LiBr\_ARS

clear all

TK=273.15;

t1=38+TK;

t2=t1;

t4=80+TK;

t8=38+TK;

t10=6+TK;

ks=0.7;

t5=t4-ks\*(t4-t2);

tt8=t8-TK;

tt10=t10-TK;

mr=0.02125;%mass fraction of refrigerant

hc=latent\_heat(tt8);%latent heat of condensation

he=latent\_heat(tt10);%latent heat of vaporization

a0=0.845;%LiBr

a1=0.538;

b0=-35.6;

b1=48.3;

cpv=1.86;

cpl=4.18;

x2=(t4-a0\*t8-b0)/(a1\*t8+b1);%mass fraction of strong solution

x1=(t1-a0\*t10-b0)/(a1\*t10+b1);%mass fraction of weak solution

t3a=(a1\*x1+a0)\*t8+(b1\*x1+b0);

t6a=(a1\*x2+a0)\*t10+(b1\*x2+b0);

t6=t5;

t45=(t4+t5)/2-TK;

cp45=libr\_birerong(t45,x2);

fa=x2/(x2-x1);

ms=mr\*fa;

t3=(ms-mr)\*(t4-t5)/ms+t2;

tol=1;

while tol>0.01

t23=(t3+t2)/2-TK;

cp23=libr\_birerong(t23,x1);

t31=(ms-mr)\*(t4-t5)\*cp45/ms/cp23+t2;

tol=abs(t31-t3);

t3=t31;

end

ag=((t4+t3a)/2/t8)^2/(a1\*(x1+x2)/2+a0);

aa=((t6a+t1)/t10/2)^2/(a1\*(x1+x2)/2+a0);

tv=t4;

t43=(t4+t3)/2-TK;

t51=(t5+t1)/2-TK;

t56=(t5+t6a)/2-TK;

cp1=libr\_birerong(t51,x1);

cp2=libr\_birerong(t43,x1);

cp3=libr\_birerong(t56,x2);

Qg=ms\*cp2\*(t4-t3)+mr\*(ag\*hc+cpv\*(tv-t4));

Qa=ms\*cp1\*(t5-t1)+mr\*(aa\*he+cpv\*(t10-t1)-cp3\*(t5-t6a));

Qc=mr\*(hc+cpv\*(tv-t8));

Qe=mr\*(he-cpl\*(t8-t10));

Qs=cp45\*(ms-mr)\*(t4-t5);

cop=Qe/Qg;

A=[Qg;Qa;Qc;Qe;Qs;cop];

LiBr\_ARS\_50

clear all

%Input given data

UAa=6.0485;

UAc=10.3873;

UAg=5.2875;

UAe=12.5657;

UAs=2.0087;

m11=2.4305;

m13=3.2926;

m15=2.5305;

m17=2.3923;

%Input value

%Assume values t10 t8 t4 t5 t1 change with input values

t11=91;

t13=30;

t15=30;

t17=13;

%Constant

a0=0.845;%LiBr

a1=0.538;

b0=-35.6;

b1=48.3;

cpv=1.86;%specific heat capacity of vapor

cpw=4.18;%specific heat capacity of water

ms=0.5004;%mass fraction of solution pump

TK=273.15;

%Calculation

t10=6\*ones(1,4);%assume t10,¡æ,set as last output

tol5=1;

n5=1;

while tol5>0.01

he=latent\_heat(t10(n5));

t8=38\*ones(1,4);%assume t8,¡æ,set as last output

tol4=1;

n4=1;

while tol4>0.01

hc=latent\_heat(t8(n4));

t4=80\*ones(1,4);%assume t4,¡æ,set as last output

tol3=1;

n3=1;

while tol3>0.01

T4=t4(n3)+TK;

T8=t8(n4)+TK;

x2=(T4-a0\*T8-b0)/(a1\*T8+b1);%mass fraction of strong solution

T10=t10(n5)+TK;

t6a=(a1\*x2+a0)\*T10+(b1\*x2+b0);

t5=50.6\*ones(1,4);%assume t5,¡æ,set as last output

tol2=1;

n2=1;

while tol2>0.01

t45=(t4(n3)+t5(n2))/2;

cp45=libr\_birerong(t45,x2);

t1=38\*ones(1,4);%assume t1,¡æ,set as last output

tol1=1;

n1=1;

while tol1>0.01

T1=t1(n1)+TK;

x1=(T1-a0\*T10-b0)/(a1\*T10+b1);%mass fraction of weak solution

fa=x2/(x2-x1);%circulation ratio

mr=ms/fa;%mass fraction of refrigerant

t3a=(a1\*x1+a0)\*T8+(b1\*x1+b0);

ag=((T4+t3a)/2/T8)^2/(a1\*(x1+x2)/2+a0);

aa=((t6a+T1)/T10/2)^2/(a1\*(x1+x2)/2+a0);

%Absorber

t51=(t5(n2)+t1(n1))/2;

t56=(t5(n2)+t6a-TK)/2;

cp1=libr\_birerong(t51,x1);

cp3=libr\_birerong(t56,x2);

Qa=ms\*cp1\*(t5(n2)-t1(n1))+mr\*(aa\*he+cpv\*(t10(n5)-t1(n1))-cp3\*(t5(n2)-t6a+TK));

t14=Qa/(m13\*cpw)+t13;

A=(Qa/UAa)^3;

f1=@(y1)(t5(n2)-t14)\*(y1-t13)\*((t5(n2)-t14)+(y1-t13))/2-A;

t1(n1+1)=fzero(f1,38);

n1=n1+1;

if n1==3

t1(4)=(t1(1)\*t1(3)-t1(2)^2)/(t1(3)-2\*t1(2)+t1(1));

tol1=abs(t1(4)-t1(1));

t1(1)=t1(4);

n1=1;

end

end

tt1=t1(4);%Çó³öt1µÄÖµ

%Solution heat exchanger

Qs=(fa-1)\*mr\*(t4(n3)-t5(n2))\*cp45;

cp23=libr\_birerong(tt1,x1);

t3=Qs/ms/cp23+tt1;

tol6=1;

while tol6>0.01

t23=(t3+tt1)/2;

cp23=libr\_birerong(t23,x1);

tt3=Qs/ms/cp23+tt1;

tol6=abs(tt3-t3);

t3=tt3;

end

B=(Qs/UAs)^3;

f2=@(y2)(t4(n3)-t3)\*(y2-tt1)\*((t4(n3)-t3)+(y2-tt1))/2-B;

t5(n2+1)=fzero(f2,50);

n2=n2+1;

if n2==3

t5(4)=(t5(1)\*t5(3)-t5(2)^2)/(t5(3)-2\*t5(2)+t5(1));

tol2=abs(t5(4)-t5(1));

t5(1)=t5(4);

n2=1;

end

end

tt5=t5(4);

%Generator

t43=(t4(n3)+t3)/2;

cp2=libr\_birerong(t43,x1);

Qg=ms\*cp2\*(t4(n3)-t3)+mr\*ag\*hc;

t12=t11-Qg/(m11\*cpw);

C=(Qg/UAg)^3;

f3=@(y3)(t12-t3)\*(t11-y3)\*((t12-t3)+(t11-y3))/2-C;

t4(n3+1)=fzero(f3,80);

n3=n3+1;

if n3==3

t4(4)=(t4(1)\*t4(3)-t4(2)^2)/(t4(3)-2\*t4(2)+t4(1));

tol3=abs(t4(4)-t4(1));

t4(1)=t4(4);

n3=1;

end

end

tt4=t4(4);

%Condenser

Qc=mr\*(hc+cpv\*(tt4-t8(n4)));

t16=t15+Qc/(m15\*cpw);

D=(Qc/UAc)^3;

f4=@(y4)(y4-t15)\*(y4-t16)\*((y4-t15)+(y4-t16))/2-D;

t8(n4+1)=fzero(f4,38);

n4=n4+1;

if n4==3

t8(4)=(t8(1)\*t8(3)-t8(2)^2)/(t8(3)-2\*t8(2)+t8(1));

tol4=abs(t8(4)-t8(1));

t8(1)=t8(4);

n4=1;

end

end

tt8=t8(4);

%Evaporator

Qe=mr\*(he-cpw\*(tt8-t10(n5)));

t18=t17-Qe/(m17\*cpw);

E=(Qe/UAe)^3;

f5=@(y5)(t17-y5)\*(t18-y5)\*((t17-y5)+(t18-y5))/2-E;

t10(n5+1)=fzero(f5,6);

n5=n5+1;

if n5==3

t10(4)=(t10(1)\*t10(3)-t10(2)^2)/(t10(3)-2\*t10(2)+t10(1));

tol5=abs(t10(4)-t10(1));

t10(1)=t10(4);

n5=1;

end

end

tt10=t10(4);

tt2=tt1;

tt6=tt5;

tt7=tt4;

tt9=tt10;

cop=Qe/Qg;

%Output

F=[Qg;Qa;Qc;Qe;Qs;cop];

G=[tt1;tt2;t3;tt4;tt5;tt6;tt7;tt8;tt9;tt10];

H=[t12;t14;t16;t18];

Licl\_ARS

clear all

TK=273.15;

t1=38+TK;

t2=t1;

t4=80+TK;

t8=38+TK;

t10=6+TK;

ks=0.7;

t5=t4-ks\*(t4-t2);

tt8=t8-TK;

tt10=t10-TK;

mr=0.02125;%mass fraction of refrigerant

hc=latent\_heat(tt8);%latent heat of condensation

he=latent\_heat(tt10);%latent heat of vaporization

a0=0.988;%Licl

a1=0.304;

b0=-27.9;

b1=59.3;

cpv=1.86;

cpl=4.18;

x2=(t4-a0\*t8-b0)/(a1\*t8+b1);%mass fraction of strong solution

x1=(t1-a0\*t10-b0)/(a1\*t10+b1);%mass fraction of weak solution

t3a=(a1\*x1+a0)\*t8+(b1\*x1+b0);

t6a=(a1\*x2+a0)\*t10+(b1\*x2+b0);

t6=t5;

t45=(t4+t5)/2-TK;

cp45=licl\_birerong(t45,x2);

fa=x2/(x2-x1);

ms=mr\*fa;

t3=(ms-mr)\*(t4-t5)/ms+t2;

tol=1;

while tol>0.01

t23=(t3+t2)/2-TK;

cp23=licl\_birerong(t23,x1);

t31=(ms-mr)\*(t4-t5)\*cp45/ms/cp23+t2;

tol=abs(t31-t3);

t3=t31;

end

ag=((t4+t3a)/2/t8)^2/(a1\*(x1+x2)/2+a0);

aa=((t6a+t1)/t10/2)^2/(a1\*(x1+x2)/2+a0);

tv=t4;

t43=(t4+t3)/2-TK;

t51=(t5+t1)/2-TK;

t56=(t5+t6a)/2-TK;

cp1=licl\_birerong(t51,x1);

cp2=licl\_birerong(t43,x1);

cp3=licl\_birerong(t56,x2);

Qg=ms\*cp2\*(t4-t3)+mr\*(ag\*hc+cpv\*(tv-t4));

Qa=ms\*cp1\*(t5-t1)+mr\*(aa\*he+cpv\*(t10-t1)-cp3\*(t5-t6a));

Qc=mr\*(hc+cpv\*(tv-t8));

Qe=mr\*(he-cpl\*(t8-t10));

Qs=cp45\*(ms-mr)\*(t4-t5);

cop=Qe/Qg;

A=[Qg;Qa;Qc;Qe;Qs;cop];

Licl\_ARS\_50

clear all

%Input given data

UAa=5.829;

UAc=10.387;

UAg=4.973;

UAe=12.566;

UAs=1.323;

m11=2.3408;

m13=3.173;

m15=2.5305;

m17=2.3923;

%Input value

%Assume values t10 t8 t4 t5 t1 change with input values

t11=91;

t13=30;

t15=30;

t17=13;

%Constant

a0=0.988;%Licl

a1=0.304;

b0=-27.9;

b1=59.3;

cpv=1.86;%specific heat capacity of vapor

cpw=4.18;%specific heat capacity of water

ms=0.25584;%mass fraction of solution pump

TK=273.15;

%Calculation

t10=6\*ones(1,4);%assume t10,¡æ,set as last output

tol5=1;

n5=1;

while tol5>0.01

he=latent\_heat(t10(n5));

t8=38\*ones(1,4);%assume t8,¡æ,set as last output

tol4=1;

n4=1;

while tol4>0.01

hc=latent\_heat(t8(n4));

t4=80\*ones(1,4);%assume t4,¡æ,set as last output

tol3=1;

n3=1;

while tol3>0.01

T4=t4(n3)+TK;

T8=t8(n4)+TK;

x2=(T4-a0\*T8-b0)/(a1\*T8+b1);%mass fraction of strong solution

T10=t10(n5)+TK;

t6a=(a1\*x2+a0)\*T10+(b1\*x2+b0);

t5=50.6\*ones(1,4);%assume t5,¡æ,set as last output

tol2=1;

n2=1;

while tol2>0.01

t45=(t4(n3)+t5(n2))/2;

cp45=licl\_birerong(t45,x2);

t1=38\*ones(1,4);%assume t1,¡æ,set as last output

tol1=1;

n1=1;

while tol1>0.01

T1=t1(n1)+TK;

x1=(T1-a0\*T10-b0)/(a1\*T10+b1);%mass fraction of weak solution

fa=x2/(x2-x1);%circulation ratio

mr=ms/fa;%mass fraction of refrigerant

t3a=(a1\*x1+a0)\*T8+(b1\*x1+b0);

ag=((T4+t3a)/2/T8)^2/(a1\*(x1+x2)/2+a0);

aa=((t6a+T1)/T10/2)^2/(a1\*(x1+x2)/2+a0);

%Absorber

t51=(t5(n2)+t1(n1))/2;

t56=(t5(n2)+t6a-TK)/2;

cp1=licl\_birerong(t51,x1);

cp3=licl\_birerong(t56,x2);

Qa=ms\*cp1\*(t5(n2)-t1(n1))+mr\*(aa\*he+cpv\*(t10(n5)-t1(n1))-cp3\*(t5(n2)-t6a+TK));

t14=Qa/(m13\*cpw)+t13;

A=(Qa/UAa)^3;

f1=@(y1)(t5(n2)-t14)\*(y1-t13)\*((t5(n2)-t14)+(y1-t13))/2-A;

t1(n1+1)=fzero(f1,36);

n1=n1+1;

if n1==3

t1(4)=(t1(1)\*t1(3)-t1(2)^2)/(t1(3)-2\*t1(2)+t1(1));

tol1=abs(t1(4)-t1(1));

t1(1)=t1(4);

n1=1;

end

end

tt1=t1(4);%Çó³öt1µÄÖµ

%Solution heat exchanger

Qs=(fa-1)\*mr\*(t4(n3)-t5(n2))\*cp45;

cp23=licl\_birerong(tt1,x1);

t3=Qs/ms/cp23+tt1;

tol6=1;

while tol6>0.01

t23=(t3+tt1)/2;

cp23=licl\_birerong(t23,x1);

tt3=Qs/ms/cp23+tt1;

tol6=abs(tt3-t3);

t3=tt3;

end

B=(Qs/UAs)^3;

f2=@(y2)(t4(n3)-t3)\*(y2-tt1)\*((t4(n3)-t3)+(y2-tt1))/2-B;

t5(n2+1)=fzero(f2,50);

n2=n2+1;

if n2==3

t5(4)=(t5(1)\*t5(3)-t5(2)^2)/(t5(3)-2\*t5(2)+t5(1));

tol2=abs(t5(4)-t5(1));

t5(1)=t5(4);

n2=1;

end

end

tt5=t5(4);

%Generator

t43=(t4(n3)+t3)/2;

cp2=licl\_birerong(t43,x1);

Qg=ms\*cp2\*(t4(n3)-t3)+mr\*ag\*hc;

t12=t11-Qg/(m11\*cpw);

C=(Qg/UAg)^3;

f3=@(y3)(t12-t3)\*(t11-y3)\*((t12-t3)+(t11-y3))/2-C;

t4(n3+1)=fzero(f3,80);

n3=n3+1;

if n3==3

t4(4)=(t4(1)\*t4(3)-t4(2)^2)/(t4(3)-2\*t4(2)+t4(1));

tol3=abs(t4(4)-t4(1));

t4(1)=t4(4);

n3=1;

end

end

tt4=t4(4);

%Condenser

Qc=mr\*(hc+cpv\*(tt4-t8(n4)));

t16=t15+Qc/(m15\*cpw);

D=(Qc/UAc)^3;

f4=@(y4)(y4-t15)\*(y4-t16)\*((y4-t15)+(y4-t16))/2-D;

t8(n4+1)=fzero(f4,38);

n4=n4+1;

if n4==3

t8(4)=(t8(1)\*t8(3)-t8(2)^2)/(t8(3)-2\*t8(2)+t8(1));

tol4=abs(t8(4)-t8(1));

t8(1)=t8(4);

n4=1;

end

end

tt8=t8(4);

%Evaporator

Qe=mr\*(he-cpw\*(tt8-t10(n5)));

t18=t17-Qe/(m17\*cpw);

E=(Qe/UAe)^3;

f5=@(y5)(t17-y5)\*(t18-y5)\*((t17-y5)+(t18-y5))/2-E;

t10(n5+1)=fzero(f5,6);

n5=n5+1;

if n5==3

t10(4)=(t10(1)\*t10(3)-t10(2)^2)/(t10(3)-2\*t10(2)+t10(1));

tol5=abs(t10(4)-t10(1));

t10(1)=t10(4);

n5=1;

end

end

tt10=t10(4);

tt2=tt1;

tt6=tt5;

tt7=tt4;

tt9=tt10;

cop=Qe/Qg;

%Output

F=[Qg;Qa;Qc;Qe;Qs;cop];

G=[tt1;tt2;t3;tt4;tt5;tt6;tt7;tt8;tt9;tt10];

H=[t12;t14;t16;t18];

latent\_heat

function h=latent\_heat(t)

a=[0.014615072315;4.20542536016;-7.03894624e-4;7.94732605e-6;-3.1034444e-8;7.9997e-11];

x=rot90(a,2);

h1=polyval(x,t);

b=[2500.904774201;1.83443741725;-3.47293054e-4;-2.0969031e-6;-3.5911751e-8;3.8508e-11];

y=rot90(b,2);

h2=polyval(y,t);

h=h2-h1;

libr\_birerong

function cp=libr\_birerong(t,k)

a=[4.07;-5.123;2.297];

b=[9.92e-4;6.29e-3;-9.38e-3];

c=[-1.1988e-5;4.3855e-6;1.2567e-5];

for i=1:3

p(i)=a(i)+b(i)\*t+c(i)\*t^2;

end

v=rot90(p,2);

cp=polyval(v,k);

licl\_birerong

function cp=licl\_birerong(t,x)

T=t+273.15;

tao=T/228-1;

a=[1.43980;-1.24317;-0.12070;0.12825;0.62934;58.5225;-105.6343;47.7948];

b=[88.7891;-120.1958;-16.9264;52.4654;0.10826;0.46988];

cps=b(1)+b(2)\*tao^0.02+b(3)\*tao^0.04+b(4)\*tao^0.06+b(5)\*tao^1.8+b(6)\*tao^8;

f1=a(6)\*tao^0.02+a(7)\*tao^0.04+a(8)\*tao^0.06;

f2=a(4)+a(5)\*x;

cp=cps\*(1-f1\*f2);