clear, clc

% Jeffery Schons project 2 aero 261

tic

%read in the geometric altiture, velocity and time

table=dlmread('ReentryInput.txt',' ');

hg=table(:,1);

Vtable=table(:,2);

time=table(:,3);

numbofelements=length(table);

constants=dlmread('constants.txt',',');

costanttable=constants(:,1);

%T=tempiture

Tsl=costanttable(1);

%Tsl=288.16;

%D=density

Dsl=costanttable(2);

%Dsl=1.225;

%P=presure

Psl=costanttable(3);

%Psl=1.01325\*10^5;

go=costanttable(4);

%go=9.80665;

%Length of

L=costanttable(5);

%L=56.05;

%C1,C2=constants that depend on the gas

C1=constants(6);

%C1=1.456\*(10^(-6));

C2=costanttable(7);

%C2=110.3;

%Y= ratio of specific heats of the gas

Y=costanttable(8);

%Y=1.4;

%Specific gas constant of air

RG=costanttable(9);

%RG=287;

%radius of earth in m

Re=costanttable(10);

%Re=6371.0008\*1000;

%u= dynamic viscosity of a fluid

%M= Mach number

%a=speed of sound for an ideal gas

for i=1:numbofelements

hgi=hg(i);

[h]= geometric\_to\_geopoterntial(hgi,Re);

V=Vtable(i);

T1=Tsl;

D1=Dsl;

P1=Psl;

if h<11000

[T,D,P] = gradient\_region(T1,-6.5\*(10^(-3)),h,D1,go,RG,P1);

Temp(i)=T;

Pres(i)=P;

Dens(i)=D;

[a] = speed\_of\_sound(Y,RG,T);

[M] = Mach\_number(V,a);

Mach(i)=M;

[u] = dynamic\_viscosity(C1,C2,T);

[Re] = Reymonds\_number(D,V,L,u);

Reymonds(i)=Re;

else

[T,D,P] = gradient\_region(T1,-6.5\*(10^(-3)),11000,D1,go,RG,P1);

T1=T;

P1=P;

D1=D;

if h<25000

[P,D] = isothermal\_region(P1,D1,go,T1,RG,h,11000);

Temp(i)=T;

Pres(i)=P;

Dens(i)=D;

[a] = speed\_of\_sound(Y,RG,T);

[M] = Mach\_number(V,a);

Mach(i)=M;

[u] = dynamic\_viscosity(C1,C2,T);

[Re] = Reymonds\_number(D,V,L,u);

Reymonds(i)=Re;

else

T1=T;

P1=P;

D1=D;

end

end

end

%disp(Reymonds)

%output is a Re vs. Hg graph, M vs. Hg. graph

%Table=[hg; hightHg; Temp; Pres; Dens; M; Re];

%disp('note: sl is short for sea level')

%disp('geometric altitude(m) Temperature(k) pressure(N/m^2) Density(kg/m^3) Mach number Reymonds\_number')

%fprintf('\n')

%fprintf('\t%5.0f \t\t\t\t\t%7.2f \t\t\t%7.2f \t\t%7.2f \t\t%7.2f \t\t\t%4.3f \n',Table)

figure(1)

plot(Reymonds, hg)

title('Plot of geometric vs Reymonds\_number')

xlabel('Reymonds\_number')

ylabel('geometric altitude')

figure(2)

plot(Mach, hg)

title('Plot of geometric vs Mach number')

xlabel('Mach number')

ylabel('geometric altitude')

toc

function [h]= geometric\_to\_geopoterntial(hg,Re)

%calculates geopoterntial altitude from geometric

h=(Re/(Re+hg))\*hg;

end

function [T,D,P] = gradient\_region(T1,a,h,D1,go,R,P1)

%calculates tempiture, presure and density in gradiunt region

T=T1+(a\*h);

D=D1\*((T/T1)^((-go/(a\*R)-1)));

P=P1\*((T/T1)^((-go/(a\*R))));

End

function [P,D] = isothermal\_region(Pcal,Dcal,go,Tcal,R,h,h1)

%calculates presure and density in isobaric region

P=Pcal\*(exp(1)^((-go/(Tcal\*R))\*(h-h1)));

D=Dcal\*(exp(1)^((-go/(Tcal\*R))\*(h-h1)));

End

function [a] = speed\_of\_sound(Y,RG,T)

%calculates speed of sound

a=(Y\*RG\*T).^(1/2);

end

function [M] = Mach\_number(V,a)

%calculates Reymonds number

M=V./a;

End

function [u] = dynamic\_viscosity(C1,C2,T)

%calculates Reymonds number

u=C1\*((T.^(3/2))./(T+C2));

end

function [Re] = Reymonds\_number(D,V,L,u)

%calculates Reymonds number

Re=(D\*V\*L)/u;

end

**Output:**

Elapsed time is 0.282681 seconds.



