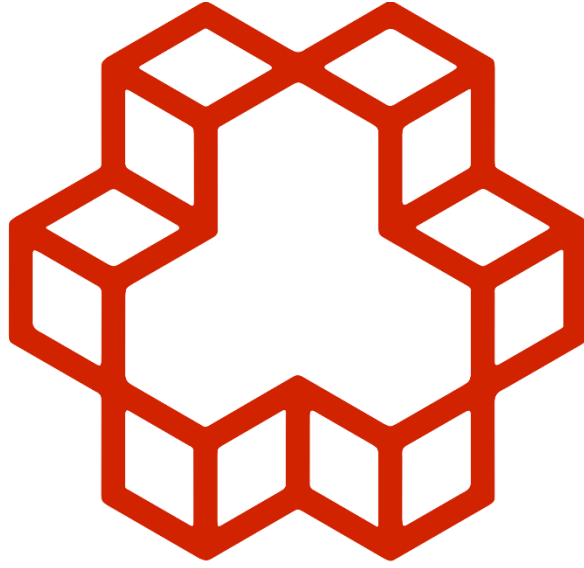


باسمہ تعالیٰ



دانشگاه صنعتی خواجه نصیرالدین طوسی

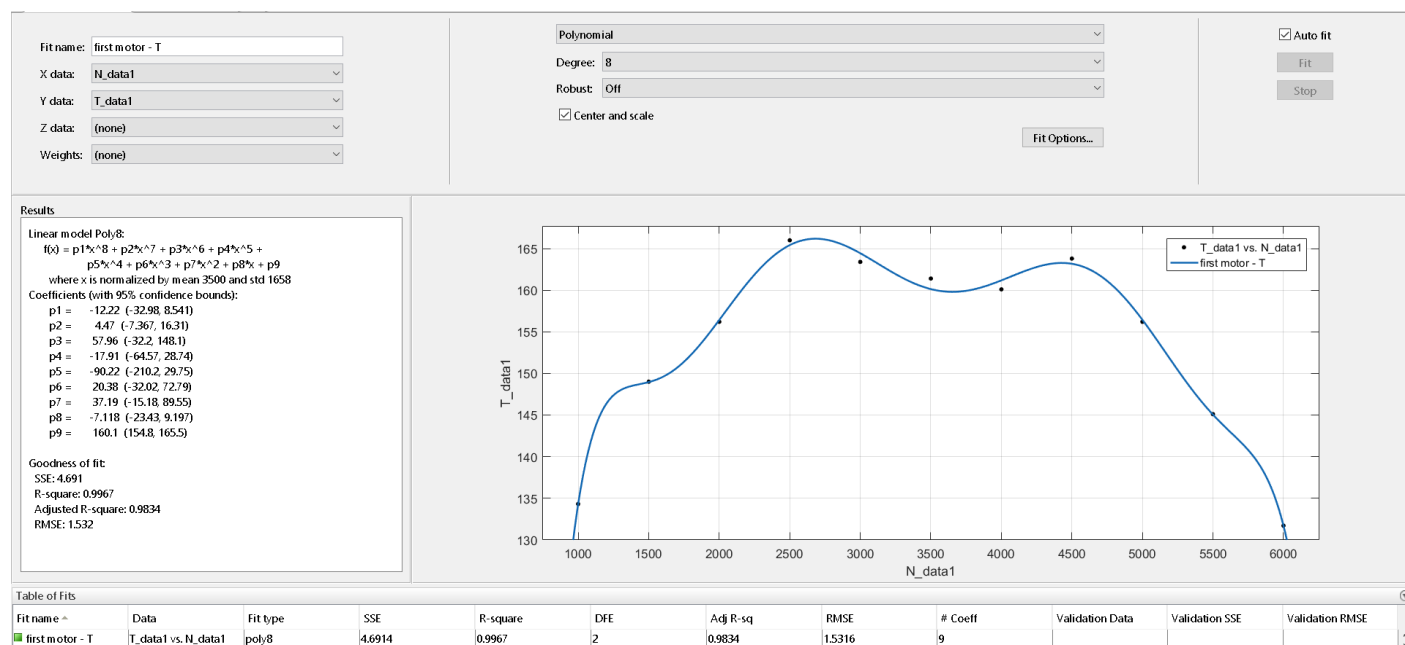
پروژه مشترک انتقال قدرت

دکتر شامخی

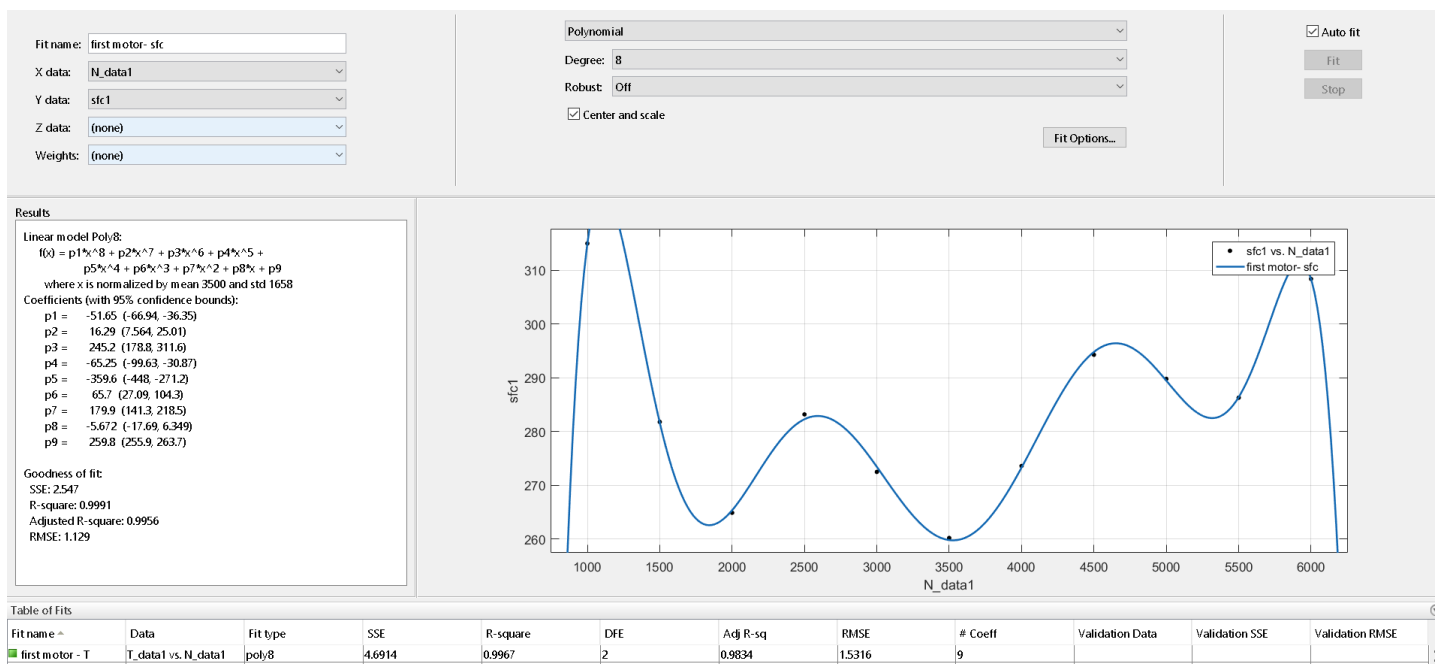
محمدرضا ملکی

9818874

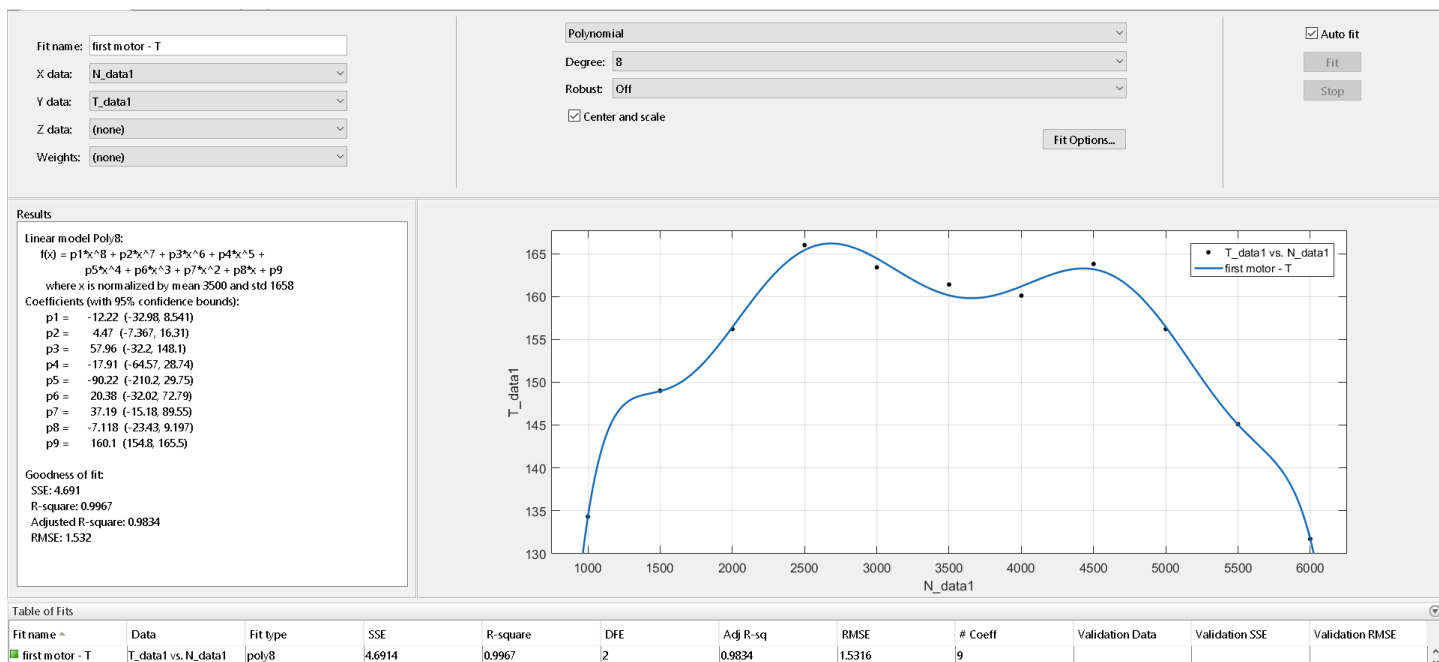
برازش منحنی ها



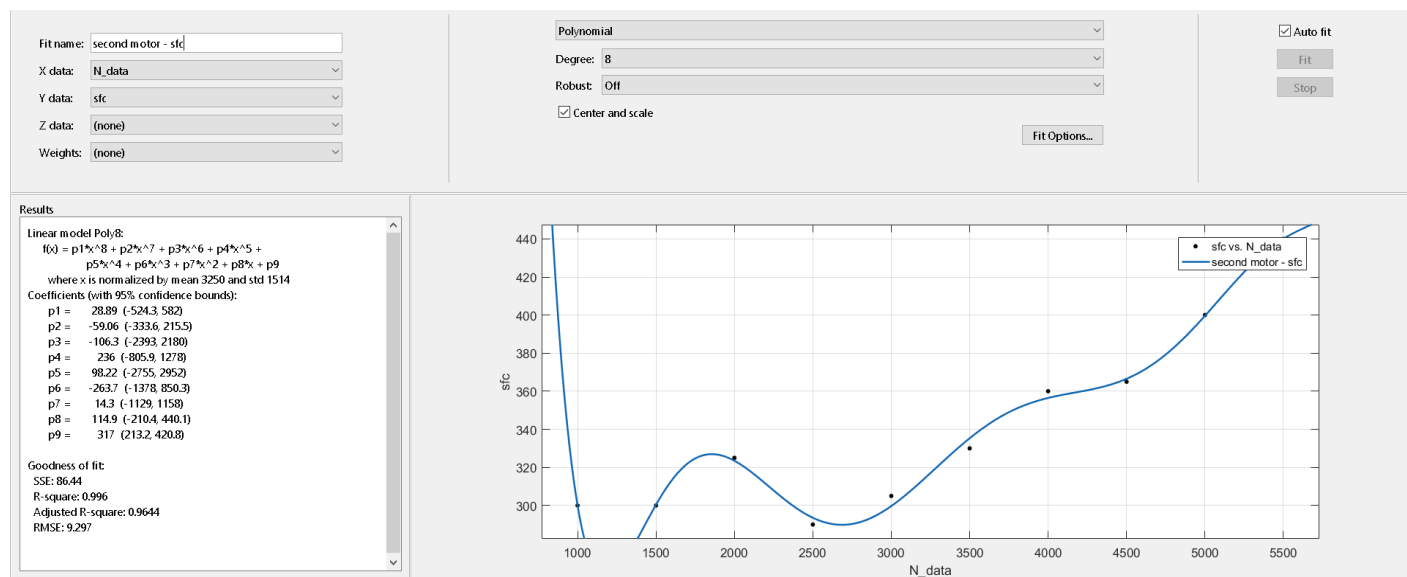
شکل الف - نمودار برازش گشتاور برای موتور اول



شکل ب- نمودار برازش sfc برای موتور اول

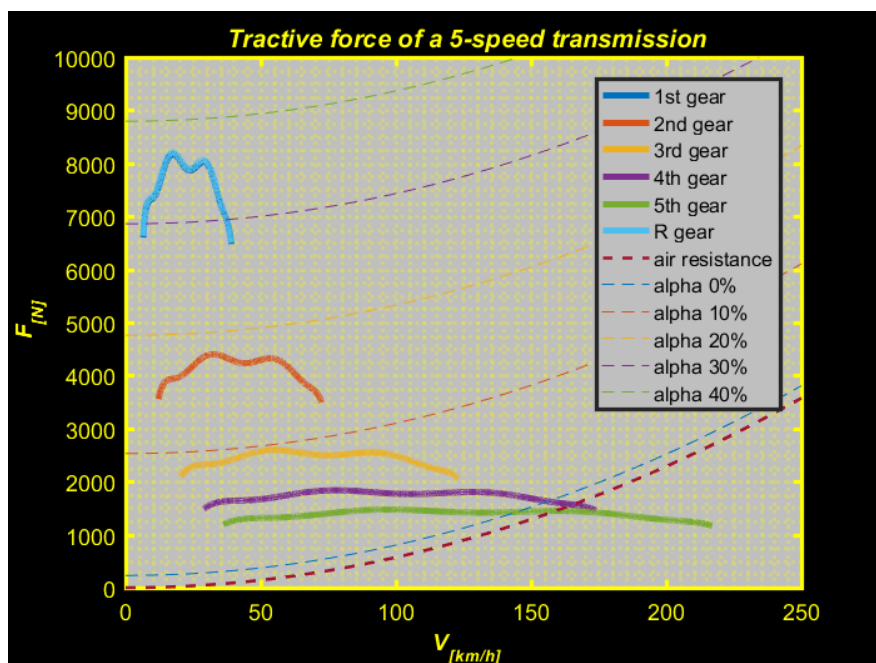


شکل ج- نمودار برازش گشتاور برای موتور دوم

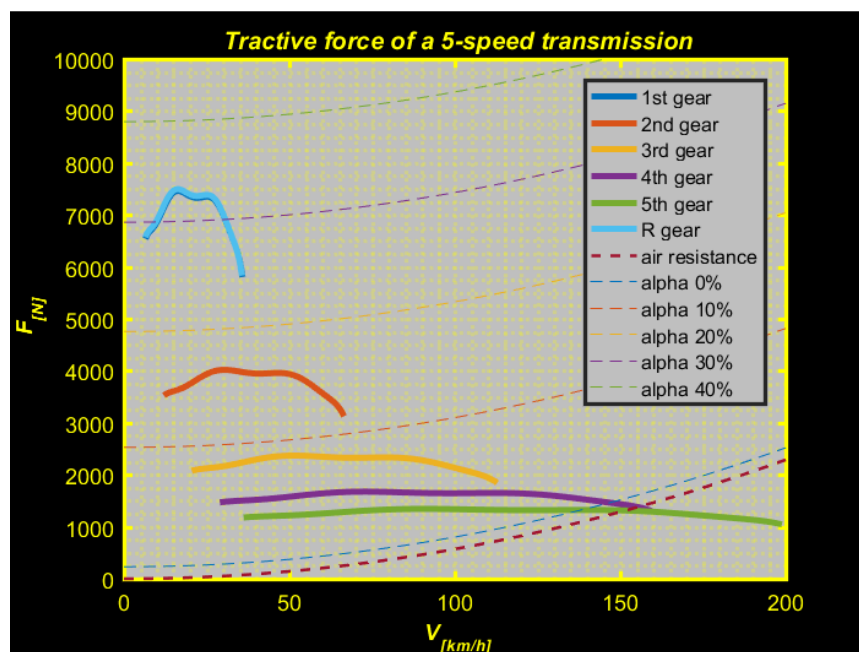


شکل د- نمودار برازش sfc برای موتور دوم

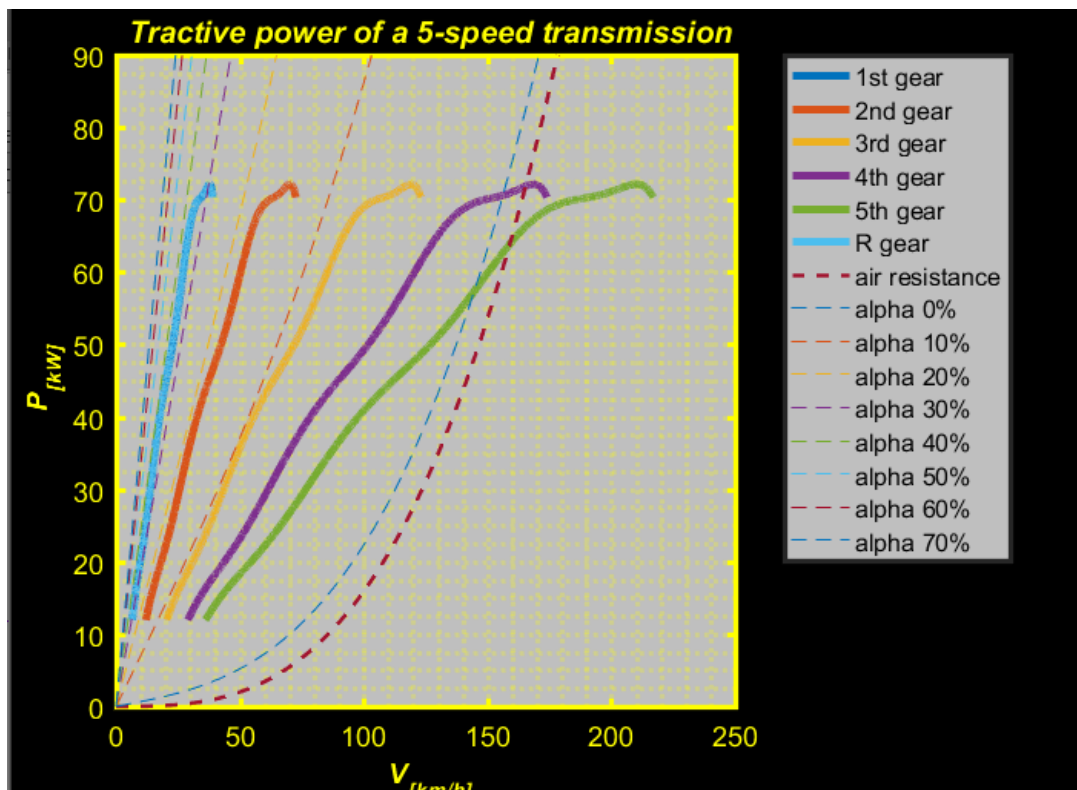
نتایج شبیه سازی



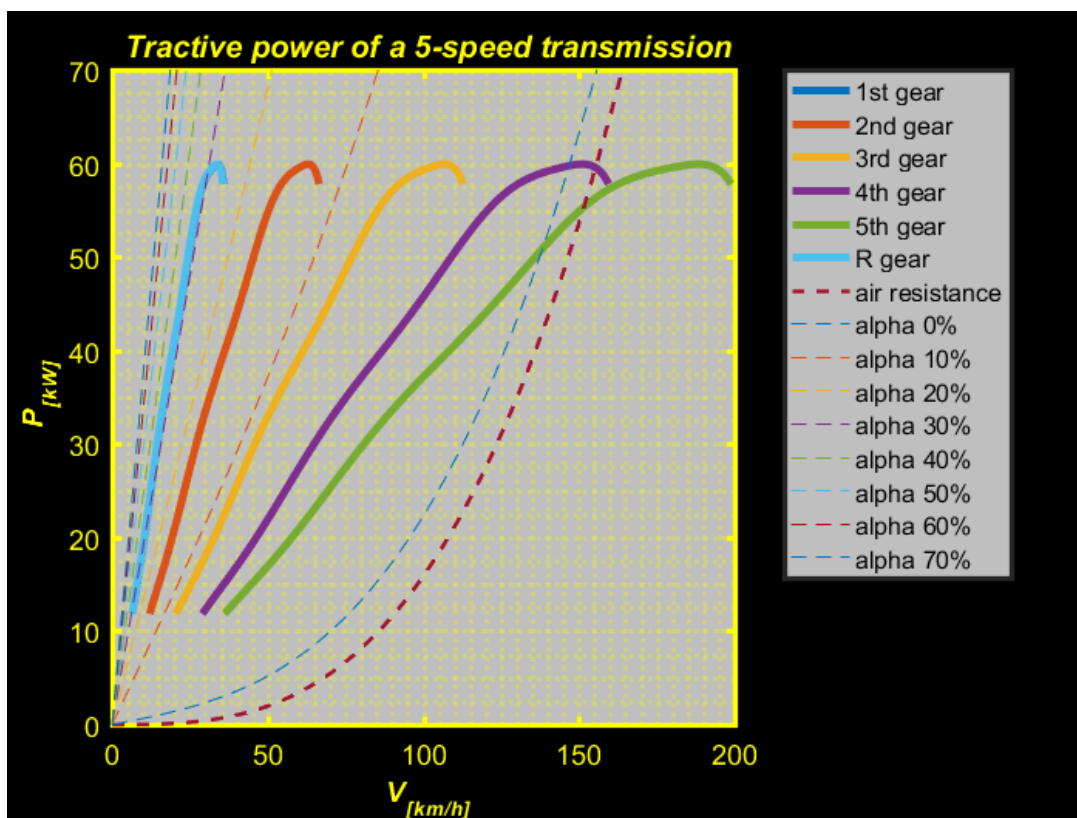
شکل 1- نمودار نیروی ترکشن بر حسب سرعت خودرو برای موتور اول



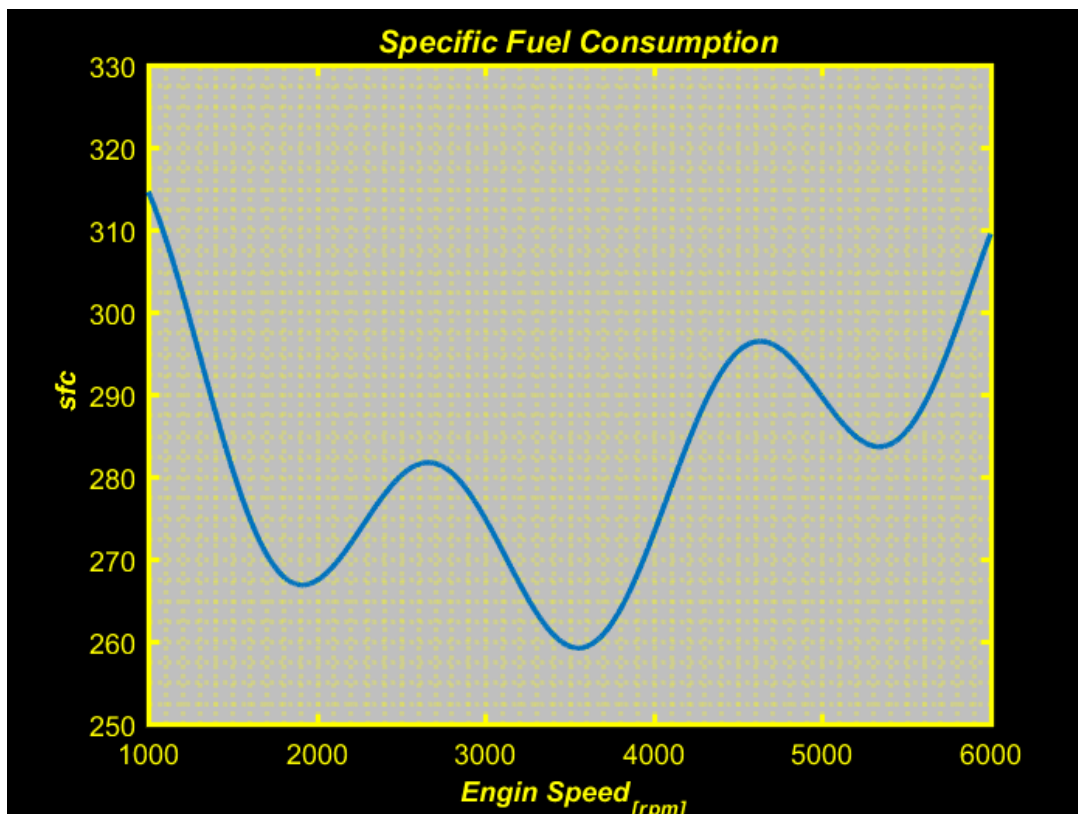
شکل 2- نمودار نیروی ترکشن بر حسب سرعت خودرو برای موتور دوم



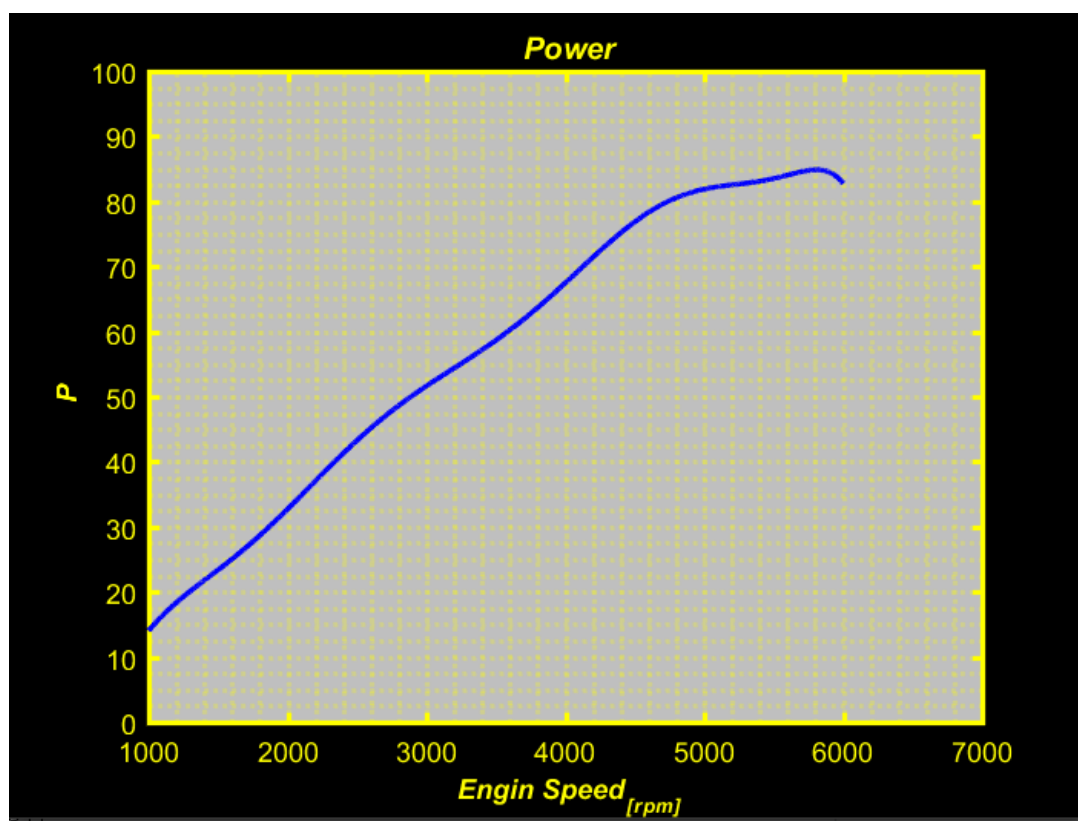
شکل 3- نمودار توان ترکشن بر حسب سرعت خودرو برای موتور اول



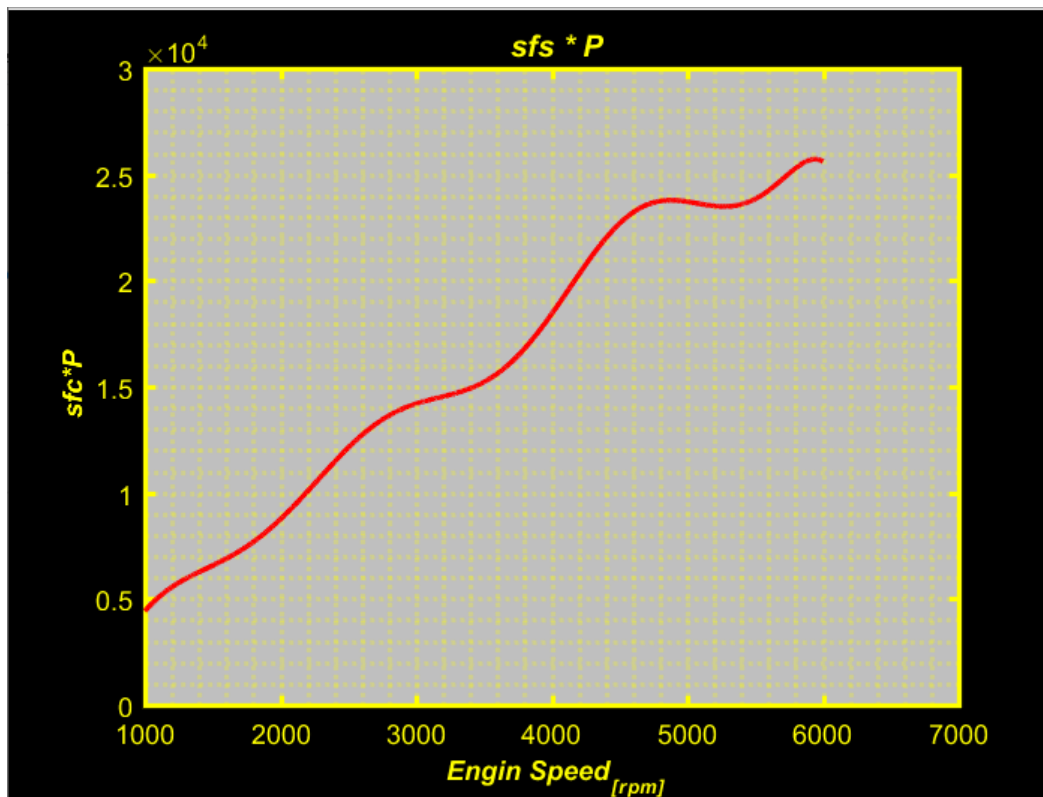
شکل 4- نمودار توان ترکشن بر حسب سرعت خودرو برای موتور دوم



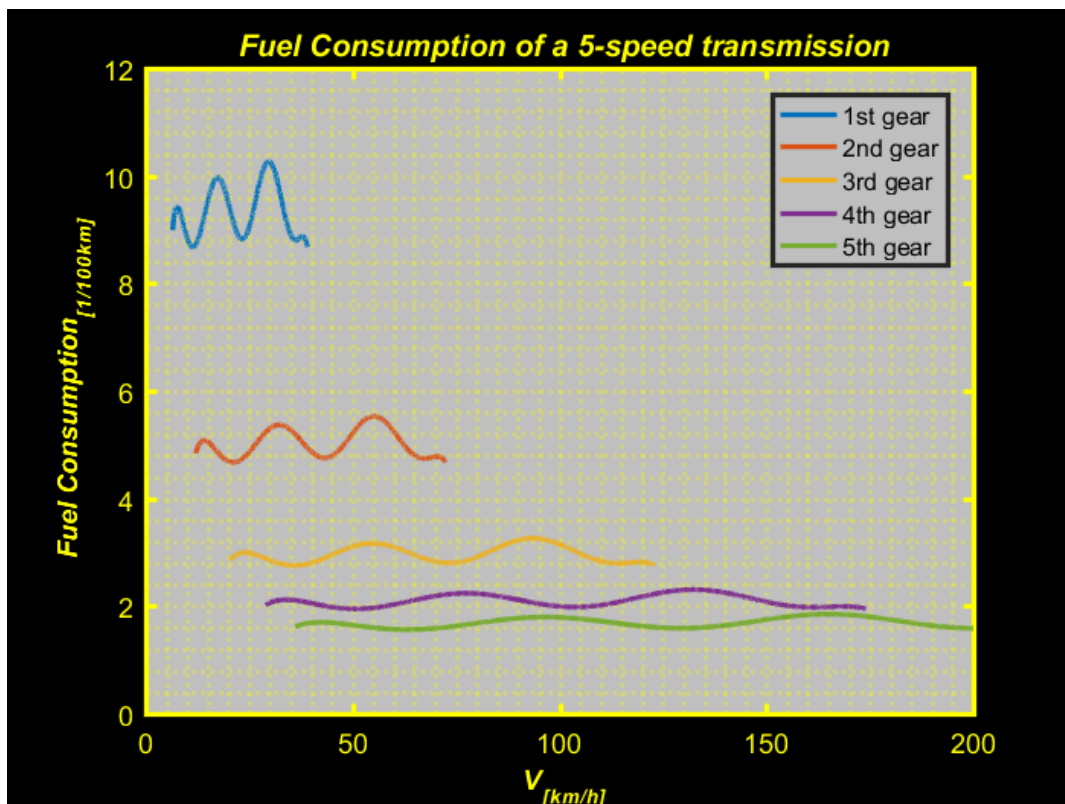
شکل 5- نمودار مصرف سوخت ویژه موتور اول



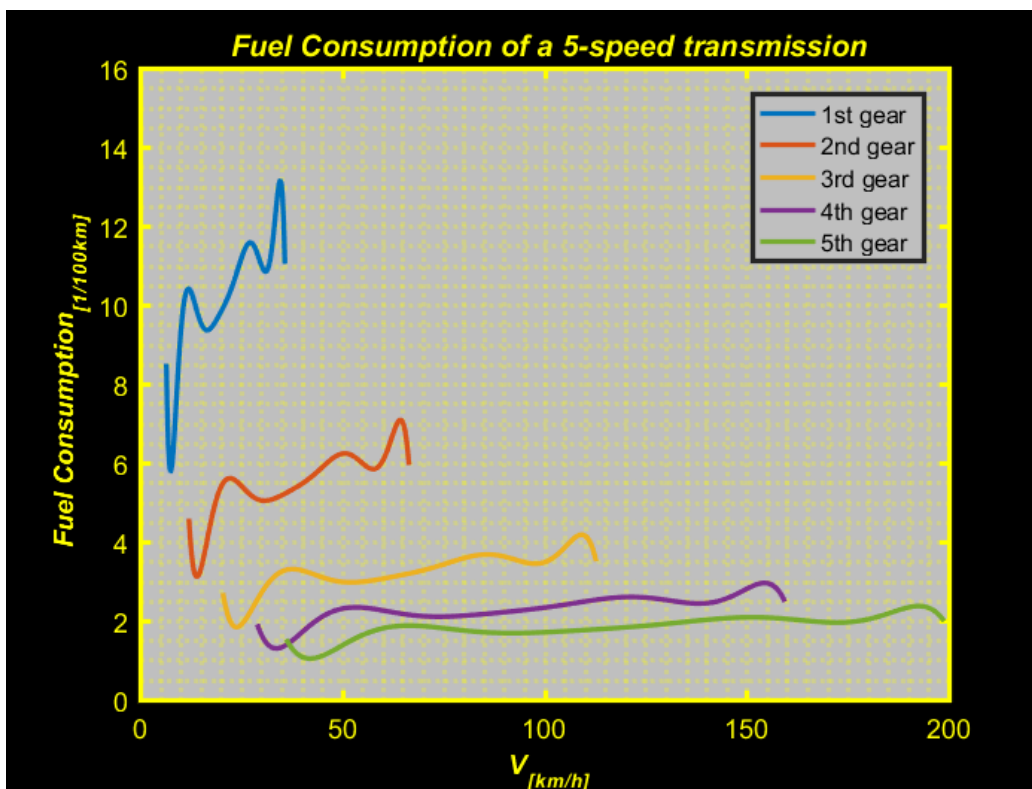
شکل 6- نمودار توان موتور اول



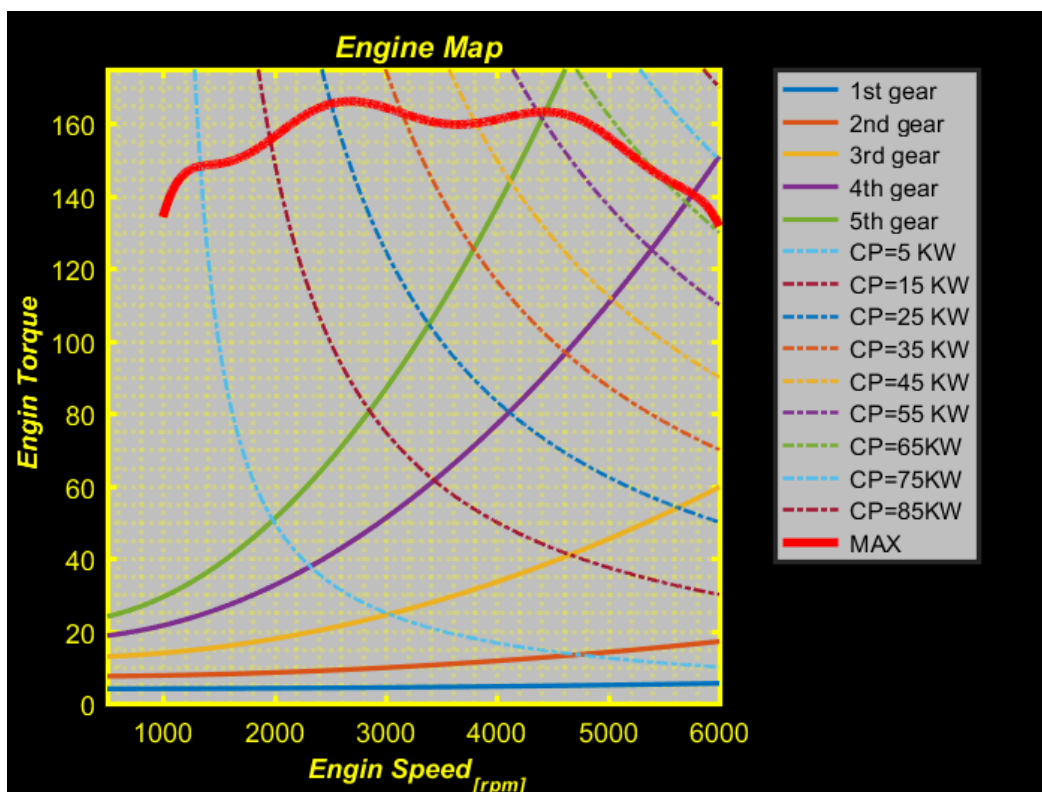
شکل 7- نمودار مصرف سوخت ویژه ضرب در توان



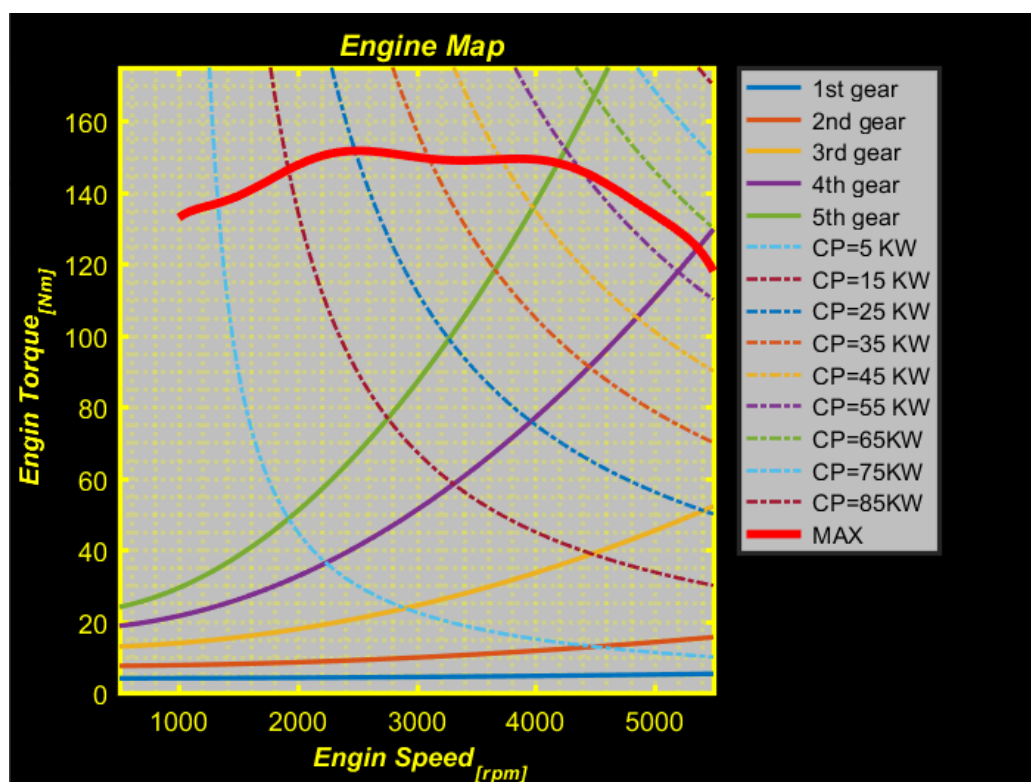
شکل 8- نمودار مصرف سوخت بر واحد مسافت در سرعت های متفاوت برای موتور اول



شکل 9- نمودار مصرف سوخت بر واحد مسافت در سرعت های متفاوت برای موتور دوم



شکل 10- نمودار نقشه موتور بر حسب دور موتور برای موتور اول



شکل 11- نمودار نقشه موتور بر حسب دور موتور برای موتور اول

کد مطلب

ابتدا موتور اول و سپس موتور دوم

```
%%be name khoda
%prozhe enteqal qodrat
%Dr. Shamekhi
%Mohammadreza Maleki
%9818874
%motor aval
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

clc;
close All;
clear All;

M= 2355;
G=9.81;
A=2.47;
c_d=0.49;
d_air=1.225 ;
i_g=[4.452,2.398,1.414,1,0.802,4.4725];
Fd_r=4.875;
eff=0.85;
r_d=0.375;
d_fuel=755;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

friction_data=[0.0122 0.0124 0.0132 0.015 0.022 0.033];
velocity_data=[0 50 100 150 200 250];

v=0:10:250;
f_r=(54804637155863*v.^4)/4835703278458516698824704 -
(5784933922007731*v.^3)/2417851639229258349412352 +
(4606930857732759*v.^2)/18889465931478580854784 -
(7096042757327543*v)/1180591620717411303424 +
1785083920872921/144115188075855872;

N_data=1000:500:6000;
```

```

T_data=[134.3 149 156.2 166 163.4 161.4 160.1 163.8 156.2 145.1
131.7];

MUE = 3500;
SIG = 1658.1;
N=1000:1:6000;
x = (N-MUE)/SIG;
T_E = -12.22 *x.^8 + 4.47*x.^7 + 57.96*x.^6 + -17.91*x.^5 + -90.22
*x.^4 + 20.38*x.^3 +37.19*x.^2+ -7.118 *x + 160.1 ;

for i=1:1:6

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

F_ZA= eff * i_g(i) .* Fd_r .* T_E / ( r_d * 1000 );
V = N * 2 * pi * r_d * 3.6 /( i_g(i) * Fd_r * 60);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(1)

plot ( V ,1000* F_ZA , 'linewidth' ,3)
hold on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Power = F_ZA .* V / 3.6 ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(2)

plot ( V , Power , 'linewidth' , 3 )
hold on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Grad = ( 0 :10 : 70 )' ;
Velocity = 0 : 1 : 250 ;
alpha = atan ( Grad / 100 ) ;
Ff = ( M * G * ( 0.01 * cos( alpha ) + sin( alpha ) ) *
(ones(1,251)) + (ones(8,1))*(0.5 * d_air * c_d * A * (( Velocity /
3.6 ).^2 ) ) ) / 1000;
%Ff = (( M * G * (( 0.01 * cos( alpha ) + sin( alpha ) ))) *
(ones(1,25001))+ (ones(8,1))*(0.5 * d_air * c_d * A * ( Velocity /
3.6 ).^2 / 1000)); % Resistance Force (KN
F_air = ( 0.5 * d_air * c_d * A * ( Velocity / 3.6 ).^2 ) / 1000 ;
Pwf = Ff .*((ones(8,1))* Velocity / 3.6) ;
resistanceair = F_air .* Velocity / 3.6 ;

```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
end
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
figure(1)
```

```
plot ( Velocity ,1000* F_air , '--','linewidth',1.5)
hold on
plot ( Velocity ,1000* Ff , ' -- ' )
hold on
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
figure(2)
```

```
plot ( Velocity , resistanceair , '--', 'linewidth' , 1.5 )
hold on;
plot ( Velocity , Pwf , '--' )
hold on
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
%fuel consumption %
```

```
%sfc=[315, 281.8 264.9 283.2 272.5 260.2 273.6 294.3 289.8 286.3
308.4];
```

```
rpm1=1000:1:6000;
```

```
    a0 = 285.3 ;
    a1 = -17.37 ;
    b1 = 6.548 ;
    a2 = 4.555 ;
    b2 = 0.6927 ;
    a3 = -13.07 ;
    b3 = -5.054 ;
    w = 1.858 ;
```

```
    mu1 = 3500;
```

```
sigma2= 1658;
```

```
x = (rpm1-mu1)./sigma2;
```

```
sfc = a0 + a1*cos(x*w) + b1*sin(x*w) + a2*cos(2*x*w) + b2*sin(2*x*w)
+ a3*cos(3*x*w) + b3*sin(3*x*w);
```

```
P_e =T_E .* rpm1 *( 2 * pi /60000);
```

```
figure(3)
```

```
plot(rpm1,sfc,'linewidth',2 )
```

```

figure(7)
plot(rpm1,P_e,'b' , 'linewidth',2 )
figure(6)
plot(rpm1,sfc.*P_e,'r' , 'linewidth',2 )
    for ii  = 1:5

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Vv = (rpm1 * r_d *2*pi* 3.6) /( i_g(ii) * Fd_r * 60) ;
FC = (sfc .*P_e*10 )./ ( d_fuel .* Vv );

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(4)

plot ( Vv , FC , 'linewidth', 2 )
hold on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

    end

% engine map %

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

S=linspace(0,200,1001);
F_ZB  = ( M * G * ( 0.01*cos(0) ) + 0.5 * d_air * c_d * A * ( S / 3.6
).^2 ) / 1000 ;
T_ZB  = F_ZB * r_d ;

for iii=1:1:5

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

T_resist = T_ZB * 1000 / ( i_g(iii) * Fd_r ) ;
vr = i_g(iii) * Fd_r * 60 * S / ( 2 * pi * r_d * 3.6 ) ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(5)

plot ( vr , T_resist,'linewidth',2 )
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

end

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
rpm2=linspace(0,5000,5001);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

for P = (5 : 10 : 85)';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

T =( P*ones(1,5001)) * 1*10^4 ./ (ones(9,1)* rpm2) ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(5)

plot ( N , T , '-.', 'linewidth' , 1.5)
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
end

figure(5)

plot ( N , T_E , 'r ', 'linewidth',3.5 );
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(1)

title('\it Tractive force of a 5-speed
transmission','fontsize',18,'color',[1 1 0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[0 250],'Xcolor',[1 1
0],'Ylim',[0 10000],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf V[_k_m/_h_'],'fontsize', 11, 'color',[1 1 0]);
ylabel('\it\bf F[_N_]','fontsize', 11, 'color',[1 1 0]);
legend( {'1st gear' , '2nd gear' , '3rd gear' , '4th gear' , '5th
gear' , 'R gear' , 'air resistance' , 'alpha 0%' , 'alpha 10%' , 'alpha
20%' , 'alpha 30%' , 'alpha 40%'} );
grid minor

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(2)

```

```

title('\it Tractive power of a 5-speed
transmission','fontsize',18,'color',[1 1 0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[0 250],'Xcolor',[1 1
0],'Ylim',[0 90],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf V[_k_m/_h_'],'fontsize', 11, 'color',[1 1 0]);
ylabel('\it\bf P[_k_W_'],'fontsize', 11, 'color',[1 1 0]);
legend( {'1st gear' , '2nd gear' , '3rd gear' , '4th gear' , '5th
gear' , 'R gear','air resistance' , 'alpha 0%' , 'alpha 10%' , 'alpha
20%' , 'alpha 30%' , 'alpha 40%' , 'alpha 50%' , 'alpha 60%' , 'alpha
70%' }, 'location' , 'bestoutside' );
grid minor

```

%%%

figure(3)

```

title('\it Specific Fuel Consumption' , 'fontsize',18,'color',[1 1
0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[1000 6000],'Xcolor',[1 1
0],'Ylim',[250 330],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf Engin Speed[_r_p_m_'],'fontsize', 11, 'color',[1 1
0]);
ylabel('\it\bf sfc','fontsize', 11, 'color',[1 1 0]);
grid minor

```

%%%

figure(4)

```

title('\it Fuel Consumption of a 5-speed
transmission','fontsize',18,'color',[1 1 0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[0 200],'Xcolor',[1 1
0],'Ylim',[0 12],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf V[_k_m/_h_'],'fontsize', 11, 'color',[1 1 0]);
ylabel('\it\bf Fuel Consumption[_l/_l_0_0_k_m_'],'fontsize', 11,
'color',[1 1 0]);
legend( {'1st gear' , '2nd gear' , '3rd gear' , '4th gear' , '5th
gear'} );
grid minor

```

%%%

figure(5)


```

title('\it Engine Map','fontsize',18,'color',[1 1 0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[500 6000],'Xcolor',[1 1 0],
'Ylim',[0 175],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf Engin Speed[_r_p_m]','fontsize', 11, 'color',[1 1 0]);
ylabel('\it\bf Engin Torque','fontsize', 11, 'color',[1 1 0]);
legend ( {' 1st gear' , ' 2nd gear' , ' 3rd gear' , ' 4th gear' , '
5th gear' , ' CP=5 KW' , ' CP=15 KW' , ' CP=25 KW' , ' CP=35 KW' ,
' CP=45 KW' , ' CP=55 KW' , ' CP=65KW' , ' CP=75KW' , ' CP=85KW' , ' MAX ' }
, 'Location' , 'bestoutside')
grid minor

```

%%%

figure(6)

```

title('\it sfs * P ' , 'fontsize',18,'color',[1 1 0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[1000 7000],'Xcolor',[1 1 0],
'Ylim',[0 3e04],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf Engin Speed[_r_p_m]','fontsize', 11, 'color',[1 1 0]);
ylabel('\it\bf sfc*P','fontsize', 11, 'color',[1 1 0]);
grid minor

```

%%%

figure(7)

```

title('\it Power ' , 'fontsize',18,'color',[1 1 0]);
set(gca,'color',[0.75 0.75 0.75],'Xlim',[1000 7000],'Xcolor',[1 1 0],
'Ylim',[0 100],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);
set(gcf,'color',[0 0 0])
xlabel('\it\bf Engin Speed[_r_p_m]','fontsize', 11, 'color',[1 1 0]);
ylabel('\it\bf P','fontsize', 11, 'color',[1 1 0]);
grid minor

```

```

%%be name khoda
%prozhe enteqal qodrat
%Dr. Shamekhi
%Mohammadreza Maleki
%9818874
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%motor dovom
clc;
close All;
clear All;

M= 2355;
g=9.81;
A=2.47;
c_d=0.49;
d_air=1.225 ;
i_g=[4.452,2.398,1.414,1,0.802,4.4725];
Fd_r=4.875;
eff=0.85;
r_d=0.375;
d_fuel=755;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

friction_data=[0.0122 0.0124 0.0132 0.015 0.022 0.033];
velocity_data=[0 50 100 150 200 250];
v=0:10:200;
f_r=(54804637155863*v.^4)/4835703278458516698824704 -
(5784933922007731*v.^3)/2417851639229258349412352 +
(4606930857732759*v.^2)/18889465931478580854784 -
(7096042757327543*v)/1180591620717411303424 +
1785083920872921/144115188075855872;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

N_data=1000:500:5500;
T_data=[133 139 148 151 151 148 150 144 134 118 8];
MUE = 3250;
SIG = 1514;
N=1000:0.1:5500;
x = (N-MUE)/SIG;
T_E = -5.429 *x.^8 + -0.4627*x.^7 + 26.88*x.^6 + 0.01767*x.^5 +
-44.51*x.^4 + 1.165 *x.^3 +14.99*x.^2+ -2.712 *x + 149.1 ;

for i=1:1:6

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

```

F_ZA= eff * i_g(i) .* Fd_r .* T_E / ( r_d * 1000 );
V = N * 2 * pi * r_d * 3.6 / ( i_g(i) * Fd_r * 60);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(1)

plot ( V ,1000* F_ZA , 'linewidth' ,3)
hold on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Power      = F_ZA .* V / 3.6 ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(2)

plot ( V , Power , 'linewidth' , 3 )
hold on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Grad      = ( 0 :10 : 70 )' ;
Velocity   = 0 : 1 : 200 ;
alpha = atan ( Grad / 100 ) ;
Ff=( M * g * ( 0.01 * cos( alpha ) + sin( alpha ) ) * (ones(1,201)) +
(ones(8,1))*(0.5 * d_air * c_d * A * (( Velocity / 3.6 ).^2 ) ) ) /
1000;
%Ff      = (( M * G * (( 0.01 * cos( alpha ) + sin( alpha ) ))) *
(ones(1,25001))+ (ones(8,1))*(0.5 * d_air * c_d * A * ( Velocity /
3.6 ).^2 / 1000)); % Resistance Force (KN
F_air = ( 0.5 * d_air * c_d * A * ( Velocity / 3.6 ).^2 ) / 1000 ;
Pwf      = Ff .* ((ones(8,1)) * Velocity / 3.6) ;
resistanceair = F_air .* Velocity / 3.6 ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(1)

plot ( Velocity ,1000* F_air , '--','linewidth',1.5)
hold on
plot ( Velocity ,1000* Ff , ' -- ' )
hold on

```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
figure(2)

plot ( Velocity , resistanceair , '--', 'linewidth' , 1.5 )
hold on;
plot ( Velocity , Pwf , '--' )
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%fuel consumption %

%sfc=[300 300 325 290 305 330 360 365 400 440 ];
rpm1=1000:0.1:5500;
p1 = -120.8;
p2 = 28.89;
p3 = 468.7;
p4 =-106.3;
p5 =-487.8;
p6 = 98.22;
p7 = 80.2;
p8 = 14.3;
p9 = 73.86;
p10 = 317;
mu1 = 3250 ;
sigma2= 1514;
x = (rpm1-mu1)/sigma2;

sfc= p1*x.^9 + p2*x.^8 + p3*x.^7 + p4*x.^6 + p5*x.^5 + p6*x.^4 +
p7*x.^3 + p8*x.^2 + p9*x + p10;
P_e    = T_E .* rpm1 * 2 * pi/ 6000 ;

for ii  = 1:5

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

Vv = rpm1 * 2 * pi * r_d*3.6 /( i_g(ii) * Fd_r * 60) ;
% Vehicle Linear Velocity (Km/h)
FC  = sfc .* P_e ./ ( d_fuel * Vv );
% Fuel Consumption (lit/100Km)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(3)

```

```

plot ( Vv , FC, 'linewidth', 2 )
hold on;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

end

% engine map %

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

S=linspace(0,200,1001);
F_ZB = ( M * g * ( 0.01*cos(0) ) + 0.5 * d_air * c_d * A * ( S / 3.6
).^2 ) / 1000 ;
T_ZB = F_ZB * r_d ;

for iii=1:1:5

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

T_resist = T_ZB * 1000 / ( i_g(iii) * Fd_r ) ;
vr = i_g(iii) * Fd_r * 60 * S / ( 2 * pi * r_d * 3.6 ) ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(4)

plot ( vr , T_resist,'linewidth',2 )
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

end

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

rpm2=linspace(0,5000,45001);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

for P = (5 : 10 : 85)';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

T =( P*ones(1,45001)) * 1*10^4 ./ (ones(9,1)* rpm2) ;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

```

figure(4)

plot ( N , T , '-.', 'linewidth' , 1.5)
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
end

figure(4)

plot ( N , T_E , 'r ' , 'linewidth' , 3.5 );
hold on

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(1)

title('\it Tractive force of a 5-speed
transmission', 'fontsize', 18, 'color', [1 1 0]);
set(gca, 'color', [0.75 0.75 0.75], 'Xlim', [0 200], 'Xcolor', [1 1
0], 'Ylim', [0 10000], 'Ycolor', [1 1 0], 'fontsize', 11, 'linewidth', 2);
set(gcf, 'color', [0 0 0])
xlabel('\it\bf V[_k_m/_h_]', 'fontsize', 11, 'color', [1 1 0]);
ylabel('\it\bf F[_N_]', 'fontsize', 11, 'color', [1 1 0]);
legend( {'1st gear' , '2nd gear' , '3rd gear' , '4th gear' , '5th
gear' , 'R gear' , 'air resistance' , 'alpha 0%' , 'alpha 10%' , 'alpha
20%' , 'alpha 30%' , 'alpha 40%'} );
grid minor

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

figure(2)

title('\it Tractive power of a 5-speed
transmission', 'fontsize', 18, 'color', [1 1 0]);
set(gca, 'color', [0.75 0.75 0.75], 'Xlim', [0 200], 'Xcolor', [1 1
0], 'Ylim', [0 70], 'Ycolor', [1 1 0], 'fontsize', 11, 'linewidth', 2);
set(gcf, 'color', [0 0 0])
xlabel('\it\bf V[_k_m/_h_]', 'fontsize', 11, 'color', [1 1 0]);
ylabel('\it\bf P[_k_W_]', 'fontsize', 11, 'color', [1 1 0]);
legend( {'1st gear' , '2nd gear' , '3rd gear' , '4th gear' , '5th
gear' , 'R gear' , 'air resistance' , 'alpha 0%' , 'alpha 10%' , 'alpha
20%' , 'alpha 30%' , 'alpha 40%' , 'alpha 50%' , 'alpha 60%' , 'alpha
70%' }, 'location' , 'bestoutside' );
grid minor

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

figure(3)

```
title('\it Fuel Consumption of a 5-speed  
transmission','fontsize',18,'color',[1 1 0]);  
set(gca,'color',[0.75 0.75 0.75],'Xlim',[0 200],'Xcolor',[1 1  
0],'Ylim',[0 16],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);  
set(gcf,'color',[0 0 0])  
xlabel('\it\bf V[_k_m/_h_'],'fontsize', 11, 'color',[1 1 0]);  
ylabel('\it\bf Fuel Consumption[_l/_l_0_0_k_m_'],'fontsize', 11,  
'color',[1 1 0]);  
legend( {'1st gear' , '2nd gear' , '3rd gear' , '4th gear' , '5th  
gear'});  
grid minor
```

%%%

figure(4)

```
title('\it Engine Map','fontsize',18,'color',[1 1 0]);  
set(gca,'color',[0.75 0.75 0.75],'Xlim',[500 5500],'Xcolor',[1 1  
0],'Ylim',[0 175],'Ycolor',[1 1 0],'fontsize',11,'linewidth',2);  
set(gcf,'color',[0 0 0])  
xlabel('\it\bf Engin Speed[_r_p_m_'],'fontsize', 11, 'color',[1 1  
0]);  
ylabel('\it\bf Engin Torque[_N_m_'],'fontsize', 11, 'color',[1 1  
0]);  
legend ( {' 1st gear' , ' 2nd gear' , ' 3rd gear' , ' 4th gear' , '  
5th gear ' , ' CP=5 KW' , ' CP=15 KW' , ' CP=25 KW' , ' CP=35 KW' ,  
' CP=45 KW' , ' CP=55 KW', ' CP=65KW' , ' CP=75KW', ' CP=85KW', ' MAX ' }  
, 'Location' , 'bestoutside')  
grid minor
```