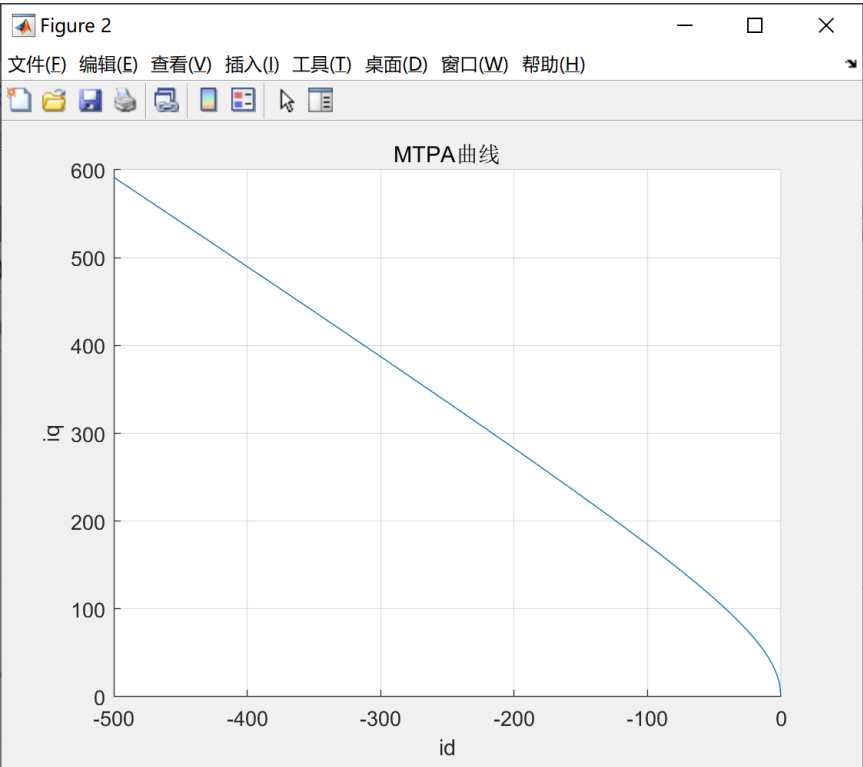
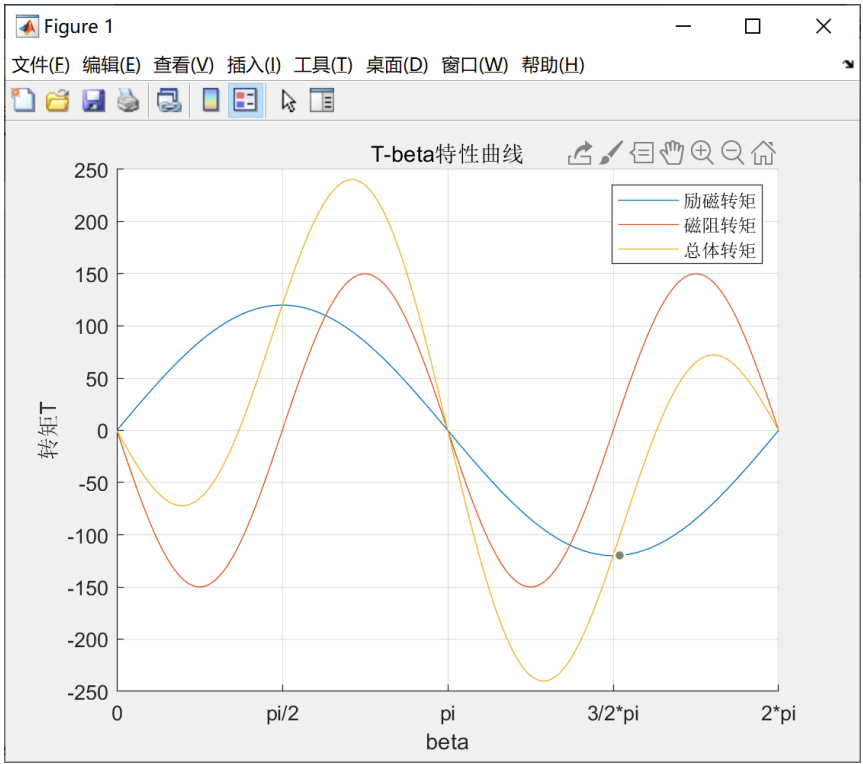


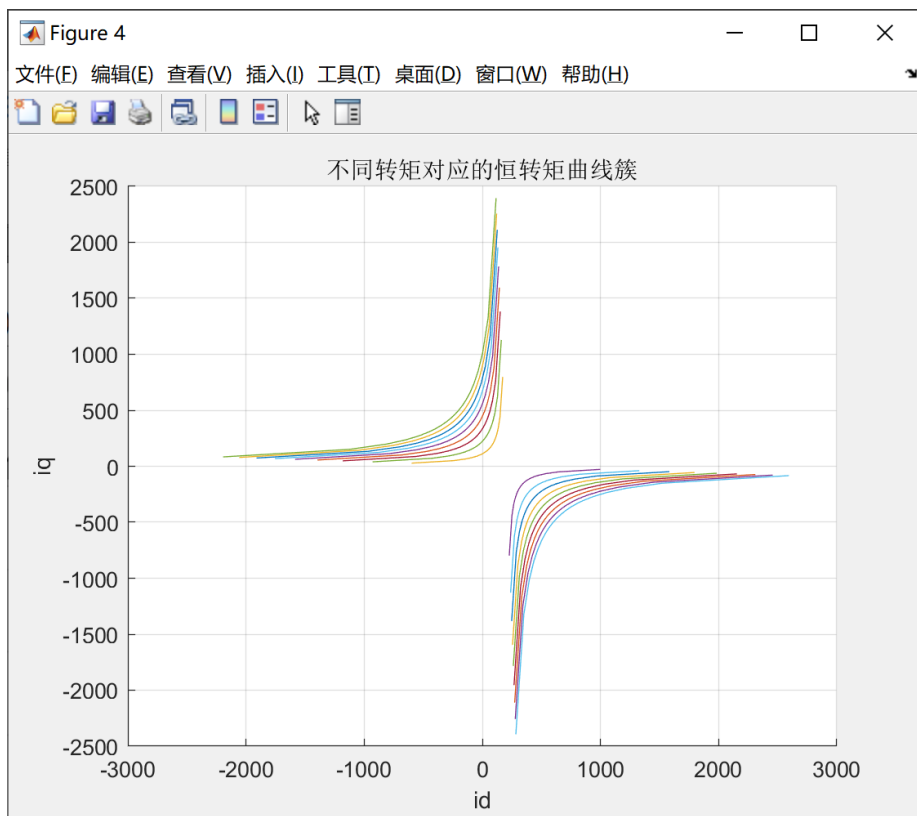
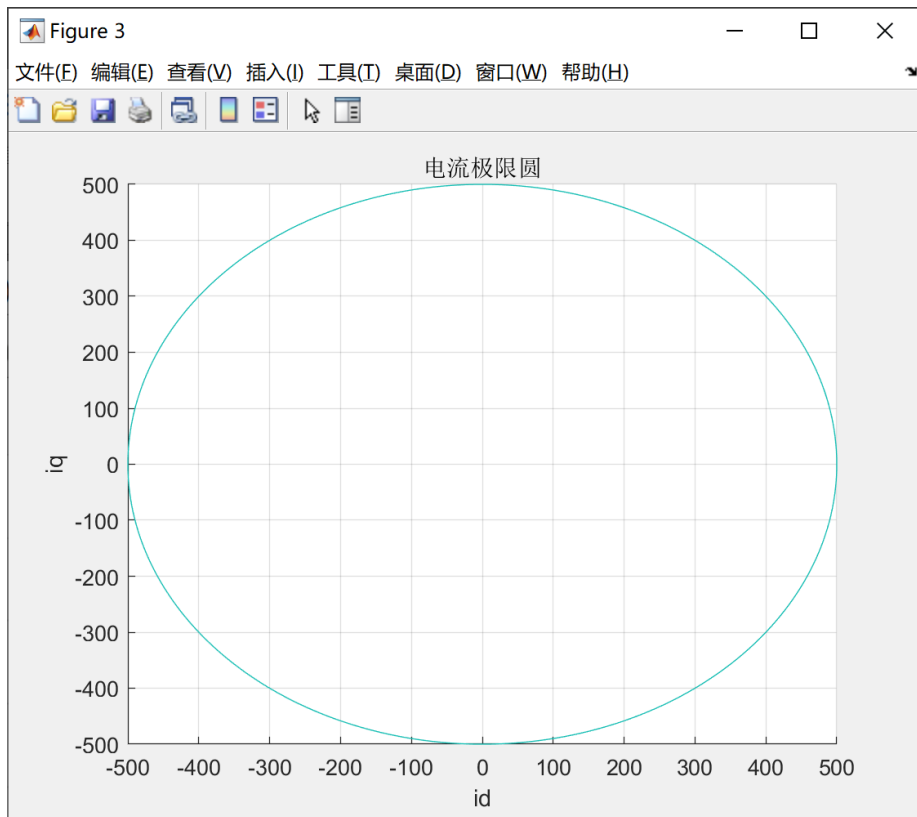
学号：2019214782

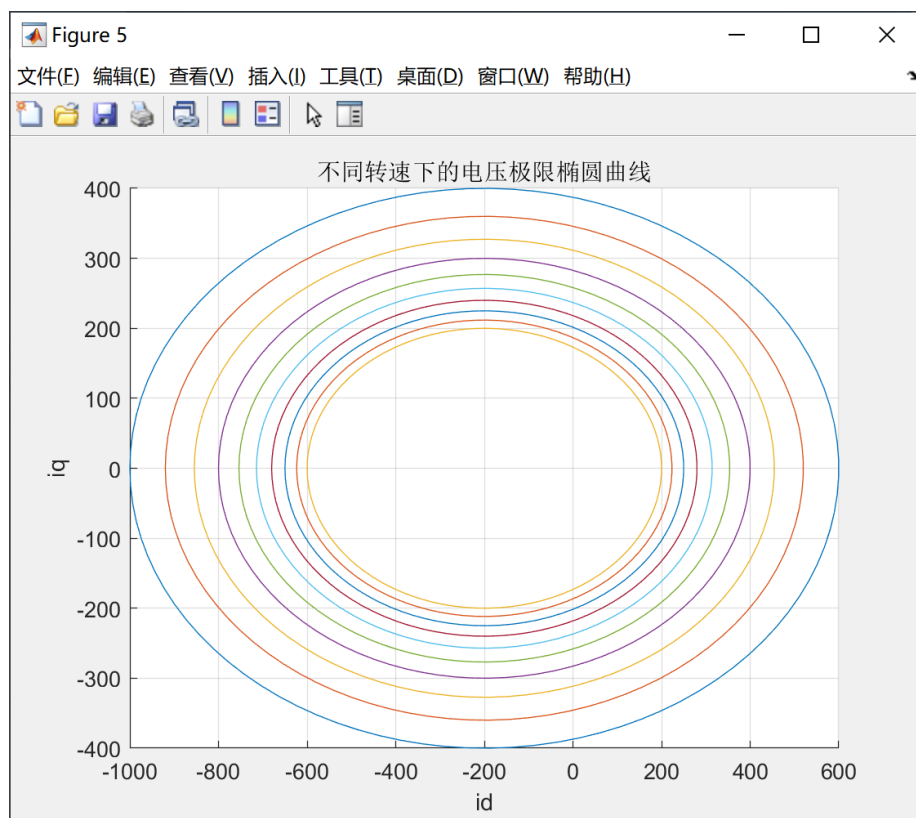
姓名：孔令鸣

班级：车辆工程 19-5 班

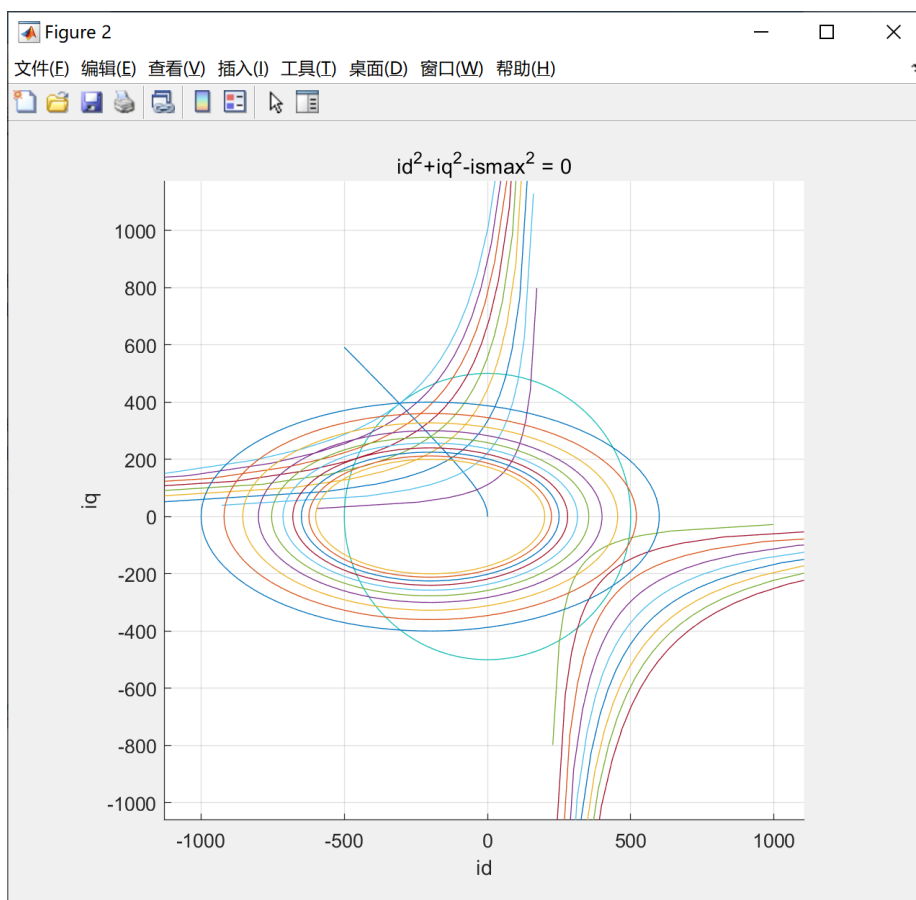
图片




































2-5 整体图形:



工作区

名称 ^	值	大小	字节	类
 beta	<i>1x100 double</i>	1x100	800	double
 beta_1	<i>1x20 double</i>	1x20	160	double
 beta_2	<i>1x20 double</i>	1x20	160	double
 beta_4	<i>1x40 double</i>	1x40	320	double
 center	-200	1x1	8	double
 i	10	1x1	8	double
 id	<i>1x100 double</i>	1x100	800	double
 Id_4	<i>10x40 double</i>	10x40	3200	double
 id_mtpa	<i>1x501 double</i>	1x501	4008	double
 iq	<i>1x100 double</i>	1x100	800	double
 Iq_4	<i>10x40 double</i>	10x40	3200	double
 iq_mtpa	<i>1x501 double</i>	1x501	4008	double
 Is_4	<i>10x40 double</i>	10x40	3200	double
 ismax	500	1x1	8	double
 Ld	2.0000e-04	1x1	8	double
 Lq	4.0000e-04	1x1	8	double
 p	4	1x1	8	double
 Psif	0.0400	1x1	8	double
 rho	2	1x1	8	double
 Rs	0.0080	1x1	8	double
 Te	<i>1x1000 double</i>	1x10...	8000	double
 Te_4	[0,26.6785,53.3571,80.0356,10...	1x10	80	double
 Tem	<i>1x1000 double</i>	1x10...	8000	double
 Temax	240.1068	1x1	8	double
 temp	10	1x1	8	double
 Ter	<i>1x1000 double</i>	1x10...	8000	double
 usmax	400	1x1	8	double
 wr	[2500,2.7778e+03,3.0556e+03,...	1x10	80	double
 y1	@(id,iq)id.^2+iq.^2-ismax.^2	1x1	32	function_handle

代码

```
clc,clear
```

```
Rs = 0.008;  
Ld = 200/10^6;  
Lq = 400/10^6;  
Psif = 0.04;  
p = 4;  
ismax = 500;  
usmax = 400;
```

```
figure(1);  
hold on;  
grid on;  
beta = linspace(0, 2 * pi, 1000);  
Tem = 3 / 2 * p * Psif * ismax * sin(beta);  
Ter = 3 / 2 * p * ( 1 / 2 * (Ld - Lq) * ismax^2 * sin(2*beta) );  
Te = Tem + Ter;
```

```
plot(beta, Tem, beta, Ter, beta, Te);  
set(gca,'XTick',[0: pi/2: 2*pi]);  
set(gca,'XTickLabel',{'0' 'pi/2' 'pi' '3/2*pi' '2*pi' });  
axis([0, 2*pi,-250, 250]);  
title('T-beta 特性曲线');  
xlabel('beta');  
ylabel('转矩 T');  
legend('励磁转矩','磁阻转矩','总体转矩');
```

```
figure(2);  
hold on;  
grid on;  
id_mtpa = -ismax : 0;  
iq_mtpa = sqrt( id_mtpa.*( id_mtpa + Psif / (Ld - Lq) ) );
```

```
plot(id_mtpa, iq_mtpa);  
xlim([-500 0]);  
title('MTPA 曲线');  
xlabel('id');  
ylabel('iq');
```

```
figure(3);
```

```

hold on;
grid on;
% 简单点直接化为三角函数画圆
% id = ismax * sin(beta);
% iq = ismax * cos(beta);
% plot(id, iq);
id = ismax * cos(beta);
iq = ismax * sin(beta);
y1 = @(id, iq) id.^2 + iq.^2 - ismax.^2;    %隐函数求解
ezplot(y1, [-500, 500, -500, 500]);
set(gca,'XTick',[-500 :100 :500]);
set(gca,'XTickLabel',{'-500' '-400' '-300' '-200' '-100' '0' '100' '200' '300' '400' '500'});
axis([-500, 500,-500, 500]);
title('电流极限圆');
xlabel('id');
ylabel('iq');

```

```

figure(4);
hold on;
grid on;
title('不同转矩对应的恒转矩曲线簇');
xlabel('id');
ylabel('iq');
center = Psif / (Ld - Lq); %双曲线中心
beta_1 = linspace( pi/2+pi*2/180, pi-pi*2/180, 20);
beta_2 = linspace( 3/2*pi+pi*2/180, 2*pi-pi*2/180, 20);
beta_4 = [beta_1 beta_2];
Tmax = max(Te);
Te_4 = linspace(0, Tmax, 10);
%初始化存储空间
ls_4 = zeros( length(Te_4), length(beta_4) );
ld_4 = zeros( length(Te_4), length(beta_4) );
lq_4 = zeros( length(Te_4), length(beta_4) );
temp = length(Te_4);
for i = 1 : temp
    ls_4(i,:) = sqrt( 4/3 .* Te_4(i) ./ ( (Ld - Lq)* p * sin(2 .* beta_4) ) );
    ld_4(i,:) = ls_4(i,:) .* cos(beta_4) - center;
    lq_4(i,:) = ls_4(i,:) .* sin(beta_4);
    plot( ld_4(i, 1:20), lq_4(i, 1:20) );
    plot( ld_4(i, 21:40), lq_4(i, 21:40) );
end

```

```

figure(5);

```

```

hold on;
grid on;
rho = Lq/Ld;
wr = linspace(2500, 5000, 10); %转速 n 和 wr 存在换算关系
temp = length(wr);

for i = 1 : temp
    beta = linspace(-pi, pi, 100);
    id = ( usmax ./ ( wr(i) .* Lq ) ) * rho * cos(beta) - Psif / Ld;
    iq = ( usmax ./ ( wr(i) .* Lq ) ) * sin(beta);
    plot(id, iq);
    title('不同转速下的电压极限椭圆曲线');
    xlabel('id');
    ylabel('iq');
end

```