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```
% Sequential-source data reconstruction from randomized 'marine' acquisiton

% this is for the lab(project2) from eosc 454

% lina miao
% 74721119



% The exercise deals with the reconstruction of a fully sampled data-volume
% from data that was subsampled by firing randomly dithered sources in marine.
```

Installation

download and install

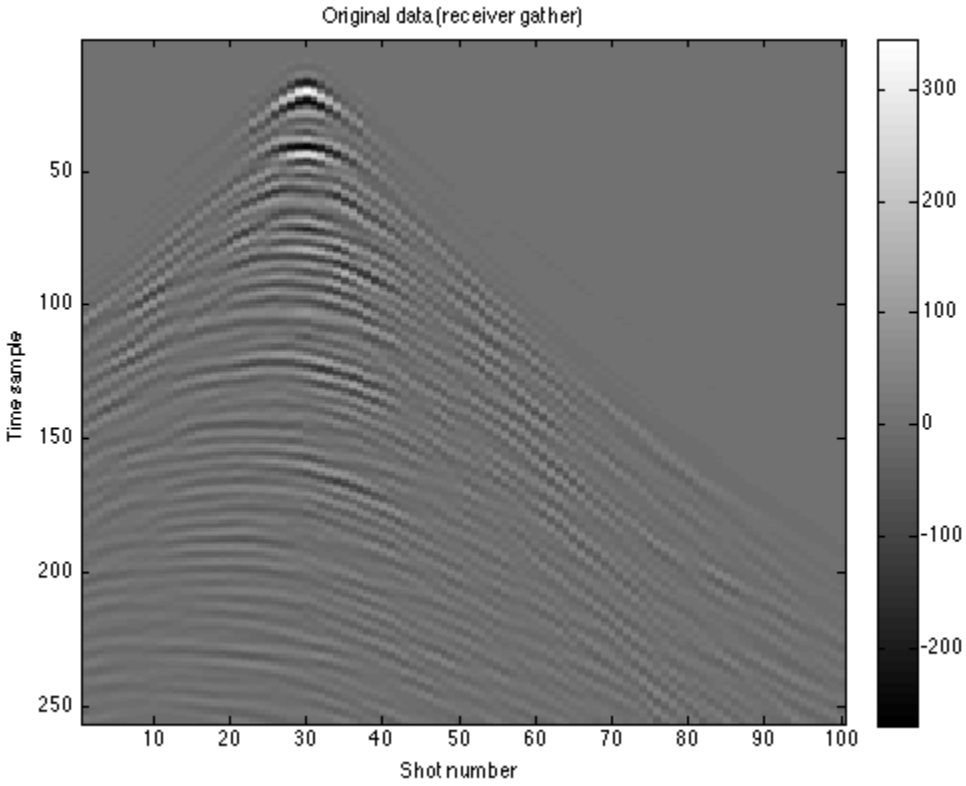
```
clear; close all;
cd ./functions
addpath(genpath(pwd))
cd ..
cd ./simu_functions/
addpath(genpath(pwd))
cd ..
```

Data

Number of time samples

```
nt = 1024;
% Number of sources
ns = 178;
% Number of receivers
nr = 178;

% Time sampling interval
dt = 0.004;

% Read data
D = ReadSuFast('GulfOfSuez178.su');
```

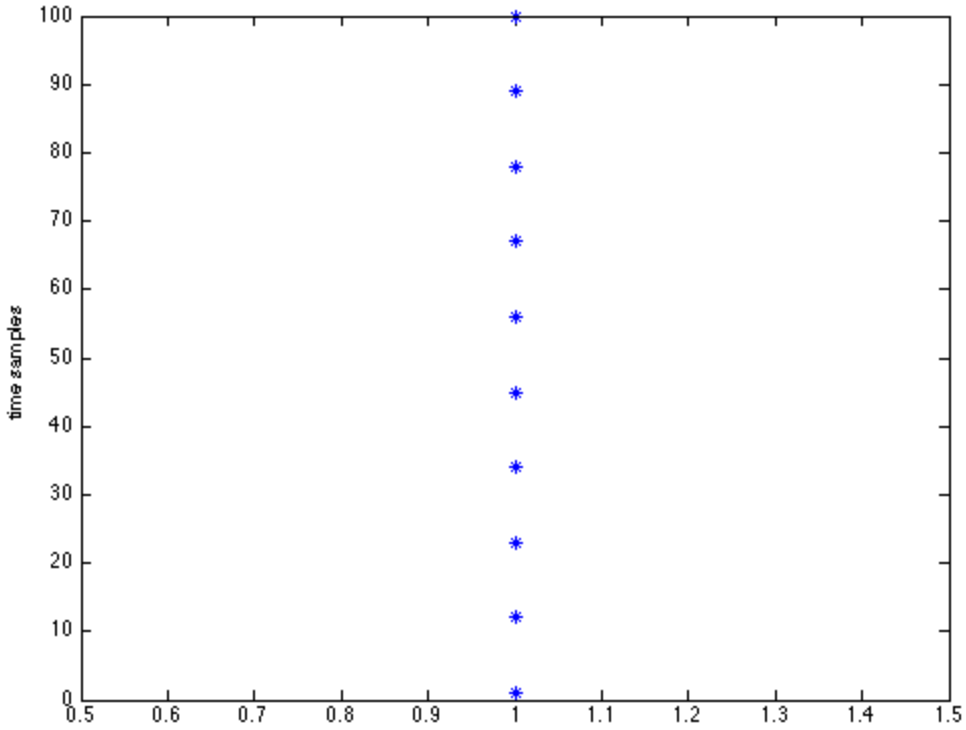
```
D = reshape(D,nt,nr,ns);

% Select small subset
D = D(1:256,30,1:100);

% Define new data sizes
[nt,nr,ns] = size(D);

% Vectorize D
D = D(:);

% Display
figure
imagesc(reshape(D,nt,ns)); colormap(gray); colorbar;
title('Original data (receiver gather)');
xlabel('Shot number'); ylabel('Time sample')
```

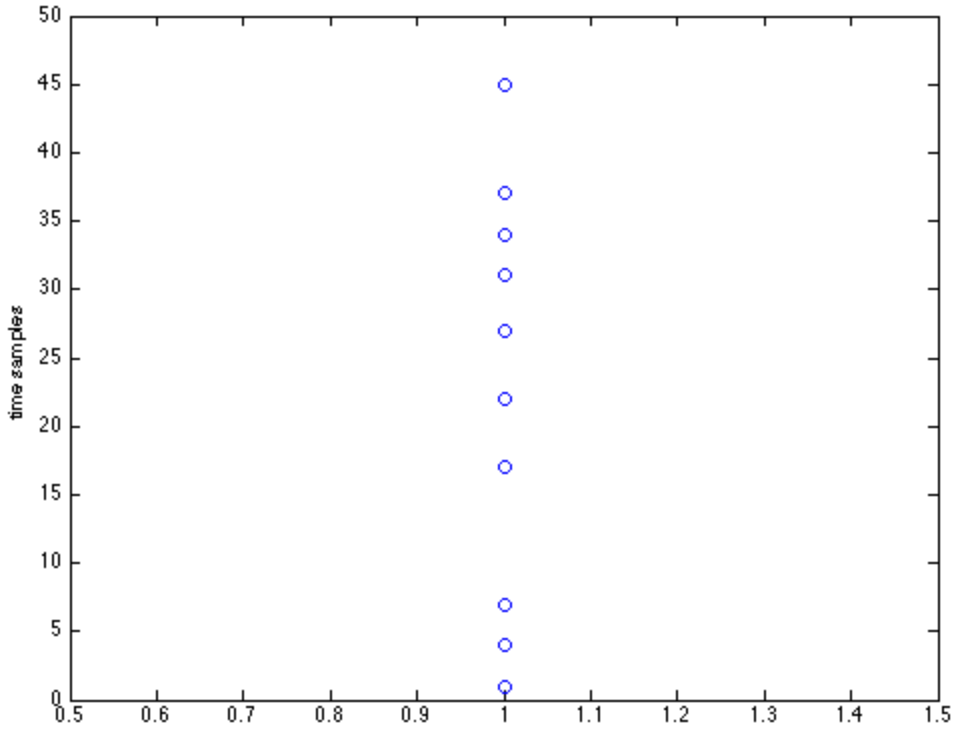


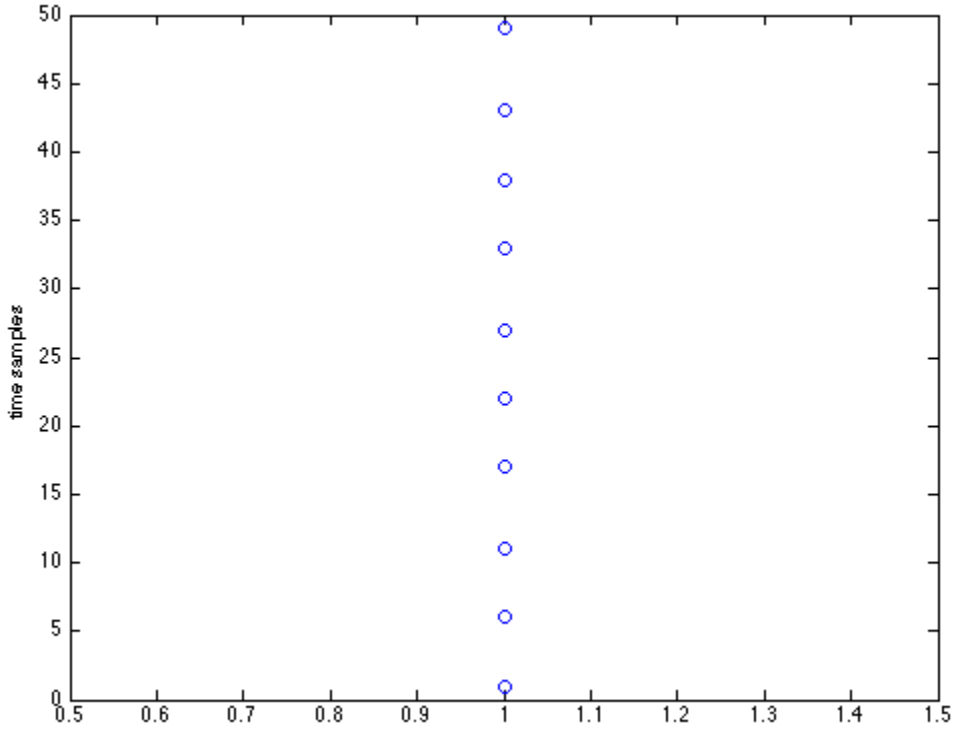
Set the patameters for randomized experiment

```
I  = eye(10);
RM1 = opSimSourceRandTimeDither([10 1 10], [5*10 1], 10);
RM2 = opSimSourcePeriodTimeDither([10 1 10], [5*10 1], 10);

% plot very long time series
figure;
plot(I(:),1:length(I(:)),'*');xlim([0.5 1.5]);ylabel('time samples');
```

```
% plot compressed series
figure;
plot(RM1*I(:),1:length(RM1*I(:)),'o');xlim([0.5 1.5]);ylabel('time samples');
figure;
plot(RM2*I(:),1:length(RM2*I(:)),'o');xlim([0.5 1.5]);ylabel('time samples');
```




time samples
50
45
40
35
30
25
20
15
10
5
0
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5


time samples
50
45
40
35
30
25
20
15
10
5
0
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5

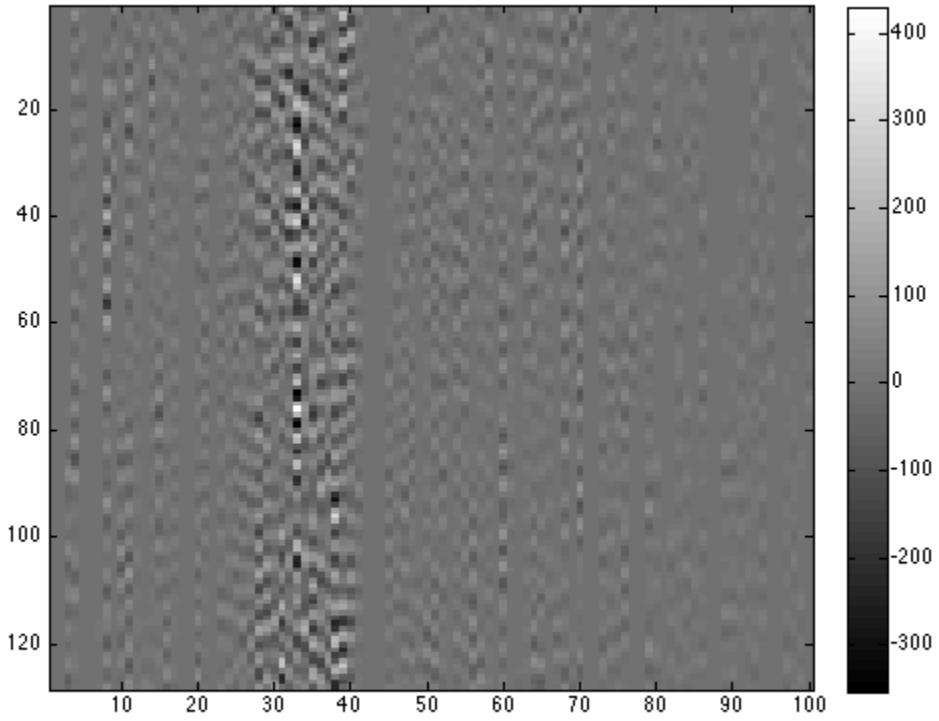
Construct the sampling operator RM for p = 0.5 that works on the vectorized version of the data using opSimSourceRandTimeDither.

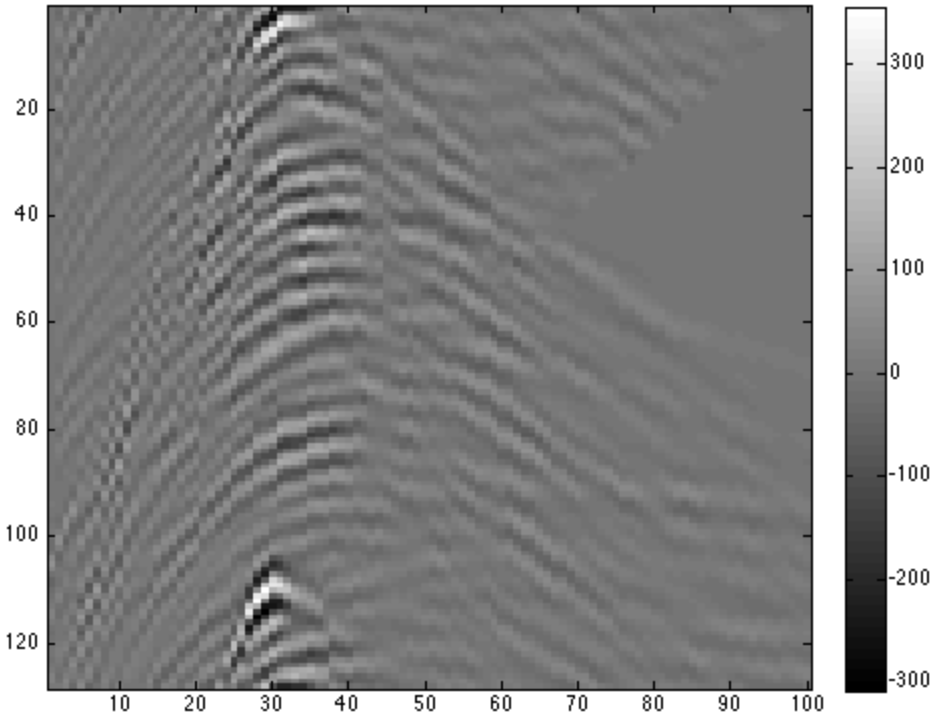
```
p = .5;
D_RM1 = opSimSourceRandTimeDither([nt,nr,ns],[p*nt*ns,1],ns);
D_RM2 = opSimSourcePeriodTimeDither([nt,nr,ns],[p*nt*ns,1],ns);

% Test the sampling operator with the dottest.
x_test = rand(size(D_RM1,2),1);
y_test = rand(size(D_RM1,1),1);
left = y_test'*(D_RM1*x_test);
right = (D_RM1'*y_test)'*x_test;
error = norm(left-right);
fprintf('In dottest error:%5.5e\n',error);
```

```
In dottest error:9.09495e-13
```

Generate simultaneous data simD and display the result.

```
simD1 = D_RM1*D;
simD2 = D_RM2*D;
figure;
imagesc(reshape(simD1,p*nt,ns)); colormap(gray); colorbar;
figure;
imagesc(reshape(simD2,p*nt,ns)); colormap(gray); colorbar;
```

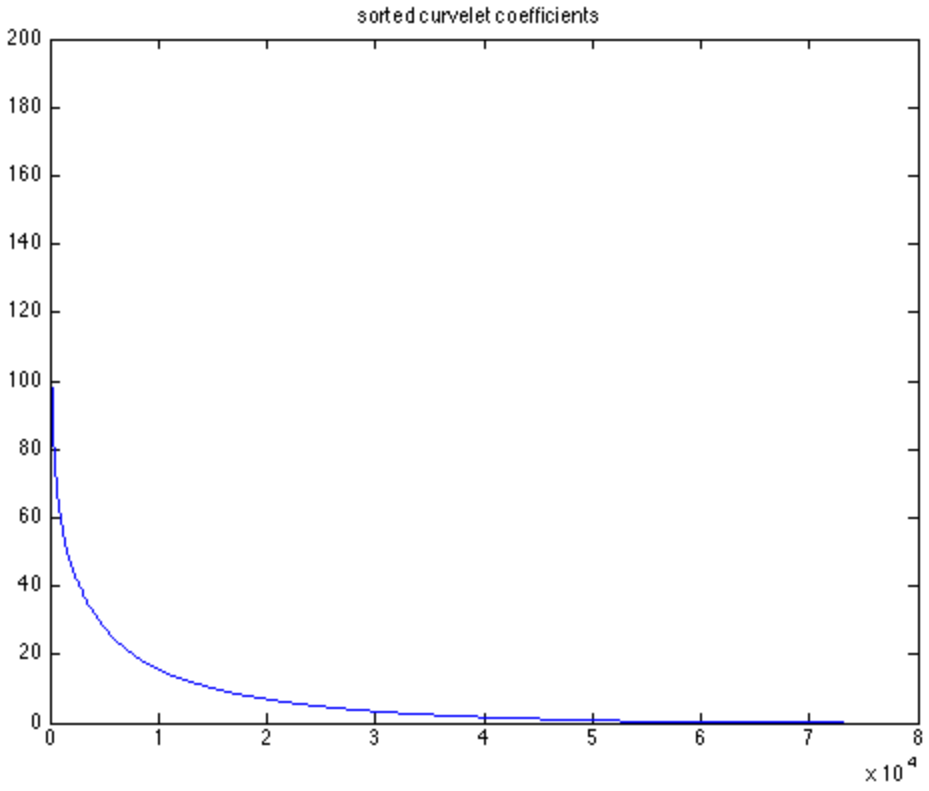




sparsifying transform

Use this to create a Curvelet SPOT operator:

```
C = opCurvelet(nt, ns);

% Transform the data into the Curvelet domain and plot the sorted coefficients
C_D = C*D;
sort_CD = sort(abs(C_D),'descend');
figure;plot(sort_CD);title('sorted curvelet coefficients')
```



exercises

Construct the measurement operator A. HINT: See 'Constructing a suitable matrix' in Lab 7. Using spgl1, estimate the curvelet coefficients xest.

```
fid = fopen('log.txt', 'w');
options = spgSetParms('optTol', 1e-4, 'iterations', 200);%, 'fid', fid);
p_list = [.5];
for i = 1:1
    p = p_list(i);
    D_RM1 = opSimSourceRandTimeDither([nt,nr,ns],[p*nt*ns,1],ns);
    simD1 = D_RM1*D;
    A = D_RM1*C';
    xestspg(:,i) = spgl1_origin(A,simD1,0,1e-3,[],options);
    options.iterations = 100;
    xestpqn(:,i) = pqnl1_2(A,simD1,0,1e-3,[],options);
    fspg(:,i) = C'*xestspg(:,i);
    snrspg(i) = SNR(D,fspg(:,i));
    fpqn(:,i) = C'*xestpqn(:,i);
    snrpqn(i) = SNR(D,fpqn(:,i));
end



figure;
subplot(1,2,1);imagesc(reshape(fspg(:,1),nt,ns)); colormap(gray);
```

```
title(strcat(['p = .5, SNR=' num2str(snrspg(1)) 'dB']))
subplot(1,2,2);imagesc(reshape(fspg(:,1)-D,nt,ns)); colormap(gray);
title('difference')


figure;
subplot(1,2,1);imagesc(reshape(fpqn(:,1),nt,ns)); colormap(gray);
title(strcat(['p = .5, SNR=' num2str(snrpqn(1)) 'dB']))
subplot(1,2,2);imagesc(reshape(fpqn(:,1)-D,nt,ns)); colormap(gray);
title('difference')
```

```
================================================================================
SPGL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
================================================================================
No. rows              :    12800      No. columns           :    73051
Initial tau           : 0.00e+00      Two-norm of b         : 4.18e+03
Optimality tol        : 1.00e-04      Target objective      : 1.00e-03
Basis pursuit tol     : 1.00e-06      Maximum iterations    :      200

 Iter      Objective   Relative Gap  Rel Error      gNorm    stepG     nnzX
    0  4.1781637e+03  0.0000000e+00   1.00e+00  2.273e+02      0.0        0
    1  4.1778195e+03  3.0710316e+00   1.00e+00  3.473e+02     -0.3        1
    2  3.0550282e+03  1.0823681e+01   1.00e+00  6.494e+02      0.0     2220
    3  2.6938334e+03  6.7133706e+00   1.00e+00  3.542e+02      0.0     5270
    4  2.5584579e+03  1.5349899e+00   1.00e+00  1.044e+02      0.0     4313
    5  2.5325814e+03  1.0059552e+00   1.00e+00  8.256e+01      0.0     3792
    6  2.5118079e+03  1.0649152e+00   1.00e+00  8.468e+01      0.0     3265
    7  2.4930769e+03  3.4264616e+00   1.00e+00  1.794e+02      0.0     2666
    8  2.4831590e+03  2.6048880e+00   1.00e+00  1.452e+02     -0.3     2536
    9  2.4710905e+03  8.4003336e-01   1.00e+00  7.464e+01      0.0     2493
   10  2.4669146e+03  6.0994154e-01   1.00e+00  6.543e+01      0.0     2449
   11  2.4597829e+03  5.8556681e-01   1.00e+00  6.430e+01      0.0     2330
   12  2.4415572e+03  4.1249755e+00   1.00e+00  1.986e+02      0.0     1617
   13  2.4430393e+03  3.1103907e+00   1.00e+00  1.604e+02     -0.3     1743
   14  2.4235912e+03  4.1045514e-01   1.00e+00  5.575e+01      0.0     1967
   15  2.4219091e+03  3.0408994e-01   1.00e+00  5.183e+01      0.0     1862
   16  2.4188825e+03  3.1246444e-01   1.00e+00  5.231e+01      0.0     1787
   17  2.4107921e+03  3.1585232e-01   1.00e+00  5.253e+01      0.0     1644
   18  2.4144079e+03  1.1852107e+00   1.00e+00  8.380e+01     -0.3     1562
   19  2.4131436e+03  2.0517805e+00   1.00e+00  1.174e+02     -0.3     1623
   20  2.4042635e+03  7.4728166e-01   1.00e+00  6.805e+01      0.0     1646
   21  2.4027047e+03  1.8775654e-01   1.00e+00  4.708e+01      0.0     1630
   22  2.4022551e+03  2.6821058e-01   1.00e+00  5.012e+01      0.0     1612
   23  2.4003927e+03  2.3567255e-01   1.00e+00  4.895e+01      0.0     1558
   24  2.4008596e+03  1.0350361e+00   1.00e+00  7.827e+01      0.0     1516
   25  2.3986192e+03  1.9211063e-01   1.00e+00  4.689e+01     -0.3     1558
   26  2.3971387e+03  4.1015172e-01   1.00e+00  5.513e+01      0.0     1573
   27  2.3965977e+03  1.3208314e-01   1.00e+00  4.479e+01      0.0     1548
   28  2.3961160e+03  1.3214806e-01   1.00e+00  4.479e+01      0.0     1528
   29  2.3949869e+03  4.1030162e-01   1.00e+00  5.514e+01      0.0     1494
   30  2.3959537e+03  1.1266956e+00   1.00e+00  8.166e+01     -0.3     1483
   31  2.3950705e+03  7.7944409e-01   1.00e+00  6.878e+01      0.0     1499
   32  2.3936098e+03  4.6215695e-01   1.00e+00  5.699e+01      0.0     1505
```

33	2.3933489e+03	1.2170763e-01	1.00e+00	4.429e+01	0.0	1497
34	2.3931464e+03	1.2347098e-01	1.00e+00	4.435e+01	0.0	1486
35	2.3919664e+03	2.3731940e-01	1.00e+00	4.852e+01	0.0	1463
36	2.3917186e+03	2.9390184e-01	1.00e+00	5.057e+01	-0.3	1469
37	2.3915397e+03	7.0730888e-01	1.00e+00	6.599e+01	0.0	1463
38	2.3913683e+03	3.2389581e-01	1.00e+00	5.170e+01	0.0	1464
39	2.3910494e+03	1.3785098e-01	1.00e+00	4.478e+01	0.0	1466
40	2.3909647e+03	1.1974740e-01	1.00e+00	4.410e+01	0.0	1458
41	1.3077700e+03	2.2215317e+01	1.00e+00	8.843e+01	0.0	9208
42	1.1445119e+03	3.1545918e+01	1.00e+00	1.111e+02	0.0	21315
43	8.9168225e+02	2.1560247e+01	1.00e+00	4.865e+01	0.0	20232
44	8.4423058e+02	4.2552110e+00	1.00e+00	1.547e+01	0.0	18875
45	8.2551837e+02	3.7379229e+00	1.00e+00	1.430e+01	0.0	16380
46	7.8820932e+02	1.7800707e+01	1.00e+00	3.521e+01	0.0	11927
47	8.0984220e+02	5.9451789e+01	1.00e+00	1.018e+02	-0.3	11117
48	7.8436540e+02	4.5365257e+01	1.00e+00	7.554e+01	0.0	11687
49	7.6494825e+02	5.6001970e+00	1.00e+00	1.592e+01	0.0	11259
50	7.6292469e+02	2.1682985e+00	1.00e+00	1.104e+01	0.0	11021
51	7.5771360e+02	2.1166305e+00	1.00e+00	1.091e+01	0.0	10494
52	7.4207650e+02	1.2804893e+01	1.00e+00	2.470e+01	0.0	8244
53	7.4025106e+02	2.1062073e+01	1.00e+00	3.571e+01	-0.3	8785
54	7.3246646e+02	1.5421324e+01	1.00e+00	2.778e+01	0.0	8961
55	7.2987002e+02	1.3958232e+00	1.00e+00	9.552e+00	0.0	8844
56	7.2891693e+02	2.4722302e+00	1.00e+00	1.092e+01	0.0	8726
57	7.2630297e+02	7.0157244e+00	1.00e+00	1.667e+01	0.0	8439
58	7.2748216e+02	2.2927851e+01	1.00e+00	3.708e+01	-0.3	8302
59	7.2760631e+02	2.6373745e+01	1.00e+00	4.149e+01	0.0	8299
60	7.2328967e+02	3.9103941e+00	1.00e+00	1.264e+01	0.0	8287
61	7.2281865e+02	1.9232176e+00	1.00e+00	1.012e+01	0.0	8239
62	7.2216002e+02	1.4648892e+00	1.00e+00	9.529e+00	0.0	8172
63	7.1717909e+02	4.8797550e+00	1.00e+00	1.369e+01	0.0	7734
64	7.1614250e+02	7.3976440e+00	1.00e+00	1.679e+01	-0.3	7821
65	7.1535282e+02	1.1156155e+01	1.00e+00	2.145e+01	0.0	7781
66	7.1464376e+02	8.4944826e+00	1.00e+00	1.812e+01	0.0	7780
67	7.1400088e+02	2.6021819e+00	1.00e+00	1.082e+01	0.0	7740
68	7.1372578e+02	1.3596163e+00	1.00e+00	9.285e+00	0.0	7713
69	7.1295092e+02	1.3832038e+00	1.00e+00	9.301e+00	0.0	7627
70	7.0983206e+02	3.3607721e+01	1.00e+00	4.851e+01	0.0	6997
71	7.0979924e+02	2.2616105e+01	1.00e+00	3.509e+01	-0.3	7194
72	5.7611993e+02	9.0650594e+00	1.00e+00	1.251e+01	0.0	25953
73	5.6483874e+02	4.2628480e+00	1.00e+00	8.688e+00	0.0	16160
74	5.6120835e+02	4.0844035e+01	1.00e+00	3.470e+01	0.0	11349
75	5.6634993e+02	7.8880657e+01	1.00e+00	6.282e+01	0.0	10165
76	5.5876092e+02	1.8521194e+01	1.00e+00	1.866e+01	0.0	10019
77	5.5799806e+02	2.2365350e+00	1.00e+00	7.145e+00	0.0	9847
78	5.5773346e+02	1.9478465e+00	1.00e+00	6.942e+00	0.0	9684
79	5.5605308e+02	1.2644395e+01	1.00e+00	1.447e+01	0.0	8484
80	5.5563295e+02	5.5092981e+00	1.00e+00	9.467e+00	-0.3	8608
81	5.5539749e+02	1.0928431e+01	1.00e+00	1.325e+01	0.0	8556
82	5.5519861e+02	3.2149193e+00	1.00e+00	7.858e+00	0.0	8503
83	5.5505294e+02	3.3119203e+00	1.00e+00	7.925e+00	0.0	8467
84	5.5477305e+02	2.4334984e+00	1.00e+00	7.309e+00	0.0	8379
85	5.5485517e+02	3.7532870e+01	1.00e+00	3.179e+01	0.0	8199
86	5.5396156e+02	1.3669053e+00	1.00e+00	6.570e+00	-0.3	8230

87	5.5382607e+02	2.6906179e+00	1.00e+00	7.488e+00	0.0	8206
88	5.5358510e+02	2.7016559e+00	1.00e+00	7.494e+00	0.0	8159
89	5.5361341e+02	3.4882396e+01	1.00e+00	2.984e+01	0.0	8020
90	5.5281663e+02	1.4009120e+00	1.00e+00	6.593e+00	-0.3	8051
91	5.5266920e+02	2.7020792e+00	1.00e+00	7.492e+00	0.0	8035
92	5.5251578e+02	1.4204206e+00	1.00e+00	6.605e+00	0.0	8017
93	5.5234757e+02	1.7357068e+01	1.00e+00	1.762e+01	0.0	7961
94	5.5242046e+02	1.0160177e+01	1.00e+00	1.264e+01	-0.3	7950
95	5.5204113e+02	6.9067898e+00	1.00e+00	1.039e+01	0.0	7958
96	5.5192492e+02	1.6379069e+00	1.00e+00	6.753e+00	0.0	7942
97	5.5185902e+02	1.4248881e+00	1.00e+00	6.606e+00	0.0	7931
98	5.5132047e+02	1.4365113e+00	1.00e+00	6.610e+00	0.0	7878
99	5.5189128e+02	6.1990085e+01	1.00e+00	4.837e+01	-0.3	7537
100	5.4896508e+02	1.4495691e+01	1.00e+00	1.552e+01	-0.3	7817
101	5.4839386e+02	9.6149893e+00	1.00e+00	1.217e+01	0.0	7793
102	5.4815516e+02	5.2914194e+00	1.00e+00	9.220e+00	0.0	7730
103	5.4797246e+02	7.5702270e+00	1.00e+00	1.077e+01	0.0	7693
104	5.4792836e+02	1.2062376e+01	1.00e+00	1.382e+01	0.0	7660
105	5.4786552e+02	1.5396737e+01	1.00e+00	1.608e+01	0.0	7655
106	5.4766163e+02	3.5891450e+00	1.00e+00	8.053e+00	0.0	7651
107	5.4762046e+02	1.9636015e+00	1.00e+00	6.948e+00	0.0	7641
108	5.4743359e+02	1.6500247e+00	1.00e+00	6.731e+00	0.0	7615
109	5.4674602e+02	2.8476897e+01	1.00e+00	2.487e+01	0.0	7480
110	5.4664050e+02	1.3670425e+01	1.00e+00	1.485e+01	-0.3	7568
111	5.4613685e+02	5.6967067e+00	1.00e+00	9.445e+00	0.0	7580
112	5.4604703e+02	1.5053672e+00	1.00e+00	6.614e+00	0.0	7555
113	5.4598141e+02	2.7657982e+00	1.00e+00	7.465e+00	0.0	7544
114	5.4573815e+02	3.7500945e+00	1.00e+00	8.123e+00	0.0	7498
115	5.4564604e+02	3.9205438e+00	1.00e+00	8.238e+00	-0.3	7520
116	5.4558333e+02	6.2620838e+00	1.00e+00	9.816e+00	0.0	7504
117	5.4553089e+02	3.6604996e+00	1.00e+00	8.061e+00	0.0	7497
118	5.4547675e+02	3.3871196e+00	1.00e+00	7.876e+00	0.0	7496
119	5.4543227e+02	1.4717319e+00	1.00e+00	6.585e+00	0.0	7490
120	5.4534373e+02	3.4635485e+00	1.00e+00	7.926e+00	0.0	7486
121	5.4532333e+02	7.2999743e+00	1.00e+00	1.051e+01	-0.3	7470
122	3.1699815e+02	1.0947236e+02	1.00e+00	2.413e+01	0.0	20640
123	2.9832891e+02	1.7114988e+02	1.00e+00	3.310e+01	0.0	23333
124	2.9178993e+02	1.6218374e+02	1.00e+00	3.016e+01	0.0	20531
125	2.8729725e+02	3.0491575e+01	1.00e+00	7.508e+00	0.0	19412
126	2.8589051e+02	7.2643018e+00	1.00e+00	3.654e+00	0.0	18614
127	2.8334528e+02	1.4231849e+01	1.00e+00	4.768e+00	0.0	17060
128	2.8132404e+02	1.6420424e+02	1.00e+00	2.860e+01	0.0	13520
129	2.7852747e+02	1.8890476e+01	1.00e+00	5.455e+00	-0.3	13787
130	2.7760823e+02	7.7973427e+00	1.00e+00	3.709e+00	0.0	13710
131	2.7715292e+02	4.3595547e+00	1.00e+00	3.168e+00	0.0	13519
132	2.7582908e+02	1.5079904e+01	1.00e+00	4.774e+00	0.0	12739
133	2.7565625e+02	4.9761997e+01	1.00e+00	1.007e+01	-0.3	12311
134	2.7512678e+02	5.8409669e+01	1.00e+00	1.136e+01	-0.3	12271
135	2.7456285e+02	2.3867154e+01	1.00e+00	6.092e+00	0.0	12181
136	2.7441734e+02	4.0834756e+00	1.00e+00	3.097e+00	0.0	12125
137	2.7425218e+02	6.1758922e+00	1.00e+00	3.411e+00	0.0	12036
138	2.7282024e+02	5.9845289e+01	1.00e+00	1.143e+01	0.0	10973
139	2.7274795e+02	5.1848017e+01	1.00e+00	1.023e+01	-0.3	11105
140	2.7214192e+02	2.1046977e+01	1.00e+00	5.619e+00	0.0	11122

141	2.7203344e+02	3.4017967e+00	1.00e+00	2.995e+00	0.0	11064
142	2.7191793e+02	5.7921607e+00	1.00e+00	3.348e+00	0.0	11023
143	2.7161355e+02	7.4861935e+01	1.00e+00	1.357e+01	0.0	10708
144	2.7123889e+02	5.1891036e+00	1.00e+00	3.249e+00	-0.3	10852
145	2.7110635e+02	1.1569247e+01	1.00e+00	4.189e+00	0.0	10829
146	2.7101124e+02	4.3286738e+00	1.00e+00	3.120e+00	0.0	10773
147	2.7077749e+02	9.4990015e+00	1.00e+00	3.881e+00	0.0	10678
148	2.7081403e+02	3.9993778e+01	1.00e+00	8.367e+00	-0.3	10542
149	2.7101040e+02	8.4945591e+01	1.00e+00	1.501e+01	-0.3	10564
150	2.7033279e+02	1.1181747e+01	1.00e+00	4.123e+00	0.0	10539
151	2.7028407e+02	2.5623721e+00	1.00e+00	2.859e+00	0.0	10531
152	2.7022977e+02	3.9030400e+00	1.00e+00	3.055e+00	0.0	10493
153	2.6969804e+02	8.3662261e+00	1.00e+00	3.704e+00	0.0	10292
154	2.6959007e+02	2.7694120e+01	1.00e+00	6.526e+00	-0.3	10332
155	2.6963999e+02	3.1874810e+01	1.00e+00	7.135e+00	0.0	10302
156	2.6944868e+02	2.8845413e+01	1.00e+00	6.688e+00	0.0	10305
157	2.6933285e+02	4.9811941e+00	1.00e+00	3.209e+00	0.0	10287
158	2.6930626e+02	2.5645279e+00	1.00e+00	2.857e+00	0.0	10279
159	2.6919330e+02	2.5524184e+00	1.00e+00	2.854e+00	0.0	10233
160	2.6887160e+02	8.6270981e+01	1.00e+00	1.501e+01	0.0	9884
161	2.6823852e+02	1.3008550e+01	1.00e+00	4.366e+00	-0.3	10034
162	2.6805352e+02	9.2236740e+00	1.00e+00	3.816e+00	0.0	10023
163	2.6799539e+02	4.9755032e+00	1.00e+00	3.203e+00	0.0	9998
164	2.6782584e+02	6.3068041e+00	1.00e+00	3.393e+00	0.0	9938
165	2.6771719e+02	1.1847443e+01	1.00e+00	4.187e+00	0.0	9885
166	2.6767289e+02	1.6862323e+01	1.00e+00	4.909e+00	-0.3	9916
167	2.6756632e+02	6.8216181e+00	1.00e+00	3.462e+00	0.0	9915
168	2.6750527e+02	8.9648589e+00	1.00e+00	3.770e+00	0.0	9885
169	2.6747689e+02	2.5901726e+00	1.00e+00	2.854e+00	0.0	9874
170	2.6742916e+02	2.5871851e+00	1.00e+00	2.853e+00	0.0	9855
171	2.6700307e+02	6.5944517e+01	1.00e+00	1.191e+01	0.0	9614
172	2.6743497e+02	7.6488374e+01	1.00e+00	1.346e+01	-0.3	9718
173	2.6646922e+02	1.0072879e+01	1.00e+00	3.914e+00	0.0	9801
174	2.6641874e+02	4.3741805e+00	1.00e+00	3.102e+00	0.0	9753
175	2.6632596e+02	3.2124632e+00	1.00e+00	2.935e+00	0.0	9700
176	2.6627757e+02	3.7889848e+01	1.00e+00	7.871e+00	-0.3	9633
177	2.6618712e+02	2.6855481e+00	1.00e+00	2.860e+00	-0.3	9658
178	2.6616485e+02	3.9435483e+00	1.00e+00	3.039e+00	0.0	9654
179	2.6613228e+02	2.6909858e+00	1.00e+00	2.860e+00	0.0	9651
180	2.6589475e+02	1.0963625e+01	1.00e+00	4.031e+00	0.0	9582
181	2.6595564e+02	3.6391633e+01	1.00e+00	7.646e+00	-0.3	9610
182	2.6586202e+02	1.7488337e+01	1.00e+00	4.958e+00	-0.3	9649
183	2.6576131e+02	7.9157889e+00	1.00e+00	3.599e+00	0.0	9634
184	2.6574246e+02	3.9520576e+00	1.00e+00	3.037e+00	0.0	9619
185	2.6570837e+02	4.1801492e+00	1.00e+00	3.068e+00	0.0	9606
186	2.6561352e+02	2.2453459e+01	1.00e+00	5.654e+00	0.0	9544
187	2.6554211e+02	3.7126894e+00	1.00e+00	2.999e+00	-0.3	9564
188	2.6549568e+02	6.3133891e+00	1.00e+00	3.368e+00	0.0	9560
189	2.6547540e+02	2.6904965e+00	1.00e+00	2.855e+00	0.0	9551
190	2.6543440e+02	2.6959107e+00	1.00e+00	2.856e+00	0.0	9540
191	2.6534495e+02	5.5424639e+01	1.00e+00	1.030e+01	0.0	9392
192	2.6507415e+02	6.3467545e+00	1.00e+00	3.369e+00	-0.3	9485
193	2.6484743e+02	4.3827047e+00	1.00e+00	3.089e+00	0.0	9508
194	2.6478403e+02	2.6461085e+00	1.00e+00	2.844e+00	0.0	9481

```
  195  2.6469386e+02  5.5072927e+00   1.00e+00  3.246e+00     0.0    9435
  196  2.6468647e+02  1.5137253e+01   1.00e+00  4.598e+00     0.0    9408
  197  1.5460576e+02  4.1656577e+02   1.00e+00  1.960e+01     0.0   17516
  198  1.4881347e+02  7.9247697e+02   1.00e+00  3.431e+01     0.0   25116
  199  1.4004915e+02  5.5953699e+02   1.00e+00  2.180e+01     0.0   22915
  200  1.3587228e+02  3.0476621e+01   1.00e+00  2.112e+00     0.0   21643

ERROR EXIT -- Too many iterations

Products with A     :     263        Total time   (secs) :    27.1
Products with A'    :     202        Project time (secs) :     2.0
Newton iterations   :       5        Mat-vec time (secs) :    22.7
Line search its     :     101        Subspace iterations :       0


================================================================================
PQNL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
================================================================================
No. rows              :    12800      No. columns           :    73051
Initial tau           : 0.00e+00      Two-norm of b         : 4.18e+03
Optimality tol        : 1.00e-04      Target objective      : 1.00e-03
Basis pursuit tol     : 1.00e-06      Maximum iterations    :      100

    0  4.1781637e+03  0.0000000e+00   1.00e+00  2.273e+02     0.0       0
Iteration   FunEvals Projections     Step Length          rNorm2        O
        1         2           4     1.00000e+00     2.84295e+03     6.688
        2         3          31     1.00000e+00     2.64616e+03     3.160
        3         4          56     1.00000e+00     2.58345e+03     1.908
        4         5          83     1.00000e+00     2.54486e+03     1.467
        5         6         114     1.00000e+00     2.50842e+03     1.101
        6         7         149     1.00000e+00     2.48090e+03     8.014
        7         8         184     1.00000e+00     2.46177e+03     6.120
        8         9         227     1.00000e+00     2.44865e+03     5.232
        9        10         278     1.00000e+00     2.43746e+03     4.725
       10        11         329     1.00000e+00     2.42926e+03     4.168
       11        12         370     1.00000e+00     2.42156e+03     3.454
       12        13         419     1.00000e+00     2.41600e+03     2.847
       13        14         464     1.00000e+00     2.41120e+03     2.348
       14        15         507     1.00000e+00     2.40784e+03     2.097
       15        17         566     5.00000e-01     2.40572e+03     2.013
       16        19         629     5.00000e-01     2.40347e+03     1.941
       17        21         688     5.00000e-01     2.40156e+03     1.842
       18        23         753     5.00000e-01     2.39976e+03     1.701
       19        25         820     5.00000e-01     2.39817e+03     1.582
       20        27         897     5.00000e-01     2.39671e+03     1.487
       21        29         970     5.00000e-01     2.39554e+03     1.430
       22        31        1047     5.00000e-01     2.39455e+03     1.372
Function Evaluations exceeds maxIter
 Iteration   FunEvals Projections     Step Length          rNorm2        O
       23         2           4     1.00000e+00     2.39370e+03     8.579
       24         3          38     1.00000e+00     2.39294e+03     1.003
       25         4          86     1.00000e+00     2.39245e+03     1.213
       26         5         134     1.00000e+00     2.39188e+03     1.191
       27         7         194     5.00000e-01     2.39141e+03     1.064
```

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        28          9        256     5.00000e-01     2.39086e+03     9.097
        29         11        329     5.00000e-01     2.39038e+03     8.695
        30         14        395     2.50000e-01     2.39014e+03     8.853
        31         17        485     2.50000e-01     2.38983e+03     9.087
        32         20        567     2.50000e-01     2.38953e+03     9.257
        33         23        670     2.50000e-01     2.38923e+03     9.277
        34         26        766     2.50000e-01     2.38890e+03     9.175
        35         29        860     2.50000e-01     2.38858e+03     8.921
        36         33        945     1.25000e-01     2.38841e+03     8.726
break of testUpdateTau    36  2.3884130e+03  1.1033754e+02   1.00e+00  4.2
 Iteration   FunEvals Projections     Step Length          rNorm2        O
        37          2          4     1.00000e+00     1.17329e+03     1.160
        38          3         29     1.00000e+00     9.25135e+02     4.326
        39          4         54     1.00000e+00     8.65006e+02     2.657
        40          5         81     1.00000e+00     8.18937e+02     1.896
        41          6        116     1.00000e+00     7.85237e+02     1.429
        42          7        155     1.00000e+00     7.60268e+02     1.064
        43          8        196     1.00000e+00     7.42887e+02     8.288
        44          9        237     1.00000e+00     7.30015e+02     6.960
        45         10        278     1.00000e+00     7.19987e+02     6.136
        46         11        333     1.00000e+00     7.11476e+02     5.431
        47         12        386     1.00000e+00     7.04119e+02     4.748
        48         13        437     1.00000e+00     6.98035e+02     4.163
        49         14        492     1.00000e+00     6.92841e+02     3.754
        50         15        549     1.00000e+00     6.88594e+02     3.437
        51         16        610     1.00000e+00     6.85047e+02     3.116
        52         17        668     1.00000e+00     6.81669e+02     2.923
        53         18        730     1.00000e+00     6.78787e+02     2.769
        54         19        790     1.00000e+00     6.76271e+02     2.588
        55         20        850     1.00000e+00     6.73993e+02     2.413
        56         21        920     1.00000e+00     6.71907e+02     2.304
        57         22        992     1.00000e+00     6.70051e+02     2.173
        58         23       1062     1.00000e+00     6.68337e+02     2.029
        59         24       1136     1.00000e+00     6.66832e+02     1.891
        60         25       1208     1.00000e+00     6.65541e+02     1.739
        61         26       1272     1.00000e+00     6.64345e+02     1.643
        62         27       1336     1.00000e+00     6.63294e+02     1.583
        63         28       1419     1.00000e+00     6.62155e+02     1.602
        64         29       1486     1.00000e+00     6.61249e+02     1.567
        65         30       1568     1.00000e+00     6.60217e+02     1.491
        66         31       1650     1.00000e+00     6.59390e+02     1.422
Function Evaluations exceeds maxIter
 Iteration   FunEvals Projections     Step Length          rNorm2        O
        67          2          4     1.00000e+00     6.58823e+02     8.686
        68          3         31     1.00000e+00     6.58457e+02     9.275
        69          4         69     1.00000e+00     6.58221e+02     1.022
        70          5        117     1.00000e+00     6.57827e+02     1.063
        71          6        184     1.00000e+00     6.57422e+02     1.081
        72          7        236     1.00000e+00     6.57026e+02     1.111
        73          8        306     1.00000e+00     6.56589e+02     1.181
        74          9        363     1.00000e+00     6.56149e+02     1.182
        75         10        437     1.00000e+00     6.55617e+02     1.156
        76         11        519     1.00000e+00     6.55161e+02     1.109
        77         12        592     1.00000e+00     6.54687e+02     1.105
```

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        78         13        668     1.00000e+00     6.54206e+02     1.109
        79         14        751     1.00000e+00     6.53771e+02     1.041
        80         15        825     1.00000e+00     6.53300e+02     9.773
        81         16        910     1.00000e+00     6.52968e+02     8.984
        82         17        987     1.00000e+00     6.52550e+02     8.819
        83         18       1067     1.00000e+00     6.52238e+02     8.653
        84         19       1117     1.00000e+00     6.51932e+02     8.098
        85         20       1205     1.00000e+00     6.51580e+02     8.119
        86         21       1305     1.00000e+00     6.51337e+02     7.881
        87         23       1404     5.00000e-01     6.51166e+02     7.613
        88         25       1502     5.00000e-01     6.50957e+02     7.208
        89         27       1588     5.00000e-01     6.50768e+02     6.890
        90         29       1669     5.00000e-01     6.50591e+02     6.707
        91         31       1754     5.00000e-01     6.50436e+02     6.554
Function Evaluations exceeds maxIter
 Iteration   FunEvals Projections     Step Length          rNorm2        O
        92          2           4     1.00000e+00     6.50295e+02     4.102
        93          3          29     1.00000e+00     6.50193e+02     4.372
        94          4          63     1.00000e+00     6.50129e+02     5.062
break of testUpdateTau    94  6.5012939e+02  2.6097696e+02   1.00e+00  7.6
 Iteration   FunEvals Projections     Step Length          rNorm2        O
        95          2           4     1.00000e+00     3.01193e+02     4.904
        96          3          29     1.00000e+00     2.17881e+02     1.657
        97          4          54     1.00000e+00     1.96975e+02     1.013
        98          5          81     1.00000e+00     1.79407e+02     6.682
        99          6         116     1.00000e+00     1.68778e+02     4.879
       100          7         151     1.00000e+00     1.61526e+02     3.730

 ERROR EXIT -- Too many iterations

 Products with A     :     138        Total time   (secs) :   136.2
 Products with A'    :     139        Project time (secs) :   146.1
 Newton iterations   :       3        Mat-vec time (secs) :    14.1
```
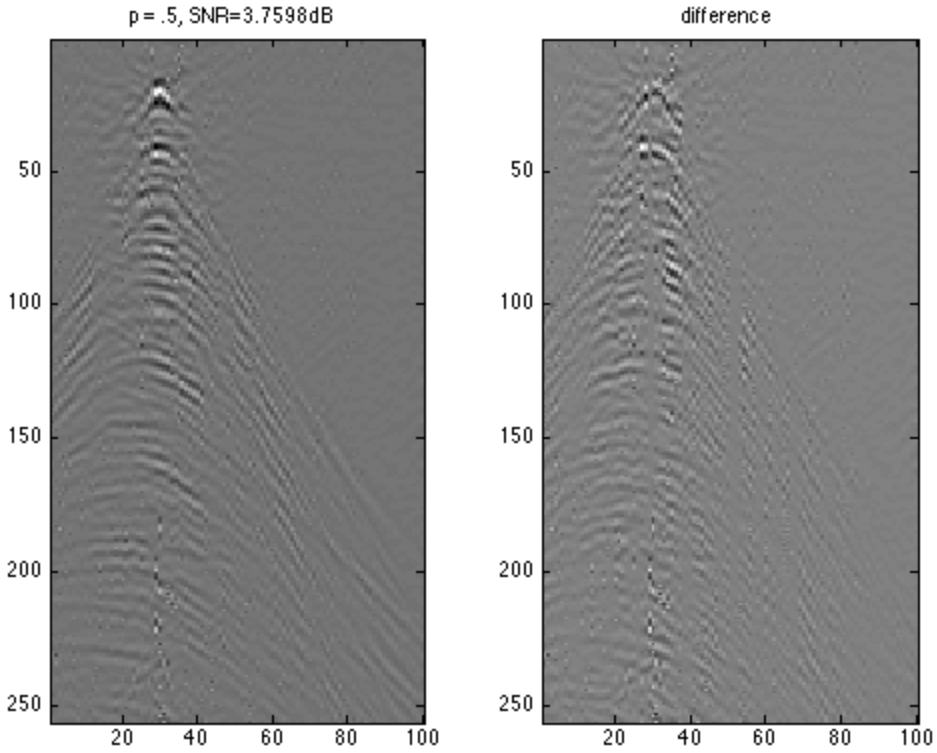
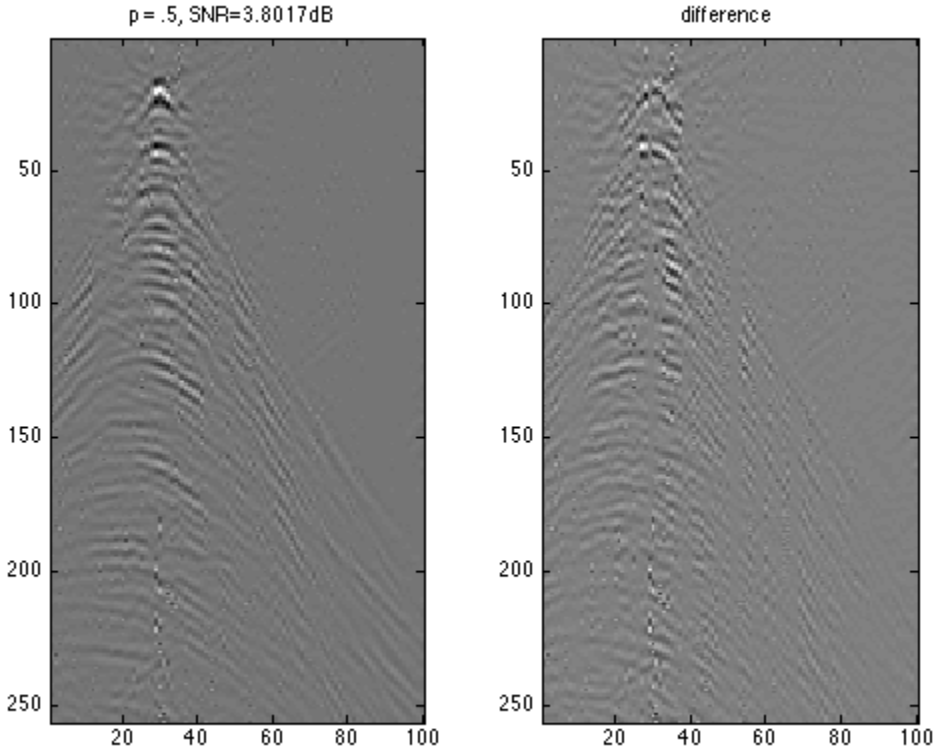


p = .5, SNR=3.7598dB
difference
50
100
150
200
250
20
40
60
80
100


p = .5, SNR=3.8017dB
difference
50
100
150
200
250
20
40
60
80
100

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