Table of Contents

add working path of tools and functions

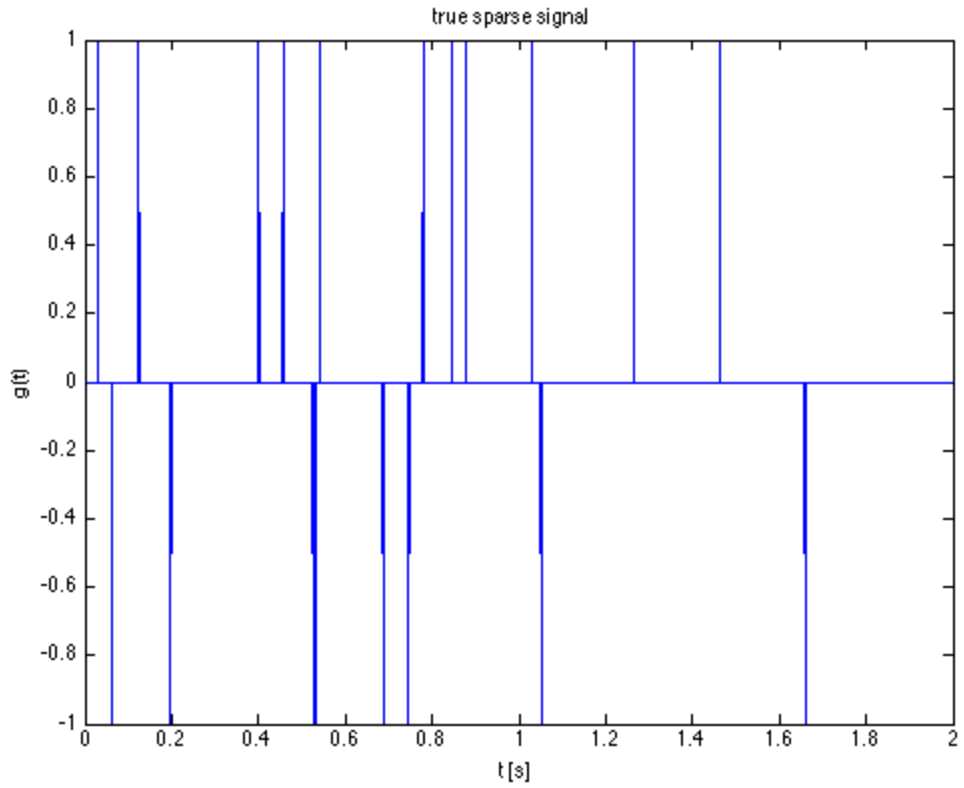
```
%addpath(genpath('e:\research\Tools\spot-slim'))
% addpath(genpath('e:\research\Tools\pSPOT'))
cd ../../../../../../pqnl1;
addpath(genpath(pwd))
cd ../experiments/help_spgl1/modifying/task16bpdn/
addpath(genpath(pwd))
cd ./seismic/deconvolution
rmpath('/Volumes/Users/linamiao/Dropbox/PQN/pqnl1/minConF/')
```

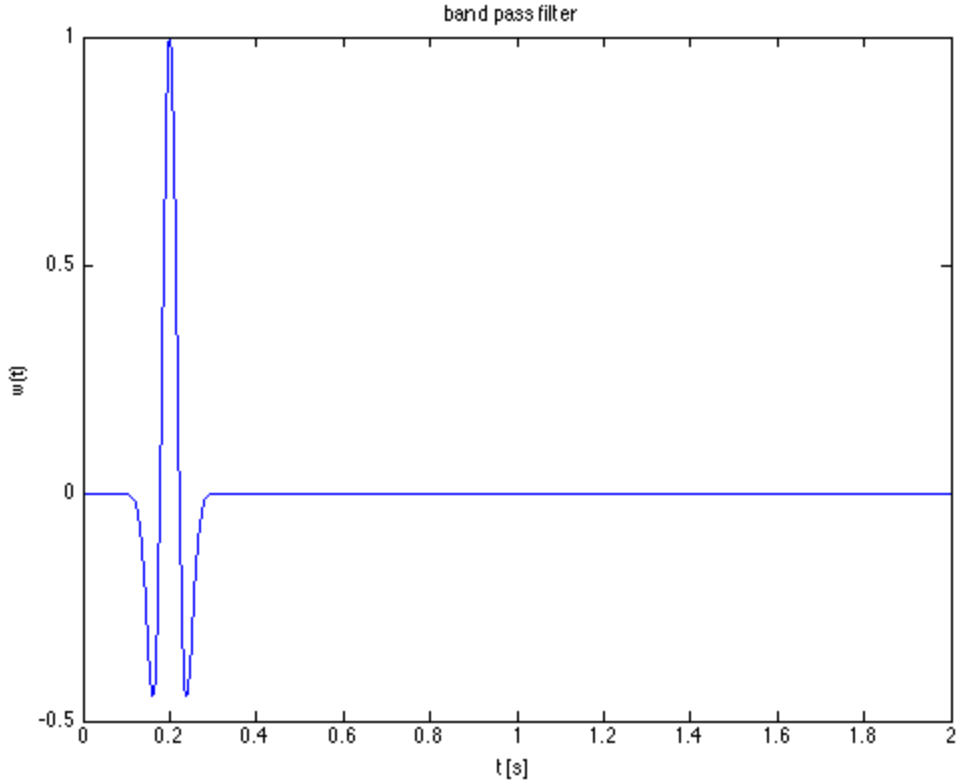
problem setting

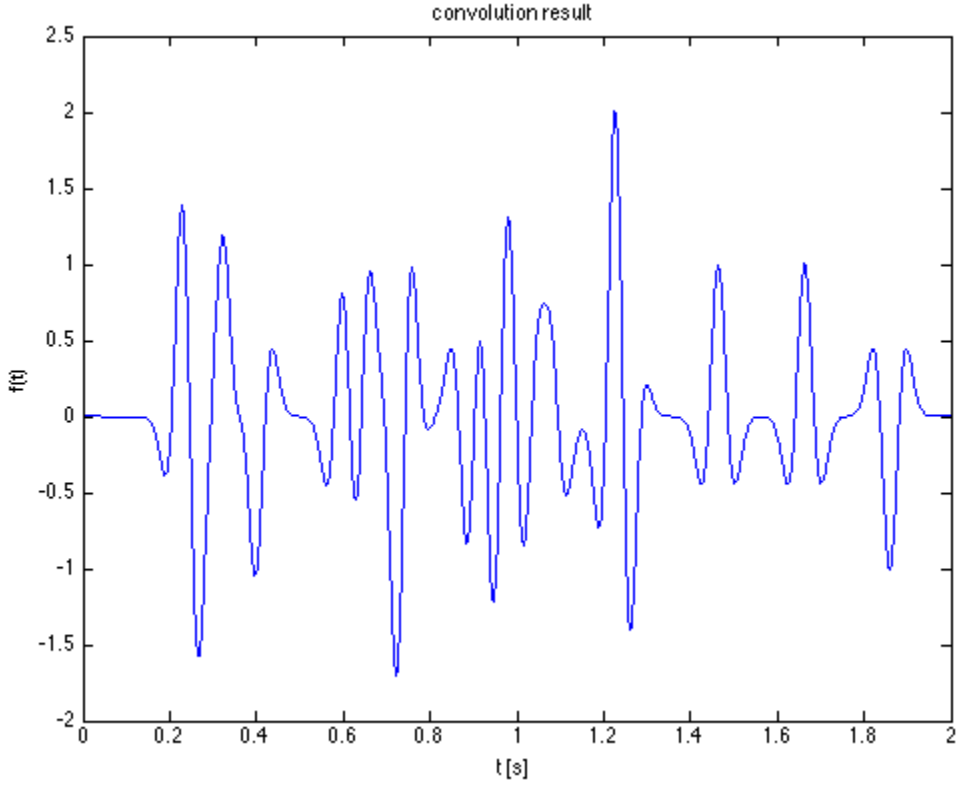
time axis

```
t = [0:.001:2]';
N = length(t);

% true signal g has approx k spikes with random amplitudes
k = 20;
g = zeros(N,1);
g(randi(N,k,1)) = sign(randn(k,1));%randn(k,1);

% filter
w = (1-2*1e3*(t-.2).^2).*exp(-1e3*(t-.2).^2);

% plot
figure;
plot(t,g);
xlabel('t [s]');ylabel('g(t)');
title('true sparse signal')

figure;
plot(t,w);
xlabel('t [s]');ylabel('w(t)');
title('band pass filter')


% fourier transform of w
wf = fft(w);
```

```
% SPOT operator to perform convolution.
C = opDFT(N)'*opDiag(wf)*opDFT(N);
f = C*g;

% plot
figure;
plot(t,f);
xlabel('t [s]');ylabel('f(t)');
title('convolution result')
```




band pass filter
w(t)
t [s]
1
0.5
0
-0.5
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


convolution result
f(t)
t [s]
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

spgl1 and pqnl1

lasso

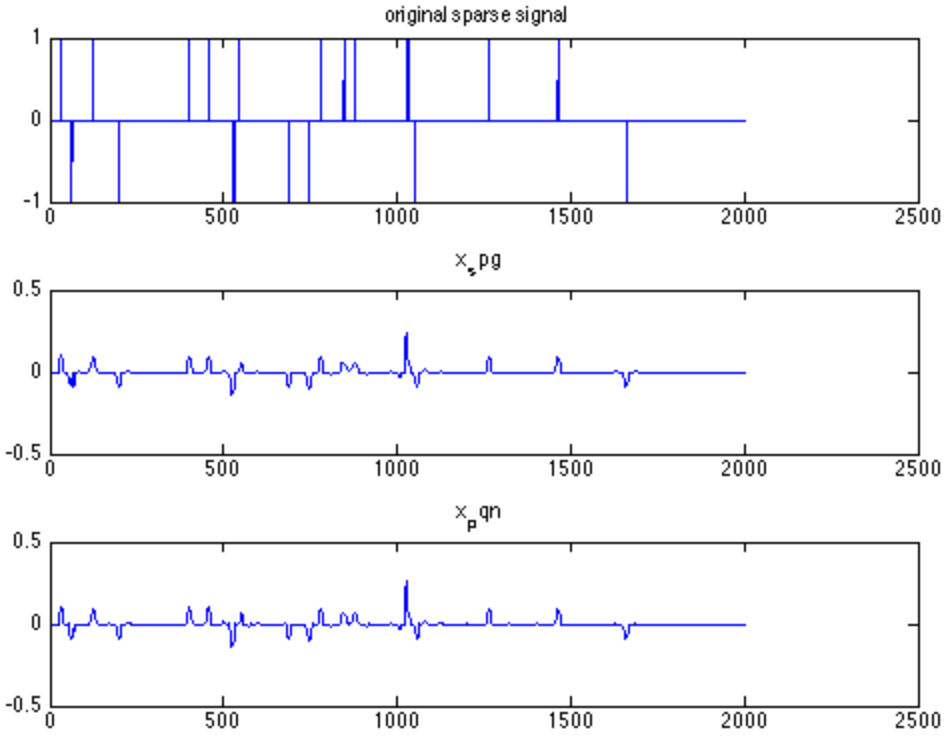
```
opts.iterations = 100;
tau = norm(g,1);

[x_spg,r_spg,g_spg,info_spg] = spgl1(C, f, tau, [], zeros(size(g)), opts);
opts.iterations = 50;
[x_pqn,r_pqn,g_pqn,info_pqn] = pqnl1_2(C, f, tau, [], zeros(size(g)), opts);

figure;
subplot(3,1,1); plot(g); title('original sparse signal')
subplot(3,1,2); plot(x_spg);title('x_spg')
subplot(3,1,3); plot(x_pqn);title('x_pqn')
```

```
================================================================================
SPGL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
================================================================================
No. rows              :     2001      No. columns           :     2001
Initial tau           : 2.00e+01      Two-norm of b         : 2.49e+01
Optimality tol        : 1.00e-04      Target one-norm of x  : 2.00e+01
Basis pursuit tol     : 1.00e-06      Maximum iterations    :      100

 Iter      Objective   Relative Gap      gNorm   stepG    nnzX    nnzG
    0  2.4852247e+01  3.8405746e+00   5.93e+01     0.0       0       0
    1  2.0299442e+01  5.1674117e+00   5.19e+01    -0.3      21       0
    2  2.0012671e+01  1.0323775e+01   7.95e+01     0.0     588       0
    3  1.1934608e+01  9.7496592e+00   3.38e+01     0.0    1218       0
    4  4.6359724e+00  9.6704407e+00   5.91e+00     0.0    1245       0
    5  4.1567032e+00  6.1825054e+00   3.73e+00     0.0    1171       0
    6  3.7769198e+00  5.4553834e+00   3.09e+00     0.0    1137       0
    7  2.9486042e+00  9.6871312e+00   3.34e+00     0.0     987       0
    8  3.0463125e+00  2.0767531e+01   5.18e+00    -0.3     906       0
    9  3.6386976e+00  2.3743391e+01   9.21e+00     0.0     983       0
   10  2.4252276e+00  7.4947125e+00   2.00e+00     0.0     895       0
   11  2.3567470e+00  5.1472819e+00   1.63e+00     0.0     882       0
   12  2.2958365e+00  5.2717038e+00   1.57e+00     0.0     865       0
   13  1.6900469e+00  1.7749809e+01   1.98e+00     0.0     685       0
   14  1.8482563e+00  3.4997028e+01   3.59e+00    -0.3     738       0
   15  1.7056585e+00  3.2403223e+01   2.97e+00     0.0     736       0
   16  1.5682040e+00  6.3718272e+00   9.75e-01     0.0     717       0
   17  1.5533706e+00  5.5037970e+00   9.01e-01     0.0     696       0
   18  1.5068121e+00  5.6643546e+00   8.68e-01     0.0     701       0
   19  1.4984873e+00  5.4054370e+01   3.46e+00     0.0     653       0
   20  1.4917043e+00  4.7472050e+01   3.22e+00    -0.3     691       0
   21  1.2656109e+00  9.1726982e+00   9.31e-01     0.0     666       0
   22  1.2501265e+00  4.2363495e+00   6.75e-01     0.0     666       0
   23  1.2375002e+00  3.6899276e+00   6.36e-01     0.0     659       0
   24  1.1797643e+00  2.5859218e+01   1.71e+00     0.0     620       0
   25  1.2298877e+00  3.2648507e+01   2.08e+00    -0.3     630       0
```

26	1.1451574e+00	1.1946415e+01	1.00e+00	0.0	624	0
27	1.1305869e+00	3.1899251e+00	5.63e-01	0.0	622	0
28	1.1256646e+00	3.1258717e+00	5.59e-01	0.0	622	0
29	1.0318709e+00	7.2515962e+00	8.01e-01	0.0	601	0
30	1.0375704e+00	1.3597418e+01	9.81e-01	-0.3	598	0
31	1.0339355e+00	1.5238130e+01	1.21e+00	0.0	600	0
32	1.0041113e+00	3.1387146e+00	4.96e-01	0.0	597	0
33	9.9948139e-01	2.2015848e+00	4.62e-01	0.0	597	0
34	9.9347868e-01	2.4212362e+00	4.73e-01	0.0	596	0
35	8.5107663e-01	1.2405563e+01	1.03e+00	0.0	536	0
36	8.3991791e-01	1.5125054e+01	1.10e+00	-0.3	540	0
37	8.1268300e-01	6.9463919e+00	6.59e-01	0.0	538	0
38	7.9708789e-01	3.5897102e+00	4.83e-01	0.0	539	0
39	7.9356925e-01	1.9159619e+00	3.85e-01	0.0	539	0
40	7.8889308e-01	1.8004626e+00	3.71e-01	0.0	537	0
41	7.6206412e-01	4.5758422e+00	4.74e-01	0.0	538	0
42	7.6122319e-01	8.5966485e+00	7.06e-01	-0.3	538	0
43	7.5433395e-01	4.5489759e+00	4.82e-01	0.0	536	0
44	7.5005384e-01	1.8129099e+00	3.50e-01	0.0	535	0
45	7.4815410e-01	1.6673463e+00	3.39e-01	0.0	533	0
46	7.3705270e-01	2.8679974e+00	4.04e-01	0.0	526	0
47	7.3877181e-01	9.4300289e+00	7.08e-01	-0.3	525	0
48	7.3554009e-01	9.0741049e+00	7.34e-01	-0.3	526	0
49	7.2475415e-01	2.2849549e+00	3.58e-01	0.0	524	0
50	7.2306973e-01	1.3671382e+00	3.16e-01	0.0	523	0
51	7.1994275e-01	1.4971987e+00	3.23e-01	0.0	523	0
52	6.3603481e-01	8.9697827e+00	6.36e-01	0.0	490	0
53	6.2962252e-01	1.0006343e+01	8.20e-01	-0.3	492	0
54	6.0793981e-01	3.7079360e+00	3.69e-01	0.0	489	0
55	6.0283431e-01	1.5606291e+00	2.88e-01	0.0	490	0
56	6.0126986e-01	1.4598470e+00	2.76e-01	0.0	490	0
57	5.9550885e-01	5.9881629e+00	5.03e-01	0.0	486	0
58	5.9125670e-01	1.1839301e+00	2.43e-01	-0.3	484	0
59	5.8961412e-01	1.5084187e+00	2.69e-01	0.0	485	0
60	5.8803851e-01	8.7103405e-01	2.32e-01	0.0	485	0
61	5.8442229e-01	3.9419798e+00	4.04e-01	0.0	487	0
62	5.8209865e-01	1.1751985e+00	2.48e-01	-0.3	487	0
63	5.8090716e-01	1.3258035e+00	2.58e-01	0.0	487	0
64	5.7915158e-01	8.8253254e-01	2.32e-01	0.0	487	0
65	5.7844901e-01	6.8199673e+00	5.49e-01	0.0	484	0
66	5.6938339e-01	1.3151518e+00	2.53e-01	-0.3	485	0
67	5.6769541e-01	1.5846119e+00	2.67e-01	0.0	486	0
68	5.6651468e-01	7.9029733e-01	2.24e-01	0.0	486	0
69	5.6230167e-01	2.0241143e+00	2.88e-01	0.0	486	0
70	5.6228521e-01	4.6497283e+00	4.08e-01	-0.3	486	0
71	5.6093086e-01	2.6604854e+00	3.21e-01	0.0	485	0
72	5.5806559e-01	1.0503468e+00	2.34e-01	0.0	486	0
73	5.5732097e-01	9.8873011e-01	2.31e-01	0.0	486	0
74	5.5496562e-01	8.8739707e-01	2.25e-01	0.0	486	0
75	5.5671204e-01	1.9827211e+01	1.14e+00	-0.3	459	0
76	5.0031575e-01	3.0245007e+00	3.70e-01	-0.3	459	0
77	4.8555600e-01	1.3457714e+00	2.41e-01	0.0	460	0
78	4.7935847e-01	8.3149190e-01	1.98e-01	0.0	460	0
79	4.7550153e-01	1.3822049e+00	2.11e-01	0.0	461	0

```
   80  4.8308161e-01  8.3377751e+00   5.91e-01     0.0     458       0
   81  4.7442744e-01  3.6530554e+00   3.30e-01    -0.3     457       0
   82  4.7054464e-01  1.3281971e+00   2.18e-01     0.0     457       0
   83  4.6980694e-01  6.5125212e-01   1.82e-01     0.0     457       0
   84  4.6833908e-01  6.6283261e-01   1.80e-01     0.0     456       0
   85  4.5646470e-01  6.6113139e+00   4.54e-01     0.0     449       0
   86  4.6531971e-01  6.8570768e+00   5.06e-01    -0.3     450       0
   87  4.5118195e-01  2.2552668e+00   2.51e-01     0.0     449       0
   88  4.4907529e-01  7.6787258e-01   1.77e-01     0.0     449       0
   89  4.4852297e-01  6.6221910e-01   1.71e-01     0.0     449       0
   90  4.4471750e-01  9.2932627e-01   1.77e-01     0.0     448       0
   91  4.4615823e-01  2.7696445e+00   2.92e-01    -0.3     449       0
   92  4.4827092e-01  3.5976963e+00   3.03e-01     0.0     448       0
   93  4.4286064e-01  2.0700801e+00   2.44e-01     0.0     448       0
   94  4.4080766e-01  7.8275398e-01   1.73e-01     0.0     448       0
   95  4.4032855e-01  5.3970323e-01   1.60e-01     0.0     448       0
   96  4.3914085e-01  7.1217702e-01   1.70e-01     0.0     448       0
   97  4.3725862e-01  5.0868691e+00   3.77e-01    -0.3     448       0
   98  4.3607068e-01  1.9923552e+00   2.41e-01    -0.3     447       0
   99  4.3220158e-01  8.8177664e-01   1.78e-01     0.0     448       0
  100  4.3161399e-01  5.7969060e-01   1.61e-01     0.0     448       0

 ERROR EXIT -- Too many iterations

 Products with A     :     140        Total time   (secs) :     1.4
 Products with A'    :     101        Project time (secs) :     0.1
 Newton iterations   :       0        Mat-vec time (secs) :     0.8
 Line search its     :      78        Subspace iterations :       0


 ================================================================================
 PQNL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
 ================================================================================
 No. rows              :     2001      No. columns           :     2001
 Initial tau           : 2.00e+01      Two-norm of b         : 2.49e+01
 Optimality tol        : 1.00e-04      Target one-norm of x  : 2.00e+01
 Basis pursuit tol     : 1.00e-06      Maximum iterations    :       50

  Iter      Objective   Relative Gap      gNorm   stepG    nnzX    nnzG
     0  2.4852247e+01  3.8405746e+00   5.93e+01     0.0       0       0
Inside of minConf_PQN
 Iteration   FunEvals Projections     Step Length          rNorm2        O
         1          1           4     2.50000e-01     2.42945e+01     2.500
         2          1          14     1.00000e+00     8.11923e+00     3.928
         3          1          30     1.00000e+00     6.10660e+00     3.884
         4          1          44     1.00000e+00     4.97982e+00     3.727
         5          1          60     1.00000e+00     3.97765e+00     3.705
         6          1          72     1.00000e+00     2.97979e+00     3.723
         7          1          85     1.00000e+00     2.49759e+00     3.504
         8          1         101     1.00000e+00     2.29259e+00     3.674
         9          1         119     1.00000e+00     2.02674e+00     3.233
        10          1         133     1.00000e+00     1.78372e+00     2.976
        11          1         149     1.00000e+00     1.58490e+00     2.916
        12          1         165     1.00000e+00     1.44923e+00     2.970
```

```
          13          1         186     1.00000e+00     1.33881e+00     2.338
          14          1         208     1.00000e+00     1.25623e+00     2.069
          15          1         226     1.00000e+00     1.18207e+00     2.339
          16          1         244     1.00000e+00     1.11934e+00     2.117
          17          1         260     1.00000e+00     1.01842e+00     2.023
          18          1         285     1.00000e+00     9.60945e-01     1.699
          19          1         309     1.00000e+00     9.20326e-01     2.143
          20          1         343     1.00000e+00     8.62819e-01     1.893
          21          1         372     1.00000e+00     8.05557e-01     1.560
          22          1         405     1.00000e+00     7.77562e-01     1.711
          23          1         435     1.00000e+00     7.52730e-01     1.569
          24          1         476     1.00000e+00     7.20155e-01     1.345
          25          1         516     1.00000e+00     6.77472e-01     1.428
          26          1         535     1.00000e+00     6.54190e-01     1.468
          27          1         555     1.00000e+00     6.36832e-01     1.461
          28          1         592     1.00000e+00     6.13463e-01     1.402
          29          1         621     1.00000e+00     5.99030e-01     1.516
          30          1         651     1.00000e+00     5.84390e-01     1.317
          31          1         677     1.00000e+00     5.71789e-01     1.400
          32          1         713     1.00000e+00     5.57583e-01     1.309
          33          1         749     1.00000e+00     5.37361e-01     1.323
          34          1         781     1.00000e+00     5.20703e-01     1.141
          35          1         819     1.00000e+00     5.03423e-01     1.012
          36          1         857     1.00000e+00     4.90579e-01     1.366
          37          1         891     1.00000e+00     4.83473e-01     1.335
          38          1         925     1.00000e+00     4.71022e-01     1.270
          39          1         975     1.00000e+00     4.62639e-01     1.464
          40          1        1027     1.00000e+00     4.54050e-01     1.304
          41          1        1036     1.00000e+00     4.49541e-01     1.158
          42          1        1091     1.00000e+00     4.42293e-01     1.205
          43          1        1124     1.00000e+00     4.34731e-01     1.231
          44          1        1166     1.00000e+00     4.22701e-01     1.015
          45          1        1217     1.00000e+00     4.13050e-01     9.071
          46          1        1262     1.00000e+00     4.06184e-01     1.022
          47          1        1305     1.00000e+00     3.99072e-01     1.088
          48          1        1358     1.00000e+00     3.89450e-01     1.254
          49          1        1439     1.00000e+00     3.78611e-01     1.317
          50          1        1493     1.00000e+00     3.71378e-01     1.195
    50  3.7137766e-01  1.7832205e+00   1.75e-01     0.0     429       0
ERROR EXIT -- Too many iterations

Products with A     :      54        Total time   (secs) :    18.1
Products with A'    :      54        Project time (secs) :    19.5
Newton iterations   :       0        Mat-vec time (secs) :     0.3
```



BPDN

noisy signal

```
f = C*g+ 1e-3*randn(N,1);

% plot
figure;
plot(t,f);
xlabel('t [s]');ylabel('f(t)');
title('convolution result')

opts.iterations = 100;


[x_spg,r_spg,g_spg,info_spg] = spgl1(C, f, 0, 1e-3, zeros(size(g)), opts);
%opts.decTol = 1e-4;
%opts.iterations = 50;
[x_pqn,r_pqn,g_pqn,info_pqn] = pqnl1_2(C, f, 0, 1-3, zeros(size(g)), opts);

figure;
subplot(3,1,1); plot(g); title('original sparse signal');axis tight;
subplot(3,1,2); plot(x_spg);title('x_spg');axis tight;
subplot(3,1,3); plot(x_pqn);title('x_pqn');axis tight;

figure('Name','Solution paths')
```

```
plot(info_spg.xNorm1,info_spg.rNorm2,info_pqn.xNorm1,info_pqn.rNorm2);hold on
scatter(info_spg.xNorm1,info_spg.rNorm2);
scatter(info_pqn.xNorm1,info_pqn.rNorm2);hold off
legend('spg','pqn')
axis tight
```

```
================================================================================
SPGL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
================================================================================
No. rows              :     2001      No. columns           :     2001
Initial tau           : 0.00e+00      Two-norm of b         : 2.49e+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  2.4851228e+01  0.0000000e+00   1.00e+00  5.930e+01      0.0        0
    1  2.2590013e+01  2.5152440e+00   1.00e+00  5.710e+01     -0.3        1
    2  1.7664701e+01  2.6209830e+00   1.00e+00  3.914e+01     -0.3       49
    3  1.6621304e+01  4.4287462e+00   1.00e+00  5.467e+01      0.0      244
    4  1.3445032e+01  4.3697115e+00   1.00e+00  4.170e+01      0.0      418
    5  1.0102269e+01  1.4210683e+00   1.00e+00  1.725e+01      0.0      489
    6  9.8260544e+00  7.5751440e-01   1.00e+00  1.403e+01      0.0      467
    7  9.6647926e+00  6.9023375e-01   1.00e+00  1.376e+01      0.0      420
    8  9.3712157e+00  6.0270765e-01   1.00e+00  1.330e+01      0.0      287
    9  9.6090772e+00  2.6104621e+00   1.00e+00  2.157e+01     -0.3      263
   10  9.4548778e+00  1.1163955e+00   1.00e+00  1.562e+01      0.0      294
   11  9.2349018e+00  5.8110116e-01   1.00e+00  1.312e+01      0.0      300
   12  9.2081494e+00  3.5800335e-01   1.00e+00  1.232e+01      0.0      271
   13  9.1862506e+00  3.2502573e-01   1.00e+00  1.218e+01      0.0      254
   14  9.0939325e+00  3.9994090e-01   1.00e+00  1.275e+01     -0.3      184
   15  9.0581733e+00  7.8966414e-01   1.00e+00  1.409e+01     -0.3      192
   16  9.0433022e+00  3.1791007e-01   1.00e+00  1.249e+01      0.0      206
   17  9.0196564e+00  2.0043061e-01   1.00e+00  1.189e+01      0.0      188
   18  9.0162095e+00  1.1445113e-01   1.00e+00  1.160e+01      0.0      186
   19  9.0109486e+00  9.5715538e-02   1.00e+00  1.153e+01      0.0      182
   20  8.9900650e+00  8.3287653e-01   1.00e+00  1.417e+01      0.0      143
   21  8.9611200e+00  2.0250271e-01   1.00e+00  1.206e+01     -0.3      169
   22  8.9422120e+00  1.9457948e-01   1.00e+00  1.191e+01      0.0      159
   23  8.9392019e+00  6.3165862e-02   1.00e+00  1.145e+01      0.0      157
   24  8.9374315e+00  5.1876147e-02   1.00e+00  1.140e+01      0.0      156
   25  8.9289812e+00  1.0720385e-01   1.00e+00  1.157e+01      0.0      141
   26  8.9268972e+00  1.4086190e-01   1.00e+00  1.166e+01     -0.3      141
   27  8.9253451e+00  8.0183232e-02   1.00e+00  1.150e+01      0.0      139
   28  8.9240283e+00  7.0194791e-02   1.00e+00  1.142e+01      0.0      138
   29  8.9227773e+00  6.3847750e-02   1.00e+00  1.142e+01      0.0      138
   30  8.9209914e+00  1.2657053e-01   1.00e+00  1.162e+01      0.0      127
   31  8.9202242e+00  1.2719588e-01   1.00e+00  1.170e+01     -0.3      129
   32  8.9187638e+00  7.0141667e-02   1.00e+00  1.142e+01      0.0      127
   33  8.9181121e+00  4.0679137e-02   1.00e+00  1.133e+01      0.0      127
   34  8.9170666e+00  4.1035004e-02   1.00e+00  1.132e+01      0.0      125
   35  8.9143182e+00  4.7784314e-01   1.00e+00  1.311e+01     -0.3      116
   36  8.9090159e+00  1.3373661e-01   1.00e+00  1.159e+01     -0.3      128
   37  8.9030003e+00  1.1502323e-01   1.00e+00  1.163e+01      0.0      116
```

38	8.9021911e+00	5.3719007e-02	1.00e+00	1.138e+01	0.0	116
39	8.9014770e+00	3.4314197e-02	1.00e+00	1.129e+01	0.0	116
40	8.8989609e+00	6.5672364e-02	1.00e+00	1.141e+01	0.0	116
41	8.8981781e+00	8.8958834e-02	1.00e+00	1.147e+01	-0.3	116
42	8.8993392e+00	2.6277545e-01	1.00e+00	1.221e+01	0.0	115
43	8.8970488e+00	6.9466852e-02	1.00e+00	1.139e+01	0.0	119
44	8.8959967e+00	5.3084501e-02	1.00e+00	1.137e+01	0.0	115
45	8.8956558e+00	3.1895871e-02	1.00e+00	1.128e+01	0.0	114
46	5.8582777e+00	2.0941661e+01	1.00e+00	1.636e+01	0.0	306
47	6.9885443e+00	1.2563926e+01	1.00e+00	2.206e+01	0.0	728
48	3.2153677e+00	1.0646361e+01	1.00e+00	3.990e+00	0.0	703
49	2.9519555e+00	5.8923003e+00	1.00e+00	2.718e+00	0.0	693
50	2.8751171e+00	5.0746745e+00	1.00e+00	2.458e+00	0.0	663
51	2.6224011e+00	7.2619609e+00	1.00e+00	2.827e+00	0.0	566
52	2.9293389e+00	2.0348499e+01	1.00e+00	5.690e+00	-0.3	556
53	2.7269740e+00	1.8262158e+01	1.00e+00	5.331e+00	0.0	604
54	2.4603256e+00	5.1829881e+00	1.00e+00	2.089e+00	0.0	545
55	2.4342023e+00	4.2033141e+00	1.00e+00	1.904e+00	0.0	540
56	2.3913441e+00	3.3415322e+00	1.00e+00	1.762e+00	0.0	522
57	2.2570471e+00	5.0292771e+00	1.00e+00	2.024e+00	0.0	448
58	2.2264579e+00	7.1307316e+00	1.00e+00	2.224e+00	-0.3	454
59	2.2062317e+00	4.8687436e+00	1.00e+00	1.885e+00	0.0	444
60	2.1901958e+00	4.2602431e+00	1.00e+00	1.767e+00	0.0	444
61	2.1785740e+00	3.0091723e+00	1.00e+00	1.597e+00	0.0	437
62	2.1554395e+00	7.5041323e+00	1.00e+00	2.163e+00	0.0	427
63	2.1749471e+00	1.4945539e+01	1.00e+00	3.232e+00	-0.3	410
64	2.1490346e+00	1.3174194e+01	1.00e+00	2.897e+00	0.0	430
65	2.1155462e+00	3.3335121e+00	1.00e+00	1.595e+00	0.0	403
66	2.1097875e+00	2.4992119e+00	1.00e+00	1.480e+00	0.0	403
67	2.0896155e+00	2.5494002e+00	1.00e+00	1.488e+00	0.0	397
68	2.0441953e+00	1.8098195e+01	1.00e+00	3.526e+00	-0.3	359
69	2.1003325e+00	1.4432957e+01	1.00e+00	3.286e+00	-0.3	367
70	1.9809129e+00	8.3403950e+00	9.99e-01	2.249e+00	0.0	372
71	1.9496519e+00	2.5090373e+00	9.99e-01	1.581e+00	0.0	352
72	1.9427765e+00	2.4718403e+00	9.99e-01	1.553e+00	0.0	353
73	1.9313531e+00	2.2541272e+00	9.99e-01	1.496e+00	0.0	348
74	1.9088000e+00	9.6335553e+00	9.99e-01	2.201e+00	0.0	337
75	1.9210798e+00	1.0994483e+01	9.99e-01	2.393e+00	-0.3	348
76	1.8966296e+00	3.9150968e+00	9.99e-01	1.615e+00	0.0	336
77	1.8934822e+00	1.9891472e+00	9.99e-01	1.409e+00	0.0	335
78	1.8902749e+00	1.9359564e+00	9.99e-01	1.401e+00	0.0	333
79	1.8060448e+00	4.0036677e+00	9.99e-01	1.663e+00	0.0	304
80	1.8236463e+00	1.1518769e+01	9.99e-01	2.349e+00	-0.3	310
81	1.8105450e+00	1.2553486e+01	9.99e-01	2.400e+00	0.0	313
82	1.7827185e+00	3.4112715e+00	9.99e-01	1.539e+00	0.0	302
83	1.7779216e+00	1.6873934e+00	9.99e-01	1.367e+00	0.0	302
84	1.7759759e+00	1.8266548e+00	9.99e-01	1.376e+00	0.0	301
85	1.7615504e+00	3.7216705e+00	9.99e-01	1.525e+00	0.0	294
86	1.7626866e+00	9.0134537e+00	9.99e-01	1.990e+00	-0.3	295
87	1.7618564e+00	7.5595657e+00	9.99e-01	1.871e+00	0.0	294
88	1.7537936e+00	2.3432408e+00	9.99e-01	1.395e+00	0.0	293
89	1.7525605e+00	1.6741395e+00	9.99e-01	1.335e+00	0.0	293
90	1.7490683e+00	1.6411651e+00	9.99e-01	1.334e+00	0.0	293
91	1.7259830e+00	2.0605246e+01	9.99e-01	2.901e+00	-0.3	281

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   92  1.7003215e+00  2.7664929e+00   9.99e-01  1.480e+00    -0.3     296
   93  1.6854992e+00  3.3471005e+00   9.99e-01  1.466e+00     0.0     285
   94  1.6828556e+00  1.6651306e+00   9.99e-01  1.329e+00     0.0     286
   95  1.6806926e+00  1.5088968e+00   9.99e-01  1.308e+00     0.0     284
   96  1.6716779e+00  2.4261420e+00   9.99e-01  1.367e+00     0.0     276
   97  1.6697029e+00  4.5693647e+00   9.99e-01  1.534e+00    -0.3     277
   98  1.6710669e+00  6.1167247e+00   9.99e-01  1.672e+00     0.0     276
   99  1.6666463e+00  4.0290152e+00   9.99e-01  1.496e+00     0.0     274
  100  1.6647643e+00  1.5983763e+00   9.99e-01  1.298e+00     0.0     274

 ERROR EXIT -- Too many iterations

 Products with A     :     137        Total time   (secs) :     1.3
 Products with A'    :     101        Project time (secs) :     0.2
 Newton iterations   :       2        Mat-vec time (secs) :     0.8
 Line search its     :      57        Subspace iterations :       0


 ================================================================================
 PQNL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
 ================================================================================
 No. rows              :     2001      No. columns           :     2001
 Initial tau           : 0.00e+00      Two-norm of b         : 2.49e+01
 Optimality tol        : 1.00e-04      Target objective      : -2.00e+00
 Basis pursuit tol     : 1.00e-06      Maximum iterations    :      100

     0  2.4851228e+01  0.0000000e+00   1.08e+00  5.930e+01     0.0       0

Inside of minConf_PQN
 Iteration   FunEvals Projections     Step Length          rNorm2        O
         1          1           4     2.50000e-01     2.27227e+01     1.403
         2          1          11     1.00000e+00     1.10680e+01     2.225
         3          1          18     1.00000e+00     1.02076e+01     2.099
         4          1          25     1.00000e+00     9.38579e+00     2.076
         5          1          35     1.00000e+00     8.90932e+00     2.016
         6          1          44     1.00000e+00     8.69794e+00     1.963
         7          1          54     1.00000e+00     8.55549e+00     1.836
         8          1          62     1.00000e+00     8.44596e+00     1.713
         9          1          72     1.00000e+00     8.35885e+00     1.670
        10          1          82     1.00000e+00     8.29702e+00     1.694
        11          1          92     1.00000e+00     8.24612e+00     1.472
        12          1         104     1.00000e+00     8.18705e+00     1.366
        13          1         112     1.00000e+00     8.16352e+00     1.281
        14          1         123     1.00000e+00     8.13139e+00     1.240
        15          1         135     1.00000e+00     8.09439e+00     1.216
        16          1         145     1.00000e+00     8.07666e+00     1.257
        17          1         155     1.00000e+00     8.06240e+00     1.154
        18          1         167     1.00000e+00     8.03622e+00     1.224
        19          1         183     1.00000e+00     8.01495e+00     1.213
        20          1         195     1.00000e+00     8.00759e+00     1.095
        21          1         207     1.00000e+00     7.99615e+00     9.952
        22          1         224     1.00000e+00     7.98542e+00     9.595
        23          1         238     1.00000e+00     7.97592e+00     9.749
        24          1         250     1.00000e+00     7.96547e+00     9.412
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          25           1         266     1.00000e+00     7.95930e+00     9.378
          26           1         285     1.00000e+00     7.94748e+00     9.793
          27           1         296     1.00000e+00     7.94045e+00     9.227
          28           1         311     1.00000e+00     7.93295e+00     8.482
          29           1         327     1.00000e+00     7.92887e+00     1.051
          30           1         346     1.00000e+00     7.92257e+00     1.211
          31           1         371     1.00000e+00     7.91596e+00     1.234
          32           1         385     1.00000e+00     7.91154e+00     1.029
          33           1         404     1.00000e+00     7.90820e+00     9.233
break of testUpdateTau    33  7.9082042e+00  1.2224048e-01   1.25e+00  1.0

Inside of minConf_PQN
 Iteration   FunEvals Projections     Step Length          rNorm2        O
          34           1           4     2.50000e-01     6.67718e+00     2.971
          35           1          12     1.00000e+00     3.79862e+00     3.630
          36           1          22     1.00000e+00     3.07439e+00     3.748
          37           1          31     1.00000e+00     2.52541e+00     3.177
          38           1          40     1.00000e+00     2.29261e+00     2.996
          39           1          52     1.00000e+00     1.98648e+00     2.740
          40           1          63     1.00000e+00     1.81169e+00     3.001
          41           1          79     1.00000e+00     1.72079e+00     2.852
          42           1          94     1.00000e+00     1.62664e+00     2.713
          43           1         108     1.00000e+00     1.54366e+00     2.409
          44           1         124     1.00000e+00     1.45300e+00     1.878
          45           1         139     1.00000e+00     1.38691e+00     1.898
          46           1         159     1.00000e+00     1.32053e+00     2.092
          47           1         186     1.00000e+00     1.26531e+00     2.139
          48           1         209     1.00000e+00     1.21683e+00     1.680
          49           1         230     1.00000e+00     1.16503e+00     1.631
          50           1         256     1.00000e+00     1.12292e+00     1.735
          51           1         282     1.00000e+00     1.08697e+00     1.612
          52           1         304     1.00000e+00     1.04459e+00     1.386
          53           1         328     1.00000e+00     1.02135e+00     1.279
          54           1         363     1.00000e+00     1.00195e+00     1.501
          55           1         386     1.00000e+00     9.83431e-01     1.520
          56           1         410     1.00000e+00     9.54638e-01     1.434
          57           1         435     1.00000e+00     9.31083e-01     1.363
          58           1         465     1.00000e+00     9.04871e-01     1.384
          59           1         491     1.00000e+00     8.83759e-01     1.440
          60           1         527     1.00000e+00     8.61616e-01     1.382
          61           1         547     1.00000e+00     8.42725e-01     1.378
          62           1         578     1.00000e+00     8.29501e-01     1.335
          63           1         623     1.00000e+00     8.10356e-01     1.360
          64           1         654     1.00000e+00     7.95520e-01     1.176
          65           1         673     1.00000e+00     7.83285e-01     1.101
          66           1         715     1.00000e+00     7.67313e-01     1.231
          67           1         734     1.00000e+00     7.58256e-01     1.220
          68           1         770     1.00000e+00     7.42645e-01     1.127
          69           1         818     1.00000e+00     7.27086e-01     9.808
          70           1         855     1.00000e+00     7.12410e-01     1.059
          71           1         891     1.00000e+00     7.00311e-01     1.266
          72           1         922     1.00000e+00     6.90283e-01     1.173
          73           1         950     1.00000e+00     6.81213e-01     1.001
          74           1         977     1.00000e+00     6.71439e-01     9.363
```

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    75          1       1008     1.00000e+00     6.64066e-01     1.029
    76          1       1060     1.00000e+00     6.49809e-01     1.132
    77          1       1122     1.00000e+00     6.36779e-01     1.117
    78          1       1153     1.00000e+00     6.21670e-01     1.037
    79          1       1214     1.00000e+00     6.05911e-01     8.569
    80          1       1255     1.00000e+00     5.99152e-01     6.646
    81          1       1290     1.00000e+00     5.91500e-01     8.955
    82          1       1325     1.00000e+00     5.87966e-01     9.126
    83          1       1398     1.00000e+00     5.78063e-01     1.133
    84          1       1442     1.00000e+00     5.69383e-01     1.171
    85          1       1490     1.00000e+00     5.60868e-01     9.900
    86          1       1520     1.00000e+00     5.55292e-01     9.206
    87          1       1551     1.00000e+00     5.51895e-01     9.438
    88          1       1576     1.00000e+00     5.47800e-01     7.937
    89          1       1602     1.00000e+00     5.43498e-01     7.487
    90          1       1635     1.00000e+00     5.38622e-01     8.629
    91          1       1663     1.00000e+00     5.34600e-01     8.055
    92          1       1696     1.00000e+00     5.27891e-01     6.564
    93          1       1713     1.00000e+00     5.23318e-01     7.915
    94          1       1761     1.00000e+00     5.17059e-01     1.109
    95          1       1789     1.00000e+00     5.11914e-01     9.537
    96          1       1829     1.00000e+00     5.07155e-01     5.726
    97          1       1859     1.00000e+00     5.05177e-01     5.713
    98          1       1920     1.00000e+00     5.01871e-01     6.148
    99          1       1966     1.00000e+00     4.97170e-01     6.234
   100          1       2003     1.00000e+00     4.94488e-01     6.405
100  4.9448832e-01  1.0278296e+00   2.49e+00  2.749e-01     0.0     282

ERROR EXIT -- Too many iterations

Products with A     :     107        Total time   (secs) :    31.5
Products with A'    :     107        Project time (secs) :    33.0
Newton iterations   :       3        Mat-vec time (secs) :     0.6
```
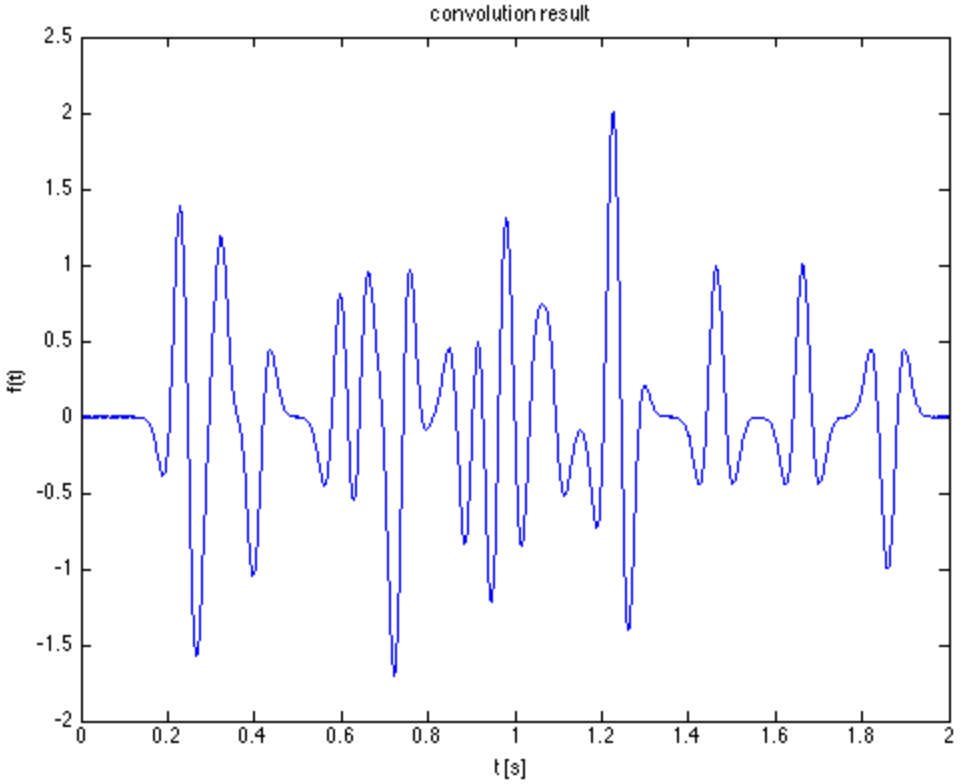
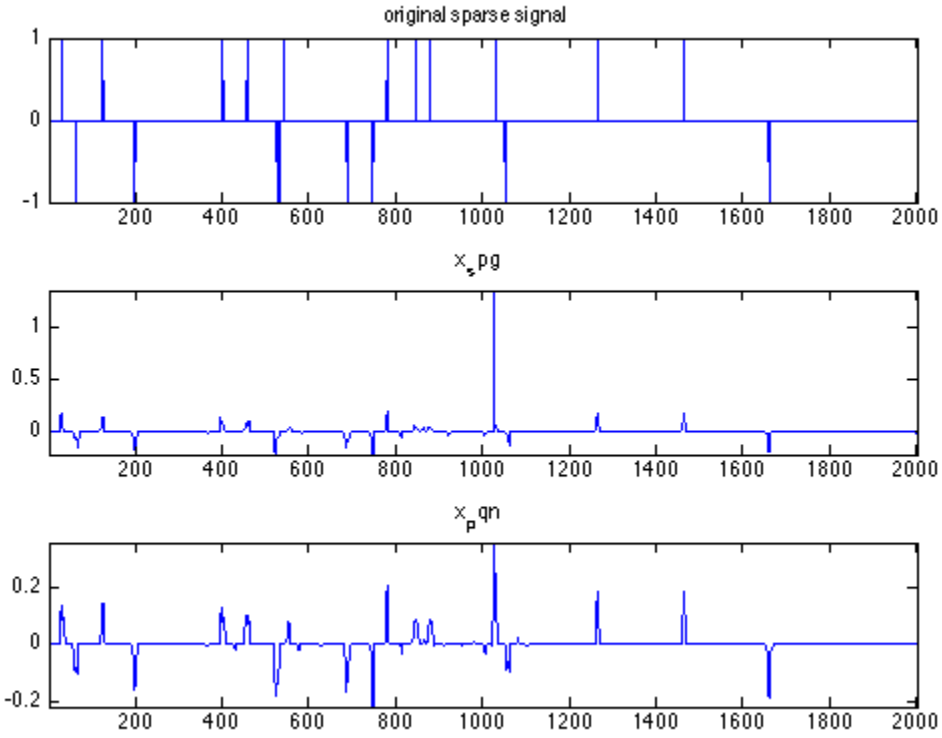
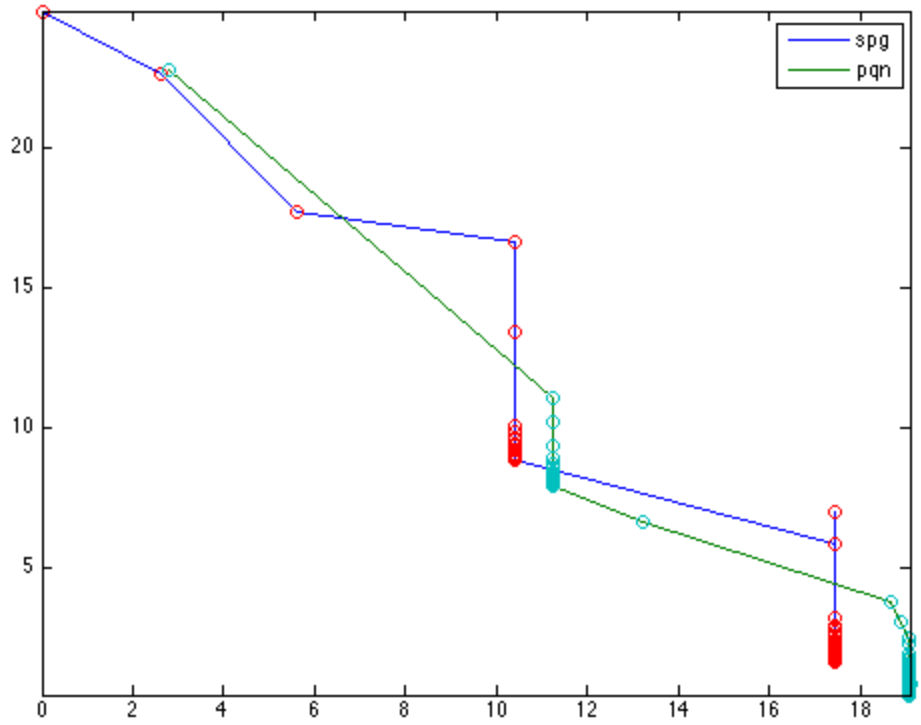


convolution result
f(t)
t [s]


original sparse signal
x_pg
x_pqn



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