|  |  |  |
| --- | --- | --- |
| Fuel in kg | Altitude in mi | Velocity in mph |
| 1200 | 1453.54 | 27075.99 |
| 1201 | 1527.28 | 28299.76 |
| 1205 | 1516.68 | 28074.51 |
| 1208 | 1508.79 | 27907.37 |
| 1209 | 1506.17 | 27851.99 |
| 1210 | 1503.56 | 27796.78 |
| 1225 | 1541.16 | 28251.91 |
| 1250 | 1551.78 | 28114.57 |
| 1300 | 1571.21 | 27931.79 |
| 1400 | 1680.01 | 28664.72 |

I think that the minimum amount of fuel that we need to get the rocket to at least 1500 mi is 1201 kg of fuel. After repeated runs of the simulation, 1201 kg of fuel is the minimum amount of fuel that gets the rocket at least past 1500m.

General Code:

% Rocket Project, Take 1

% Deepak Warrier

% September 22, 2016

clc;

clear all;

close all;

g = 9.8; % acceleration of gravity

thrust = 25000; % thrust of the rocket motor in Newtons (kg\*m/s^2)

rocketMass = 400; % mass of the rocket itself in kg

fuel = 1201; % mass of fuel in kg

burnRate = 2; % rate of rocket fuel burn in kg/second

mass = rocketMass+fuel; % mass of the rocket in kg

%burnTime = 30; % burn time of the rocket in seconds

stopTime = 300; % time (in seconds) when the simulation stops

timeStep = 10; % time step size for the simulation (every 0.1 seconds)

v(1) = 0; % rocket velocity in m/s

vY(1) = 0; % Velocity in x direction

vX(1)= 0; % Velocity in y direction

downRange(1) = 0; % rocket downRange in m

altitude(1) = 0; % rocket altitude in m

time(1) = 0; % time since launch, in seconds

fuel(1)=fuel;

angle = 85;

earth = 6400000; % Earth's radius in meters

g(1) = 9.8; % acceleration of gravity

i=1;

while(fuel(i)>0)

if(fuel(i)>0)

vY(i+1)=vY(i)+((thrust\*sind(angle))/mass-g(i))\*timeStep;

vX(i+1)=vX(i)+(thrust\*cosd(angle)/mass)\*timeStep;

else

vY(i+1)=vY(i)-g\*(timeStep);

vX(i+1)=vX(i);

end

avgVelY=(vY(i+1)+vY(i))/2;

avgVelX=(vX(i+1)+vX(i))/2;

v(i)=(vX(i+1)^2+vY(i+1)^2)^.5;

downRange(i+1)=downRange(i)+avgVelX\*timeStep;

altitude(i+1)=altitude(i)+avgVelY\*timeStep;

time(i+1)=time(i)+timeStep;

fuel(i+1)=fuel(i)-timeStep\*burnRate;

mass=rocketMass+fuel(i+1);

g(i+1)= ((earth^2)\*g(1))/((altitude(i+1)+earth)^2);

i=i+1;

end

printf('\n');

disp(fuel(1))

printf('Max Altitude: %.2f m\n', max(altitude));

printf('Max Down Range: %.2f m\n', max(downRange));

printf('Max Altitude: %.2f mi\n', (max(altitude)/1609.34));

printf('Max Down Range: %.2f mi\n', (max(downRange)/1609.34));

printf('Max Velocity: %.2f m/s\n', (max(v)));

printf('Max Velocity: %.2f mph\n', (max(v)\*2.23694));

%disp(min(g));

%max(altitude)

%max(downRange)

%max(time)

plot(time, altitude, time, downRange);

title('Altitude/Distance v. Time @ 80 degrees');

xlabel('Time (in seconds)');

ylabel('Altitude/Distance (in meters)');

legend('Altitude','Distance');