baseline

```
function [omc,bas] = baseline(X_i,obs1,obs2,sats,time,Eph)
% BASELINE Computation of baseline between master and rover
%          from pseudoranges alone

%Kai Borre 31-10-2001
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%$Revision: 1.1 $  $Date: 2002/11/24  $

m = size(obs1,1);  % number of svs
% identify ephemerides columns in Eph
for t = 1:m
    col_Eph(t) = find_eph(Eph,sats(t),time);
end
% preliminary guess for receiver position
X_j = X_i(1:3,1);
% Computation of weight matrix
D = [ones(m-1,1) -eye(m-1) -ones(m-1,1) eye(m-1)];
C = inv(D*D');
```

```
for iter = 1:8
    % k is the reference satellite. We select the first one
    [tcorr,rhok_j,Xk_ECF] = get_rho(time, obs2(1), Eph(:,col_Eph(1)),X_j);
    [tcorr,rhok_i,Xk_ECF] = get_rho(time, obs1(1), Eph(:,col_Eph(1)),X_i);
    for t = 2:m % t runs over PRNs given in sats; ref.sat. is number 1
        [tcorr,rhol_j,Xl_ECF] = get_rho(time, obs2(t), Eph(:,col_Eph(t)), X_j);
        [tcorr,rhol_i,Xl_ECF] = get_rho(time, obs1(t), Eph(:,col_Eph(t)), X_i);
        A(t-1,:) = [(Xk_ECF(1)-X_j(1))/rhok_j - (Xl_ECF(1)-X_j(1))/rhol_j,  ...
                    (Xk_ECF(2)-X_j(2))/rhok_j - (Xl_ECF(2)-X_j(2))/rhol_j,  ...
                    (Xk_ECF(3)-X_j(3))/rhok_j - (Xl_ECF(3)-X_j(3))/rhol_j];
        observed = obs1(1)-obs2(1)-obs1(t)+obs2(t);
        calculated = rhok_i-rhok_j-rhol_i+rhol_j;
        omc(t-1,1) = observed - calculated;
    end; % t
    x = inv(A'*C*A)*A'*C*omc;
    X_j = X_j+x;
end % iter
bas = X_i(1:3,1)-X_j;
```

easy4.m

```
%EASY4   The master reciever position is computed like in EASY3.
%               Next the observations taken by the rover receiver are
%               introduced and the function baseline returns the baseline
%               components epoch by epoch.
%               Note that the sequence of satellites in the stored data is
%              not the same at master and rover receivers. Therefore we
%              must introduce a matching mechanism.

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%$Revision: 1.1 $  $Date: 2009/04/04  $

% Read RINEX ephemerides file and convert to internal Matlab format
rinexe('SITE247J.01N','eph.dat');
Eph = get_eph('eph.dat');

% We identify the master observation file and open it
ofile1 = 'SITE24~1.01O';
fid1 = fopen(ofile1,'rt');
[Obs_types1, ant_delta1, ifound_types1, eof11] = anheader(ofile1);
NoObs_types1 = size(Obs_types1,2)/2;
```

```
Pos = [];
Gdop = [];
% There are 22 epochs of data in ofile1
qend = 22;

for q = 1:qend
    [time1, dt1, sats1, eof1] = fepoch_0(fid1);
    NoSv1 = size(sats1,1);
    % We pick the observed C1 pseudoranges
    obs1 = grabdata(fid1, NoSv1, NoObs_types1);
    i = fobs_typ(Obs_types1,'C1');
    [pos, el, gdop] = recpo_ls(obs1(:,i),sats1,time1,Eph);
    Gdop = [Gdop gdop];
    Pos = [Pos pos];
end
me = mean(Pos,2);
spread = std(Pos,1,2)
fprintf('\nMean position as computed from %2.0f epochs:',qend)
fprintf('\n\nX: %12.3f  Y: %12.3f  Z: %12.3f\n\n', me(1,1), me(2,1), me(3,1))

figure(1);
plot((Pos(1:3,:)-Pos(1:3,1)*ones(1,q))','linewidth',2)
title(['Variation of Receiver Coordinates Over ',int2str(qend),' Epochs'],'fontsize',16)
legend('X','Y','Z')
xlabel('Epochs [1 s interval]','fontsize',16)
ylabel('[m]','fontsize',16)
print -depsc easy4_1
```

Solution to EASY4

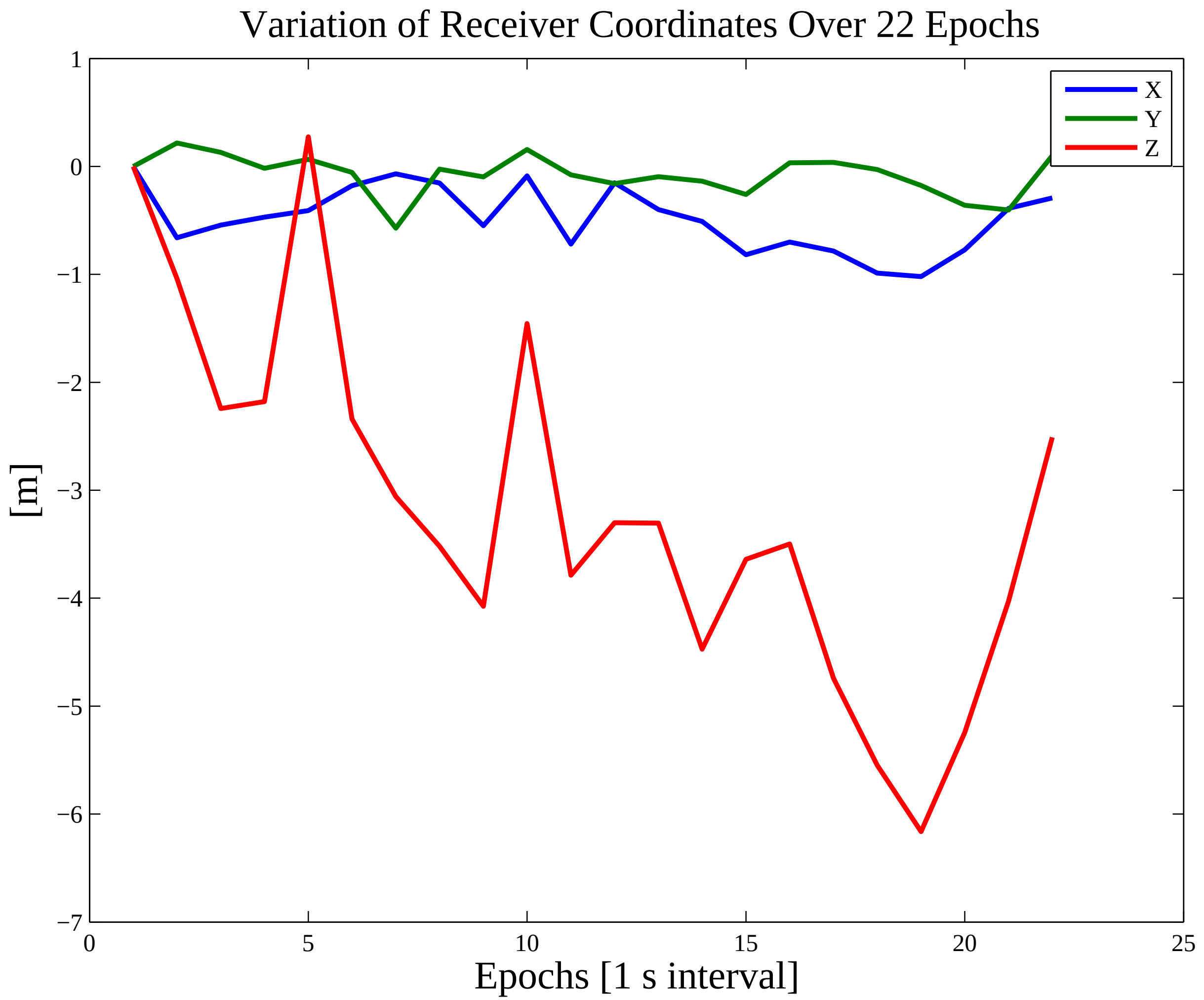
```
% we need to close all open files and then open to read from the beginning
fclose all;

ofile1 = 'SITE24~1.010';
fid1 = fopen(ofile1,'rt');
[Obs_types1, ant_delta1, ifound_types1, eof11] = anheader(ofile1);
NoObs_types1 = size(Obs_types1,2)/2;
% Next we include the rover and identify the rover
% observation file and open it
ofile2 = 'SITE247j.010';
fid2 = fopen(ofile2,'rt');
[Obs_types2, ant_delta2, ifound_types2, eof12] = anheader(ofile2);
NoObs_types2 = size(Obs_types2,2)/2;
master_pos = me;  % best possible estimate of master position
bases = [];
Omc = [];

for q = 1:qend
    [time1, dt1, sats1, eof1] = fepoch_0(fid1);
    [time2, dt2, sats2, eof2] = fepoch_0(fid2);
    if time1 ~= time2
        disp('Epochs not corresponding')
        break
    end;
    NoSv1 = size(sats1,1);
    NoSv2 = size(sats2,1);
```

```
    % We pick the observations
    obsm = grabdata(fid1, NoSv1, NoObs_types1);
    obsr = grabdata(fid2, NoSv2, NoObs_types2);
    i = fobs_typ(Obs_types1,'C1');
    obs1 = obsm(:,i);
    for s = 1:NoSv1
        ind = find(sats1(s) == sats2(:));
        obs2(s,1) = obsr(ind,1);
    end
    % master observations: obs1, and rover observations: obs2
    [omc,base] = baseline(master_pos,obs1,obs2,sats1,time1,Eph);
    Omc = [Omc, omc];
    bases = [bases base];
end
me1 = mean(bases,2);
spread1 = std(bases,1,2)
fprintf('\nBaseline Components as Computed From %2.0f Epochs:',qend)
fprintf('\n\nX: %12.3f  Y: %12.3f  Z: %12.3f', me1(1,1),me1(2,1),me1(3,1))

figure(2);
plot((bases-bases(:,1)*ones(1,q))','linewidth',2)
title(['Variation of Baseline Components Over ',int2str(qend),' Epochs'],'fontsize',16)
legend('X','Y','Z')
xlabel('Epochs [1 s interval]','fontsize',16)
ylabel('[m]','fontsize',16)
set(gca,'fontsize',16)
legend
```

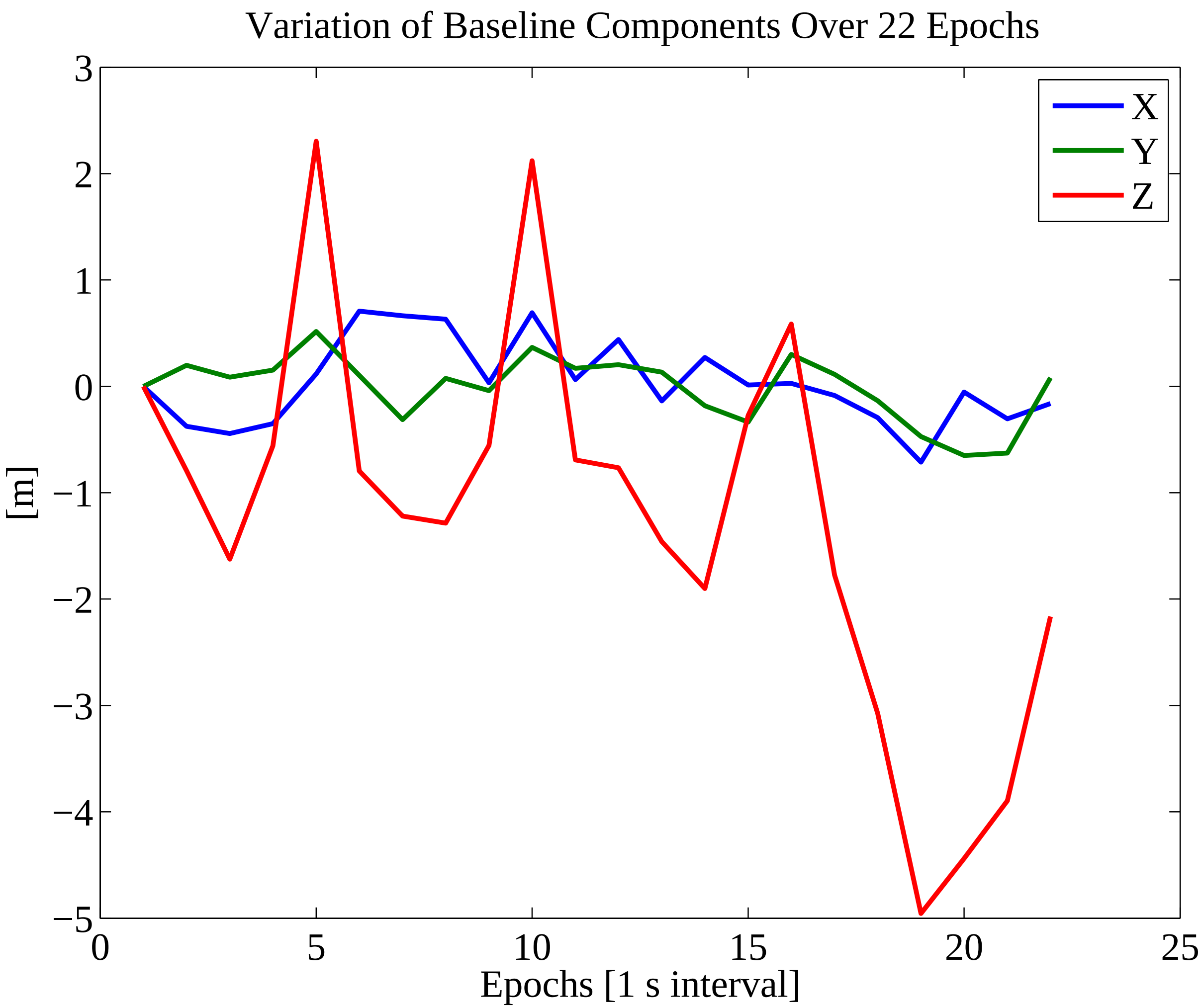
```
print -depsc easy4_2

figure(3);
plot(Gdop,'linewidth',2)
axis([1 length(Gdop) 0 5])
title('GDOP')

print -depsc easy4_3
```

```
>>easy4
head_lines =
          8.00
noeph =
          7.00
status =
             0
ans =
             0
spread =
          0.29
          0.19
          1.62
        584.78

Mean position as computed from 22 epochs:
X:  3427821.181  Y:   603657.387  Z:  5326875.567
spread1 =
          0.39
          0.30
          1.75

Baseline Components as Computed From 22 Epochs:
X:        0.571  Y:       -7.724  Z:       -0.622
```

Solution to EASY4



Solution to EASY4



Solution to EASY4