```
>> demo_Polynomial_Dictionary_Learning
Starting to train the dictionary
solving the quadratic problem with YALMIP...

 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.1e+00|3.5e+01|4.3e+06| 2.221660e+04  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.979|6.1e-06|8.5e-01|1.2e+05| 2.217331e+04 -1.135326e+02| 0:0:00| chol  1↙
1
 2|0.706|0.836|4.8e-06|1.7e-01|4.6e+04| 2.404502e+04 -1.606244e+02| 0:0:00| chol  1↙
1
 3|0.845|1.000|4.8e-07|1.0e-02|1.8e+04| 1.706815e+04 -1.985758e+02| 0:0:00| chol  1↙
1
 4|0.971|0.978|7.6e-07|3.1e-03|5.4e+02| 3.426454e+02 -1.842973e+02| 0:0:00| chol  1↙
1
 5|0.266|0.421|9.3e-07|1.9e-03|5.0e+02| 3.548399e+02 -1.381015e+02| 0:0:00| chol  1↙
1
 6|0.376|1.000|6.0e-07|3.0e-05|4.2e+02| 3.183349e+02 -1.003525e+02| 0:0:00| chol  1↙
1
 7|1.000|1.000|1.5e-09|3.1e-06|2.7e+02| 1.826441e+02 -8.408682e+01| 0:0:00| chol  1↙
1
 8|1.000|1.000|1.3e-09|3.0e-07|1.5e+02| 7.447724e+01 -7.071554e+01| 0:0:00| chol  1↙
1
 9|0.980|1.000|3.4e-10|3.0e-08|6.0e+01|-5.085025e+00 -6.518300e+01| 0:0:00| chol  1↙
1
10|1.000|1.000|1.7e-13|3.1e-09|2.8e+01|-2.881547e+01 -5.640647e+01| 0:0:00| chol  1↙
1
11|1.000|1.000|2.0e-13|3.0e-10|1.1e+01|-4.318343e+01 -5.411663e+01| 0:0:00| chol  1↙
1
12|1.000|1.000|1.9e-14|3.1e-11|4.0e+00|-4.840806e+01 -5.239875e+01| 0:0:00| chol  1↙
1
13|1.000|1.000|2.5e-14|4.0e-12|1.4e+00|-5.048710e+01 -5.193013e+01| 0:0:00| chol  1↙
1
14|1.000|1.000|2.5e-14|1.3e-12|5.4e-01|-5.113374e+01 -5.167745e+01| 0:0:00| chol  1↙
1
15|1.000|1.000|4.1e-14|1.0e-12|1.7e-01|-5.143180e+01 -5.160514e+01| 0:0:00| chol  1↙
1
16|1.000|1.000|4.1e-14|1.0e-12|6.8e-02|-5.150606e+01 -5.157425e+01| 0:0:00| chol  1↙
1
17|1.000|1.000|3.1e-14|1.0e-12|1.9e-02|-5.154581e+01 -5.156465e+01| 0:0:00| chol  1↙
1
18|1.000|1.000|1.3e-12|1.0e-12|7.5e-03|-5.155401e+01 -5.156151e+01| 0:0:00| chol  1↙
1
19|0.976|0.924|4.1e-13|1.1e-12|1.6e-03|-5.155891e+01 -5.156048e+01| 0:0:00| chol  2↙
2
```

```
20|0.941|1.000|1.4e-12|1.0e-12|7.1e-04|-5.155961e+01 -5.156032e+01| 0:0:00| chol  2↙
2
21|1.000|0.954|8.4e-13|1.0e-12|1.6e-04|-5.156010e+01 -5.156026e+01| 0:0:00| chol  2↙
2
22|0.844|1.000|1.6e-12|1.0e-12|6.0e-05|-5.156018e+01 -5.156024e+01| 0:0:00| chol  2↙
2
23|0.848|0.756|6.4e-13|1.2e-12|1.7e-05|-5.156023e+01 -5.156024e+01| 0:0:01| chol  2↙
2
24|0.584|0.872|1.0e-12|1.2e-12|8.4e-06|-5.156023e+01 -5.156024e+01| 0:0:01|
  stop: max(relative gap, infeasibilities) < 1.00e-07
-----------------------------------------------------------------
 number of iterations   = 24
 primal objective value = -5.15602345e+01
 dual   objective value = -5.15602429e+01
 gap := trace(XZ)       = 8.35e-06
 relative gap           = 8.02e-08
 actual relative gap    = 8.02e-08
 rel. primal infeas     = 1.02e-12
 rel. dual   infeas     = 1.16e-12
 norm(X), norm(y), norm(Z) = 9.3e-01, 5.2e+01, 2.0e+01
 norm(A), norm(b), norm(C) = 6.9e+02, 1.4e+01, 7.7e+01
 Total CPU time (secs)  = 0.51
 CPU time per iteration = 0.02
 termination code       =  0
 DIMACS errors: 2.2e-12  0.0e+00  1.7e-12  0.0e+00  8.0e-08  8.0e-08
-----------------------------------------------------------------

ans =

   51.5602


 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*****************************************************************
   SDPT3: Infeasible path-following algorithms
*****************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-----------------------------------------------------------------
 0|0.000|0.000|1.0e+00|3.5e+01|3.6e+07| 1.870912e+05  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.971|8.4e-07|1.2e+00|1.4e+06| 1.841303e+05 -1.262915e+02| 0:0:00| chol  1↙
1
 2|0.663|0.757|2.3e-07|3.7e-01|6.2e+05| 2.073682e+05 -7.602518e+02| 0:0:00| chol  1↙
1
 3|0.645|0.636|1.1e-07|1.6e-01|3.9e+05| 2.049981e+05 -1.200886e+03| 0:0:00| chol  1↙
1
 4|0.456|0.874|7.5e-08|4.1e-02|2.3e+05| 1.830723e+05 -1.739780e+03| 0:0:00| chol  1↙
1
 5|1.000|1.000|2.0e-08|1.2e-02|6.2e+04| 5.620726e+04 -1.664942e+03| 0:0:00| chol  1↙
1
```

```
 6|0.739|0.680|1.1e-08|6.0e-03|3.3e+04| 3.052331e+04 -1.192361e+03| 0:0:00| chol  1↙
1
 7|1.000|1.000|5.0e-09|1.0e-03|2.2e+04| 2.110984e+04 -9.217236e+02| 0:0:00| chol  1↙
1
 8|1.000|1.000|3.1e-10|3.1e-04|1.1e+04| 1.078950e+04 -5.607489e+02| 0:0:00| chol  1↙
1
 9|1.000|1.000|9.8e-11|9.3e-05|6.0e+03| 5.556445e+03 -4.591493e+02| 0:0:00| chol  1↙
1
10|1.000|1.000|1.4e-11|2.8e-05|2.7e+03| 2.511482e+03 -2.129753e+02| 0:0:00| chol  1↙
1
11|1.000|1.000|6.3e-12|2.8e-06|1.2e+03| 1.045982e+03 -1.640785e+02| 0:0:00| chol  1↙
1
12|1.000|1.000|6.8e-13|2.8e-07|5.1e+02| 4.297270e+02 -8.318792e+01| 0:0:00| chol  1↙
1
13|1.000|1.000|5.4e-12|2.8e-08|1.8e+02| 1.162650e+02 -6.361477e+01| 0:0:00| chol  1↙
1
14|1.000|1.000|4.5e-14|2.8e-09|7.1e+01| 2.221647e+01 -4.886617e+01| 0:0:00| chol  1↙
1
15|0.972|1.000|4.0e-13|2.8e-10|2.1e+01|-2.271191e+01 -4.337616e+01| 0:0:00| chol  1↙
1
16|1.000|1.000|4.1e-13|2.9e-11|9.8e+00|-3.143819e+01 -4.123834e+01| 0:0:00| chol  1↙
1
17|1.000|1.000|1.2e-11|3.8e-12|3.5e+00|-3.689353e+01 -4.035223e+01| 0:0:00| chol  1↙
1
18|1.000|1.000|9.8e-12|1.8e-12|1.3e+00|-3.858920e+01 -3.989007e+01| 0:0:00| chol  1↙
2
19|1.000|1.000|2.9e-13|2.0e-12|3.8e-01|-3.934081e+01 -3.972235e+01| 0:0:00| chol  2↙
2
20|1.000|1.000|2.3e-12|1.0e-12|1.5e-01|-3.952557e+01 -3.967378e+01| 0:0:00| chol  2↙
2
21|1.000|1.000|4.3e-12|1.0e-12|4.7e-02|-3.960997e+01 -3.965727e+01| 0:0:00| chol  2↙
2
22|1.000|1.000|2.5e-12|1.0e-12|1.9e-02|-3.963365e+01 -3.965268e+01| 0:0:00| chol  2↙
2
23|0.699|1.000|8.9e-12|1.0e-12|9.8e-03|-3.964172e+01 -3.965148e+01| 0:0:00| chol  2↙
2
24|0.778|1.000|1.7e-11|1.5e-12|3.8e-03|-3.964739e+01 -3.965118e+01| 0:0:00| chol  2↙
3
25|0.957|0.911|2.9e-11|2.4e-12|9.6e-04|-3.965011e+01 -3.965107e+01| 0:0:00| chol  3↙
3
26|1.000|1.000|3.9e-11|3.4e-12|3.1e-04|-3.965072e+01 -3.965103e+01| 0:0:00| chol  3↙
3
27|0.933|1.000|9.1e-11|5.1e-12|4.3e-05|-3.965098e+01 -3.965103e+01| 0:0:00| chol  6↙
6
28|0.974|1.000|6.8e-10|7.6e-12|3.1e-06|-3.965102e+01 -3.965103e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
------------------------------------------------------------------------
 number of iterations   = 28
 primal objective value = -3.96510224e+01
 dual   objective value = -3.96510256e+01
 gap := trace(XZ)       = 3.10e-06
 relative gap           = 3.86e-08
 actual relative gap    = 3.95e-08
 rel. primal infeas     = 6.84e-10
```

```
 rel. dual   infeas     = 7.59e-12
 norm(X), norm(y), norm(Z) = 1.2e+02, 6.3e+01, 2.7e+01
 norm(A), norm(b), norm(C) = 1.3e+03, 1.7e+03, 7.7e+01
 Total CPU time (secs)  = 0.23
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 1.5e-09  0.0e+00  1.1e-11  0.0e+00  3.9e-08  3.9e-08
------------------------------------------------------------------

ans =

   39.6510

Iteration   2   Total error is: 0.29954

 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.0e+00|3.5e+01|6.6e+06| 3.369293e+04  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.983|6.4e-06|6.9e-01|1.6e+05| 3.397944e+04 -1.298120e+02| 0:0:00| chol  1↙
1
 2|0.635|0.632|1.8e-06|2.7e-01|8.7e+04| 3.471000e+04 -2.034356e+02| 0:0:00| chol  1↙
1
 3|0.467|0.726|9.0e-07|8.2e-02|5.0e+04| 3.393370e+04 -3.245244e+02| 0:0:00| chol  1↙
1
 4|0.729|1.000|6.0e-07|3.0e-03|2.4e+04| 2.363993e+04 -3.806665e+02| 0:0:00| chol  1↙
1
 5|1.000|0.819|3.9e-08|1.3e-03|4.6e+03| 4.309838e+03 -3.041767e+02| 0:0:00| chol  1↙
1
 6|0.339|1.000|5.5e-08|9.0e-05|4.2e+03| 3.969303e+03 -2.296696e+02| 0:0:00| chol  1↙
1
 7|1.000|1.000|1.2e-09|9.0e-06|2.7e+03| 2.500685e+03 -1.554717e+02| 0:0:00| chol  1↙
1
 8|1.000|1.000|1.1e-09|9.0e-07|1.4e+03| 1.275018e+03 -1.394747e+02| 0:0:00| chol  1↙
1
 9|1.000|1.000|1.0e-10|9.0e-08|6.2e+02| 5.338308e+02 -8.624635e+01| 0:0:00| chol  1↙
1
10|1.000|1.000|2.6e-10|9.0e-09|2.8e+02| 2.078331e+02 -7.698456e+01| 0:0:00| chol  1↙
1
11|1.000|1.000|2.1e-12|9.3e-10|1.3e+02| 7.013577e+01 -5.659296e+01| 0:0:00| chol  1↙
1
12|1.000|1.000|1.1e-11|9.1e-11|4.7e+01|-4.252288e+00 -5.122151e+01| 0:0:00| chol  1↙
1
13|1.000|1.000|1.5e-12|1.0e-11|2.0e+01|-2.643092e+01 -4.656375e+01| 0:0:00| chol  1↙
1
14|1.000|1.000|9.7e-13|1.9e-12|6.9e+00|-3.813932e+01 -4.506448e+01| 0:0:00| chol  1↙
```

```
1
15|1.000|1.000|3.2e-13|1.1e-12|2.7e+00|-4.146478e+01 -4.417496e+01| 0:0:00| chol  1↙
1
16|1.000|1.000|7.3e-13|1.0e-12|7.3e-01|-4.311187e+01 -4.384158e+01| 0:0:00| chol  1↙
1
17|1.000|1.000|1.2e-12|1.0e-12|2.7e-01|-4.347533e+01 -4.374594e+01| 0:0:00| chol  1↙
1
18|0.974|0.947|3.1e-12|1.1e-12|4.5e-02|-4.365556e+01 -4.370029e+01| 0:0:00| chol  2↙
2
19|0.685|0.961|1.2e-12|1.0e-12|2.3e-02|-4.367210e+01 -4.369484e+01| 0:0:00| chol  2↙
2
20|0.888|1.000|7.8e-12|1.0e-12|7.6e-03|-4.368558e+01 -4.369320e+01| 0:0:00| chol  2↙
2
21|1.000|0.828|4.3e-11|1.7e-12|3.7e-03|-4.368920e+01 -4.369289e+01| 0:0:00| chol  2↙
2
22|0.984|0.930|1.7e-11|2.4e-12|9.9e-04|-4.369158e+01 -4.369256e+01| 0:0:00| chol  2↙
2
23|0.838|0.770|6.1e-11|3.9e-12|4.7e-04|-4.369205e+01 -4.369252e+01| 0:0:00| chol  2↙
2
24|0.854|0.851|3.9e-11|5.6e-12|1.6e-04|-4.369235e+01 -4.369251e+01| 0:0:00| chol  3↙
3
25|0.951|0.898|1.5e-10|8.1e-12|3.0e-05|-4.369247e+01 -4.369250e+01| 0:0:00| chol  3↙
3
26|0.997|0.978|1.6e-10|1.2e-11|2.0e-06|-4.369250e+01 -4.369250e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
-----------------------------------------------------------------
 number of iterations   = 26
 primal objective value = -4.36924980e+01
 dual   objective value = -4.36925000e+01
 gap := trace(XZ)       = 1.98e-06
 relative gap           = 2.24e-08
 actual relative gap    = 2.24e-08
 rel. primal infeas     = 1.55e-10
 rel. dual   infeas     = 1.15e-11
 norm(X), norm(y), norm(Z) = 2.0e+01, 5.7e+01, 2.1e+01
 norm(A), norm(b), norm(C) = 6.7e+02, 1.7e+02, 7.7e+01
 Total CPU time (secs)  = 0.20
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 5.4e-10  0.0e+00  1.7e-11  0.0e+00  2.2e-08  2.2e-08
-----------------------------------------------------------------

ans =

   43.6925

Iteration   3   Total error is: 0.26241

 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*****************************************************************
   SDPT3: Infeasible path-following algorithms
*****************************************************************
```

```
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
---------------------------------------------------------------------
 0|0.000|0.000|1.0e+00|3.5e+01|1.2e+07| 5.986527e+04  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.988|4.8e-07|5.3e-01|2.4e+05| 6.076065e+04 -7.271565e+01| 0:0:00| chol  1↙
1
 2|0.983|0.922|3.3e-07|7.2e-02|7.5e+04| 5.384186e+04 -1.709352e+02| 0:0:00| chol  1↙
1
 3|1.000|1.000|7.0e-08|1.0e-02|1.5e+04| 1.414052e+04 -1.841013e+02| 0:0:00| chol  1↙
1
 4|0.782|0.770|1.5e-07|4.6e-03|3.3e+03| 3.069519e+03 -1.421126e+02| 0:0:00| chol  1↙
1
 5|0.324|1.000|1.1e-07|3.0e-04|3.0e+03| 2.851558e+03 -9.483106e+01| 0:0:00| chol  1↙
1
 6|1.000|1.000|8.7e-10|3.0e-05|1.9e+03| 1.871158e+03 -7.695635e+01| 0:0:00| chol  1↙
1
 7|1.000|1.000|2.2e-10|3.0e-06|8.4e+02| 7.860662e+02 -5.540613e+01| 0:0:00| chol  1↙
1
 8|1.000|1.000|7.8e-11|3.0e-07|3.9e+02| 3.503802e+02 -4.391510e+01| 0:0:00| chol  1↙
1
 9|1.000|1.000|1.6e-11|3.0e-08|1.7e+02| 1.391857e+02 -3.161159e+01| 0:0:00| chol  1↙
1
10|1.000|1.000|7.0e-13|3.0e-09|7.1e+01| 4.361613e+01 -2.718016e+01| 0:0:00| chol  1↙
1
11|1.000|1.000|1.8e-14|3.0e-10|3.2e+01| 8.592761e+00 -2.318971e+01| 0:0:00| chol  1↙
1
12|1.000|1.000|1.3e-14|3.1e-11|1.1e+01|-1.050633e+01 -2.186122e+01| 0:0:00| chol  1↙
1
13|1.000|1.000|2.8e-14|4.0e-12|4.6e+00|-1.626321e+01 -2.088007e+01| 0:0:00| chol  1↙
1
14|0.997|1.000|3.3e-14|1.3e-12|1.2e+00|-1.933657e+01 -2.050954e+01| 0:0:00| chol  1↙
1
15|1.000|1.000|2.2e-13|1.0e-12|4.9e-01|-1.990993e+01 -2.040217e+01| 0:0:00| chol  1↙
1
16|1.000|0.933|2.1e-13|1.1e-12|9.9e-02|-2.025092e+01 -2.035017e+01| 0:0:00| chol  1↙
1
17|0.589|0.968|4.1e-12|1.0e-12|5.4e-02|-2.028535e+01 -2.033927e+01| 0:0:00| chol  1↙
1
18|0.930|1.000|2.8e-12|1.0e-12|1.4e-02|-2.032188e+01 -2.033603e+01| 0:0:00| chol  2↙
2
19|1.000|0.924|6.5e-13|1.1e-12|4.3e-03|-2.033075e+01 -2.033502e+01| 0:0:00| chol  1↙
1
20|1.000|1.000|2.7e-11|1.0e-12|8.8e-04|-2.033363e+01 -2.033451e+01| 0:0:00| chol  2↙
2
21|0.918|0.928|1.2e-11|1.6e-12|1.4e-04|-2.033427e+01 -2.033441e+01| 0:0:00| chol  3↙
3
22|1.000|1.000|5.7e-11|2.3e-12|7.8e-05|-2.033432e+01 -2.033440e+01| 0:0:00| chol  3↙
3
23|1.000|1.000|2.8e-11|3.4e-12|2.2e-05|-2.033437e+01 -2.033439e+01| 0:0:00| chol  3↙
3
24|1.000|1.000|1.0e-11|5.1e-12|3.6e-06|-2.033439e+01 -2.033439e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
```

```
-----------------------------------------------------------------
 number of iterations   = 24
 primal objective value = -2.03343852e+01
 dual   objective value = -2.03343888e+01
 gap := trace(XZ)       = 3.57e-06
 relative gap           = 8.56e-08
 actual relative gap    = 8.56e-08
 rel. primal infeas     = 1.02e-11
 rel. dual   infeas     = 5.06e-12
 norm(X), norm(y), norm(Z) = 2.2e+01, 8.2e+01, 4.8e+01
 norm(A), norm(b), norm(C) = 5.3e+02, 5.6e+02, 7.7e+01
 Total CPU time (secs)  = 0.23
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 3.0e-11  0.0e+00  7.2e-12  0.0e+00  8.6e-08  8.6e-08
-----------------------------------------------------------------

ans =

   20.3344

Iteration   4   Total error is: 0.33308

 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*****************************************************************
   SDPT3: Infeasible path-following algorithms
*****************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-----------------------------------------------------------------
 0|0.000|0.000|1.0e+00|4.7e+01|1.2e+08| 6.372806e+05  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.982|8.1e-07|1.0e+00|3.4e+06| 6.250414e+05 -6.530005e+02| 0:0:00| chol  1↙
1
 2|1.000|0.768|6.3e-07|2.9e-01|1.4e+06| 5.828768e+05 -1.204658e+03| 0:0:00| chol  1↙
1
 3|0.427|0.600|4.1e-07|1.4e-01|9.1e+05| 5.264925e+05 -2.163369e+03| 0:0:00| chol  1↙
1
 4|0.369|0.601|2.9e-07|7.0e-02|6.6e+05| 4.795080e+05 -3.292742e+03| 0:0:00| chol  1↙
1
 5|0.443|0.739|1.7e-07|2.7e-02|4.7e+05| 4.035159e+05 -4.198249e+03| 0:0:00| chol  1↙
1
 6|1.000|1.000|3.2e-08|5.8e-03|1.4e+05| 1.321238e+05 -3.676178e+03| 0:0:00| chol  1↙
1
 7|0.847|0.878|2.9e-07|3.2e-03|8.5e+04| 8.138088e+04 -2.082704e+03| 0:0:00| chol  1↙
1
 8|1.000|1.000|1.1e-07|1.4e-03|5.4e+04| 5.210236e+04 -1.766361e+03| 0:0:00| chol  1↙
1
 9|1.000|1.000|1.2e-07|4.3e-04|2.1e+04| 1.973656e+04 -7.578917e+02| 0:0:00| chol  1↙
1
10|1.000|1.000|2.4e-09|1.3e-04|9.9e+03| 9.308275e+03 -5.338387e+02| 0:0:00| chol  1↙
```

```
1
11|1.000|1.000|2.6e-10|3.9e-05|4.0e+03| 3.763265e+03 -2.027160e+02| 0:0:00| chol  1↙
1
12|1.000|1.000|5.8e-10|1.2e-05|1.4e+03| 1.287134e+03 -1.209106e+02| 0:0:00| chol  1↙
1
13|1.000|1.000|2.2e-11|1.2e-06|5.8e+02| 5.105483e+02 -6.619809e+01| 0:0:00| chol  1↙
1
14|1.000|1.000|3.2e-12|1.2e-07|1.6e+02| 1.103778e+02 -4.934428e+01| 0:0:00| chol  1↙
1
15|1.000|1.000|8.2e-12|1.2e-08|7.5e+01| 3.348534e+01 -4.113568e+01| 0:0:00| chol  1↙
1
16|1.000|1.000|1.7e-11|1.2e-09|2.6e+01|-1.282791e+01 -3.842415e+01| 0:0:00| chol  1↙
1
17|1.000|1.000|1.8e-11|1.2e-10|1.3e+01|-2.432699e+01 -3.686831e+01| 0:0:00| chol  1↙
1
18|1.000|1.000|4.2e-12|1.5e-11|3.1e+00|-3.304323e+01 -3.612160e+01| 0:0:00| chol  1↙
1
19|1.000|1.000|4.9e-13|2.2e-12|1.2e+00|-3.465520e+01 -3.589674e+01| 0:0:00| chol  1↙
1
20|0.948|0.986|1.3e-11|1.1e-12|2.0e-01|-3.557871e+01 -3.577676e+01| 0:0:00| chol  1↙
1
21|1.000|1.000|1.5e-12|1.5e-12|6.0e-02|-3.569926e+01 -3.575926e+01| 0:0:00| chol  2↙
1
22|0.695|0.837|3.4e-12|1.2e-12|3.4e-02|-3.572068e+01 -3.575437e+01| 0:0:00| chol  2↙
1
23|0.767|1.000|1.1e-11|1.0e-12|2.1e-02|-3.573184e+01 -3.575291e+01| 0:0:00| chol  2↙
1
24|1.000|1.000|6.7e-12|1.5e-12|9.7e-03|-3.574161e+01 -3.575131e+01| 0:0:00| chol  1↙
1
25|1.000|1.000|1.3e-10|1.3e-12|4.5e-03|-3.574603e+01 -3.575051e+01| 0:0:00| chol  1↙
1
26|1.000|1.000|2.0e-12|2.0e-12|1.7e-03|-3.574830e+01 -3.575001e+01| 0:0:00| chol  1↙
1
27|1.000|1.000|2.6e-11|1.0e-12|6.3e-04|-3.574921e+01 -3.574983e+01| 0:0:00| chol  1↙
2
28|1.000|1.000|6.5e-13|1.5e-12|2.4e-04|-3.574952e+01 -3.574976e+01| 0:0:00| chol  2↙
1
29|1.000|1.000|5.7e-12|1.0e-12|7.3e-05|-3.574967e+01 -3.574974e+01| 0:0:00| chol  2↙
2
30|1.000|1.000|2.3e-12|1.1e-12|2.6e-05|-3.574970e+01 -3.574973e+01| 0:0:00| chol  1↙
2
31|1.000|1.000|3.8e-11|1.0e-12|5.5e-06|-3.574972e+01 -3.574973e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
------------------------------------------------------------------------
 number of iterations   = 31
 primal objective value = -3.57497221e+01
 dual   objective value = -3.57497276e+01
 gap := trace(XZ)       = 5.51e-06
 relative gap           = 7.60e-08
 actual relative gap    = 7.60e-08
 rel. primal infeas     = 3.81e-11
 rel. dual   infeas     = 1.00e-12
 norm(X), norm(y), norm(Z) = 1.2e+01, 6.7e+01, 3.0e+01
 norm(A), norm(b), norm(C) = 4.4e+03, 1.9e+03, 7.7e+01
```

```
 Total CPU time (secs)  = 0.28
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 8.6e-11  0.0e+00  1.4e-12  0.0e+00  7.6e-08  7.6e-08
------------------------------------------------------------------

ans =

   35.7497

Iteration   5   Total error is: 0.26048

 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.0e+00|4.5e+01|2.1e+08| 1.126855e+06  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.978|1.5e-07|1.2e+00|6.9e+06| 1.105049e+06 -1.169029e+02| 0:0:00| chol  1↙
1
 2|1.000|0.821|6.2e-08|2.7e-01|2.6e+06| 1.110750e+06 -2.037521e+03| 0:0:00| chol  1↙
1
 3|0.574|0.551|4.8e-08|1.5e-01|1.7e+06| 9.490569e+05 -3.448903e+03| 0:0:00| chol  1↙
1
 4|0.304|0.618|5.4e-08|7.0e-02|1.2e+06| 8.865789e+05 -5.840456e+03| 0:0:00| chol  1↙
1
 5|0.448|0.636|3.0e-08|3.3e-02|9.0e+05| 7.551045e+05 -7.715864e+03| 0:0:00| chol  1↙
1
 6|0.551|1.000|1.5e-08|5.8e-03|5.7e+05| 5.415943e+05 -8.756949e+03| 0:0:00| chol  1↙
1
 7|1.000|0.868|2.4e-09|3.3e-03|1.1e+05| 9.991031e+04 -6.702849e+03| 0:0:00| chol  1↙
2
 8|0.213|1.000|2.4e-09|1.4e-03|1.0e+05| 9.437070e+04 -6.797548e+03| 0:0:00| chol  1↙
1
 9|1.000|0.786|4.4e-08|8.8e-04|6.1e+04| 5.716787e+04 -3.321956e+03| 0:0:00| chol  1↙
1
10|1.000|1.000|3.8e-10|3.6e-04|4.1e+04| 3.851262e+04 -2.208069e+03| 0:0:00| chol  1↙
1
11|1.000|1.000|9.9e-11|1.1e-04|1.7e+04| 1.608697e+04 -1.283365e+03| 0:0:00| chol  1↙
1
12|1.000|1.000|5.6e-11|3.2e-05|7.7e+03| 7.072871e+03 -6.162598e+02| 0:0:00| chol  1↙
1
13|1.000|1.000|2.2e-11|9.7e-06|3.0e+03| 2.677111e+03 -2.923084e+02| 0:0:00| chol  1↙
1
14|1.000|1.000|5.8e-12|2.9e-06|1.2e+03| 1.044715e+03 -1.162422e+02| 0:0:00| chol  1↙
1
15|1.000|1.000|6.7e-12|2.9e-07|3.8e+02| 3.276359e+02 -5.250112e+01| 0:0:00| chol  1↙
1
```

```
16|1.000|1.000|5.3e-12|2.9e-08|1.5e+02| 1.171417e+02 -2.842545e+01| 0:0:00| chol  1↙
1
17|1.000|1.000|2.4e-12|2.9e-09|3.5e+01| 1.564440e+01 -1.936130e+01| 0:0:00| chol  1↙
1
18|1.000|1.000|2.1e-12|2.9e-10|1.5e+01|-8.861277e-01 -1.630228e+01| 0:0:00| chol  1↙
1
19|1.000|1.000|5.2e-12|3.0e-11|4.4e+00|-1.095650e+01 -1.538158e+01| 0:0:00| chol  2↙
2
20|1.000|1.000|1.2e-12|4.0e-12|2.1e+00|-1.300234e+01 -1.506814e+01| 0:0:00| chol  2↙
2
21|0.994|1.000|7.8e-13|1.3e-12|5.7e-01|-1.434411e+01 -1.491786e+01| 0:0:00| chol  2↙
2
22|1.000|1.000|1.7e-12|1.0e-12|2.9e-01|-1.459034e+01 -1.487834e+01| 0:0:00| chol  2↙
2
23|0.994|1.000|1.4e-12|1.0e-12|7.3e-02|-1.478570e+01 -1.485900e+01| 0:0:00| chol  2↙
2
24|1.000|1.000|1.2e-12|1.0e-12|3.3e-02|-1.482185e+01 -1.485523e+01| 0:0:00| chol  2↙
2
25|1.000|1.000|2.0e-12|1.0e-12|7.0e-03|-1.484627e+01 -1.485329e+01| 0:0:00| chol  2↙
2
26|0.893|0.978|1.3e-12|1.0e-12|2.0e-03|-1.485108e+01 -1.485309e+01| 0:0:00| chol  2↙
3
27|0.961|0.852|5.6e-12|1.2e-12|1.2e-04|-1.485291e+01 -1.485303e+01| 0:0:00| chol  4↙
4
28|0.913|0.917|3.6e-10|1.2e-12|2.5e-05|-1.485300e+01 -1.485303e+01| 0:0:00| chol
  linsysolve: Schur complement matrix not positive definite
  switch to LU factor. lu 30  30
29|0.980|1.000|1.3e-09|1.7e-12|5.9e-06|-1.485302e+01 -1.485303e+01| 0:0:00| lu 30↙
^21
30|0.982|0.989|1.1e-09|2.5e-12|4.0e-07|-1.485303e+01 -1.485303e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
------------------------------------------------------------------
 number of iterations   = 30
 primal objective value = -1.48530275e+01
 dual   objective value = -1.48530278e+01
 gap := trace(XZ)       = 4.02e-07
 relative gap           = 1.31e-08
 actual relative gap    = 7.81e-09
 rel. primal infeas     = 1.09e-09
 rel. dual   infeas     = 2.52e-12
 norm(X), norm(y), norm(Z) = 3.4e+01, 8.4e+01, 5.1e+01
 norm(A), norm(b), norm(C) = 5.4e+03, 6.9e+03, 7.7e+01
 Total CPU time (secs)  = 0.26
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 2.8e-09  0.0e+00  3.6e-12  0.0e+00  7.8e-09  1.3e-08
------------------------------------------------------------------

ans =

   14.8530

Iteration   6   Total error is: 2.4679
```

```
 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.0e+00|3.5e+01|6.9e+06| 3.513517e+04  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.994|1.5e-06|3.2e-01|9.9e+04| 3.596790e+04 -1.106016e+02| 0:0:00| chol  1↙
1
 2|0.841|0.773|1.0e-06|9.9e-02|3.8e+04| 2.469455e+04 -1.334579e+02| 0:0:00| chol  1↙
1
 3|0.989|1.000|3.1e-07|1.0e-02|1.3e+04| 1.187430e+04 -1.651651e+02| 0:0:00| chol  1↙
1
 4|1.000|0.983|3.5e-07|3.1e-03|4.5e+03| 4.251725e+03 -1.280452e+02| 0:0:00| chol  1↙
1
 5|0.415|1.000|2.1e-07|3.0e-04|3.7e+03| 3.556408e+03 -1.267546e+02| 0:0:00| chol  1↙
1
 6|1.000|0.901|3.8e-09|5.6e-05|1.6e+03| 1.544520e+03 -8.534716e+01| 0:0:00| chol  1↙
1
 7|1.000|1.000|1.6e-09|3.0e-06|9.5e+02| 8.782890e+02 -7.644879e+01| 0:0:00| chol  1↙
1
 8|1.000|1.000|1.7e-10|3.0e-07|4.1e+02| 3.543479e+02 -5.479489e+01| 0:0:00| chol  1↙
1
 9|1.000|1.000|4.7e-11|3.0e-08|1.8e+02| 1.320676e+02 -5.140019e+01| 0:0:00| chol  1↙
1
10|1.000|1.000|3.7e-14|3.0e-09|8.2e+01| 3.833080e+01 -4.378152e+01| 0:0:00| chol  1↙
1
11|1.000|1.000|2.1e-14|3.0e-10|2.8e+01|-1.262725e+01 -4.108571e+01| 0:0:00| chol  1↙
1
12|1.000|1.000|5.6e-15|3.1e-11|1.3e+01|-2.654680e+01 -3.922883e+01| 0:0:00| chol  1↙
1
13|1.000|1.000|4.2e-14|4.0e-12|3.8e+00|-3.465279e+01 -3.845047e+01| 0:0:00| chol  1↙
1
14|1.000|1.000|3.9e-14|1.3e-12|1.5e+00|-3.659136e+01 -3.814119e+01| 0:0:00| chol  1↙
1
15|1.000|1.000|2.9e-14|1.0e-12|4.3e-01|-3.755545e+01 -3.798827e+01| 0:0:00| chol  1↙
1
16|1.000|1.000|9.1e-14|1.0e-12|1.9e-01|-3.774673e+01 -3.793996e+01| 0:0:00| chol  1↙
1
17|0.986|1.000|9.1e-14|1.0e-12|4.9e-02|-3.786709e+01 -3.791642e+01| 0:0:00| chol  1↙
2
18|1.000|1.000|3.9e-13|1.0e-12|2.2e-02|-3.789123e+01 -3.791301e+01| 0:0:00| chol  1↙
1
19|0.989|0.940|2.0e-11|1.1e-12|4.6e-03|-3.790598e+01 -3.791060e+01| 0:0:00| chol  2↙
2
20|0.666|1.000|6.6e-12|1.5e-12|2.8e-03|-3.790759e+01 -3.791043e+01| 0:0:00| chol  2↙
2
21|1.000|0.978|4.5e-13|1.3e-12|7.1e-04|-3.790960e+01 -3.791031e+01| 0:0:00| chol  2↙
2
```

```
22|0.950|0.999|2.4e-12|1.0e-12|2.2e-04|-3.791007e+01 -3.791029e+01| 0:0:00| chol  2↙
2
23|0.964|1.000|5.1e-12|1.0e-12|4.8e-05|-3.791024e+01 -3.791029e+01| 0:0:00| chol  2↙
2
24|1.000|1.000|2.8e-11|1.0e-12|1.5e-05|-3.791027e+01 -3.791028e+01| 0:0:00| chol  2↙
2
25|1.000|1.000|3.9e-11|1.5e-12|1.7e-06|-3.791028e+01 -3.791028e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
-------------------------------------------------------------------
 number of iterations   = 25
 primal objective value = -3.79102824e+01
 dual   objective value = -3.79102841e+01
 gap := trace(XZ)       = 1.72e-06
 relative gap           = 2.24e-08
 actual relative gap    = 2.24e-08
 rel. primal infeas     = 3.93e-11
 rel. dual   infeas     = 1.53e-12
 norm(X), norm(y), norm(Z) = 6.4e+00, 5.8e+01, 2.1e+01
 norm(A), norm(b), norm(C) = 5.0e+02, 1.1e+02, 7.7e+01
 Total CPU time (secs)  = 0.20
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 9.2e-11  0.0e+00  2.2e-12  0.0e+00  2.2e-08  2.2e-08
-------------------------------------------------------------------

ans =

   37.9103

Iteration   7   Total error is: 0.079615

 num. of constraints = 65
 dim. of socp   var  = 66,   num. of socp blk  =  1
 dim. of linear var  = 800
*******************************************************************
   SDPT3: Infeasible path-following algorithms
*******************************************************************
 version  predcorr  gam  expon  scale_data
   HKM      1      0.000   1        0
it pstep dstep pinfeas dinfeas  gap      prim-obj      dual-obj    cputime
-------------------------------------------------------------------
 0|0.000|0.000|1.0e+00|3.5e+01|9.7e+06| 4.893222e+04  0.000000e+00| 0:0:00| chol  1↙
1
 1|1.000|0.998|3.0e-07|1.8e-01|9.9e+04| 5.016692e+04 -4.472065e+01| 0:0:00| chol  1↙
1
 2|1.000|1.000|2.8e-08|3.3e-02|1.0e+04| 8.838600e+03 -2.627582e+01| 0:0:00| chol  1↙
1
 3|0.994|1.000|1.4e-08|1.0e-02|1.8e+02| 1.489988e+02 -2.554760e+01| 0:0:00| chol  1↙
1
 4|0.840|0.380|1.3e-07|6.6e-03|1.5e+02| 1.167983e+02 -2.399937e+01| 0:0:00| chol  1↙
1
 5|0.450|0.520|6.9e-08|3.2e-03|1.3e+02| 1.043416e+02 -2.276622e+01| 0:0:00| chol  1↙
1
 6|0.329|1.000|4.6e-08|1.0e-05|1.1e+02| 8.965394e+01 -2.426751e+01| 0:0:00| chol  1↙
```

```
1
 7|1.000|1.000|2.8e-11|1.0e-06|6.3e+01| 4.058921e+01 -2.209081e+01| 0:0:00| chol  1↙
1
 8|0.952|0.975|2.8e-11|1.2e-07|2.6e+01| 4.635773e+00 -2.094522e+01| 0:0:00| chol  1↙
1
 9|1.000|1.000|8.5e-11|1.0e-08|1.7e+01|-3.898057e+00 -2.046305e+01| 0:0:00| chol  1↙
1
10|1.000|1.000|1.3e-13|1.0e-09|5.6e+00|-1.423650e+01 -1.982661e+01| 0:0:00| chol  1↙
1
11|1.000|1.000|5.0e-13|1.0e-10|3.0e+00|-1.653594e+01 -1.958302e+01| 0:0:00| chol  1↙
1
12|1.000|1.000|4.9e-13|1.1e-11|1.1e+00|-1.827976e+01 -1.939914e+01| 0:0:00| chol  1↙
1
13|1.000|1.000|8.6e-12|2.0e-12|3.9e-01|-1.891383e+01 -1.930875e+01| 0:0:00| chol  1↙
2
14|1.000|1.000|1.3e-12|1.6e-12|1.4e-01|-1.913992e+01 -1.928130e+01| 0:0:00| chol  2↙
1
15|1.000|1.000|1.1e-11|1.0e-12|5.7e-02|-1.921221e+01 -1.926958e+01| 0:0:00| chol  1↙
2
16|1.000|1.000|2.3e-12|1.5e-12|1.5e-02|-1.924990e+01 -1.926523e+01| 0:0:00| chol  2↙
2
17|0.673|1.000|2.4e-12|1.0e-12|8.7e-03|-1.925588e+01 -1.926461e+01| 0:0:00| chol  2↙
2
18|0.987|0.938|5.6e-12|1.1e-12|2.7e-03|-1.926160e+01 -1.926431e+01| 0:0:00| chol  2↙
2
19|0.599|0.972|1.3e-12|1.2e-12|1.5e-03|-1.926273e+01 -1.926419e+01| 0:0:00| chol  2↙
2
20|0.975|0.969|9.8e-12|1.0e-12|3.6e-04|-1.926381e+01 -1.926417e+01| 0:0:00| chol  2↙
2
21|1.000|1.000|8.9e-11|1.5e-12|8.5e-05|-1.926407e+01 -1.926416e+01| 0:0:00| chol  3↙
3
22|1.000|1.000|2.8e-11|2.3e-12|2.3e-05|-1.926413e+01 -1.926416e+01| 0:0:00| chol  3↙
4
23|1.000|1.000|3.2e-11|3.4e-12|6.4e-06|-1.926415e+01 -1.926416e+01| 0:0:00| chol  3↙
4
24|1.000|1.000|3.0e-11|5.1e-12|6.4e-07|-1.926415e+01 -1.926416e+01| 0:0:00|
  stop: max(relative gap, infeasibilities) < 1.00e-07
-----------------------------------------------------------------
 number of iterations   = 24
 primal objective value = -1.92641550e+01
 dual   objective value = -1.92641556e+01
 gap := trace(XZ)       = 6.36e-07
 relative gap           = 1.61e-08
 actual relative gap    = 1.60e-08
 rel. primal infeas     = 2.97e-11
 rel. dual   infeas     = 5.06e-12
 norm(X), norm(y), norm(Z) = 2.1e+01, 8.1e+01, 4.6e+01
 norm(A), norm(b), norm(C) = 3.7e+02, 3.7e+02, 7.7e+01
 Total CPU time (secs)  = 0.16
 CPU time per iteration = 0.01
 termination code       =  0
 DIMACS errors: 7.0e-11  0.0e+00  7.2e-12  0.0e+00  1.6e-08  1.6e-08
-----------------------------------------------------------------
```

```
ans =

   19.2642

Iteration   8   Total error is: 0.040532
The total representation error of the testing signals is: 0.032309
>>
```