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#include <iostream.h>
#include <math.h>

//Modelling of heat transfer and optimum choice of TECs
//for optimum COP based on optimum current
//Calculation of right number of thermal couples for optimum current

double a,p,k,Z;
//a is Seebeck coefficient; p is resistivity;
//k is thermal conductivity; Z is Figure of merit;
double Th,Tc,G,Qh,Qc;
//Th is hot side temperature; Tc is cold side temperature;
//G is geometry factor;
//Qc is cooling capacity;
//Qh is heating capacity;
int N;
//N is the number of the thermal couples;
int selection;
//selection==1 for cooling mode;selection==2 for heating mode;
double Tm,deltT,Iopt,COP,V;
//Tm is average temperature;deltT is temperature difference;
//Iopt is optimum current(=operating current);
//V is operating voltage;
main()
{
cout<<"the hot side temperature(oC),Th=";
cin>>Th;
Th=Th+273.15;
cout<<"the cold side temperature(oC),Tc=";
cin>>Tc;
Tc=Tc+273.15;
Tm=(Th+Tc)/2;
a=22224.0e-9+930.6e-9*Tm-0.9905e-9*Tm*Tm;
p=5112.0e-8+163.4e-8*Tm+0.6279e-8*Tm*Tm;
k=62605.0e-6-277.7e-6*Tm+0.4131e-6*Tm*Tm;
Z=a*a/(p*k);
cout<<"the geometry factor,G=";
cin>>G;
deltT=Th-Tc;
Iopt=(k*deltT*G*(1+sqrt(1+Z*Tm)))/(a*Tm);
cout<<"Your selection (cooling=1;heating=2)=";
cin>>selection;
if(selection==1)
{
cout<<"the cooling capacity(W),Qc=";
cin>>Qc;
N=0.5*Qc/(a*Iopt*Tc-Iopt*Iopt*p/(2*G)-k*deltT*G);
COP=(Tm/deltT)*((sqrt(1+Z*Tm)-1)/(sqrt(1+Z*Tm)+1))-0.5;
V=2*N*(Iopt*p/G+a*deltT);
}
else
{
cout<<"the heating capacity(W),Qh=";
cin>>Qh;
N=0.5*Qh/(a*Iopt*Th+Iopt*Iopt*p/(2*G)-k*deltT*G);
COP=1+(Tm/deltT)*((sqrt(1+Z*Tm)-1)/(sqrt(1+Z*Tm)+1))-0.5;
V=2*N*(Iopt*p/G+a*deltT);
}
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cout<<"optimum current(=operating current),Iopt="<<Iopt<<"\n";
cout<<"number of thermal couples,N="<<N<<"\n";
cout<<"coefficient of performance,COP="<<COP<<"\n";
cout<<"operating voltage, V="<<V<<"\n";
return 0;
}
```