```
hw2_a
ans =
        0.0264942800716238       -0.0308373389718786        0.0170453526529462
         -2.23085223808766         -3.24163943802738          3.40114763115001
ans =
     -0.000311193509777884     -0.000577937075227173      0.000407036352140442
        -0.568950435467068         0.439550586114589         0.498171001916247
ans =
     -7.96810912867162e-07     -9.14874720446597e-07      2.83153808750871e-07
      -0.00110049112506329      0.000785962485530771     -3.96717474198467e-05
ans =
       7.5869180321914e-12      1.63284325630194e-10     -7.61623553100311e-12
      1.08260322203646e-07      5.89710660913801e-08     -6.30072868857377e-09
ans =
     -9.99682000311159e-11     -7.58642831901298e-11      9.99745877946153e-12
     -4.56064328385741e-08       6.4527075506441e-08     -4.08975872015927e-09
w,p,k radians
ans =
        0.0261822896585517       -0.0314161908344061        0.0174526721612766
w,p,k degrees
ans =
           1.50013469542404         -1.80001514318905         0.999964456066617
XL,YL,ZL
ans =
           2377.19909689797          10377.1986972341          703.899278950928
residuals
v =
     -8.40100208681763e-05
     -8.97768347702828e-05
     -0.000337316902309624
     -0.000338236682989443
      0.000425362702144377
      -0.00011714091583586
     -6.34700033249018e-05
      0.000241937719434792
     -5.10732286614943e-05
      2.88851669287129e-05
      0.000115988717924273
      0.000287504283988529
diary off
```

```
hw2_b
ans =
          3.42692241169692         -2.51869337142686          3.9302734246534
ans =
       -0.0259582893745893        0.0187265748917872       -0.0302657661116996
ans =
     -1.29601286395284e-06      2.51919442105796e-06     -2.17629026759148e-06
ans =
       -5.192345733902e-10      2.73033687870597e-09      5.98148461872325e-09
ans =
     -7.48746926703021e-10     -2.76217354652948e-12      2.46729786182303e-09
XYZ intersected point
ans =
          2603.40096282504          10227.5000357254           203.9000054907
residuals
v =
      7.29197273731052e-09
     -9.32153427710551e-05
      6.10718591300596e-07
      9.61745241713147e-05
diary off
```

```
% hw2a.m  23-jan-2013
% solve resection problem

degrad=180/pi;

% initial approximations
XL=2380;
YL=10380;
ZL=700;
om=0;
ph=0;
kp=0;

x=[-77.667 -72.762 -71.985 39.628 39.786 38.931];
y=[-97.007 -3.299 86.212 -95.267 -8.508 82.168];
X=[2150.8 2155.3 2152.7 2528.0 2525.6 2520.3];
Y=[10077.2 10375.5 10668.1 10080.6 10364.4 10671.0];
Z=[203.5 198.2 205.7 201.4 201.8 199.6];

% fill in the p-vector
p=zeros(14,1);
dp=ones(14,1)*1.0e-08;
x0=0;
y0=0;
foc=152.4;
p(3)=x0;
p(4)=y0;
p(5)=foc;
p(6)=om;
p(7)=ph;
p(8)=kp;
p(9)=XL;
p(10)=YL;
p(11)=ZL;

partials=zeros(2,14);
for iter=1:5
  B=zeros(12,6);
  f=zeros(12,1);
  rc=1;
  for i=1:6
    p(1)=x(i);
    p(2)=y(i);
    p(12)=X(i);
    p(13)=Y(i);
    p(14)=Z(i);
    F0=col(p);
    for j=1:14
      pp=p;
      pp(j)=pp(j) + dp(j);
      F1=col(pp);
      partials(:,j)=(F1-F0)*(1/dp(j));
      end
    B(rc:rc+1,:)=partials(:,6:11);
    f(rc:rc+1)=-F0;
    rc=rc+2;
    end
  %B
  %f
  del=inv(B'*B)*B'*f;
  [del(1:3)'; del(4:6)']
  %pause
  om=om+del(1);
```

```
  ph=ph+del(2);
  kp=kp+del(3);
  XL=XL+del(4);
  YL=YL+del(5);
  ZL=ZL+del(6);
  p(6:11)=[om;ph;kp;XL;YL;ZL];
  end
disp('w,p,k radians');
[om ph kp]
disp('w,p,k degrees');
[om ph kp]*degrad
disp('XL,YL,ZL');
[XL YL ZL]
disp('residuals');
v=f-B*del
```

```
% hw2b.m  23-jan-2013
% solve intersection problem

degrad=180/pi;

% fixed data
XL1=2377.2;
YL1=10377.2;
ZL1=703.9;
om1=1.5/degrad;
ph1=-1.8/degrad;
kp1=1.0/degrad;

XL2=2678.8;
YL2=10380.3;
ZL2=707.1;
om2=-2.0/degrad;
ph2=1.0/degrad;
kp2=0.5/degrad;

x0=0;
y0=0;
foc=152.4;

% initial approximation
X=2600.0;
Y=10230.0;
Z=200.0;

% fill in the two p-vectors
p1=zeros(14,1);
p2=zeros(14,1);
dp=ones(14,1)*1.0e-08;

p1(1)=62.940;
p1(2)=-50.435;
p1(3)=x0;
p1(4)=y0;
p1(5)=foc;
p1(6)=om1;
p1(7)=ph1;
p1(8)=kp1;
p1(9)=XL1;
p1(10)=YL1;
p1(11)=ZL1;
p1(12)=X;
p1(13)=Y;
p1(14)=Z;

p2(1)=-20.250;
p2(2)=-40.252;
p2(3)=x0;
p2(4)=y0;
p2(5)=foc;
p2(6)=om2;
p2(7)=ph2;
p2(8)=kp2;
p2(9)=XL2;
p2(10)=YL2;
p2(11)=ZL2;
p2(12)=X;
p2(13)=Y;
p2(14)=Z;
```

```
partials=zeros(2,14);
for iter=1:5
  B=zeros(4,3);
  f=zeros(4,1);
  % equations for left photo
  F0=col(p1);
  for j=1:14
    pp=p1;
    pp(j)=pp(j) + dp(j);
    F1=col(pp);
    partials(:,j)=(F1-F0)*(1/dp(j));
    end
  B(1:2,:)=partials(:,12:14);
  f(1:2)=-F0;
  % equations for right photo
  F0=col(p2);
  for j=1:14
    pp=p2;
    pp(j)=pp(j) + dp(j);
    F1=col(pp);
    partials(:,j)=(F1-F0)*(1/dp(j));
    end
  B(3:4,:)=partials(:,12:14);
  f(3:4)=-F0;

  %B
  %f
  del=inv(B'*B)*B'*f;
  del'
  %pause
  X=X+del(1);
  Y=Y+del(2);
  Z=Z+del(3);
  p1(12:14)=[X;Y;Z];
  p2(12:14)=[X;Y;Z];
  end

disp('XYZ intersected point');
[X Y Z]
disp('residuals');
v=f-B*del
```

```
% col.m  23-jan-2013
% evaluate collinearity eqns

function result=col(p);
x=p(1);
y=p(2);
x0=p(3);
y0=p(4);
f=p(5);
om=p(6);
ph=p(7);
kp=p(8);
XL=p(9);
YL=p(10);
ZL=p(11);
X=p(12);
Y=p(13);
Z=p(14);
m1=[1 0 0;0 cos(om) sin(om);0 -sin(om) cos(om)];
m2=[cos(ph) 0 -sin(ph);0 1 0;sin(ph) 0 cos(ph)];
m3=[cos(kp) sin(kp) 0;-sin(kp) cos(kp) 0;0 0 1];
M=m3*m2*m1;
UVW=M*[X-XL;Y-YL;Z-ZL];
U=UVW(1);
V=UVW(2);
W=UVW(3);
Fx=x-x0+f*(U/W);
Fy=y-y0+f*(V/W);
result=[Fx;Fy];
```