

```

data1_14_hw5a_sol
initial approx
om =
0
ph =
0
kp =
1.309
XL =
600.74
YL =
2099
ZL =
152.9
B =
101.33      -65.59      -32.64      0.12353     0.46103     -0.54293
-17.398     78.525     -56.953     -0.46103     0.12353     0.31116
81.443      20.575     60.063      0.13183     0.49198     -0.34728
71.165      107.36     -34.137     -0.49198     0.13183     -0.61103
80.882      21.596     -62.387     0.12881     0.48073     0.33341
73.449      112.63     33.541      -0.48073     0.12881     0.62016
115.38      -76.075    34.281      0.1283      0.47883     0.63078
-23.101     82.323     63.708     -0.47883     0.1283      -0.33942
48.87       -12.774    3.2861      0.12767     0.47647     -0.046469
13.313      48.489     -4.7165     -0.47647     0.12767     -0.032375
f =
18.547
4.2641
11.728
10.198
9.7725
8.9053
16.06
4.2513
10.226
8.4719
Wt =
1 0 0 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 1
iter =
1
del =
0.070503
-0.052202
-0.0028766
-16.389
17.09
-1.9684
iter =
2
del =
-0.00071125
-0.00013172
0.011387
-0.14736
-0.2382
1.7419
iter =
3
del =
-4.9995e-05
2.0239e-05
0.00020902
0.0045514
3.5826e-05
0.026037
iter =
4
del =
-3.8187e-08
3.6393e-08
5.6608e-08
8.2693e-06
4.643e-06
5.3777e-06
iter =
5
del =
-4.5499e-12
4.1807e-12
7.6129e-13
5.7298e-10
6.9621e-10
-6.0632e-11
iter =
6
del =
-4.8407e-16
1.9286e-16
-2.5514e-17
8.4617e-15
6.5003e-14
-2.2796e-14
om =
0.069742
ph =

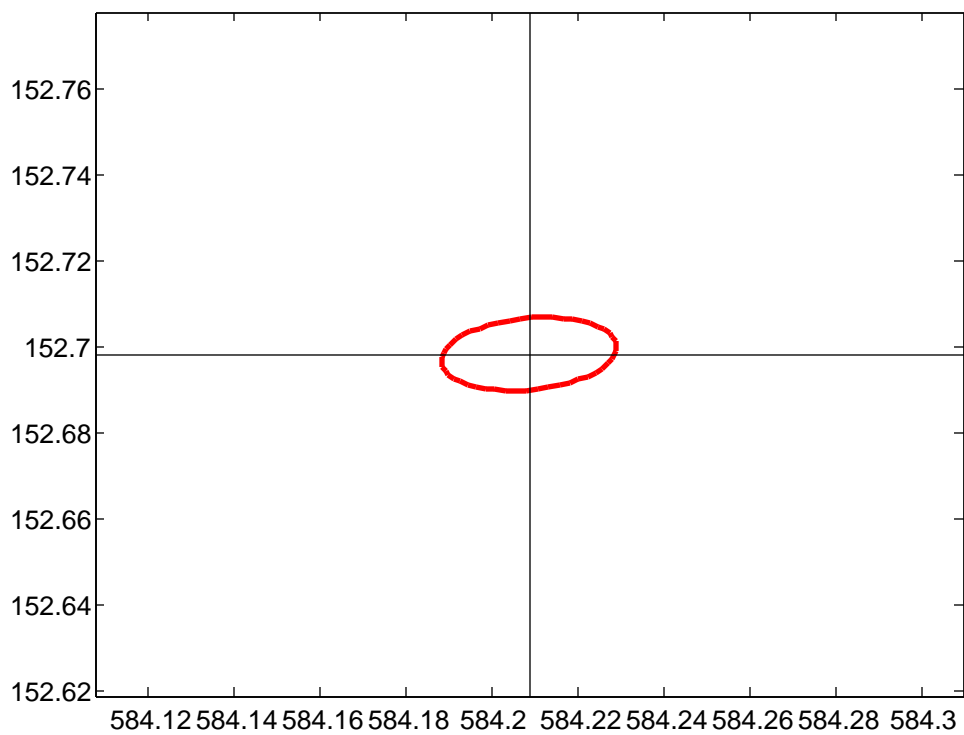
```

```

-0.052314
kp =
  1.3177
XL =
  584.21
YL =
  2115.8
ZL =
  152.7
v =
  0.0033044
  0.0010242
  -0.001134
  -0.0013975
  0.0021796
  0.0019133
  -0.00066164
  0.0050382
  -0.0039747
  -0.0060184
tst =
  4.0583
cv1 =
  0.48442
cv2 =
  11.143
assume pass
Qdd =
  8.9507e-05  1.8473e-06  4.7514e-06  0.00037337  -0.015817  0.002731
  1.8473e-06  8.1104e-05  -1.6342e-05  0.014945  -0.00039283  0.0015601
  4.7514e-06  -1.6342e-05  5.4616e-05  -0.0047328  -0.0011272  -0.00030788
  0.00037337  0.014945  -0.0047328  3.6065  -0.084602  0.2911
  -0.015817  -0.00039283  -0.0011272  -0.084602  3.6369  -0.26516
  0.002731  0.0015601  -0.00030788  0.2911  -0.26516  0.63791
SS =
  2.2377e-09  4.6183e-11  1.1879e-10  9.3342e-09  -3.9542e-07  6.8276e-08
  4.6183e-11  2.0276e-09  -4.0856e-10  3.7363e-07  -9.8208e-09  3.9003e-08
  1.1879e-10  -4.0856e-10  1.3654e-09  -1.1832e-07  -2.8179e-08  -7.697e-09
  9.3342e-09  3.7363e-07  -1.1832e-07  9.0163e-05  -2.115e-06  7.2774e-06
  -3.9542e-07  -9.8208e-09  -2.8179e-08  -2.115e-06  9.922e-05  -6.6289e-06
  6.8276e-08  3.9003e-08  -7.697e-09  7.2774e-06  -6.6289e-06  1.5948e-05
V =
  0.096678  -0.99532
  -0.99532  -0.096678
D =
  1.5241e-05  0
  0  9.087e-05
lam1 =
  9.087e-05
lam2 =
  1.5241e-05
evec1 =
  -0.99532
  -0.096678
evec2 =
  0.096678
  -0.99532
a =
  0.020457
b =
  0.0083777
thetad =
  -174.45
ax =
  584.11  584.31  152.62  152.78
ax =
  584.11  584.31  152.62  152.78
hlfxax =
  0.10104
hlfyax =
  0.07969
diary off

```

90% confidence region, XL,ZL, HW5-1(a)



```

                                datal14_hw5a_sol
% datal14_hw5a_sol.m 1-dec-2014
% solve the resection problem (hw5a) with analytical derivatives

% indirect observations
np=5;
n=np*2;
n0=6;
r=n-n0;
u=n0;
c=n;
degrad=180/pi;

% 1(a)
x=[-75.470;-45.835;23.798;47.678;-14.913];
y=[28.384;-70.253;53.490;-38.524;-11.750];
X=[503.8;697.3;497.1;700.8;604.7];
Y=[2001.4;2003.7;2196.5;2205.2;2088.0];
Z=[48.0;54.6;52.3;51.9;51.4];

%plot(x,y);
%title('image coordinates');
%axis equal
%figure(2);
%plot(X,Y);
%title('object_coordinates');
%axis equal
%pause

x0=0.030;
y0=0.008;
foc=50.067;

om=0;
ph=0;
kp=75/degrad;
Xm=mean(X);
Ym=mean(Y);
Zm=mean(Z);
d14=sqrt((x(1)-x(4))^2 + (y(1)-y(4))^2);
D14=sqrt((X(1)-X(4))^2 + (Y(1)-Y(4))^2);
sca=D14/d14;
FOC=sca*foc;
ZL=Zm + FOC;
XL=Xm;
YL=Ym;

disp('initial approx');
om
ph
kp
XL
YL
ZL

sig=0.005;
sig0=0.005;
sig0_sqr=sig0*sig0;
Wt=eye(n);

for iter=1:6
    B=zeros(c,u);
    f=zeros(c,1);
    for i=1:np
        ndx=(i-1)*2 + 1;
        M=m3(kp)*m2(ph)*m1(om);
        dM1dw=[0 0 0;0 -sin(om) cos(om);0 -cos(om) -sin(om)];
        dM2dp=[-sin(ph) 0 -cos(ph);0 0 0;cos(ph) 0 -sin(ph)];
        dM3dk=[-sin(kp) cos(kp) 0;-cos(kp) -sin(kp) 0;0 0 0];
        dUVDw=m3(kp)*m2(ph)*dM1dw*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
        dUdw=dUVDw(1);
        dVdw=dUVDw(2);
        dWdw=dUVDw(3);
        dUVDp=m3(kp)*dM2dp*m1(om)*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
        dUdp=dUVDp(1);
        dVdp=dUVDp(2);
        dWdp=dUVDp(3);
        dUVDk=dM3dk*m2(ph)*m1(om)*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
        dUdk=dUVDk(1);
        dVdk=dUVDk(2);
        dWdk=dUVDk(3);
        dUVDx1=-M(:,1);
        dUdx1=dUVDx1(1);
        dVdx1=dUVDx1(2);
        dWdx1=dUVDx1(3);
        dUVDy1=-M(:,2);
        dUdy1=dUVDy1(1);
        dVdy1=dUVDy1(2);
        dWdy1=dUVDy1(3);
        dUVDz1=-M(:,3);
        dUdz1=dUVDz1(1);
        dVdz1=dUVDz1(2);
        dWdz1=dUVDz1(3);
        UVW=M*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
        U=UVW(1);
        V=UVW(2);
        W=UVW(3);
        % x-equation
        dFxdw=(foc/W)*(dUdw-(U/W)*dWdw);
        dFxdp=(foc/W)*(dUdp-(U/W)*dWdp);
        dFxdk=(foc/W)*(dUdk-(U/W)*dWdk);
        dFxdx1=(foc/W)*(dUdx1-(U/W)*dWdx1);
        dFxdy1=(foc/W)*(dUdy1-(U/W)*dWdy1);
    end
end

```

```

dFxdz1=(foc/W)*(dUdz1-(U/W)*dWdz1);
B(ndx,:)=dFxdw dFxdp dFxdk dFxdx1 dFxdy1 dFxdz1;
F=x(i)-x0 + foc*(U/W);
f(ndx)=-F;
% y-equation
dFydw=(foc/W)*(dVdw-(V/W)*dWdw);
dFydp=(foc/W)*(dVdp-(V/W)*dWdp);
dFydk=(foc/W)*(dVdk-(V/W)*dWdk);
dFydx1=(foc/W)*(dVdx1-(V/W)*dWdx1);
dFydy1=(foc/W)*(dVdy1-(V/W)*dWdy1);
dFydz1=(foc/W)*(dVdz1-(V/W)*dWdz1);
B(ndx+1,:)=dFydw dFydp dFydk dFydx1 dFydy1 dFydz1;
F=y(i)-y0 + foc*(V/W);
f(ndx+1)=-F;
end
if(iter == 1)
    B
    f
    Wt
end
N=B'*Wt*B;
t=B'*Wt*f;
iter
del=inv(N)*t;
om=om+del(1);
ph=ph+del(2);
kp=kp+del(3);
XL=XL+del(4);
YL=YL+del(5);
ZL=ZL+del(6);
end

om
ph
kp
XL
YL
ZL

v=f-B*del

tst=v'*Wt*v/sig0_sqr
cv1=icdf('chi2',0.025,r)
cv2=icdf('chi2',0.975,r)

% assume pass
% error ellipse 90% XL,ZL

disp('assume pass');
Qdd=inv(N);
SS=sig0_sqr*Qdd;
S=[SS(4,4) SS(4,6); SS(4,6) SS(6,6)];
[V,D]=eig(S);
% largest eigenvalue is #2
lam1=D(2,2);
lam2=D(1,1);
evec1=V(:,2);
evec2=V(:,1);
P=0.9;
a=sqrt(lam1*icdf('chi2',P,2));
b=sqrt(lam2*icdf('chi2',P,2));
theta=atan2(evec1(2),evec1(1));
thetad=theta*degrad;

draw_ell(XL,ZL,a,b,theta);
title('90% confidence region, XL,ZL, HW5-1(a)');
hold on
% force same scale as part b
hlfxax=0.10104;
hlfyax=0.07969;
ax=[XL-hlfxax XL+hlfxax ZL-hlfyax ZL+hlfyax]
axis(ax);
%axis equal
ax=axis;
plot([XL XL],[ax(3) ax(4)],'k-');
plot([ax(1) ax(2)],[ZL ZL],'k-');
ax
hlfxax=(ax(2)-ax(1))/2
hlfyax=(ax(4)-ax(3))/2

```

```

data1_14_hw5b_sol
initial approx
om =
0
ph =
0
kp =
-0.34907
XL =
600.74
YL =
2099
ZL =
356.19
B =
-42.756   -151.02   61.254   0.4611   -0.16783   -0.091909
 161.5    -70.99   -28.326   0.16783   0.4611    -0.19875
-71.254   -161.9   28.325   0.47119   -0.1715   0.20503
 151.05   -42.654   61.835   0.1715   0.47119   -0.09392
-72.607   -164.3   -27.972   0.46762   -0.1702   -0.21411
 151.09   -42.183   -65.066   0.1702   0.46762   0.092047
-41.713   -151.53   -66.623   0.46701   -0.16998   0.09422
 165.37   -73.63   28.67    0.16998   0.46701   0.21894
-51.856   -142.16   4.438    0.46624   -0.1697   0.01216
 142.27   -51.665   3.7062   0.1697   0.46624   -0.014561
f =
-21.278
 4.6343
-18.674
-6.2185
-11.055
 11.465
-3.4436
-2.6793
-13.145
 1.202
Wt =
 1  0  0  0  0  0  0  0  0  0
 0  1  0  0  0  0  0  0  0  0
 0  0  1  0  0  0  0  0  0  0
 0  0  0  1  0  0  0  0  0  0
 0  0  0  0  1  0  0  0  0  0
 0  0  0  0  0  1  0  0  0  0
 0  0  0  0  0  0  1  0  0  0
 0  0  0  0  0  0  0  1  0  0
 0  0  0  0  0  0  0  0  1  0
 0  0  0  0  0  0  0  0  0  1
iter =
1
del =
0.041452
0.066238
-0.13824
-2.5592
-1.1403
0.64912
iter =
2
del =
-0.0063537
0.0033583
-0.0014107
 3.152
 5.3349
-1.0853
iter =
3
del =
1.2492e-05
-2.6618e-05
 1.761e-05
-0.015367
-0.025434
-0.049308
iter =
4
del =
3.4746e-08
 7.3119e-08
-5.5842e-09
 2.6888e-05
-7.496e-06
 7.0852e-06
iter =
5
del =
3.6116e-11
-4.6906e-11
 3.1717e-12
-1.5605e-08
-1.2156e-08
-7.5803e-11
iter =
6
del =
1.8276e-14
 4.5234e-14
-2.2186e-15
 1.5058e-11
-5.872e-12
 4.0955e-14
om =
0.035111
ph =

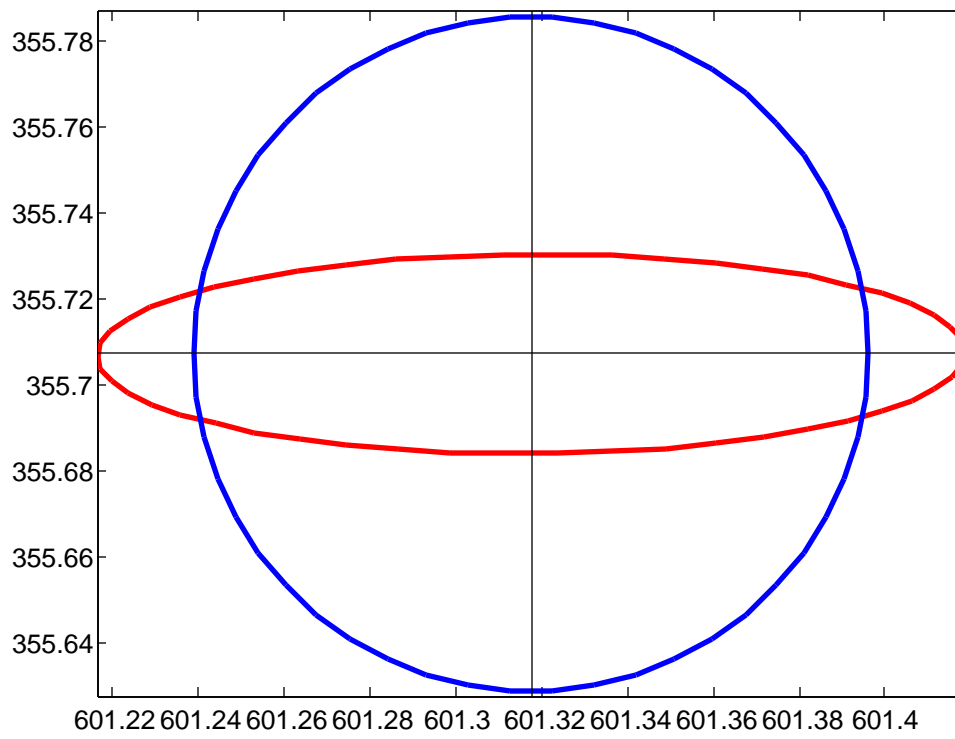
```

```

0.06957
kp = -0.4887
XL = 601.32
YL = 2103.1
ZL = 355.71
v =
0.0047894
0.0019505
0.0010682
-0.0052484
-0.0016023
0.0067952
-0.0070447
-0.0010762
0.0028761
-0.0019108
tst = 6.6752
cv1 = 0.48442
cv2 = 11.143
assume pass
Qdd =
0.00080347 9.1422e-05 7.357e-06 0.029959 -0.26544 0.00048636
9.1422e-05 0.0008062 -3.3348e-05 0.26614 -0.029334 0.0017668
7.357e-06 -3.3348e-05 5.2584e-05 -0.011849 -0.0037403 -4.0475e-05
0.029959 0.26614 -0.011849 88.671 -9.5896 0.43442
-0.26544 -0.029334 -0.0037403 -9.5896 88.528 -0.029504
0.00048636 0.0017668 -4.0475e-05 0.43442 -0.029504 4.6979
SS =
2.0087e-08 2.2855e-09 1.8392e-10 7.4897e-07 -6.636e-06 1.2159e-08
2.2855e-09 2.0155e-08 -8.3369e-10 6.6535e-06 -7.3334e-07 4.417e-08
1.8392e-10 -8.3369e-10 1.3146e-09 -2.9624e-07 -9.3507e-08 -1.0119e-09
7.4897e-07 6.6535e-06 -2.9624e-07 0.0022168 -0.00023974 1.0861e-05
-6.636e-06 -7.3334e-07 -9.3507e-08 -0.00023974 0.0022132 -7.3759e-07
1.2159e-08 4.417e-08 -1.0119e-09 1.0861e-05 -7.3759e-07 0.00011745
V =
0.0051731 -0.99999
-0.99999 -0.0051731
D =
0.00011739 0
0 0.0022168
lam1 =
0.0022168
lam2 =
0.00011739
evec1 =
-0.99999
-0.0051731
evec2 =
0.0051731
-0.99999
a =
0.10104
b =
0.023251
thetad =
-179.7
circ_rad =
0.078628
ax = 601.22 601.42 355.63 355.79
hlfxax =
0.10104
hlfyax =
0.07969
diary off

```

90% confidence region, XL,ZL, HW5-1(b)




```
% data14_hw5b_sol.m 1-dec-2014
% solve the resection problem (hw5b) with analytical derivatives
```

```
% indirect observations
```

```
np=5;
n=np*2;
n0=6;
r=n-n0;
u=n0;
c=n;
degrad=180/pi;
```

```
X=[503.8;697.3;497.1;700.8;604.7];
Y=[2001.4;2003.7;2196.5;2205.2;2088.0];
Z=[48.0;54.6;52.3;51.9;51.4];
```

```
% 1 (b)
```

```
x=[-7.066;80.491;-54.029;32.096;16.833];
y=[-65.846;-22.065;16.549;69.344;-5.5980];
x0=-0.018;
y0=0.042;
foc=151.227;
d14=sqrt((x(1)-x(4))^2 + (y(1)-y(4))^2);
D14=sqrt((X(1)-X(4))^2 + (Y(1)-Y(4))^2);
sca=D14/d14;
FOC=sca*foc;
ZL=Zm + FOC;
XL=Xm;
YL=Ym;
om=0;
ph=0;
kp=-20/degrad;
```

```
disp('initial approx');
```

```
om
ph
kp
XL
YL
ZL
```

```
sig=0.005;
sig0=0.005;
sig0_sqr=sig0*sig0;
Wt=eye(n);
```

```
for iter=1:6
```

```
  B=zeros(c,u);
  f=zeros(c,1);
  for i=1:np
    ndx=(i-1)*2 + 1;
    M=m3(kp)*m2(ph)*m1(om);
    dM1dw=[0 0 0;0 -sin(om) cos(om);0 -cos(om) -sin(om)];
    dM2dp=[-sin(ph) 0 -cos(ph);0 0 0;cos(ph) 0 -sin(ph)];
    dM3dk=[-sin(kp) cos(kp) 0;-cos(kp) -sin(kp) 0;0 0 0];
    dUVWdw=m3(kp)*m2(ph)*dM1dw*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
    dUdw=dUVWdw(1);
    dVdw=dUVWdw(2);
    dWdw=dUVWdw(3);
    dUVWdp=m3(kp)*dM2dp*m1(om)*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
    dUdp=dUVWdp(1);
    dVdp=dUVWdp(2);
    dWdp=dUVWdp(3);
    dUVWdk=dM3dk*m2(ph)*m1(om)*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
    dUdk=dUVWdk(1);
    dVdk=dUVWdk(2);
    dWdk=dUVWdk(3);
    dUVWdx1=-M(:,1);
    dUdx1=dUVWdx1(1);
    dVdx1=dUVWdx1(2);
    dWdx1=dUVWdx1(3);
    dUVWdy1=-M(:,2);
    dUdy1=dUVWdy1(1);
    dVdy1=dUVWdy1(2);
    dWdy1=dUVWdy1(3);
    dUVWdz1=-M(:,3);
    dUdz1=dUVWdz1(1);
    dVdz1=dUVWdz1(2);
    dWdz1=dUVWdz1(3);
    UVW=M*[X(i)-XL;Y(i)-YL;Z(i)-ZL];
    U=UVW(1);
    V=UVW(2);
    W=UVW(3);
    % x-equation
    dFxdw=(foc/W)*(dUdw-(U/W)*dWdw);
    dFxdp=(foc/W)*(dUdp-(U/W)*dWdp);
    dFxdk=(foc/W)*(dUdk-(U/W)*dWdk);
    dFxdx1=(foc/W)*(dUdx1-(U/W)*dWdx1);
    dFxdy1=(foc/W)*(dUdy1-(U/W)*dWdy1);
    dFxdz1=(foc/W)*(dUdz1-(U/W)*dWdz1);
    B(ndx,:)=dFxdw dFxdp dFxdk dFxdx1 dFxdy1 dFxdz1;
    F=x(i)-x0 + foc*(U/W);
    f(ndx)=-F;
    % y-equation
    dFydw=(foc/W)*(dVdw-(V/W)*dWdw);
    dFydp=(foc/W)*(dVdp-(V/W)*dWdp);
    dFydk=(foc/W)*(dVdk-(V/W)*dWdk);
    dFydx1=(foc/W)*(dVdx1-(V/W)*dWdx1);
    dFydy1=(foc/W)*(dVdy1-(V/W)*dWdy1);
    dFydz1=(foc/W)*(dVdz1-(V/W)*dWdz1);
    B(ndx+1,:)=dFydw dFydp dFydk dFydx1 dFydy1 dFydz1;
    F=y(i)-y0 + foc*(V/W);
    f(ndx+1)=-F;
```

```

end
if(iter == 1)
B
f
Wt
end
N=B'*Wt*B;
t=B'*Wt*f;
iter
del=inv(N)*t
om=om+del(1);
ph=ph+del(2);
kp=kp+del(3);
XL=XL+del(4);
YL=YL+del(5);
ZL=ZL+del(6);
end

om
ph
kp
XL
YL
ZL

v=f-B*del

tst=v'*Wt*v/sig0_sqr
cv1=icdf('chi2',0.025,r)
cv2=icdf('chi2',0.975,r)

% assume pass
% error ellipse 90% XL,ZL + error circle

disp('assume pass');
Qdd=inv(N)
SS=sig0_sqr*Qdd
S=[SS(4,4) SS(4,6); SS(4,6) SS(6,6)];
[V,D]=eig(S)
% largest eigenvalue is #2
lam1=D(2,2)
lam2=D(1,1)
evecl=V(:,2)
evec2=V(:,1)
P=0.9;
a=sqrt(lam1*icdf('chi2',P,2))
b=sqrt(lam2*icdf('chi2',P,2))
theta=atan2(evec1(2),evec1(1));
thetad=theta*degrad

draw_ell(XL,ZL,a,b,theta);
title('90% confidence region, XL,ZL, HW5-1(b)');
hold on

circ_rad=cep2(P,S);
circ_rad
% draw the circle
draw_ell2(XL,ZL,circ_rad,circ_rad,0,'b-');
axis equal
ax=axis;
plot([XL XL],[ax(3) ax(4)],'k-');
plot([ax(1) ax(2)],[ZL ZL],'k-');

ax
hlfxax=(ax(2)-ax(1))/2
hlfyax=(ax(4)-ax(3))/2

```

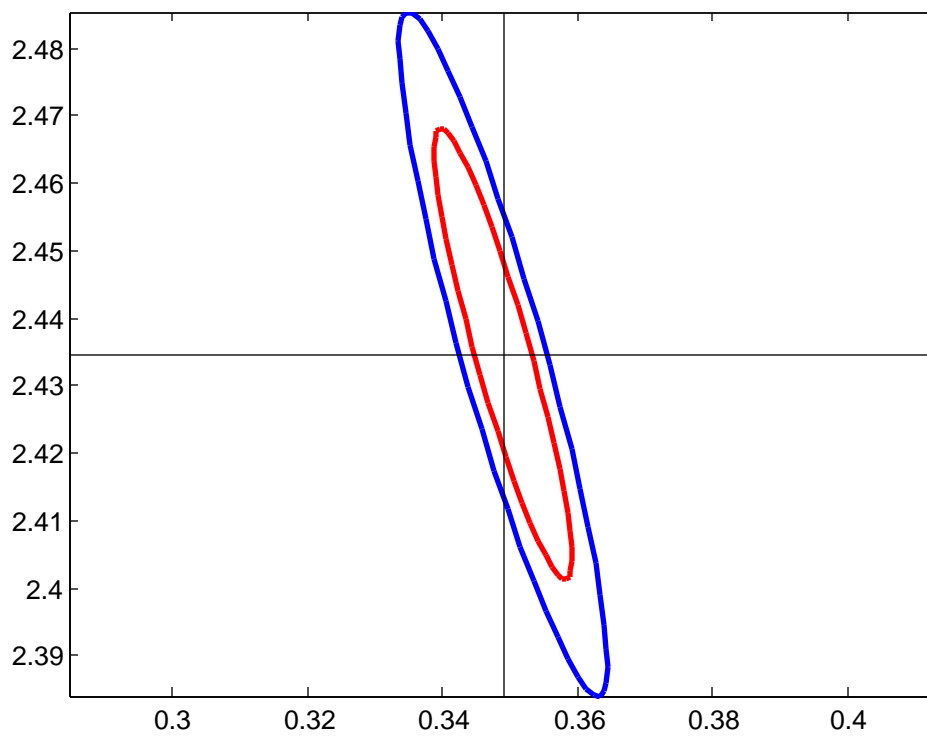
```

data1_14_hw5_2_sol
n =
  10
n0 =
  7
r =
  3
u =
  2
c =
  5
m =
  0.25
b =
  2.5
A =
Columns 1 through 8
  -0.25    0    0    0    0    0    0    0
    0    0    -0.25    0    0    0    0    0
    0    0    0    0    -0.25    1    0    0
    0    0    0    0    0    0    -0.25    1
    0    0    0    0    0    0    0    0
Columns 9 through 10
    0    0
    0    0
    0    0
    0    0
  -0.25    1
B =
  -1.08    -1
  -1.98    -1
  -2.95    -1
  -3.99    -1
  -4.92    -1
W =
  1    0    0    0    0    0    0    0    0    0
  0    1    0    0    0    0    0    0    0    0
  0    0    1    0    0    0    0    0    0    0
  0    0    0    1    0    0    0    0    0    0
  0    0    0    0    1    0    0    0    0    0
  0    0    0    0    0    1    0    0    0    0
  0    0    0    0    0    0    1    0    0    0
  0    0    0    0    0    0    0    1    0    0
  0    0    0    0    0    0    0    0    1    0
  0    0    0    0    0    0    0    0    0    1
f =
  -0.02
  -0.195
  -0.1725
  -0.3325
  -0.43
del =
  0.098701
  -0.064524
del =
  0.00019076
  -0.00056923
del =
  6.1309e-05
  -0.00018295
del =
  1.2048e-07
  -3.595e-07
del =
  3.9507e-08
  -1.1789e-07
del =
  7.7635e-11
  -2.3166e-10
m =
  0.34895
b =
  2.4347
v =
  -0.0067169
  0.019249
  0.020017
  -0.057364
  -0.01684
  0.048259
  0.00091857
  -0.0026324
  0.0026212
  -0.0075116
tst =
  10.865
cv1 =
  0.2158
cv2 =
  9.3484
assume pass
Qdd =
  0.11942    -0.35634
  -0.35634    1.2877
S =
  7.4635e-05    -0.00022271
  -0.00022271    0.00080479
V =
  -0.96273    -0.27047
  -0.27047    0.96273
D =
  1.2066e-05    0
  0    0.00086736
lam1 =

```

```
0.00086736
lam2 =
1.2066e-05
evec1 =
-0.27047
0.96273
evec2 =
-0.96273
-0.27047
aa =
0.034676
bb =
0.0040898
thetad =
105.69
sig0_sqr_hat =
0.0022635
assume not pass
Qdd =
0.11942 -0.35634
-0.35634 1.2877
S =
0.0002703 -0.00080658
-0.00080658 0.0029147
V =
-0.96273 -0.27047
-0.27047 0.96273
D =
4.3698e-05 0
0 0.0031413
lam1 =
0.0031413
lam2 =
4.3698e-05
evec1 =
-0.27047
0.96273
evec2 =
-0.96273
-0.27047
aa =
0.05261
bb =
0.006205
thetad =
105.69
diary off
```

50% confidence region, m,b, HW5-2, red=assume pass, blue=assume not pass



```

% data1_14_hw5_2_sol.m 8-dec-2014
% GLS line fit with conf region

degrad=180/pi;
x=[1.08;1.98;2.95;3.99;4.92];
y=[2.79;3.19;3.41;3.83;4.16];
x0=x;
y0=y;
l=[x(1);y(1);x(2);y(2);x(3);y(3);x(4);y(4);x(5);y(5)];
l0=l;

np=5;
n=10
n0=7
r=n-n0
u=2
c=r+u

% initial approx.
m=0.25
b=2.5

sigx=0.025;
sigy=0.025;
sig0=sigx;
sig0_sqr=sig0*sig0;
W=eye(10);
Q=eye(10);

for iter=1:6
x0=[l0(1);l0(3);l0(5);l0(7);l0(9)];
y0=[l0(2);l0(4);l0(6);l0(8);l0(10)];
A=zeros(c,n);
B=zeros(c,u);
f=zeros(c,1);
F=zeros(c,1);
for i=1:np
j=(i-1)*2 + 1;
A(i,j:j+1)=[-m 1];
B(i,:)=[-x0(i) -1];
F(i)=y0(i)-m*x0(i)-b;
end
f=-F - A*(l-l0);

if (iter==1)
A
B
W
f
end
Qe=A*Q*A';
We=inv(Qe);
N=B'*We*B;
t=B'*We*f;
del=inv(N)*t;
m=m+del(1);
b=b+del(2);
v=Q*A'*We*(f-B*del);
l0=l+v;
end

m
b

v

tst=v'*W*v/sig0_sqr
cv1=icdf('chi2',0.025,r)
cv2=icdf('chi2',0.975,r)

% assume pass

disp('assume pass');
Qdd=inv(N)
S=sig0_sqr*Qdd
[V,D]=eig(S)
% largest eigenvalue is #2
lam1=D(2,2)
lam2=D(1,1)
evec1=V(:,2)
evec2=V(:,1)
P=0.5;
aa=sqrt(lam1*icdf('chi2',P,2))
bb=sqrt(lam2*icdf('chi2',P,2))
theta=atan2(evec1(2),evec1(1));
thetad=theta*degrad

draw_ell(m,b,aa,bb,theta);
title('50% confidence region, m,b, HW5-2, red=assume pass, blue=assume not pass');
hold on
axis equal

% assume not pass

sig0_sqr_hat=v'*W*v/r
disp('assume not pass');
Qdd=inv(N)
S=sig0_sqr_hat*Qdd
[V,D]=eig(S)
% largest eigenvalue is #2
lam1=D(2,2)
lam2=D(1,1)
evec1=V(:,2)

```

```
evect2=V(:,1)
P=0.5;
aa=sqrt(lam1*icdf('f',P,2,r))
bb=sqrt(lam2*icdf('f',P,2,r))
theta=atan2(evect2(2),evect2(1));
thetad=theta*degrad

colstr='b-';
draw_ell2(m,b,aa,bb,theta,colstr);
ax=axis;
plot([m m],[ax(3) ax(4)],'k-');
plot([ax(1) ax(2)],[b b], 'k-');
```