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```
% this experiment is to test whether pqnl1 can work for the expqnle given
% by help spgl1
```

addpath for PQN working

```
%addpath(genpath('/Volumes/Users/linamiao/Dropbox/PQN/'))
cd ../../../../pqnl1;
addpath(genpath(pwd))
cd ../experiments/help_spgl1/modifying/task10strictvssparse

%stream = RandStream.getGlobalStream;
%reset(stream);
```

sample matrix

```
m = 120; n = 512; k = 20; % m rows, n cols, k nonzeros.
A  = randn(m,n); [Q,R] = qr(A',0);  A = Q';

opts.decTol = 1e-3;
opts.optTol = 1e-4;
opts.iterations = 100;
opts.nPrevVals = 1; % opt out the nonmonotone line search
%
% save temp A m n k opts
% clear;
% load temp
```

problem setting

strict problem setting

```
p = randperm(n); x0 = zeros(n,1); x0(p(1:k)) = sign(randn(k,1));
figure;plot(x0)
b0  = A*x0 + 0.005 * randn(m,1);

% compressible problem setting
nn = linspace(0,1,n);
x0_compress = exp(-nn.^.1);
```

```
x0_compress = x0_compress - min(x0_compress);
figure;plot(x0_compress)
x0_compress = x0_compress(:);
b_compress  = A*x0_compress + 0.005 * randn(m,1);
```
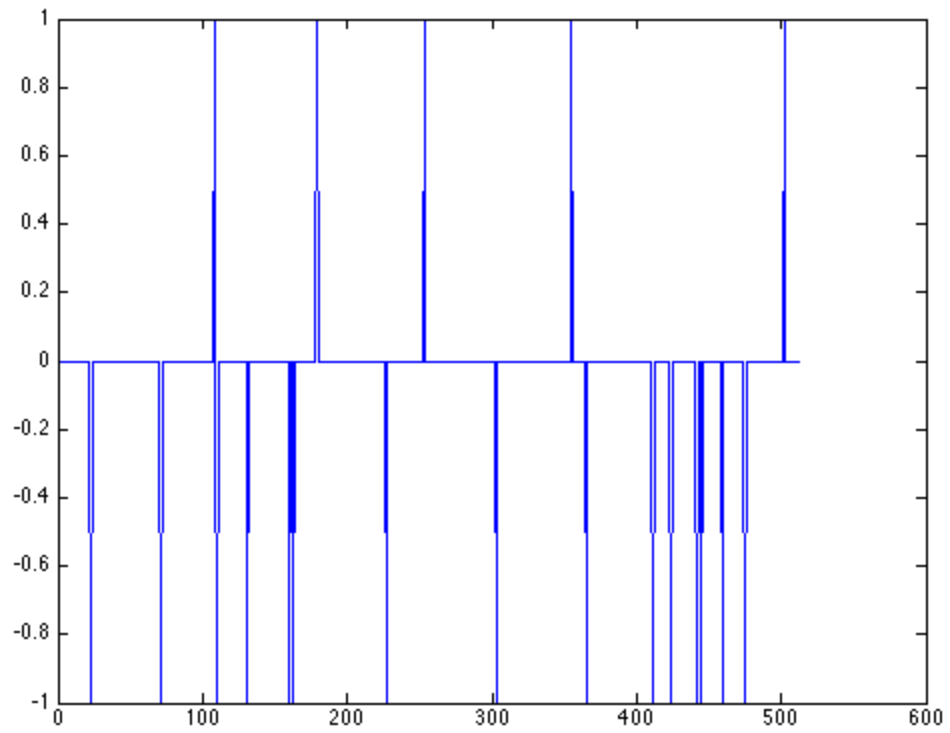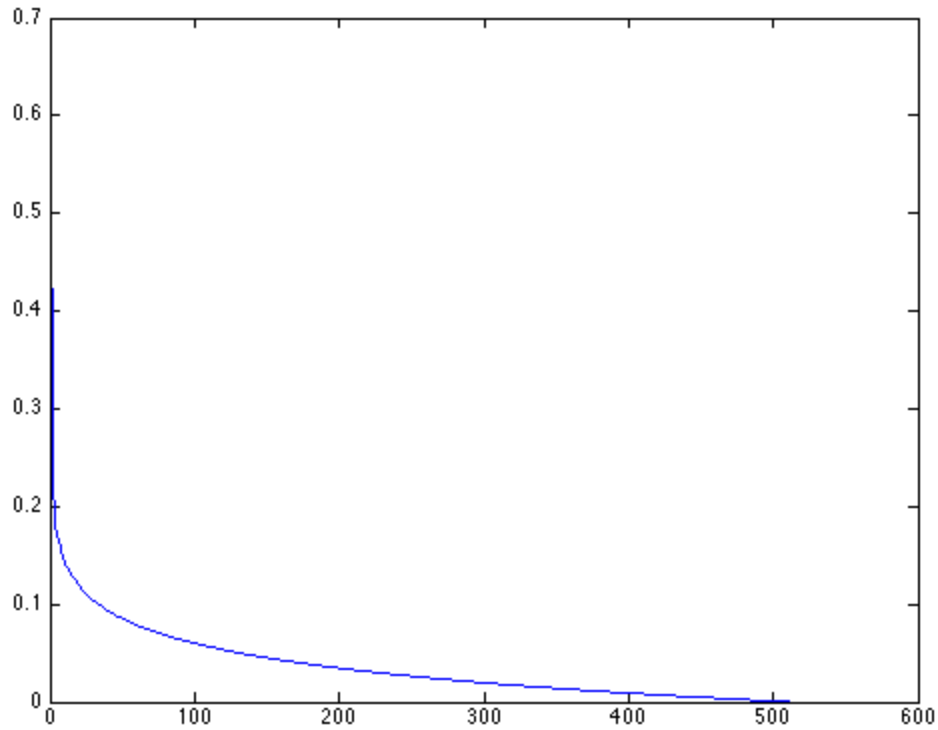
reconstruct

```
[x_sparse,r_sparse,g_sparse,info_sparse] = pqnl1_2(A, b0, 0, 1e-3, zeros(size(A,2)
[x_compress,r_compress,g_compress,info_compress] = pqnl1_2(A, b_compress, 0, 1e-3,
figure('Name','pqn');
subplot(2,1,1);plot(x_sparse);subplot(2,1,2);plot(x_compress);


[x_spg1,r_spgl,g_spgl,info_spg1] = spgl1(A, b0, 0, 1e-3, zeros(size(A,2),1), opts)
[x_spg2,r_spg2,g_spg2,info_spg2] = spgl1(A, b_compress, 0, 1e-3, zeros(size(A,2),1
figure('Name','spg');
subplot(2,1,1);plot(x_spg1);subplot(2,1,2);plot(x_spg2);
```

```
        ======================================================================
        PQNL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017

        ======================================================================
        No. rows            :      120      No. columns            :      512
        Initial tau         : 0.00e+00      Two-norm of b          : 2.05e+00
        Optimality tol      : 1.00e-04      Target objective       : 1.00e-03
        Basis pursuit tol   : 1.00e-06      Maximum iterations     :      100


           0  2.0454968e+00  0.0000000e+00   1.00e+00  3.608e-01      0.0        0
        Iteration   FunEvals Projections     Step Length          rNorm2        O
                1          1           4   1.00000e+00     1.09666e+00      3.305
                2          1          17   1.00000e+00     9.82391e-01      1.798
```

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Iteration	FunEvals	Projections	Step Length	rNorm2	O
3	1	36	1.00000e+00	9.00711e-01	9.739
4	1	53	1.00000e+00	8.59786e-01	7.022
5	1	76	1.00000e+00	8.34578e-01	5.531
6	1	101	1.00000e+00	8.15903e-01	4.333
7	1	126	1.00000e+00	8.00785e-01	3.165
8	1	151	1.00000e+00	7.91943e-01	2.147
9	1	176	1.00000e+00	7.86603e-01	1.598
10	1	205	1.00000e+00	7.83640e-01	1.562
11	1	224	1.00000e+00	7.81768e-01	1.344
12	1	243	1.00000e+00	7.79726e-01	9.113
13	1	268	1.00000e+00	7.78431e-01	6.084
14	1	286	1.00000e+00	7.78131e-01	5.066
14	7.7813140e-01	4.2870223e-02	7.77e-01 7.489e-02	0.0	35
Iteration	FunEvals	Projections	Step Length	rNorm2	O
15	1	4	1.00000e+00	2.71421e-01	1.400
16	1	15	1.00000e+00	2.35658e-01	8.990
17	1	32	1.00000e+00	2.00675e-01	4.788
18	1	47	1.00000e+00	1.83638e-01	3.544
19	1	66	1.00000e+00	1.69294e-01	2.724
20	1	87	1.00000e+00	1.59306e-01	2.347
21	1	112	1.00000e+00	1.48433e-01	2.003
22	1	133	1.00000e+00	1.40821e-01	1.757
23	1	162	1.00000e+00	1.31801e-01	1.689
24	1	182	1.00000e+00	1.26904e-01	1.464
25	1	209	1.00000e+00	1.20856e-01	1.124
26	1	237	1.00000e+00	1.16600e-01	1.095
27	1	265	1.00000e+00	1.12721e-01	1.143
28	1	294	1.00000e+00	1.08313e-01	1.210
29	1	332	1.00000e+00	1.04104e-01	1.230
30	1	363	1.00000e+00	9.99478e-02	1.072
31	1	391	1.00000e+00	9.58345e-02	9.888
32	1	420	1.00000e+00	9.11939e-02	1.137
33	1	459	1.00000e+00	8.71417e-02	1.115
34	1	501	1.00000e+00	8.08699e-02	1.099
35	1	532	1.00000e+00	7.57167e-02	9.853
36	1	578	1.00000e+00	7.02204e-02	8.792
37	1	623	1.00000e+00	6.50937e-02	8.819
38	1	655	1.00000e+00	6.13523e-02	7.631
39	1	684	1.00000e+00	5.60250e-02	7.130
40	1	711	1.00000e+00	5.41341e-02	5.843
41	1	739	1.00000e+00	5.13828e-02	4.290
42	1	756	1.00000e+00	5.05536e-02	3.423
43	1	773	1.00000e+00	4.92975e-02	2.799
44	1	795	1.00000e+00	4.86645e-02	2.586
45	1	812	1.00000e+00	4.81145e-02	1.826
46	1	824	1.00000e+00	4.77929e-02	1.322
47	1	831	1.00000e+00	4.77097e-02	1.163
48	1	840	1.00000e+00	4.74761e-02	9.954
49	1	847	1.00000e+00	4.74256e-02	8.450
50	1	856	1.00000e+00	4.72715e-02	6.323

Directional Derivative below optTol

51	4.7271511e-02	4.0442620e-03	4.63e-02 3.892e-03	0.0	71
Iteration	FunEvals	Projections	Step Length	rNorm2	O
52	1	4	1.00000e+00	1.36203e-02	7.200

```
      53           1        11    1.00000e+00    1.20304e-02     4.821
      54           1        22    1.00000e+00    1.02804e-02     2.827
      55           1        31    1.00000e+00    9.34590e-03     1.830
      56           1        40    1.00000e+00    8.74746e-03     1.207
      57           1        45    1.00000e+00    8.62308e-03     1.120
Directional Derivative below optTol
   58  8.6230786e-03  2.6986580e-03   7.62e-03  7.147e-04    0.0     164
 Iteration   FunEvals Projections     Step Length        rNorm2        O
      59           1         4    1.00000e+00    3.31817e-03     1.190
Directional Derivative below optTol
   60  3.3181683e-03  1.3386350e-03   2.32e-03  2.743e-04    0.0     178
 Iteration   FunEvals Projections     Step Length        rNorm2        O
      61           1         4    1.00000e+00    1.70549e-03     6.648
Directional Derivative below optTol
   62  1.7054900e-03  8.8617772e-04   7.05e-04  1.458e-04    0.0     181
 Iteration   FunEvals Projections     Step Length        rNorm2        O
Directional Derivative below optTol
   63  1.7054900e-03  8.8738093e-04   7.05e-04  1.458e-04    0.0     181
 Iteration   FunEvals Projections     Step Length        rNorm2        O
      64           1         4    1.00000e+00    7.91425e-04     3.432
Directional Derivative below optTol
   65  7.9142463e-04  4.6454479e-04   2.09e-04  6.855e-05    0.0     182
 Iteration   FunEvals Projections     Step Length        rNorm2        O
Directional Derivative below optTol
   66  9.0504957e-04  5.1168777e-04   9.50e-05  7.770e-05    0.0     182

 EXIT -- Found a root

 Products with A     :      68     Total time  (secs) :     1.6
 Products with A'    :      68     Project time (secs) :     1.8
 Newton iterations   :       9     Mat-vec time (secs) :     0.0


 ========================================================================
 PQNL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
 ========================================================================
 No. rows              :      120     No. columns          :      512
 Initial tau           : 0.00e+00     Two-norm of b        : 6.84e-01
 Optimality tol        : 1.00e-04     Target objective     : 1.00e-03
 Basis pursuit tol     : 1.00e-06     Maximum iterations   :      100

    0  6.8394737e-01  0.0000000e+00   6.83e-01  1.808e-01    0.0      0
 Iteration   FunEvals Projections     Step Length        rNorm2        O
       1           1         4    1.00000e+00    4.46732e-01     7.421
       2           1        17    1.00000e+00    4.18709e-01     3.803
       3           1        32    1.00000e+00    4.00070e-01     2.175
       4           1        47    1.00000e+00    3.93033e-01     1.560
       5           1        68    1.00000e+00    3.89744e-01     1.207
       6           1        87    1.00000e+00    3.87990e-01     8.549
       7           1       102    1.00000e+00    3.87271e-01     5.418
       8           1       117    1.00000e+00    3.86786e-01     2.857
       9           1       134    1.00000e+00    3.86653e-01     2.087
    9  3.8665338e-01  2.6275832e-03   3.86e-01  3.405e-02    0.0     39
 Iteration   FunEvals Projections     Step Length        rNorm2        O
```

```
        10           1          4    1.00000e+00    1.16809e-01    5.975
        11           1         13    1.00000e+00    1.03062e-01    3.748
        12           1         28    1.00000e+00    9.06327e-02    2.054
        13           1         43    1.00000e+00    8.56050e-02    1.616
        14           1         58    1.00000e+00    8.12729e-02    1.321
        15           1         73    1.00000e+00    7.81513e-02    1.035
        16           1         88    1.00000e+00    7.60228e-02    8.142
        17           1        105    1.00000e+00    7.41087e-02    7.613
        18           1        122    1.00000e+00    7.25829e-02    7.674
        19           1        140    1.00000e+00    7.11147e-02    6.812
        20           1        157    1.00000e+00    7.01973e-02    5.385
        21           1        174    1.00000e+00    6.93996e-02    4.152
        22           1        191    1.00000e+00    6.88972e-02    3.785
        23           1        205    1.00000e+00    6.84337e-02    3.258
        24           1        219    1.00000e+00    6.80418e-02    3.283
        25           1        237    1.00000e+00    6.76638e-02    3.398
        26           1        253    1.00000e+00    6.73126e-02    3.302
        27           1        269    1.00000e+00    6.69474e-02    2.955
        28           1        280    1.00000e+00    6.67052e-02    3.202
        29           1        287    1.00000e+00    6.65871e-02    2.570
        30           1        304    1.00000e+00    6.61785e-02    2.072
        31           1        311    1.00000e+00    6.61167e-02    1.756
        32           1        320    1.00000e+00    6.58713e-02    2.148
        33           1        336    1.00000e+00    6.56755e-02    1.853
        34           1        348    1.00000e+00    6.55692e-02    1.820
        35           1        355    1.00000e+00    6.55211e-02    1.505
        36           1        369    1.00000e+00    6.53244e-02    1.291
        37           1        374    1.00000e+00    6.53028e-02    1.137
     37  6.5302810e-02  2.2182569e-03   6.43e-02  4.607e-03      0.0     133
 Iteration    FunEvals Projections    Step Length          rNorm2        O
        38           1          4    1.00000e+00    1.53251e-02    7.881
        39           1         11    1.00000e+00    1.38599e-02    5.727
        40           1         22    1.00000e+00    1.17607e-02    3.569
        41           1         31    1.00000e+00    1.06597e-02    2.456
        42           1         40    1.00000e+00    9.96401e-03    1.789
        43           1         49    1.00000e+00    9.48106e-03    1.405
        44           1         54    1.00000e+00    9.36591e-03    1.246
Directional Derivative below optTol
     45  9.3659070e-03  1.1942710e-03   8.37e-03  7.092e-04      0.0     229
 Iteration    FunEvals Projections    Step Length          rNorm2        O
        46           1          4    1.00000e+00    3.33679e-03    1.249
Directional Derivative below optTol
     47  3.3367917e-03  8.5886232e-04   2.34e-03  2.957e-04      0.0     236
 Iteration    FunEvals Projections    Step Length          rNorm2        O
        48           1          4    1.00000e+00    1.86006e-03    7.195
Directional Derivative below optTol
     49  1.8600625e-03  5.6660102e-04   8.60e-04  1.729e-04      0.0     237
 Iteration    FunEvals Projections    Step Length          rNorm2        O
        50           1          4    1.00000e+00    1.30318e-03    4.803
Function value changing by less than optTol
 Iteration    FunEvals Projections    Step Length          rNorm2         O
Directional Derivative below optTol
     51  1.3031838e-03  4.1083201e-04   3.03e-04  1.223e-04      0.0     241
 Iteration    FunEvals Projections    Step Length          rNorm2        O
```

```
Directional Derivative below optTol
    52  1.3031838e-03  4.1122712e-04   3.03e-04  1.223e-04    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    53  1.3031838e-03  4.1162222e-04   3.03e-04  1.223e-04    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    54  1.3031838e-03  4.1201733e-04   3.03e-04  1.223e-04    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    55  1.3031838e-03  4.1241243e-04   3.03e-04  1.223e-04    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
        56           1           4    1.00000e+00     4.61038e-04    2.099
Function value changing by less than optTol
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    57  4.6103794e-04  1.6398030e-04   5.39e-04  4.503e-05    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    58  7.1800419e-04  2.4253071e-04   2.82e-04  6.883e-05    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    59  8.5932061e-04  2.7511260e-04   1.41e-04  8.072e-05    0.0      241
 Iteration    FunEvals Projections    Step Length         rNorm2       O
Directional Derivative below optTol
    60  9.3181077e-04  2.9133721e-04   6.82e-05  8.679e-05    0.0      241


 EXIT -- Found a root

 Products with A     :      65       Total time   (secs) :      0.6
 Products with A'    :      65       Project time (secs) :      0.7
 Newton iterations   :      15       Mat-vec time (secs) :      0.0



 ===========================================================================
 SPGL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
 ===========================================================================
 No. rows              :      120     No. columns           :      512
 Initial tau           : 0.00e+00     Two-norm of b         : 2.05e+00
 Optimality tol        : 1.00e-04     Target objective      : 1.00e-03
 Basis pursuit tol     : 1.00e-06     Maximum iterations    :      100

  Iter      Objective   Relative Gap  Rel Error      gNorm    stepG    nnzX
     0  2.0454968e+00  0.0000000e+00   1.00e+00  3.608e-01    0.0       0
     1  1.9400242e+00  2.1112766e+00   9.99e-01  3.339e-01   -0.3       1
     2  9.5969575e-01  1.0169190e+00   9.59e-01  1.409e-01    0.0      66
     3  8.6457253e-01  3.0048961e-01   8.64e-01  9.813e-02    0.0      94
     4  8.4040246e-01  2.3381723e-01   8.39e-01  9.075e-02    0.0      73
     5  8.0841799e-01  1.1420638e-01   8.07e-01  8.102e-02    0.0      57
     6  7.9588382e-01  3.0743424e-01   7.95e-01  9.266e-02    0.0      40
     7  7.8867650e-01  2.4678957e-01   7.88e-01  9.154e-02   -0.3      42
     8  7.8126385e-01  7.2526399e-02   7.80e-01  7.608e-02    0.0      44
     9  7.8021385e-01  3.9614850e-02   7.79e-01  7.352e-02    0.0      42
    10  7.7888643e-01  2.4222550e-02   7.78e-01  7.277e-02    0.0      38
```

11	7.7759607e-01	2.4143141e-02	7.77e-01	7.372e-02	0.0	36
12	7.7751772e-01	9.3268826e-03	7.77e-01	7.267e-02	-0.3	36
13	2.3424687e-01	5.7973954e-01	2.33e-01	3.365e-02	0.0	163
14	1.7021631e-01	9.7992961e-02	1.69e-01	1.761e-02	0.0	243
15	1.5806620e-01	1.2223578e-01	1.57e-01	1.691e-02	0.0	214
16	1.4746071e-01	8.6239799e-02	1.46e-01	1.525e-02	0.0	185
17	1.3380809e-01	1.0882526e-01	1.33e-01	1.437e-02	0.0	149
18	1.2824875e-01	5.9741859e-02	1.27e-01	1.293e-02	-0.3	157
19	1.2455692e-01	6.3205040e-02	1.24e-01	1.233e-02	0.0	145
20	1.1998890e-01	5.7758338e-02	1.19e-01	1.211e-02	0.0	140
21	1.1774220e-01	1.2208183e-01	1.17e-01	1.363e-02	0.0	128
22	1.1387733e-01	7.8312810e-02	1.13e-01	1.279e-02	-0.3	138
23	1.0751179e-01	4.0070057e-02	1.07e-01	1.011e-02	0.0	132
24	1.0625703e-01	4.1706315e-02	1.05e-01	1.016e-02	0.0	127
25	1.0182760e-01	3.6929957e-02	1.01e-01	9.558e-03	0.0	118
26	9.7708156e-02	9.0548799e-02	9.67e-02	1.190e-02	-0.3	119
27	9.4533008e-02	2.9343661e-02	9.35e-02	8.674e-03	-0.3	120
28	9.3228387e-02	3.4463123e-02	9.22e-02	8.864e-03	0.0	116
29	9.1693457e-02	3.3452244e-02	9.07e-02	8.641e-03	0.0	114
30	8.8882964e-02	1.0816336e-01	8.79e-02	1.201e-02	0.0	102
31	8.4013034e-02	4.2489263e-02	8.30e-02	8.598e-03	-0.3	108
32	8.2781529e-02	2.3289880e-02	8.18e-02	7.513e-03	0.0	106
33	8.1917293e-02	2.6730591e-02	8.09e-02	7.574e-03	0.0	105
34	7.8219630e-02	3.9109098e-02	7.72e-02	7.930e-03	0.0	104
35	7.7639409e-02	5.7581712e-02	7.66e-02	8.725e-03	-0.3	105
36	7.6397849e-02	3.2000787e-02	7.54e-02	7.435e-03	0.0	107
37	7.5374421e-02	2.5035507e-02	7.44e-02	7.007e-03	0.0	104
38	7.4838596e-02	2.2774375e-02	7.38e-02	6.858e-03	0.0	103
39	7.1879460e-02	2.5935200e-02	7.09e-02	6.763e-03	0.0	100
40	7.1457445e-02	5.1533869e-02	7.05e-02	7.986e-03	-0.3	103
41	6.9896896e-02	4.1374468e-02	6.89e-02	7.342e-03	-0.3	102
42	6.8693705e-02	1.9914898e-02	6.77e-02	6.265e-03	0.0	104
43	6.8260665e-02	2.1082824e-02	6.73e-02	6.282e-03	0.0	102
44	6.5833021e-02	1.6772586e-02	6.48e-02	5.877e-03	0.0	100
45	6.4857099e-02	5.9158620e-02	6.39e-02	7.908e-03	-0.3	100
46	6.3367005e-02	1.7311687e-02	6.24e-02	5.765e-03	-0.3	104
47	6.2923578e-02	1.9607765e-02	6.19e-02	5.822e-03	0.0	100
48	6.1825497e-02	1.7384824e-02	6.08e-02	5.609e-03	0.0	99
49	6.1569241e-02	9.1241989e-02	6.06e-02	9.063e-03	-0.3	98
50	5.8121493e-02	1.5516010e-02	5.71e-02	5.304e-03	-0.3	104
51	5.7608359e-02	1.7660439e-02	5.66e-02	5.332e-03	0.0	101
52	5.6996868e-02	1.5952624e-02	5.60e-02	5.183e-03	0.0	98
53	5.3539533e-02	2.4239161e-02	5.25e-02	5.303e-03	0.0	97
54	5.2985984e-02	2.5948455e-02	5.20e-02	5.420e-03	-0.3	97
55	5.2309431e-02	2.1292140e-02	5.13e-02	5.069e-03	0.0	97
56	5.1802632e-02	1.3116553e-02	5.08e-02	4.665e-03	0.0	96
57	5.1415146e-02	1.5868510e-02	5.04e-02	4.759e-03	0.0	96
58	5.0354828e-02	1.6358874e-02	4.94e-02	4.707e-03	0.0	95
59	4.9901979e-02	1.7435152e-02	4.89e-02	4.708e-03	-0.3	97
60	4.9470921e-02	1.1696955e-02	4.85e-02	4.407e-03	0.0	94
61	4.9070515e-02	1.5061970e-02	4.81e-02	4.534e-03	0.0	97
62	4.8583199e-02	1.3830536e-02	4.76e-02	4.443e-03	0.0	95
63	4.8565643e-02	3.1070752e-02	4.76e-02	5.213e-03	0.0	97
64	2.1945281e-02	3.9187218e-02	2.09e-02	3.090e-03	0.0	156

```
   65   1.8435312e-02   8.1369831e-03    1.74e-02   1.694e-03      0.0      154
   66   1.8000500e-02   7.9329778e-03    1.70e-02   1.644e-03      0.0      151
   67   1.7450810e-02   6.6558114e-03    1.65e-02   1.570e-03      0.0      143
   68   1.6952720e-02   9.8659324e-03    1.60e-02   1.651e-03      0.0      127
   69   1.6549786e-02   4.7339928e-03    1.55e-02   1.415e-03     -0.3      126
   70   1.6415177e-02   4.5211502e-03    1.54e-02   1.390e-03      0.0      126
   71   1.6199822e-02   4.8327431e-03    1.52e-02   1.395e-03      0.0      127
   72   1.5868826e-02   9.2048238e-03    1.49e-02   1.568e-03     -0.3      127
   73   1.5522703e-02   5.3553132e-03    1.45e-02   1.389e-03     -0.3      130
   74   1.5424670e-02   4.5325744e-03    1.44e-02   1.334e-03      0.0      127
   75   1.5272581e-02   4.7354865e-03    1.43e-02   1.334e-03      0.0      128
   76   1.4710556e-02   1.6504964e-02    1.37e-02   1.861e-03      0.0      117
   77   1.4401193e-02   1.7467122e-02    1.34e-02   1.904e-03     -0.3      118
   78   1.3501925e-02   2.8428116e-03    1.25e-02   1.142e-03      0.0      118
   79   1.3399682e-02   3.4359229e-03    1.24e-02   1.160e-03      0.0      117
   80   1.3289609e-02   3.4760555e-03    1.23e-02   1.146e-03      0.0      118
   81   1.2717605e-02   4.8500654e-03    1.17e-02   1.175e-03      0.0      120
   82   1.2702025e-02   7.2176411e-03    1.17e-02   1.252e-03     -0.3      119
   83   1.2495403e-02   4.5622801e-03    1.15e-02   1.138e-03      0.0      121
   84   1.2402857e-02   3.0464056e-03    1.14e-02   1.054e-03      0.0      121
   85   1.2345635e-02   3.0937196e-03    1.13e-02   1.053e-03      0.0      121
   86   1.1590625e-02   3.6301834e-03    1.06e-02   1.018e-03      0.0      120
   87   1.1523151e-02   5.6420283e-03    1.05e-02   1.132e-03     -0.3      122
   88   1.1398258e-02   1.9596616e-03    1.04e-02   9.264e-04      0.0      119
   89   1.1344128e-02   2.3379563e-03    1.03e-02   9.449e-04      0.0      119
   90   1.1258921e-02   2.2315514e-03    1.03e-02   9.305e-04      0.0      119
   91   1.1209096e-02   1.1594645e-02    1.02e-02   1.366e-03      0.0      119
   92   1.0525524e-02   3.4219284e-03    9.53e-03   9.371e-04     -0.3      119
   93   1.0426946e-02   1.9820379e-03    9.43e-03   8.594e-04      0.0      119
   94   1.0385607e-02   1.9321501e-03    9.39e-03   8.519e-04      0.0      119
   95   1.0061377e-02   2.4156710e-03    9.06e-03   8.553e-04      0.0      118
   96   1.0004449e-02   3.8802317e-03    9.00e-03   9.066e-04     -0.3      117
   97   9.9119898e-03   2.5276024e-03    8.91e-03   8.498e-04     -0.3      117
   98   9.8666062e-03   1.5519424e-03    8.87e-03   7.947e-04      0.0      118
   99   9.8136845e-03   1.6319675e-03    8.81e-03   7.965e-04      0.0      118
  100   9.5309581e-03   7.6856707e-03    8.53e-03   1.042e-03      0.0      117

ERROR EXIT -- Too many iterations

Products with A     :     147      Total time   (secs) :      0.3
Products with A'    :     101      Project time (secs) :      0.1
Newton iterations   :       3      Mat-vec time (secs) :      0.0
Line search its     :      69      Subspace iterations :        0


================================================================================
SPGL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
================================================================================
No. rows                :      120      No. columns            :      512
Initial tau             : 0.00e+00      Two-norm of b          : 6.84e-01
Optimality tol          : 1.00e-04      Target objective       : 1.00e-03
Basis pursuit tol       : 1.00e-06      Maximum iterations     :      100

 Iter      Objective   Relative Gap   Rel Error      gNorm    stepG    nnzX
```

0	6.8394737e-01	0.0000000e+00	6.83e-01	1.808e-01	0.0	0
1	6.7022010e-01	6.4488302e-01	6.69e-01	1.664e-01	-0.3	1
2	4.3999758e-01	1.3037532e-01	4.39e-01	8.322e-02	0.0	51
3	3.9651933e-01	3.6323641e-02	3.96e-01	4.071e-02	0.0	58
4	3.8967301e-01	2.0874561e-02	3.89e-01	3.945e-02	0.0	55
5	3.8792285e-01	1.1804886e-02	3.87e-01	3.667e-02	0.0	49
6	3.8666633e-01	3.1904214e-03	3.86e-01	3.396e-02	0.0	40
7	3.8665345e-01	6.4030471e-03	3.86e-01	3.509e-02	0.0	41
8	1.4535569e-01	1.1835392e-01	1.44e-01	1.640e-02	0.0	131
9	9.9250097e-02	1.8244307e-02	9.83e-02	8.746e-03	0.0	267
10	9.1708599e-02	2.2282958e-02	9.07e-02	8.284e-03	0.0	228
11	8.7390605e-02	1.3480744e-02	8.64e-02	7.280e-03	0.0	209
12	8.3185920e-02	1.0954207e-02	8.22e-02	6.679e-03	0.0	178
13	8.2555368e-02	2.6988586e-02	8.16e-02	9.258e-03	-0.3	174
14	8.1510858e-02	2.0468427e-02	8.05e-02	7.812e-03	0.0	164
15	7.9820753e-02	7.7865536e-03	7.88e-02	6.248e-03	0.0	168
16	7.9390147e-02	5.7029416e-03	7.84e-02	5.881e-03	0.0	166
17	7.8302070e-02	5.9726673e-03	7.73e-02	5.914e-03	0.0	160
18	7.8218296e-02	2.3096748e-02	7.72e-02	8.209e-03	-0.3	145
19	7.6493817e-02	4.4111846e-03	7.55e-02	5.688e-03	-0.3	151
20	7.6308109e-02	3.8022283e-03	7.53e-02	5.544e-03	0.0	148
21	7.6033201e-02	3.0575887e-03	7.50e-02	5.404e-03	0.0	147
22	7.5136614e-02	7.5559324e-03	7.41e-02	6.004e-03	0.0	139
23	7.5057344e-02	1.1352560e-02	7.41e-02	6.635e-03	-0.3	140
24	7.4615811e-02	3.2753459e-03	7.36e-02	5.388e-03	0.0	138
25	7.4537646e-02	2.3200611e-03	7.35e-02	5.251e-03	0.0	137
26	7.4415209e-02	2.4030956e-03	7.34e-02	5.256e-03	0.0	136
27	7.4099132e-02	7.7381368e-03	7.31e-02	6.054e-03	0.0	126
28	7.3709947e-02	6.4087535e-03	7.27e-02	5.807e-03	-0.3	127
29	7.3486991e-02	2.3779708e-03	7.25e-02	5.214e-03	0.0	128
30	7.3432724e-02	1.8442018e-03	7.24e-02	5.127e-03	0.0	129
31	7.3368636e-02	1.3477443e-03	7.24e-02	5.048e-03	0.0	128
32	7.3226600e-02	3.8954622e-03	7.22e-02	5.397e-03	0.0	124
33	7.3154247e-02	2.1659035e-03	7.22e-02	5.160e-03	-0.3	126
34	7.3125949e-02	1.6497832e-03	7.21e-02	5.074e-03	0.0	125
35	1.8352737e-02	1.8187343e-02	1.74e-02	2.448e-03	0.0	228
36	1.1667410e-02	2.3889148e-03	1.07e-02	9.687e-04	0.0	250
37	1.0976562e-02	2.7911199e-03	9.98e-03	9.510e-04	0.0	248
38	9.9873963e-03	1.5417957e-03	8.99e-03	7.855e-04	0.0	241
39	9.6760057e-03	4.3622067e-03	8.68e-03	1.040e-03	0.0	225
40	9.1386600e-03	2.3154930e-03	8.14e-03	8.664e-04	-0.3	224
41	8.7165121e-03	1.2064413e-03	7.72e-03	6.674e-04	0.0	224
42	8.6108594e-03	1.0199379e-03	7.61e-03	6.481e-04	0.0	220
43	8.3082550e-03	8.9267350e-04	7.31e-03	6.130e-04	0.0	212
44	8.1453514e-03	1.5352157e-03	7.15e-03	7.012e-04	-0.3	207
45	8.1334459e-03	2.7064162e-03	7.13e-03	8.031e-04	-0.3	203
46	7.8588978e-03	9.8950059e-04	6.86e-03	6.068e-04	0.0	204
47	7.7858141e-03	6.3684006e-04	6.79e-03	5.539e-04	0.0	203
48	7.7152865e-03	5.9058285e-04	6.72e-03	5.455e-04	0.0	202
49	7.5176222e-03	2.5550043e-03	6.52e-03	7.734e-04	0.0	190
50	7.1961606e-03	1.2562225e-03	6.20e-03	6.093e-04	-0.3	193
51	7.0986973e-03	6.2748877e-04	6.10e-03	5.220e-04	0.0	192
52	7.0574082e-03	4.0408771e-04	6.06e-03	4.907e-04	0.0	191
53	6.9968790e-03	5.0984993e-04	6.00e-03	4.998e-04	0.0	189

```
54   6.9610639e-03   1.0597304e-03    5.96e-03   5.641e-04    -0.3     188
55   6.9118084e-03   8.2831831e-04    5.91e-03   5.355e-04    -0.3     188
56   6.8777667e-03   3.4280981e-04    5.88e-03   4.713e-04     0.0     188
57   6.8570122e-03   3.6970161e-04    5.86e-03   4.741e-04     0.0     188
58   6.7209634e-03   5.9103058e-04    5.72e-03   4.918e-04     0.0     184
59   6.7141698e-03   1.1382823e-03    5.71e-03   5.669e-04    -0.3     184
60   6.6708772e-03   4.7455419e-04    5.67e-03   4.752e-04     0.0     184
61   6.6519476e-03   2.9831803e-04    5.65e-03   4.543e-04     0.0     184
62   6.6339322e-03   3.1106994e-04    5.63e-03   4.543e-04     0.0     184
63   6.4644337e-03   1.4854764e-03    5.46e-03   5.998e-04     0.0     180
64   6.4549552e-03   1.2200491e-03    5.45e-03   5.526e-04    -0.3     180
65   6.3746627e-03   3.4879728e-04    5.37e-03   4.480e-04     0.0     180
66   6.3639717e-03   2.5660712e-04    5.36e-03   4.342e-04     0.0     180
67   6.3276361e-03   2.4916896e-04    5.33e-03   4.310e-04     0.0     178
68   6.2413579e-03   1.8982823e-03    5.24e-03   6.140e-04    -0.3     172
69   6.2254981e-03   2.2967487e-03    5.23e-03   6.964e-04    -0.3     172
70   6.0835403e-03   4.0426799e-04    5.08e-03   4.345e-04     0.0     172
71   6.0723444e-03   2.3541559e-04    5.07e-03   4.137e-04     0.0     172
72   6.0587816e-03   2.5102844e-04    5.06e-03   4.144e-04     0.0     172
73   5.9620570e-03   7.3521858e-04    4.96e-03   4.835e-04     0.0     166
74   5.9176597e-03   9.7775724e-04    4.92e-03   4.906e-04    -0.3     166
75   5.8820345e-03   6.6585598e-04    4.88e-03   4.622e-04     0.0     165
76   5.8651251e-03   2.5239908e-04    4.87e-03   4.052e-04     0.0     165
77   5.8586573e-03   2.3412428e-04    4.86e-03   4.028e-04     0.0     165
78   5.8266535e-03   2.7917609e-04    4.83e-03   4.048e-04     0.0     163
79   5.8175120e-03   5.0605979e-04    4.82e-03   4.375e-04    -0.3     162
80   5.8066973e-03   4.2304115e-04    4.81e-03   4.211e-04    -0.3     162
81   5.7980911e-03   2.4421748e-04    4.80e-03   4.005e-04     0.0     162
82   5.7918070e-03   2.3041657e-04    4.79e-03   3.976e-04     0.0     162
83   5.7663516e-03   4.2113624e-04    4.77e-03   4.224e-04     0.0     161
84   5.7658304e-03   6.2981370e-04    4.77e-03   4.433e-04    -0.3     161
85   2.1458016e-03   8.8879071e-04    1.15e-03   2.228e-04     0.0     164
86   2.0201242e-03   3.4285441e-04    1.02e-03   1.606e-04     0.0     163
87   1.9700970e-03   2.3384562e-04    9.70e-04   1.464e-04     0.0     164
88   1.8912390e-03   2.0812510e-04    8.91e-04   1.452e-04     0.0     163
89   1.8792295e-03   3.8875035e-04    8.79e-04   1.603e-04    -0.3     163
90   1.8536360e-03   2.9711757e-04    8.54e-04   1.529e-04     0.0     163
91   1.8367651e-03   1.6181536e-04    8.37e-04   1.339e-04     0.0     163
92   1.8311424e-03   1.0063765e-04    8.31e-04   1.269e-04     0.0     163
93   1.8232548e-03   1.2004280e-04    8.23e-04   1.289e-04     0.0     163
94   1.8148963e-03   2.5052813e-04    8.15e-04   1.471e-04    -0.3     164
95   1.8040467e-03   1.0313743e-04    8.04e-04   1.263e-04    -0.3     163
96   1.8014157e-03   7.3081728e-05    8.01e-04   1.227e-04     0.0     163
97   1.7945912e-03   8.6040768e-05    7.95e-04   1.238e-04     0.0     163
98   1.7934309e-03   4.6206501e-04    7.93e-04   1.744e-04    -0.3     162
99   1.7674481e-03   1.3204900e-04    7.67e-04   1.287e-04    -0.3     162
100   1.7641083e-03   7.1171565e-05    7.64e-04   1.214e-04     0.0     162
```

ERROR EXIT -- Too many iterations

```
Products with A      :      142     Total time   (secs) :      0.3
Products with A'     :      101     Project time (secs) :      0.1
Newton iterations    :        4     Mat-vec time (secs) :      0.0
Line search its      :       60     Subspace iterations :        0
```
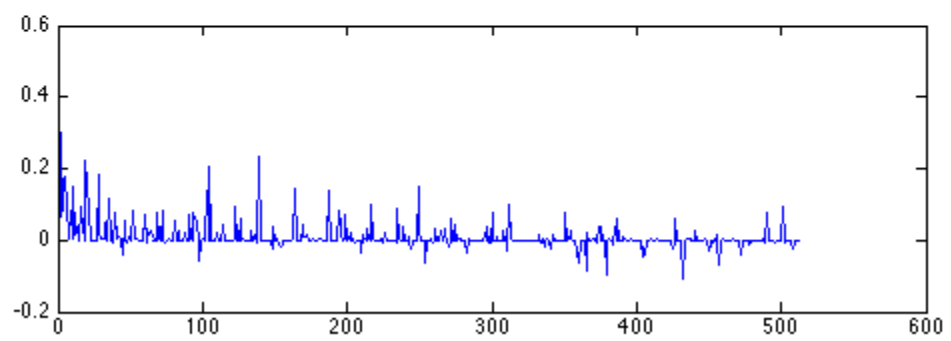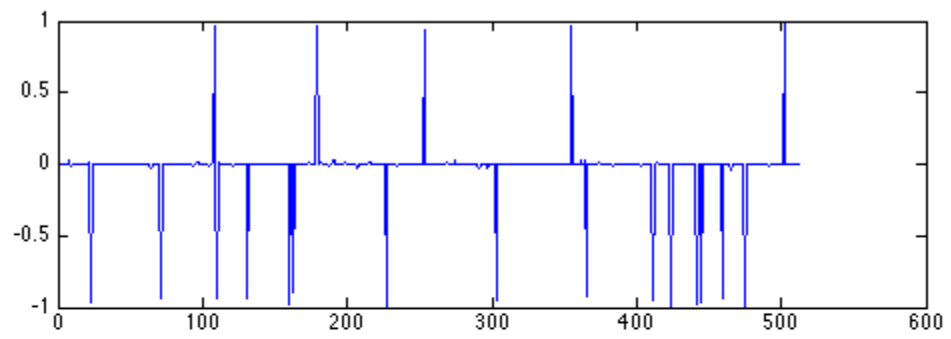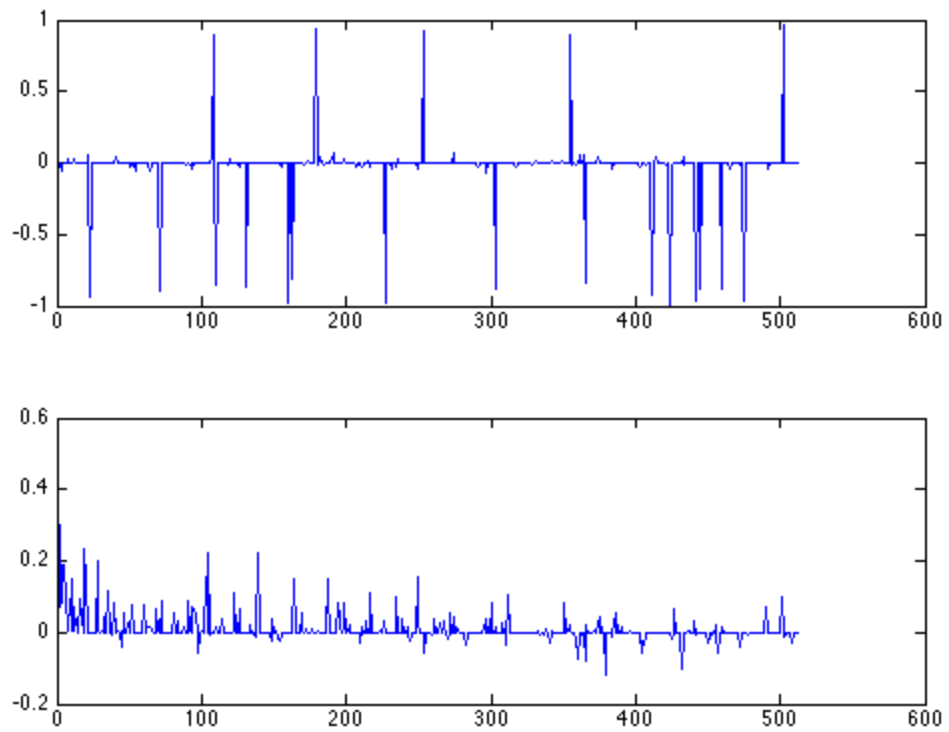
show result

```
info_sparse
info_spg1
info_compress
info_spg2

figure('Name','strict sparse Solution paths')
plot(info_sparse.xNorm1,info_sparse.rNorm2,info_spg1.xNorm1,info_spg1.rNorm2);hold
scatter(info_sparse.xNorm1,info_sparse.rNorm2);
scatter(info_spg1.xNorm1,info_spg1.rNorm2);hold off
legend('pqn','spg')
axis tight

figure('Name','compress signal Solution paths')
plot(info_compress.xNorm1,info_compress.rNorm2,info_spg2.xNorm1,info_spg2.rNorm2);
scatter(info_compress.xNorm1,info_compress.rNorm2);
scatter(info_spg2.xNorm1,info_spg2.rNorm2);hold off
legend('pqn','spg')
axis tight
```

```
info_sparse =

        tau: 20.3619
      rNorm: 9.0505e-04
```

```
              rGap: 5.1169e-04
             gNorm: 7.7698e-05
              stat: 1
              iter: 66
             nProdA: 68
            nProdAt: 68
            nNewton: 9
        timeProject: 1.7993
        timeMatProd: 0.0229
            itnLSQR: 0
            options: [1x1 struct]
          timeTotal: 1.6018
             xNorm1: [66x1 double]
             rNorm2: [66x1 double]
             lambda: [66x1 double]


    info_spg1 =

                tau: 20.3433
              rNorm: 0.0095
               rGap: 0.0077
              gNorm: 0.0010
               stat: 5
               iter: 100
             nProdA: 147
            nProdAt: 101
            nNewton: 3
        timeProject: 0.0723
        timeMatProd: 0.0213
            itnLSQR: 0
            options: [1x1 struct]
          timeTotal: 0.3077
             xNorm1: [100x1 double]
             rNorm2: [100x1 double]
             lambda: [100x1 double]


    info_compress =

                tau: 8.0253
              rNorm: 9.3181e-04
               rGap: 2.9134e-04
              gNorm: 8.6791e-05
               stat: 1
               iter: 60
             nProdA: 65
            nProdAt: 65
            nNewton: 15
        timeProject: 0.7391
        timeMatProd: 0.0162
            itnLSQR: 0
            options: [1x1 struct]
          timeTotal: 0.6477
```

```
              xNorm1: [60x1 double]

              rNorm2: [60x1 double]
              lambda: [60x1 double]


     info_spg2 =

                 tau: 7.9341
               rNorm: 0.0018
                rGap: 7.1172e-05
               gNorm: 1.2141e-04
                stat: 5
                iter: 100
              nProdA: 142
             nProdAt: 101
             nNewton: 4
         timeProject: 0.0675
         timeMatProd: 0.0331
             itnLSQR: 0
             options: [1x1 struct]
           timeTotal: 0.2557
              xNorm1: [100x1 double]
              rNorm2: [100x1 double]
              lambda: [100x1 double]
```
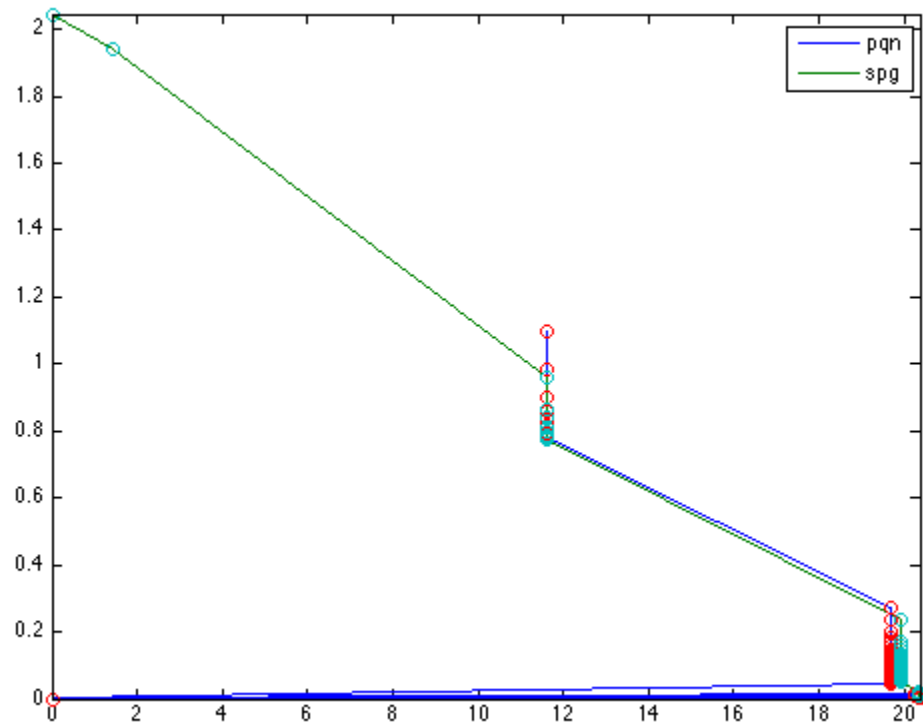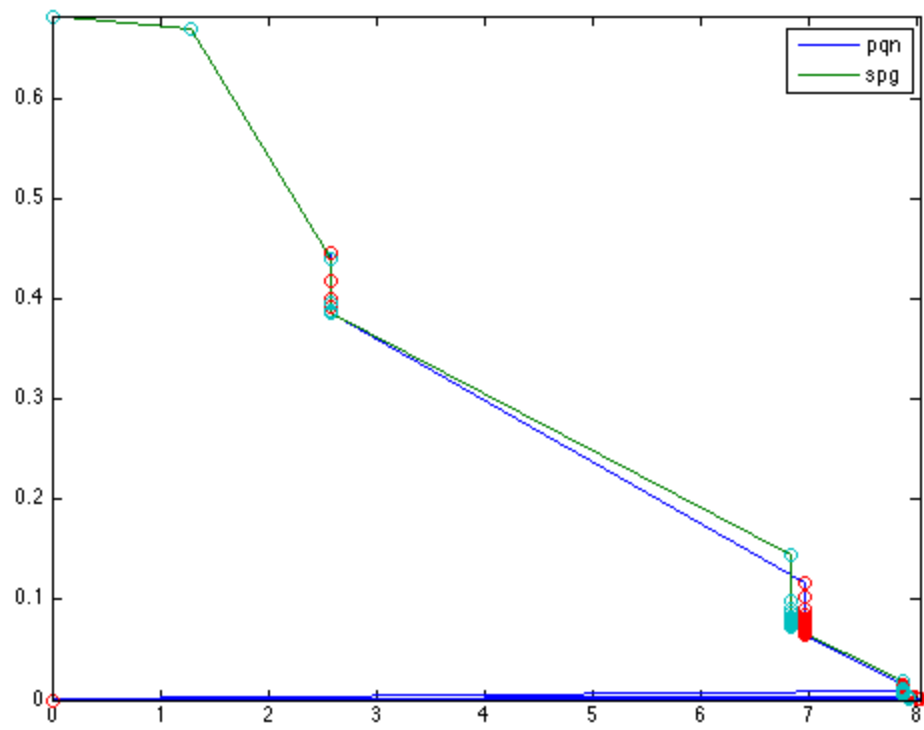
Published with MATLAB® 7.13