```
clear all; close all; clc; format long;
name = 'Mayuki Adam Sasagawa';

global r A p g dT
r=0.2; A=pi*r^2; p=1.2; g = 9.81; dT = 0.005;
numberofmissile = 7;
T = cell(1,7);X = cell(1,7);Y = cell(1,7);Z = cell(1,7);U = cell(1,7);
V = cell(1,7);W = cell(1,7);
for i = 1:numberofmissile
    [X0,Y0,Z0,m0,mf,Thmag0,theta,phi,Tburn] = read_input('missile_data.txt',i);
    [T{i}, X{i}, Y{i}, Z{i}, U{i}, V{i}, W{i}] = missile(X0,Y0,Z0,m0,mf,...
        Thmag0,theta,phi,Tburn);
end
%% Task 1: Create 3 figures based on simulation results: fig1: Trajectories, fig2: Mach vs. Time, fig3: Altitude vs. Mach
color = 'krbgmcy';
figure(1);hold on;
for i = 1:numberofmissile
    plot3(X{i}/1000, Y{i}/1000, Z{i}/1000,color(i));
end
legendz = cell(1,7);
for i = 1:numberofmissile
   legendz{i} = sprintf('M.%1.0f',i);
end
legend(legendz,'location','Northeast');
for i = 1:numberofmissile
    plot3(X{i}(end)/1000,Y{i}(end)/1000,Z{i}(end)/1000,'ro', 'MarkerSize'...
        ,10,'MarkerFaceColor',color(i),'MarkerEdgeColor',color(i));
end

load('terrain.mat')
surf(x_terrain/1000, y_terrain/1000, h_terrain/1000);
shading interp; hold off
xlabel('x (km)'); ylabel('y (km)'); zlabel('z (km)');
view(3); axis([0 30 0 30 0 3.5]); grid on;
set(gca,'LineWidth',2,'FontSize',16,'Xtick',0:5:30,'Ytick',0:5:30,'Ztick',0:.5:3.5);
title('Missile Trajectories')

figure(2);
subplot(2,1,1)
hold on
Vmag = cell(1,7); Ma = cell(1,7);
for i = 1:numberofmissile
    Vmag{i} = sqrt(U{i}.^2+V{i}.^2+W{i}.^2);
    Ma{i} = Vmag{i}/340;
    plot(T{i},Ma{i},color(i),'Linewidth',1.75);
end
axis([0 60 0 8]); grid on; ylabel('Ma');
title('Evolution of Speed and Acceleration')
%% Figure 2
subplot(2,1,2)
hold on
Acc = cell(1,7);
for i = 1:numberofmissile
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    Acc{i} = diff(Vmag{i})/0.005;
    plot(T{i}(1:end-1),Acc{i}/g,color(i),'Linewidth',1.75)
end
legend(legendz,'location','Northeast');
ylabel('Acc/g'); xlabel('Time (s)');
axis([0 60 -120 50]); grid on;
%% Figure 3
figure(3);hold on;
for i = 1:numberofmissile
    plot(Ma{i},Z{i}/1000,color(i),'Linewidth',1.75);
end
for i = 1:numberofmissile
    for j = 3:length(Ma{i})
        if ((Ma{i}(j-2)-1) <= 0 && (Ma{i}(j)-1)>=0) || ((Ma{i}(j-2)-1) >= 0 && (Ma{i}(j)-1) <= 0)
            plot(Ma{i}(j-1), Z{i}(j-1)/1000,'ro', 'MarkerSize',...
                10,'MarkerFaceColor',color(i),'MarkerEdgeColor',color(i));
        end
    end
end
legend(legendz,'location','Northeast');
axis([0 9 0 3.5]); grid on; ylabel('Altitude (km)'); xlabel('Ma');
title('Sonic Barrier')
hold off




%% Task 2: Create a 7-element data structure named flightstat----------------------------------------------------------------
flight_stat(7) = struct('missile_ID',[],'landing_time',[],'travel_distance',...
    [],'max_height_position',[],'max_height_Ma',[],'max_height_Acc',[],...
    'landing_location',[],'landing_Ma',[],'landing_Acc',[]);
travel_distance = cell(1,7);
landing_Acc = cell(1,7);
landing_Speed = cell(1,7);
for i=1:numberofmissile
    travel_distance{i} = sum(sqrt(diff(X{i}).^2+diff(Y{i}).^2+diff(Z{i}).^2));
    MHP = find(Z{i}==max(Z{i}));
    MaxHeight = [X{i}(MHP) Y{i}(MHP) Z{i}(MHP)];
    landing_location = [X{i}(end) Y{i}(end) Z{i}(end)];
    max_height_Ma = Ma{i}(MHP);
    max_height_Acc = Acc{i}(MHP);
    landing_Ma = Ma{i}(end);
    landing_Acc{i} = Acc{i}(end);
    flight_stat(i)=struct('missile_ID',i,'landing_time',T{i}(end),...
        'travel_distance',travel_distance{i},'max_height_position',...
        MaxHeight,'max_height_Ma',max_height_Ma,'max_height_Acc',...
        max_height_Acc,'landing_location',landing_location,'landing_Ma'...
        ,landing_Ma,'landing_Acc',landing_Acc{i});
end
```

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%% Task 2: Use function fprintf to create a text file named report.txt ----------------------------------------------------------------
filename='report.txt';
fid = fopen(filename,'w');
fprintf(fid,'%s \n %s \n %s,%s,%s,%s,%s',name,id,'M_ID','landing time (s)','travel distance (m)','landing speed
(m/s)','landing acceleration (m/s^2)');
for i = 1:numberofmissile
    fprintf(fid,'\n M.%1.0f %15.9e %15.9e %15.9e %15.9e',i,T{i}(end),travel_distance{i},Vmag{i}(end),landing_Acc{i});
 end
fclose(fid);
%% Things to fix
p1a ='See figure 1';
p1b ='See figure 2';
p1c ='See figure 3';
p2a = flight_stat(1);
p2b = flight_stat(2);
p2c = flight_stat(3);
p2d = flight_stat(4);
p2e = flight_stat(5);
p2f = flight_stat(6);
p2g = flight_stat(7);
p3 = evalc('type report.txt');
```