```
% qbresect.m  5-april-2008
% qb resection module based on polynomial
% corrections to ephemeris data, based on
% notes & code in lecture 22

NPAR=18
par=zeros(18,1);
% parameter order:
% dxo,dx1,dx2,dy0,dy1,dy2,dz0,dz1,dz2
% dw0,dw1,dw2,dp0,dp1,dp2,dk0,dk1,dk2
puse=[1;4;7;2;5;8];
[m,n]=size(puse);
npuse=m;
% use = 1/0 parameter index array
use=zeros(NPAR,1);
for i=1:NPAR
  for j=1:npuse
    if(puse(j)==i)
      use(i)=1;
      end
    end
  end

% read support data
eph=dlmread('eph_cdf.txt');
att=dlmread('att_cdf.txt');

% read GCPs & image measurements
[id,pd,pm,ps,ld,lm,ls,h,l,s]=textread('gcp.txt','%s %f %f %f %f %f %f %f↙
%f %f');
[m,n]=size(pd);
npts=m;

% init LS matrices
N=zeros(npuse,npuse);
t=zeros(npuse,1);
B=zeros(2*npts,npuse);
f=zeros(2*npts,1);
delta=zeros(NPAR,1);
% deltas might need tweaking based on units
% for i=1:NPAR
%   delta(i)=1.0e-06;
%   end
for i=1:9
  delta(i)=1.0e-03;
  end
for i=10:18
  delta(i)=1.0e-06;
  end

% nonlinear LS iteration loop
for iter=1:10
  nxeqn=1;
  nyeqn=2;
  dispv=zeros(npts,3);
  rmsl=0;
  rmss=0;
  % build condition equations
  for j=1:npts
    % convert GCPs
    phi=(pd(j)+pm(j)/60+ps(j)/3600)*(pi/180);
    lam=(ld(j)+lm(j)/60+ls(j)/3600)*(pi/180);
    lam=-lam;
    ht=h(j);
    line=l(j);
    sample=s(j);
    % nominal value of condition equations
    F=qb(line,sample,phi,lam,ht,eph,att,par);
    % v + B*del = f
    dispv(j,1)=j;
    dispv(j,2)=F(1);
    dispv(j,3)=F(2);
    rmsl=rmsl+F(1)^2;
    rmss=rmss+F(2)^2;
    col=1;
    for i=1:NPAR
      if(use(i) == 1)
        % compute dFx/dp dFy/dp numerically
        % fill coeff matrices B,f
        pardel=par;
        pardel(i)=pardel(i) + delta(i);
        Fdel=qb(line,sample,phi,lam,ht,eph,att,pardel);
        dFxdp=(Fdel(1)-F(1))/delta(i);
        dFydp=(Fdel(2)-F(2))/delta(i);
        B(nxeqn,col)=dFxdp;
        B(nyeqn,col)=dFydp;
        col=col+1;
        f(nxeqn)=-F(1);
        f(nyeqn)=-F(2);
        end; % use(i) == 1
      end; % parameter loop
    nxeqn=nxeqn+2;
    nyeqn=nyeqn+2;
    end; % point loop
  N=B'*B;
  t=B'*f;
  con_num=cond(N)
  del=inv(N)*t;
  disp('parameter corrections');
  del
  % apply to the parameters
  col=1;
  for i=1:NPAR
    if(use(i) == 1)
      par(i)=par(i) + del(col);
      col=col+1;
      end
    end
  rmsl=sqrt(rmsl/npts);
  rmss=sqrt(rmss/npts);
  % next iteration
  end

% if you want to terminate the iterations look at
% magnitude of the delta vector, or stability of vTWv

disp('parameters');
par
disp('residuals');
dispv  % #,vx,vy
disp('rms l&s');
[rmsl rmss]
```

```
qbresect
NPAR =
    18
con_num =
  2.2227e+005
parameter corrections
del =
      -16.499
       1.4814
       40.044
      -10.016
      -13.898
       7.6394
con_num =
  2.2221e+005
parameter corrections
del =
    0.0029844
   -0.0011474
   -0.0080711
    0.0033319
     0.004551
   -0.0020478
con_num =
  2.2221e+005
parameter corrections
del =
  -0.00011254
  5.2713e-005
   0.00037149
  -0.00017632
  -0.00028001
   0.00013176
con_num =
   2.222e+005
parameter corrections
del =
   -0.0003239
  6.6485e-005
    0.0010499
  -0.00020743
   -0.0008011
   0.00016189
con_num =
  2.2221e+005
parameter corrections
del =
   0.00023958
 -6.3711e-005
  -0.00077985
   0.00020459
   0.00059329
  -0.00015677
con_num =
  2.2221e+005
parameter corrections
del =
  1.3593e-005
 -1.5759e-005
 -4.6976e-005
  5.4341e-005
  3.4341e-005
 -3.9858e-005
con_num =
  2.2221e+005
parameter corrections
```

```
del =
  1.2751e-005
 -2.9488e-005
 -4.7735e-005
   0.00010286
  3.2843e-005
 -7.4806e-005
con_num =
  2.2221e+005
parameter corrections
del =
  -0.00011473
  5.7434e-005
   0.00037985
  -0.00019284
  -0.00028545
   0.00014365
con_num =
   2.222e+005
parameter corrections
del =
   0.00014676
 -6.1863e-005
  -0.00048316
   0.00020581
   0.00036449
  -0.00015416
con_num =
   2.222e+005
parameter corrections
del =
  -0.00045022
   0.00017186
    0.0014776
  -0.00056807
   -0.0011175
   0.00042738
parameters
par =
      -16.497
       1.4804
            0
       40.038
      -10.013
            0
      -13.895
       7.6378
            0
            0
            0
            0
            0
            0
            0
            0
            0
            0
residuals
dispv =
            1     -0.31039    -0.026166
            2     -0.25922     -0.63109
            3      -0.7227     -0.96499
            4     -0.34161       0.8446
            5      0.34066      0.70344
            6      0.30551      0.65204
            7      0.38188     -0.54277
            8    -0.074751     -0.66921
            9       -1.558      0.44008
           10      -1.4858       2.1287
           11        0.262      -1.1526
           12       1.4793       1.2583
           13     -0.15006      -1.6297
           14      -0.3407     -0.31858
           15       0.5507    -0.021001
           16      0.28856     0.028249
           17      0.96791      0.16172
           18     -0.74097     -0.38447
           19       1.1655      0.39014
           20      0.22776     -0.26674
rms l&s
ans =
      0.75752      0.85144
diary off
```