clear all;
close all;
cic

%Graphing velocity and position as function of time in 1/4 mile
%acceleration

%Parameters
M=800*0.45359;  %mass of vehicle - kg
theta=0;  %Grade angle
A_f=0.65032128;  %frontal area - m^2
C_d=0.45;  %Drag coefficient
C_r=0.04;  %Rolling resistance
T_m=25;  %Engine torque - N-m
rho_a=1.2;  %Density of air - kg/m^3
G_r=25;  %Gear ratio
r_w=10*0.0254;  %Wheel radius - in converted to m
q=9.81;  %Gravity - m/s^2
N_max=12000;  %Maximum engine speed RPM
eta_d=0.85;  %driveline efficiency

%Governing Equations
% F_t=T_m*(G_r/r_w);  %Force from motor - N
F_g=M*g*sin(theta);  %Force from gravity -N
F_r=C_r*M*g*cos(theta);  %Resistance Force - N

%Initial Conditions
x(1)=0;
v(1)=0;
t(1)=0;
DT=0.001;
i=2;
DV(i)=0;

%The if then statements inside of this loop are what allowed me to play
%around with shift points based on rpm or time or distance. In the code
%shown below it is currently set up to shift based on the maximum rpm of
%the engine. It then runs through the loop again in the new gear until it
%hits max rpm again then it shifts to the next and so on.

while x(i-1)<75
    F_d(i)=0.5*C_d*rho_a*A_f*v(i-1)^2;
    DV(i-1)=(1/M)*eta_d*((T_m*(G_r/r_w))-(F_d(i)+F_g+F_r));  %acceleration
    DX=v(i-1);  
v(i)=v(i-1)+DV(i-1)*DT;
x(i)=x(i-1)+DX*DT;
t(i)=t(i-1)+DT;
    RPM(i)=v(i-1)*((G_r*60)/(2*pi*r_w));
end

%Each if loop defines the gear ratio based on engine RPM

file:///E:/classes/ME433/html/hw4.html
if RPM(i) >= 12000
    G_r = 15;
end

if RPM(i) >= N_max
    G_r = 15;
end
i = i + 1;
end

% Total time to race 75 meter track
G_r = 15;

% Total time to race 75 meter track
RPM_end = RPM(end) % engine rpm at end of track
Gr_end = G_r(end) % gear ratio at end of track

[AX,HL,H2]=plotyy(t,x,t,v,'plot'); % plot of velocity and position vs time
set(ax1,'XTickLabel',{'String', 'Distance (m)'},
    set(ax2,'YTickLabel',{'String', 'Velocity (m/s)'},
    xlabel('Time (s)');
figure(2) % new figure to plot acceleration vs time
plot(t(1:length(DV)), DV) % plot of acceleration vs time
xlabel('Time (s)');
ylabel('Acceleration (m/s^2)');
figure(3)
plot(t(1:length(v)), RPM/1000)
xlabel('Time (s)');
ylabel('RPM*1000');

% t_end =
5.7210

% RPM_end =
1.2866e+04

% Gr_end =
15