^2+(LB(i,St(t))-
Wb)^2).^0.5)).*(atan(zot./(yo.^2+(LB(i,St(t))-
Wb)^2).^0.5)+atan(zo./(yo.^2+(LB(i,St(t))-Wb)^2).^0.5));
FHub=(Hu*Lu)/((LB(i,St(t))-Wb)*WF)*FubH;
 FubWN=(1/(3.14159*2))*(atan((Hc(j)-yo)./zo)-
(zo./(Wbrd^2+zo.^2).^0.5).*atan((Hc(j)-yo)./((Wbrd^2+zo.^2).^0.5))-(atan((Hb-
yo)./zo)-(zo./(Wbrd^2+zo.^2).^0.5).*atan((Hb-yo)./((Wbrd^2+zo.^2).^0.5))));
 FWNub=(Hu*Lu)./(Wbrd*(Hc(j)-yo)).*FubWN;
  FubWS=(1/(3.14159*2))*(atan((Hc(j)-yo)./zot)-
(zot./(Wbrd^2+zot.^2).^0.5).*atan((Hc(j)-yo)./((Wbrd^2+zot.^2).^0.5))-
(atan((Hb-yo)./zot)-(zot./(Wbrd^2+zot.^2).^0.5).*atan((Hb-
yo)./((Wbrd^2+zot.^2).^0.5))));
  FWSub=(Hu*Lu)./(Wbrd*(Hc(j)-yo)).*FubWS;
   FubWNl=(1/(3.14159*2))*(atan(yo./zo)+atan((Hb-yo)./zo))-
(zo./(2*3.14159*((zo.^2+(LB(i,St(t))-
Wb)^2).^0.5))).*(atan(yo./((zo.^2+(LB(i,St(t))-Wb)^2).^0.5))+atan((Hb-
yo)./((zo.^2+(LB(i,St(t))-Wb)^2).^0.5)));
   FWNlub=(Hu*Lu)/(Hb*(LB(i,St(t))-Wb))*FubWNl;
    FubWSl=(1/(3.14159*2))*(atan(yo./zot)+atan((Hb-yo)./zot))-
(zot./(2*3.14159*((zot.^2+(LB(i,St(t))-
Wb)^2).^0.5))).*(atan(yo./((zot.^2+(LB(i,St(t))-Wb)^2).^0.5))+atan((Hb-
yo)./((zot.^2+(LB(i,St(t))-Wb)^2).^0.5)));
    FWSlub=(Hu*Lu)/(Hb*(LB(i,St(t))-Wb))*FubWSl;
     theta=atan((Hb-yo)/(LB(i,St(t))-Wb));
     theta1=atan(((Hc(j)-Hbw(j))-yo)/Wbrd);
     theta2=atan((Hc(j)-yo)/Wbrd);
     phi=theta;
     phi2=theta;
     phi(phi<theta1)=0;
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      phi(phi>theta2)=0;
      phi(theta1<=phi & phi<=theta2)=1;
      phi=phi.*((Hc(j)-((Hb-yo)/(LB(i,St(t))-Wb))*Wbrd)-yo);
      theta(theta>theta1)=10;
      theta(theta<=theta1)=Hbw(j);
      theta(theta<11)=0;
      zero=zeros(Wb/Wu,Hb/Hu,fix(L/Lu));
      Ewh=zero+phi+theta;
      Fubdw1=(1/(3.14159*2))*(((Hc(j)-yo)./(((Hc(j)-
yo).^2+Wbrd^2).^0.5)).*atan(zo./(((Hc(j)-
yo).^2+Wbrd^2).^0.5))+(zo./((zo.^2+Wbrd^2).^0.5)).*atan((Hc(j)-
yo)./((zo.^2+Wbrd^2).^0.5)));
      Fubdw2=(1/(3.14159*2))*(((Hc(j)-yo)./(((Hc(j)-
yo).^2+Wbrd^2).^0.5)).*atan((WF-zo)./(((Hc(j)-yo).^2+Wbrd^2).^0.5))+((WF-
zo)./(((WF-zo).^2+Wbrd^2).^0.5)).*atan((Hc(j)-yo)./(((WF-
zo).^2+Wbrd^2).^0.5)));
      Fubdw3=(1/(3.14159*2))*(((Hc(j)-yo-Ewh)./(((Hc(j)-yo-
Ewh).^2+Wbrd^2).^0.5)).*atan((WF-zo)./(((Hc(j)-yo-
Ewh).^2+Wbrd^2).^0.5))+((WF-zo)./(((WF-zo).^2+Wbrd^2).^0.5)).*atan((Hc(j)-yo-
Ewh)./(((WF-zo).^2+Wbrd^2).^0.5)));
      Fubdw4=(1/(3.14159*2))*(((Hc(j)-yo-Ewh)./(((Hc(j)-yo-
Ewh).^2+Wbrd^2).^0.5)).*atan(zo./(((Hc(j)-yo-
Ewh).^2+Wbrd^2).^0.5))+(zo./((zo.^2+Wbrd^2).^0.5)).*atan((Hc(j)-yo-
Ewh)./((zo.^2+Wbrd^2).^0.5)));
      Fubdw=Fubdw1+Fubdw2-Fubdw3-Fubdw4;
      Fdwub=(Hu*Lu)./(Ewh*WF).*Fubdw;
       phi2(phi2<=theta2)=0;
       phi2(phi2>theta2)=1;
       phi2=phi2.*(((Hc(j)-yo)./(Hb-yo))*(LB(i,St(t))-Wb));
       phi2(phi2<=0)=Wbrd;
       Fubc=(1/(3.14159*2))*(atan((WF-zo)./(Hc(j)-yo))+atan(zo./(Hc(j)-yo)))-
((Hc(j)-yo)./(2*3.14159*(((Hc(j)-yo).^2+phi2.^2).^0.5))).*(atan((WF-
zo)./(((Hc(j)-yo).^2+phi2.^2).^0.5))+atan(zo./(((Hc(j)-
yo).^2+phi2.^2).^0.5)));
       Fcub=(Hu*Lu)./(Wbrd*WF)*Fubc;

FWubAN=(FubWN+FubWNl)*(Hu*Lu)*(10^(-6));
FWubAS=(FubWS+FubWSl)*(Hu*Lu)*(10^(-6));
FWubAM=(FubH+Fubdw+Fubc)*(Hu*Lu)*(10^(-6));

%View factor between billet/bloom surface at downstream side and furnace
FdbH=(1/(3.14159*2))*(atan((WF-zo)./yo)+atan(zo./yo))-
(yo./(2*3.14159*((yo.^2+(LF(i,St(t))-Wb)^2).^0.5))).*(atan((WF-
zo)./((yo.^2+(LF(i,St(t))-Wb)^2).^0.5))+atan(zo./((yo.^2+(LF(i,St(t))-
Wb)^2).^0.5)));
FHdb=(Hu*Lu)/((LF(i,St(t))-Wb)*WF)*FdbH;
 FdbWN=(1/(3.14159*2))*(atan((Hc(j)-yo)./zo)-
(zo./(Wfrd^2+zo.^2).^0.5).*atan((Hc(j)-yo)./((Wfrd^2+zo.^2).^0.5))-(atan((Hb-
yo)./zo)-(zo./(Wfrd^2+zo.^2).^0.5).*atan((Hb-yo)./((Wfrd^2+zo.^2).^0.5))));
  FWNdb=(Hu*Lu)./(Wfrd*(Hc(j)-yo)).*FdbWN;
  FdbWS=(1/(3.14159*2))*(atan((Hc(j)-yo)./zot)-
(zot./(Wfrd^2+zot.^2).^0.5).*atan((Hc(j)-yo)./((Wfrd^2+zot.^2).^0.5))-
(atan((Hb-yo)./zot)-(zot./(Wfrd^2+zot.^2).^0.5).*atan((Hb-
yo)./((Wfrd^2+zot.^2).^0.5))));
  FWSdb=(Hu*Lu)./(Wfrd*(Hc(j)-yo)).*FdbWS;
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   FdbWNl=(1/(3.14159*2))*(atan(yo./zo)+atan((Hb-yo)./zo))-
(zo./(2*3.14159*((zo.^2+(LF(i,St(t))-
Wb)^2).^0.5))).*(atan(yo./((zo.^2+(LF(i,St(t))-Wb)^2).^0.5))+atan((Hb-
yo)./((zo.^2+(LF(i,St(t))-Wb)^2).^0.5)));
   FWNldb=(Hu*Lu)./(Hb*(LF(i,St(t))-Wb))*FdbWNl;
    FdbWSl=(1/(3.14159*2))*(atan(yo./zot)+atan((Hb-yo)./zot))-
(zot./(2*3.14159*((zot.^2+(LF(i,St(t))-
Wb)^2).^0.5))).*(atan(yo./((zot.^2+(LF(i,St(t))-Wb)^2).^0.5))+atan((Hb-
yo)./((zot.^2+(LF(i,St(t))-Wb)^2).^0.5)));
    FWSldb=(Hu*Lu)./(Hb*(LF(i,St(t))-Wb))*FdbWSl;
     theta3=atan((Hb-yo)/(LF(i,St(t))-Wb));
     theta4=atan(((Hc(j)-Hbw(j))-yo)/Wfrd);
     theta5=atan((Hc(j)-yo)/Wfrd);
     phi3=theta3;
     phi4=theta3;
     phi3(phi3<theta4)=0;
     phi3(phi3>theta5)=0;
     phi3(theta4<=phi3 & phi3<=theta5)=1;
     phi3=phi3.*((Hc(j)-((Hb-yo)/(LF(i,St(t))-Wb))*Wfrd)-yo);
     theta3(theta3>theta4)=10;
     theta3(theta3<=theta4)=Hbw(j);
     theta3(theta3<11)=0;
     zero2=zeros(Wb/Wu,Hb/Hu,fix(L/Lu));
     Ewh2=zero2+phi3+theta3;
     CL2=Ewh2;
     CL2(CL2>0)=1;
     Fdbdw1=(1/(3.14159*2))*(((Hc(j)-yo)./(((Hc(j)-
yo).^2+Wfrd^2).^0.5)).*atan(zo./(((Hc(j)-
yo).^2+Wfrd^2).^0.5))+(zo./((zo.^2+Wfrd^2).^0.5)).*atan((Hc(j)-
yo)./((zo.^2+Wfrd^2).^0.5)));
     Fdbdw2=(1/(3.14159*2))*(((Hc(j)-yo)./(((Hc(j)-
yo).^2+Wfrd^2).^0.5)).*atan((WF-zo)./(((Hc(j)-yo).^2+Wfrd^2).^0.5))+((WF-
zo)./(((WF-zo).^2+Wfrd^2).^0.5)).*atan((Hc(j)-yo)./(((WF-
zo).^2+Wfrd^2).^0.5)));
     Fdbdw3=(1/(3.14159*2))*(((Hc(j)-yo-Ewh2)./(((Hc(j)-yo-
Ewh2).^2+Wfrd^2).^0.5)).*atan((WF-zo)./(((Hc(j)-yo-
Ewh2).^2+Wfrd^2).^0.5))+((WF-zo)./(((WF-zo).^2+Wfrd^2).^0.5)).*atan((Hc(j)-
yo-Ewh2)./(((WF-zo).^2+Wfrd^2).^0.5)));
     Fdbdw4=(1/(3.14159*2))*(((Hc(j)-yo-Ewh2)./(((Hc(j)-yo-
Ewh2).^2+Wfrd^2).^0.5)).*atan(zo./(((Hc(j)-yo-
Ewh2).^2+Wfrd^2).^0.5))+(zo./((zo.^2+Wfrd^2).^0.5)).*atan((Hc(j)-yo-
Ewh2)./((zo.^2+Wfrd^2).^0.5)));
     Fdbdw=Fdbdw1+Fdbdw2-Fdbdw3-Fdbdw4;
     Fdwdb=(Hu*Lu)./(Ewh2*WF).*Fdbdw;
     Fdwdb=CL2.*Fdwdb;
     Fdwdb(isnan(Fdwdb))=0;
      phi4(phi4<=theta4)=0;
      phi4(phi4>theta5)=1;
      phi4=phi4.*(((Hc(j)-yo)./(Hb-yo))*(LF(i,St(t))-Wb));
      phi4(phi4<=0)=Wfrd;
      Fdbc=(1/(3.14159*2))*(atan((WF-zo)./(Hc(j)-yo))+atan(zo./(Hc(j)-yo)))-
((Hc(j)-yo)./(2*3.14159*(((Hc(j)-yo).^2+phi4.^2).^0.5))).*(atan((WF-
zo)./(((Hc(j)-yo).^2+phi4.^2).^0.5))+atan(zo./(((Hc(j)-
yo).^2+phi4.^2).^0.5)));
      Fcdb=(Hu*Lu)./(Wfrd*WF)*Fdbc;

FWdbAN=(FdbWN+FdbWNl)*(Hu*Lu)*(10^(-6));
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FWdbAS=(FdbWS+FdbWSl)*(Hu*Lu)*(10^(-6));
FWdbAM=(FdbH+Fdbdw+Fdbc)*(Hu*Lu)*(10^(-6));


%View factor of between billet/bloom upper surface and furnace
FbufWN=(1/(3.14159*2))*(atan((Wbrd+Wb-xo)./zo)+atan((Wfrd+xo)./zo))-
zo./(2*314159*((zo.^2+(Hc(j)-Hb)^2).^0.5)).*(atan((Wbrd+Wb-
xo)./((zo.^2+(Hc(j)-Hb)^2).^0.5))+atan((Wfrd+xo)./((zo.^2+(Hc(j)-
Hb)^2).^0.5)));
FWNbuf=(Lu*Wu)/((Hc(j)-Hb)*Lz(j))*FbufWN;
 FbufWS=(1/(3.14159*2))*(atan((Wbrd+Wb-xo)./(WF-zo))+atan((Wfrd+xo)./(WF-
zo)))-(WF-zo)./(2*314159*(((WF-zo).^2+(Hc(j)-Hb)^2).^0.5)).*(atan((Wbrd+Wb-
xo)./(((WF-zo).^2+(Hc(j)-Hb)^2).^0.5))+atan((Wfrd+xo)./(((WF-zo).^2+(Hc(j)-
Hb)^2).^0.5)));
 FWSbuf=(Lu*Wu)/((Hc(j)-Hb)*Lz(j))*FbufWS;
  FbufbdW1=(1/(3.14159*2))*(atan(zo./(Wbrd+Wb-xo))-(Wbrd+Wb-xo)./(((Hc(j)-
Hb)^2+(Wbrd+Wb-xo).^2).^0.5).*atan(zo./(((Hc(j)-Hb)^2+(Wbrd+Wb-
xo).^2).^0.5)));
  FbufbdW2=(1/(3.14159*2))*(atan(zo./(Wbrd+Wb-xo))-(Wbrd+Wb-xo)./(((Hc(j)-Hb-
Hbw(j))^2+(Wbrd+Wb-xo).^2).^0.5).*atan(zo./(((Hc(j)-Hb-Hbw(j))^2+(Wbrd+Wb-
xo).^2).^0.5)));
  FbufbdW3=(1/(3.14159*2))*(atan((WF-zo)./(Wbrd+Wb-xo))-(Wbrd+Wb-
xo)./(((Hc(j)-Hb)^2+(Wbrd+Wb-xo).^2).^0.5).*atan((WF-zo)./(((Hc(j)-
Hb)^2+(Wbrd+Wb-xo).^2).^0.5)));
  FbufbdW4=(1/(3.14159*2))*(atan((WF-zo)./(Wbrd+Wb-xo))-(Wbrd+Wb-
xo)./(((Hc(j)-Hb-Hbw(j))^2+(Wbrd+Wb-xo).^2).^0.5).*atan((WF-zo)./(((Hc(j)-Hb-
Hbw(j))^2+(Wbrd+Wb-xo).^2).^0.5)));
  FbufbdW=FbufbdW1-FbufbdW2+FbufbdW3-FbufbdW4;
  FbdWbuf=(Lu*Wu)/(Hbw(j)*WF)*FbufbdW;
   FbuffdW1=(1/(3.14159*2))*(atan(zo./(Wfrd+xo))-(Wfrd+xo)./(((Hc(j)-
Hb)^2+(Wfrd+xo).^2).^0.5).*atan(zo./(((Hc(j)-Hb)^2+(Wfrd+xo).^2).^0.5)));
   FbuffdW2=(1/(3.14159*2))*(atan(zo./(Wfrd+xo))-(Wfrd+xo)./(((Hc(j)-Hb-
Hfw(j))^2+(Wfrd+xo).^2).^0.5).*atan(zo./(((Hc(j)-Hb-
Hfw(j))^2+(Wfrd+xo).^2).^0.5)));
   FbuffdW3=(1/(3.14159*2))*(atan((WF-zo)./(Wfrd+xo))-(Wfrd+xo)./(((Hc(j)-
Hb)^2+(Wfrd+xo).^2).^0.5).*atan((WF-zo)./(((Hc(j)-
Hb)^2+(Wfrd+xo).^2).^0.5)));
   FbuffdW4=(1/(3.14159*2))*(atan((WF-zo)./(Wfrd+xo))-(Wfrd+xo)./(((Hc(j)-Hb-
Hfw(j))^2+(Wfrd+xo).^2).^0.5).*atan((WF-zo)./(((Hc(j)-Hb-
Hfw(j))^2+(Wfrd+xo).^2).^0.5)));
   FbuffdW=FbuffdW1-FbuffdW2+FbuffdW3-FbuffdW4;
   FfdWbuf=(Lu*Wu)/(Hfw(j)*WF)*FbuffdW;

FWbufAN=(FbufWN)*(Lu*Wu)*(10^(-6));
FWbufAS=(FbufWS)*(Lu*Wu)*(10^(-6));
FWbufAM=(FbufbdW+FbuffdW)*(Lu*Wu)*(10^(-6));

%Transmitted heat by radiation [W/(K^4)] %F value includes area and view
factor
qraddstN=SBC*(Embr+erbr)*FWdbAN.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
N(j,t)^4-Tb1.^4).*Sds; %Assuming wall temperature is the same as the
atmosphere temperature at the same position
qraddstS=SBC*(Embr+erbr)*FWdbAS.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
S(j,t)^4-Tb1.^4).*Sds;
qraddstM=SBC*(Embr+erbr)*FWdbAM.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
M(j,t)^4-Tb1.^4).*Sds;
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qradustN=SBC*(Embr+erbr)*FWubAN.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
N(j,t)^4-Tb1.^4).*Sus;
qradustS=SBC*(Embr+erbr)*FWubAS.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
S(j,t)^4-Tb1.^4).*Sus;
qradustM=SBC*(Embr+erbr)*FWubAM.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
M(j,t)^4-Tb1.^4).*Sus;

qradufN=SBC*(Embr+erbr)*FWbufAN.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
N(j,t)^4-Tb1.^4).*Scs;
qradufS=SBC*(Embr+erbr)*FWbufAS.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
S(j,t)^4-Tb1.^4).*Scs;
qradufM=SBC*(Embr+erbr)*FWbufAM.*(aea*Tb1.^3+aeb*Tb1.^2+aec*Tb1+aed+erb).*(Ta
M(j,t)^4-Tb1.^4).*Scs;

qradtotal=qraddstN+qraddstS+qraddstM+qradustN+qradustS+qradustM+qradufN+qradu
fS+qradufM;
%qradtotalcum=qradtotalcum+qradtotal;

%Overall transmitted heat
Qoverall=(qtrantotal+qcondtotal+qradtotal)*tp.*CLm(i,t);

%Specific heat
cb=asb(i,1)*Tb1.^3+asb(i,2)*Tb1.^2+asb(i,3)*Tb1+asb(i,4);
ca=asa(i,1)*Tb1.^3+asa(i,2)*Tb1.^2+asa(i,3)*Tb1+asa(i,4);
spch=Tb1;
spch(spch<=TT(i))=1;
spch(spch>TT(i))=0;
spch1=ones(Wb/Wu,Hb/Hu,fix(L/Lu))-spch;
spch=spch.*cb+spch1.*ca;

%Temperature changes [K]
dTb=Qoverall./(Ds(i)*spch.*V);
Tb1=Tb1+dTb;

end
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