

```
>> demo_Polynomial_Dictionary_Learning
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```
Starting to train the dictionary
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```
solving the quadratic problem with YALMIP...
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```
num. of constraints = 85
dim. of socp var = 86, num. of socp blk = 1
dim. of linear var = 1000
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SDPT3: Infeasible path-following algorithms
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```

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	1.4e+02	2.3e+07	2.432290e+04	0.000000e+00	0:0:00	chol	1✓	
1	1	1.000	0.989	2.0e-07	1.7e+00	2.9e+05	2.580869e+04	-1.054901e+02	0:0:00	chol	1✓
1	2	1.000	0.975	2.3e-07	7.7e-02	2.9e+04	1.900016e+04	-2.468907e+01	0:0:00	chol	1✓
1	3	0.980	1.000	9.0e-08	1.1e-02	2.1e+03	1.733380e+03	-2.620710e+01	0:0:00	chol	1✓
1	4	1.000	1.000	1.6e-08	3.3e-03	2.4e+02	1.901217e+02	-2.641100e+01	0:0:00	chol	1✓
1	5	0.707	0.716	1.2e-08	1.2e-03	7.8e+01	4.968567e+01	-2.570444e+01	0:0:00	chol	1✓
1	6	0.816	0.866	4.3e-09	1.9e-04	6.2e+01	3.629037e+01	-2.505104e+01	0:0:00	chol	1✓
1	7	0.603	1.000	1.8e-09	3.3e-06	4.9e+01	2.404438e+01	-2.501366e+01	0:0:00	chol	1✓
2	8	1.000	1.000	5.2e-11	3.3e-07	3.0e+01	5.443650e+00	-2.472309e+01	0:0:00	chol	1✓
1	9	1.000	1.000	1.6e-11	3.3e-08	1.2e+01	-1.252480e+01	-2.440595e+01	0:0:00	chol	1✓
1	10	1.000	1.000	1.6e-12	3.3e-09	5.6e+00	-1.860734e+01	-2.420563e+01	0:0:00	chol	1✓
1	11	1.000	1.000	1.4e-13	3.3e-10	1.7e+00	-2.233857e+01	-2.401655e+01	0:0:00	chol	1✓
1	12	1.000	1.000	9.8e-13	3.4e-11	5.2e-01	-2.338874e+01	-2.390853e+01	0:0:01	chol	1✓
1	13	1.000	1.000	7.1e-13	4.3e-12	1.1e-01	-2.376573e+01	-2.387592e+01	0:0:01	chol	1✓
1	14	0.977	0.960	4.9e-11	1.5e-12	1.2e-02	-2.385401e+01	-2.386650e+01	0:0:01	chol	2✓
2	15	0.930	0.913	5.8e-12	1.7e-12	1.2e-03	-2.386405e+01	-2.386524e+01	0:0:01	chol	2✓
2	16	0.956	0.910	1.6e-11	1.3e-12	1.7e-04	-2.386494e+01	-2.386511e+01	0:0:01	chol	3✓
3	17	1.000	1.000	6.9e-11	1.7e-12	3.2e-05	-2.386506e+01	-2.386509e+01	0:0:01	chol	4✓
4	18	1.000	1.000	1.2e-10	2.6e-12	1.1e-06	-2.386509e+01	-2.386509e+01	0:0:01		
stop: max(relative gap, infeasibilities) < 1.00e-07											
-----											
number of iterations = 18											

```

primal objective value = -2.38650877e+01
dual   objective value = -2.38650888e+01
gap := trace(XZ)       = 1.13e-06
relative gap           = 2.32e-08
actual relative gap    = 2.29e-08
rel. primal infeas     = 1.22e-10
rel. dual   infeas     = 2.62e-12
norm(X), norm(y), norm(Z) = 8.8e+00, 6.3e+01, 2.4e+01
norm(A), norm(b), norm(C) = 1.4e+03, 9.3e+02, 7.8e+01
Total CPU time (secs)   = 0.58
CPU time per iteration  = 0.03
termination code        = 0
DIMACS errors: 2.9e-10  0.0e+00  3.8e-12  0.0e+00  2.3e-08  2.3e-08

```

ans =

23.8651

```
num. of constraints = 85
dim. of socp var = 86,    num. of socp blk = 1
dim. of linear var = 1000
```

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SDPT3: Infeasible path-following algorithms

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```
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 1.4e+02 5.9e+07	6.506103e+04	0.000000e+00	0:0:00	chol	1	✓	
1	1	1.000 0.990 1.8e-07 1.7e+00 7.5e+05	6.675606e+04	-2.484517e+02	0:0:00	chol	1	✓
1	2	1.000 0.941 1.6e-07 2.0e-01 1.1e+05	4.596681e+04	-1.593037e+01	0:0:00	chol	1	✓
1	3	0.960 1.000 4.6e-08 3.0e-02 2.2e+04	1.649508e+04	-3.180983e+01	0:0:00	chol	1	✓
1	4	1.000 1.000 1.6e-08 9.1e-03 3.3e+03	2.819857e+03	-2.347812e+01	0:0:00	chol	2	✓
2	5	0.880 0.871 1.7e-08 3.6e-03 4.4e+02	3.771240e+02	-1.855220e+01	0:0:00	chol	1	✓
1	6	0.166 1.000 1.5e-08 2.7e-04 3.8e+02	3.673404e+02	-1.383279e+01	0:0:00	chol	1	✓
2	7	1.000 1.000 1.2e-09 2.7e-05 3.0e+02	2.859018e+02	-1.178569e+01	0:0:00	chol	1	✓
1	8	1.000 0.973 3.4e-10 3.4e-06 9.7e+01	8.854631e+01	-8.046511e+00	0:0:00	chol	1	✓
1	9	1.000 1.000 4.4e-11 2.7e-07 5.6e+01	4.869150e+01	-7.529674e+00	0:0:00	chol	1	✓
1	10	1.000 1.000 2.1e-11 2.7e-08 1.9e+01	1.264019e+01	-6.470666e+00	0:0:00	chol	1	✓
1	11	1.000 1.000 5.0e-12 2.7e-09 6.6e+00	2.795882e-01	-6.315056e+00	0:0:00	chol	1	✓
1								

```

12|1.000|1.000|2.3e-11|2.7e-10|2.2e+00|-3.969849e+00 -6.204280e+00| 0:0:00| chol 1✓
1
13|0.927|0.991|3.6e-12|3.1e-11|3.9e-01|-5.788696e+00 -6.175088e+00| 0:0:00| chol 2✓
2
14|1.000|0.989|5.3e-12|4.1e-12|1.8e-01|-5.986546e+00 -6.163466e+00| 0:0:00| chol 2✓
2
15|1.000|1.000|3.0e-12|1.3e-12|7.7e-02|-6.085174e+00 -6.161938e+00| 0:0:00| chol 2✓
2
16|0.929|0.846|4.2e-12|1.2e-12|1.4e-02|-6.145883e+00 -6.160323e+00| 0:0:00| chol 2✓
2
17|0.661|0.948|4.8e-12|1.1e-12|8.8e-03|-6.151329e+00 -6.160178e+00| 0:0:00| chol 2✓
3
18|1.000|1.000|8.0e-11|1.0e-12|2.4e-03|-6.157644e+00 -6.160076e+00| 0:0:00| chol 3✓
3
19|1.000|1.000|2.2e-10|1.5e-12|8.7e-04|-6.159178e+00 -6.160043e+00| 0:0:00| chol 4✓
3
20|1.000|1.000|1.7e-10|2.3e-12|1.2e-04|-6.159918e+00 -6.160034e+00| 0:0:00| chol 7✓
7
21|1.000|1.000|3.6e-10|3.4e-12|2.2e-05|-6.160010e+00 -6.160033e+00| 0:0:00| chol 18✓
16
22|1.000|1.000|6.2e-10|5.1e-12|1.2e-06|-6.160031e+00 -6.160032e+00| 0:0:00|
stop: max(relative gap, infeasibilities) < 1.00e-07

```

```

-----
number of iterations    = 22
primal objective value = -6.16003125e+00
dual   objective value = -6.16003240e+00
gap := trace(XZ)        = 1.17e-06
relative gap           = 8.78e-08
actual relative gap    = 8.68e-08
rel. primal infeas     = 6.24e-10
rel. dual   infeas     = 5.06e-12
norm(X), norm(y), norm(Z) = 3.3e+01, 9.7e+01, 6.7e+01
norm(A), norm(b), norm(C) = 2.0e+03, 2.1e+03, 7.8e+01
Total CPU time (secs)   = 0.28
CPU time per iteration = 0.01
termination code        = 0
DIMACS errors: 1.2e-09  0.0e+00  7.4e-12  0.0e+00  8.7e-08  8.8e-08
-----

```

ans =

6.1600

Iteration 2 Total error is: 0.01012

```

num. of constraints = 85
dim. of socp var   = 86,   num. of socp blk = 1
dim. of linear var = 1000

```

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SDPT3: Infeasible path-following algorithms

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```

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|1.4e+02|5.8e+07| 6.350438e+04 0.000000e+00| 0:0:00| chol 1✓
1
1|1.000|0.990|2.0e-07|1.7e+00|7.3e+05| 6.512814e+04 -2.457206e+02| 0:0:00| chol 1✓
1
2|1.000|0.939|1.8e-07|2.0e-01|1.0e+05| 4.476138e+04 -1.474036e+01| 0:0:00| chol 1✓
1
3|0.943|1.000|5.0e-08|3.0e-02|2.2e+04| 1.709581e+04 -3.151551e+01| 0:0:00| chol 1✓
1
4|1.000|1.000|1.4e-08|9.1e-03|3.4e+03| 2.896639e+03 -2.302612e+01| 0:0:00| chol 2✓
2
5|0.893|0.888|1.5e-08|3.5e-03|4.1e+02| 3.488153e+02 -1.800192e+01| 0:0:00| chol 1✓
1
6|0.133|1.000|1.4e-08|2.7e-04|3.6e+02| 3.422688e+02 -1.289182e+01| 0:0:00| chol 1✓
2
7|1.000|1.000|1.5e-09|2.7e-05|2.8e+02| 2.671104e+02 -8.687970e+00| 0:0:00| chol 1✓
2
8|1.000|1.000|2.4e-10|2.7e-06|1.1e+02| 9.955220e+01 -6.330433e+00| 0:0:00| chol 1✓
1
9|1.000|1.000|2.1e-11|2.7e-07|5.1e+01| 4.502695e+01 -5.709178e+00| 0:0:00| chol 1✓
1
10|1.000|1.000|1.1e-11|2.7e-08|1.8e+01| 1.295365e+01 -4.828978e+00| 0:0:00| chol 1✓
1
11|1.000|1.000|1.1e-12|2.7e-09|4.1e+00|-5.277841e-01 -4.651634e+00| 0:0:00| chol 1✓
1
12|1.000|1.000|2.5e-11|2.7e-10|1.3e+00|-3.327315e+00 -4.596636e+00| 0:0:00| chol 2✓
2
13|0.888|0.914|2.3e-12|5.0e-11|2.0e-01|-4.374384e+00 -4.577999e+00| 0:0:00| chol 2✓
2
14|1.000|1.000|3.8e-11|3.7e-12|1.2e-01|-4.448897e+00 -4.569251e+00| 0:0:00| chol 2✓
2
15|0.918|1.000|7.3e-11|1.8e-12|4.9e-02|-4.519171e+00 -4.568142e+00| 0:0:00| chol 2✓
2
16|1.000|1.000|5.1e-11|2.3e-12|2.3e-02|-4.543766e+00 -4.567234e+00| 0:0:00| chol 3✓
2
17|1.000|1.000|3.4e-11|3.4e-12|5.1e-03|-4.561475e+00 -4.566601e+00| 0:0:00| chol 3✓
3
18|0.889|1.000|5.2e-11|5.1e-12|2.3e-03|-4.564230e+00 -4.566524e+00| 0:0:00| chol 3✓
3
19|1.000|0.968|7.9e-11|7.8e-12|3.7e-04|-4.566111e+00 -4.566485e+00| 0:0:00| chol 4✓
3
20|0.870|0.948|5.1e-11|1.2e-11|7.4e-05|-4.566406e+00 -4.566480e+00| 0:0:00| chol 7✓
7
21|0.995|0.951|3.4e-10|1.1e-11|5.5e-06|-4.566474e+00 -4.566479e+00| 0:0:00| chol
linsysolve: Schur complement matrix not positive definite
switch to LU factor. lu 30 ^ 4
22|0.947|0.874|7.3e-09|1.7e-11|1.0e-06|-4.566478e+00 -4.566479e+00| 0:0:00| lu 30✓
^13
23|0.916|0.556|1.2e-08|3.0e-11|7.0e-07|-4.566479e+00 -4.566479e+00| 0:0:00|
stop: max(relative gap, infeasibilities) < 1.00e-07
-----

number of iterations = 23
primal objective value = -4.56647897e+00
dual objective value = -4.56647919e+00

```

```

gap := trace(XZ)          = 6.97e-07
relative gap              = 6.88e-08
actual relative gap      = 2.14e-08
rel. primal infeas       = 1.23e-08
rel. dual infeas         = 3.05e-11
norm(X), norm(y), norm(Z) = 3.5e+01, 1.0e+02, 7.1e+01
norm(A), norm(b), norm(C) = 2.0e+03, 2.2e+03, 7.8e+01
Total CPU time (secs)    = 0.32
CPU time per iteration   = 0.01
termination code          = 0
DIMACS errors: 2.4e-08  0.0e+00  4.4e-11  0.0e+00  2.1e-08  6.9e-08
-----

```

ans =

4.5665

Iteration 3 Total error is: 0.0087116

```

num. of constraints = 85
dim. of socp var = 86, num. of socp blk = 1
dim. of linear var = 1000

```

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SDPT3: Infeasible path-following algorithms

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```

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	1.5e+02	1.7e+08	1.922432e+05	0.000000e+00	0:0:00	chol	1✓
1	1.000	0.990	1.7e-07	1.7e+00	2.2e+06	1.928945e+05	-5.404829e+02	0:0:00	chol	1✓
2	1.000	0.912	1.1e-07	2.4e-01	3.5e+05	1.346140e+05	-3.904347e+01	0:0:00	chol	1✓
3	0.643	1.000	5.4e-08	5.1e-02	1.3e+05	9.035147e+04	-1.164461e+02	0:0:00	chol	1✓
4	1.000	1.000	3.4e-09	2.5e-02	9.8e+03	6.869556e+03	-5.839998e+01	0:0:00	chol	1✓
5	0.792	0.729	1.8e-08	1.2e-02	2.6e+03	1.968033e+03	-4.078983e+01	0:0:00	chol	1✓
6	0.346	1.000	1.3e-08	2.3e-03	2.0e+03	1.824423e+03	-3.188023e+01	0:0:00	chol	1✓
7	1.000	0.929	2.8e-09	8.0e-04	1.2e+03	1.146465e+03	-1.839123e+01	0:0:00	chol	1✓
8	1.000	1.000	3.1e-10	2.1e-04	6.2e+02	6.036683e+02	-1.567777e+01	0:0:00	chol	1✓
9	1.000	0.996	1.5e-10	2.1e-05	2.9e+02	2.818035e+02	-6.789829e+00	0:0:00	chol	1✓
10	1.000	1.000	1.6e-12	2.1e-06	1.4e+02	1.306492e+02	-6.479009e+00	0:0:00	chol	1✓
11	1.000	1.000	2.3e-13	2.1e-07	7.1e+01	6.842737e+01	-2.837955e+00	0:0:00	chol	1✓
12	0.985	1.000	9.0e-14	2.1e-08	1.9e+01	1.627509e+01	-2.454012e+00	0:0:00	chol	1✓

```

1
13|1.000|1.000|7.1e-13|2.1e-09|9.0e+00| 6.938368e+00 -2.093940e+00| 0:0:00| chol 1✓
1
14|0.935|0.964|4.9e-12|2.7e-10|1.0e+00|-9.835493e-01 -1.981785e+00| 0:0:00| chol 2✓
1
15|0.759|0.882|8.7e-12|5.1e-11|4.5e-01|-1.481980e+00 -1.927538e+00| 0:0:00| chol 2✓
2
16|1.000|1.000|1.0e-11|3.6e-12|2.2e-01|-1.704363e+00 -1.921375e+00| 0:0:00| chol 2✓
2
17|0.946|0.966|2.9e-11|2.4e-12|4.6e-02|-1.867102e+00 -1.912741e+00| 0:0:00| chol 2✓
3
18|1.000|1.000|9.6e-11|3.2e-12|1.8e-02|-1.893892e+00 -1.911690e+00| 0:0:00| chol 2✓
3
19|0.995|0.855|5.1e-11|5.2e-12|1.9e-03|-1.909055e+00 -1.910998e+00| 0:0:00| chol 3✓
4
20|0.487|0.928|1.0e-10|7.4e-12|1.3e-03|-1.909689e+00 -1.910940e+00| 0:0:00| chol 4✓
5
21|0.646|1.000|1.7e-10|1.1e-11|6.5e-04|-1.910268e+00 -1.910922e+00| 0:0:00| chol 5✓
5
22|0.627|0.710|6.5e-10|1.9e-11|2.9e-04|-1.910631e+00 -1.910919e+00| 0:0:00| chol 11✓
17
23|1.000|1.000|1.7e-09|2.4e-11|6.8e-05|-1.910847e+00 -1.910915e+00| 0:0:00| chol 18✓
24
24|1.000|1.000|1.5e-09|3.6e-11|1.7e-05|-1.910897e+00 -1.910914e+00| 0:0:00| chol
linsysolve: Schur complement matrix not positive definite
switch to LU factor. lu 30 30
25|1.000|0.920|3.7e-09|5.6e-11|4.3e-06|-1.910910e+00 -1.910914e+00| 0:0:00| lu 30✓
30
26|0.861|0.719|6.7e-09|9.6e-11|1.5e-06|-1.910915e+00 -1.910914e+00| 0:0:00| lu 30✓
^30
27|0.504|0.422|1.9e-08|1.8e-10|1.2e-06|-1.910913e+00 -1.910914e+00| 0:0:00| lu 11✓
30
28|0.184|0.338|6.6e-09|3.0e-10|1.2e-06|-1.910913e+00 -1.910914e+00| 0:0:00|
stop: progress is too slow
-----
number of iterations    = 28
primal objective value = -1.91091274e+00
dual   objective value = -1.91091400e+00
gap := trace(XZ)       = 1.16e-06
relative gap           = 2.41e-07
actual relative gap    = 2.62e-07
rel. primal infeas     = 6.63e-09
rel. dual   infeas     = 2.97e-10
norm(X), norm(y), norm(Z) = 3.8e+01, 1.0e+02, 7.7e+01
norm(A), norm(b), norm(C) = 3.1e+03, 3.5e+03, 7.8e+01
Total CPU time (secs)   = 0.40
CPU time per iteration = 0.01
termination code        = -5
DIMACS errors: 1.7e-08  0.0e+00  4.3e-10  0.0e+00  2.6e-07  2.4e-07
-----

```

ans =

1.9109

Iteration 4 Total error is: 0.0056266

num. of constraints = 85  
 dim. of socp var = 86, num. of socp blk = 1  
 dim. of linear var = 1000

\*\*\*\*\*

SDPT3: Infeasible path-following algorithms

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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	1.5e+02	1.7e+08	1.958305e+05	0.000000e+00	0:0:00	chol	1✓
1	1	1.000	0.990	1.6e-07	1.7e+00	2.2e+06	1.964845e+05	-5.408913e+02	0:0:00	chol 1✓
1	2	1.000	0.912	1.0e-07	2.4e-01	3.6e+05	1.371125e+05	-3.968175e+01	0:0:00	chol 1✓
1	3	0.641	1.000	5.3e-08	5.1e-02	1.3e+05	9.199312e+04	-1.180120e+02	0:0:00	chol 1✓
1	4	1.000	1.000	3.4e-09	2.5e-02	1.0e+04	7.250763e+03	-5.912525e+01	0:0:00	chol 1✓
1	5	0.800	0.738	1.8e-08	1.2e-02	2.5e+03	1.953646e+03	-4.130069e+01	0:0:00	chol 1✓
1	6	0.333	1.000	1.4e-08	2.3e-03	1.9e+03	1.818449e+03	-3.268322e+01	0:0:00	chol 1✓
1	7	1.000	0.901	2.9e-09	8.4e-04	1.2e+03	1.140538e+03	-1.872120e+01	0:0:00	chol 1✓
1	8	1.000	1.000	3.3e-10	2.1e-04	6.2e+02	6.052256e+02	-1.535446e+01	0:0:00	chol 1✓
1	9	1.000	0.996	1.5e-10	2.1e-05	2.8e+02	2.739482e+02	-6.533049e+00	0:0:00	chol 1✓
1	10	1.000	1.000	2.6e-12	2.1e-06	1.4e+02	1.337928e+02	-6.146407e+00	0:0:00	chol 1✓
1	11	1.000	1.000	2.2e-13	2.1e-07	7.2e+01	6.928447e+01	-2.225487e+00	0:0:00	chol 1✓
1	12	1.000	1.000	6.4e-13	2.1e-08	2.1e+01	1.901944e+01	-1.851164e+00	0:0:00	chol 1✓
1	13	1.000	1.000	1.4e-12	2.1e-09	1.0e+01	8.982911e+00	-1.366352e+00	0:0:00	chol 1✓
2	14	0.938	0.968	8.8e-12	2.7e-10	1.3e+00	8.137991e-02	-1.217076e+00	0:0:00	chol 2✓
2	15	0.840	0.914	7.2e-13	4.3e-11	5.3e-01	-6.312165e-01	-1.160364e+00	0:0:00	chol 2✓
2	16	1.000	1.000	1.3e-11	3.1e-12	2.7e-01	-8.790784e-01	-1.150833e+00	0:0:00	chol 2✓
2	17	0.949	0.961	2.7e-11	1.8e-12	5.2e-02	-1.088187e+00	-1.140042e+00	0:0:00	chol 2✓
2	18	1.000	1.000	1.3e-11	2.3e-12	1.7e-02	-1.121293e+00	-1.138519e+00	0:0:00	chol 2✓
3	19	0.977	0.912	4.4e-11	2.7e-12	3.0e-03	-1.134926e+00	-1.137909e+00	0:0:00	chol 3✓
3	20	0.575	0.835	8.3e-11	4.2e-12	1.7e-03	-1.136145e+00	-1.137869e+00	0:0:00	chol 4✓

```

4
21|0.768|1.000|1.9e-10|5.7e-12|7.5e-04|-1.137090e+00 -1.137842e+00| 0:0:00| chol 5✓
5
22|0.844|0.820|2.6e-10|9.5e-12|1.9e-04|-1.137648e+00 -1.137837e+00| 0:0:00| chol 25✓
27
23|1.000|1.000|6.5e-09|1.3e-11|5.8e-05|-1.137778e+00 -1.137835e+00| 0:0:00| chol 18✓
24
24|1.000|1.000|2.1e-09|1.9e-11|1.1e-05|-1.137822e+00 -1.137834e+00| 0:0:00| chol
linsysolve: Schur complement matrix not positive definite
switch to LU factor. lu 16 ^25
25|0.681|0.496|2.1e-08|3.8e-11|6.2e-06|-1.137826e+00 -1.137834e+00| 0:0:00| lu 30✓
30
26|0.375|0.272|4.9e-08|7.1e-11|5.4e-06|-1.137821e+00 -1.137834e+00| 0:0:00| lu 11✓
^15
27|0.006|0.011|6.0e-08|1.3e-10|5.4e-06|-1.137821e+00 -1.137834e+00| 0:0:00|
stop: progress is too slow
stop: progress is bad

```

```

-----
number of iterations    = 27
primal objective value = -1.13782575e+00
dual   objective value = -1.13783443e+00
gap := trace(XZ)       = 6.23e-06
relative gap           = 1.90e-06
actual relative gap    = 2.65e-06
rel. primal infeas     = 2.15e-08
rel. dual   infeas     = 3.83e-11
norm(X), norm(y), norm(Z) = 3.8e+01, 1.0e+02, 7.8e+01
norm(A), norm(b), norm(C) = 3.1e+03, 3.6e+03, 7.8e+01
Total CPU time (secs)   = 0.37
CPU time per iteration = 0.01
termination code        = -5
DIMACS errors: 5.3e-08  0.0e+00  5.6e-11  0.0e+00  2.7e-06  1.9e-06
-----

```

ans =

1.1378

Iteration 5 Total error is: 0.00433

```

num. of constraints = 85
dim. of socp var = 86, num. of socp blk = 1
dim. of linear var = 1000

```

\*\*\*\*\*

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|1.5e+02|1.7e+08| 1.906120e+05  0.000000e+00| 0:0:00| chol 1✓
1
1|1.000|0.990|1.3e-07|1.7e+00|2.2e+06| 1.912583e+05 -5.402164e+02| 0:0:00| chol 1✓
1

```



```
2|1.000|0.913|8.8e-08|2.4e-01|3.5e+05| 1.333300e+05 -3.969635e+01| 0:0:00| chol 1✓
1
3|0.650|1.000|4.5e-08|5.1e-02|1.2e+05| 8.864614e+04 -1.147423e+02| 0:0:00| chol 1✓
1
4|1.000|1.000|3.5e-09|2.5e-02|1.0e+04| 7.188929e+03 -5.802242e+01| 0:0:00| chol 1✓
1
5|0.801|0.740|1.8e-08|1.2e-02|2.5e+03| 1.924573e+03 -4.048989e+01| 0:0:00| chol 1✓
1
6|0.337|1.000|1.4e-08|2.3e-03|1.9e+03| 1.788827e+03 -3.216791e+01| 0:0:00| chol 1✓
1
7|1.000|0.906|3.0e-09|8.4e-04|1.2e+03| 1.118639e+03 -1.863264e+01| 0:0:00| chol 1✓
1
8|1.000|1.000|3.4e-10|2.1e-04|6.1e+02| 5.883090e+02 -1.532030e+01| 0:0:00| chol 1✓
1
9|1.000|0.994|1.5e-10|2.2e-05|2.7e+02| 2.659532e+02 -6.659438e+00| 0:0:00| chol 1✓
1
10|1.000|1.000|8.3e-13|2.1e-06|1.4e+02| 1.315902e+02 -6.166083e+00| 0:0:00| chol 1✓
1
11|1.000|1.000|2.9e-13|2.1e-07|7.2e+01| 6.988496e+01 -2.158128e+00| 0:0:00| chol 1✓
1
12|1.000|1.000|9.6e-13|2.1e-08|2.3e+01| 2.090962e+01 -1.702619e+00| 0:0:00| chol 1✓
1
13|1.000|1.000|5.7e-13|2.1e-09|1.1e+01| 9.705901e+00 -1.117107e+00| 0:0:00| chol 1✓
1
14|0.939|0.993|2.4e-12|2.2e-10|1.7e+00| 7.036785e-01 -9.490434e-01| 0:0:00| chol 1✓
2
15|0.952|1.000|7.1e-13|2.2e-11|6.3e-01|-2.679341e-01 -8.970469e-01| 0:0:00| chol 2✓
2
16|1.000|1.000|3.2e-12|3.1e-12|3.2e-01|-5.656454e-01 -8.817854e-01| 0:0:00| chol 2✓
2
17|0.932|0.953|4.9e-12|1.3e-12|6.0e-02|-8.094189e-01 -8.697848e-01| 0:0:00| chol 2✓
2
18|1.000|1.000|1.8e-11|1.0e-12|1.9e-02|-8.495030e-01 -8.681622e-01| 0:0:00| chol 2✓
2
19|1.000|0.880|2.3e-11|1.6e-12|2.9e-03|-8.646194e-01 -8.674978e-01| 0:0:00| chol 3✓
3
20|0.679|0.893|3.0e-11|2.4e-12|1.1e-03|-8.663076e-01 -8.674373e-01| 0:0:00| chol 4✓
5
21|0.777|0.796|4.2e-10|3.9e-12|4.5e-04|-8.669699e-01 -8.674162e-01| 0:0:00| chol 5✓
5
22|0.754|0.910|2.2e-09|5.4e-12|2.3e-04|-8.671852e-01 -8.674122e-01| 0:0:00| chol 11✓
7
23|0.991|1.000|2.1e-09|7.6e-12|8.4e-05|-8.673254e-01 -8.674097e-01| 0:0:00| chol 9✓
13
24|0.994|0.995|2.4e-10|1.1e-11|1.6e-05|-8.673933e-01 -8.674090e-01| 0:0:00| chol
linsysolve: Schur complement matrix not positive definite
switch to LU factor. lu 30 30
25|1.000|0.985|1.9e-08|1.7e-11|4.2e-06|-8.674039e-01 -8.674088e-01| 0:0:00| lu 30✓
30
26|1.000|0.889|1.5e-08|2.8e-11|9.3e-07|-8.674102e-01 -8.674088e-01| 0:0:00| lu 30✓
30
27|1.000|0.534|5.9e-09|5.1e-11|6.1e-07|-8.674099e-01 -8.674088e-01| 0:0:00| lu 18✓
30
28|0.245|0.255|1.9e-08|9.6e-11|5.2e-07|-8.674101e-01 -8.674088e-01| 0:0:01| lu 30✓
```

```

^19
29|0.351|0.266|8.6e-09|1.6e-10|4.8e-07|-8.674091e-01 -8.674088e-01| 0:0:01| lu 11✓
30
30|0.004|0.010|1.2e-08|2.9e-10|4.8e-07|-8.674101e-01 -8.674088e-01| 0:0:01|
  stop: progress is too slow
  stop: progress is bad
-----
number of iterations    = 30
primal objective value = -8.67409094e-01
dual   objective value = -8.67408794e-01
gap := trace(XZ)       = 4.77e-07
relative gap           = 1.74e-07
actual relative gap    = -1.10e-07
rel. primal infeas     = 8.61e-09
rel. dual   infeas     = 1.57e-10
norm(X), norm(y), norm(Z) = 3.8e+01, 1.0e+02, 7.8e+01
norm(A), norm(b), norm(C) = 3.0e+03, 3.5e+03, 7.8e+01
Total CPU time (secs)   = 0.57
CPU time per iteration = 0.02
termination code        = -5
DIMACS errors: 2.1e-08  0.0e+00  2.3e-10  0.0e+00  -1.1e-07  1.7e-07
-----

```

ans =

0.8674

Iteration 6 Total error is: 0.0037721

```

num. of constraints = 85
dim. of socp var = 86, num. of socp blk = 1
dim. of linear var = 1000
*****
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|1.5e+02|1.7e+08| 1.873788e+05  0.000000e+00| 0:0:00| chol 1✓
1
1|1.000|0.990|1.3e-07|1.7e+00|2.1e+06| 1.880248e+05 -5.376585e+02| 0:0:00| chol 1✓
1
2|1.000|0.914|9.2e-08|2.4e-01|3.4e+05| 1.309894e+05 -3.941445e+01| 0:0:00| chol 1✓
1
3|0.655|1.000|4.6e-08|5.1e-02|1.2e+05| 8.649882e+04 -1.122713e+02| 0:0:00| chol 1✓
1
4|1.000|1.000|3.5e-09|2.5e-02|1.0e+04| 7.245445e+03 -5.706094e+01| 0:0:00| chol 1✓
1
5|0.805|0.746|1.8e-08|1.2e-02|2.4e+03| 1.878498e+03 -3.983723e+01| 0:0:00| chol 1✓
1
6|0.332|1.000|1.4e-08|2.3e-03|1.9e+03| 1.748730e+03 -3.197248e+01| 0:0:00| chol 1✓
1
7|1.000|0.897|3.0e-09|8.5e-04|1.1e+03| 1.093489e+03 -1.861546e+01| 0:0:00| chol 1✓

```

```

1
8|1.000|1.000|3.6e-10|2.1e-04|5.9e+02| 5.733634e+02 -1.514850e+01| 0:0:00| chol 1✓
1
9|1.000|0.995|1.5e-10|2.1e-05|2.6e+02| 2.559143e+02 -6.759906e+00| 0:0:00| chol 1✓
1
10|1.000|1.000|6.5e-12|2.1e-06|1.4e+02| 1.291390e+02 -6.182975e+00| 0:0:00| chol 1✓
1
11|1.000|1.000|2.2e-13|2.1e-07|7.1e+01| 6.923157e+01 -2.146144e+00| 0:0:00| chol 1✓
1
12|1.000|1.000|4.9e-13|2.1e-08|2.3e+01| 2.178823e+01 -1.625259e+00| 0:0:00| chol 1✓
1
13|1.000|1.000|5.0e-13|2.1e-09|1.1e+01| 1.015584e+01 -9.612687e-01| 0:0:00| chol 1✓
1
14|0.942|1.000|9.0e-13|2.1e-10|2.0e+00| 1.225459e+00 -7.639719e-01| 0:0:00| chol 2✓
2
15|1.000|1.000|7.7e-13|2.2e-11|7.9e-01| 7.543723e-02 -7.117555e-01| 0:0:00| chol 2✓
2
16|0.985|0.971|2.1e-12|3.6e-12|1.8e-01|-5.034503e-01 -6.835722e-01| 0:0:00| chol 2✓
2
17|1.000|1.000|7.3e-12|1.2e-12|7.8e-02|-5.988774e-01 -6.770243e-01| 0:0:00| chol 2✓
2
18|1.000|0.962|3.6e-11|1.5e-12|1.3e-02|-6.606795e-01 -6.734305e-01| 0:0:00| chol 2✓
3
19|0.601|0.933|3.3e-11|2.3e-12|7.0e-03|-6.661814e-01 -6.731414e-01| 0:0:00| chol 3✓
3
20|0.899|0.996|7.0e-11|3.3e-12|2.1e-03|-6.708844e-01 -6.730134e-01| 0:0:00| chol 4✓
4
21|0.978|1.000|1.8e-10|4.9e-12|6.2e-04|-6.723659e-01 -6.729891e-01| 0:0:00| chol 5✓
6
22|1.000|1.000|4.3e-10|7.4e-12|1.6e-04|-6.728128e-01 -6.729774e-01| 0:0:00| chol 7✓
5
23|1.000|0.947|2.2e-10|1.1e-11|3.6e-05|-6.729392e-01 -6.729755e-01| 0:0:00| chol
warning: symqmr failed: 0.3
switch to LU factor. lu 30 ^ 7
24|1.000|1.000|1.4e-09|1.7e-11|3.2e-06|-6.729720e-01 -6.729750e-01| 0:0:00| lu 30✓
30
25|0.892|0.752|2.1e-09|2.9e-11|4.1e-07|-6.729761e-01 -6.729750e-01| 0:0:00| lu 30✓
30
26|1.000|0.975|4.1e-09|3.8e-11|2.5e-07|-6.729750e-01 -6.729750e-01| 0:0:00| lu 12✓
^13
27|0.241|0.412|2.8e-09|7.8e-11|2.0e-07|-6.729756e-01 -6.729750e-01| 0:0:00|
stop: max(relative gap, infeasibilities) < 1.00e-07
-----
number of iterations = 27
primal objective value = -6.72975012e-01
dual objective value = -6.72974976e-01
gap := trace(XZ) = 2.53e-07
relative gap = 1.08e-07
actual relative gap = -1.56e-08
rel. primal infeas = 4.10e-09
rel. dual infeas = 3.80e-11
norm(X), norm(y), norm(Z) = 3.8e+01, 1.0e+02, 7.8e+01
norm(A), norm(b), norm(C) = 3.0e+03, 3.4e+03, 7.8e+01
Total CPU time (secs) = 0.43

```

```

CPU time per iteration = 0.02
termination code       = 0
DIMACS errors: 1.0e-08  0.0e+00  5.5e-11  0.0e+00  -1.6e-08  1.1e-07
-----

```

```
ans =
```

```
0.6730
```

```
Iteration 7 Total error is: 0.0033116
```

```

num. of constraints = 85
dim. of socp var   = 86,   num. of socp blk = 1
dim. of linear var = 1000

```

```
*****
```

```
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|1.5e+02|1.7e+08| 1.869040e+05  0.000000e+00| 0:0:00| chol 1✓
1
1|1.000|0.990|1.4e-07|1.7e+00|2.1e+06| 1.875636e+05 -5.335600e+02| 0:0:00| chol 1✓
1
2|1.000|0.914|9.3e-08|2.4e-01|3.4e+05| 1.306447e+05 -3.916110e+01| 0:0:00| chol 1✓
1
3|0.657|1.000|4.7e-08|5.1e-02|1.2e+05| 8.604776e+04 -1.113353e+02| 0:0:00| chol 1✓
1
4|1.000|1.000|3.5e-09|2.5e-02|1.1e+04| 7.467869e+03 -5.665520e+01| 0:0:00| chol 1✓
1
5|0.814|0.758|1.8e-08|1.2e-02|2.4e+03| 1.806778e+03 -3.971352e+01| 0:0:00| chol 1✓
1
6|0.315|1.000|1.4e-08|2.3e-03|1.8e+03| 1.691375e+03 -3.242384e+01| 0:0:00| chol 1✓
1
7|1.000|0.869|3.2e-09|8.9e-04|1.1e+03| 1.060983e+03 -1.880028e+01| 0:0:00| chol 1✓
1
8|1.000|1.000|4.0e-10|2.1e-04|5.8e+02| 5.624218e+02 -1.482537e+01| 0:0:00| chol 1✓
1
9|1.000|1.000|1.5e-10|2.1e-05|2.5e+02| 2.440342e+02 -6.836602e+00| 0:0:00| chol 1✓
1
10|1.000|1.000|1.0e-11|2.1e-06|1.3e+02| 1.266192e+02 -5.989992e+00| 0:0:00| chol 1✓
1
11|1.000|1.000|1.6e-13|2.1e-07|6.6e+01| 6.359785e+01 -2.063623e+00| 0:0:00| chol 1✓
1
12|1.000|1.000|7.2e-13|2.1e-08|2.2e+01| 2.066404e+01 -1.611631e+00| 0:0:00| chol 1✓
1
13|1.000|1.000|4.2e-13|2.1e-09|1.1e+01| 1.017465e+01 -9.121913e-01| 0:0:00| chol 1✓
1
14|0.944|1.000|4.3e-13|2.1e-10|2.1e+00| 1.369644e+00 -6.875788e-01| 0:0:00| chol 1✓
2
15|1.000|1.000|5.5e-13|2.2e-11|8.5e-01| 2.179544e-01 -6.340978e-01| 0:0:00| chol 2✓
1
16|1.000|1.000|3.8e-12|3.1e-12|1.9e-01|-4.146535e-01 -6.034107e-01| 0:0:00| chol 2✓

```

```

2
17|0.904|1.000|1.4e-11|1.2e-12|8.8e-02|-5.092669e-01 -5.970467e-01| 0:0:00| chol 2✓
2
18|1.000|1.000|2.9e-11|1.5e-12|2.2e-02|-5.713661e-01 -5.938065e-01| 0:0:00| chol 2✓
2
19|1.000|0.956|1.6e-11|2.3e-12|4.6e-03|-5.882612e-01 -5.928506e-01| 0:0:00| chol 2✓
3
20|0.491|0.927|1.8e-11|3.4e-12|2.5e-03|-5.902035e-01 -5.927406e-01| 0:0:00| chol 3✓
3
21|0.777|0.929|6.8e-11|3.8e-12|8.9e-04|-5.918271e-01 -5.927124e-01| 0:0:00| chol 3✓
4
22|0.901|1.000|1.9e-10|5.3e-12|2.2e-04|-5.924928e-01 -5.927084e-01| 0:0:00| chol 7✓
8
23|0.963|0.979|2.5e-09|8.0e-12|4.9e-05|-5.926557e-01 -5.927052e-01| 0:0:00| chol
linsysolve: Schur complement matrix not positive definite
switch to LU factor. lu 30 ^11
24|1.000|0.908|1.6e-08|1.3e-11|4.0e-05|-5.926702e-01 -5.927052e-01| 0:0:00| lu 6✓
2
25|0.743|1.000|4.0e-09|1.8e-11|1.9e-05|-5.926874e-01 -5.927049e-01| 0:0:00| lu 30✓
2
26|0.979|0.800|1.1e-08|3.0e-11|1.1e-05|-5.926917e-01 -5.927047e-01| 0:0:00| lu 30 ^✓
7
27|0.999|1.000|6.7e-09|4.0e-11|3.7e-06|-5.927017e-01 -5.927046e-01| 0:0:00| lu 28✓
^21
28|1.000|0.767|6.6e-09|6.9e-11|1.3e-06|-5.927034e-01 -5.927046e-01| 0:0:00| lu 30✓
30
29|1.000|0.975|1.1e-08|9.2e-11|7.7e-07|-5.927061e-01 -5.927046e-01| 0:0:00| lu 30 ^✓
9
30|0.491|0.517|9.8e-09|1.8e-10|5.0e-07|-5.927055e-01 -5.927046e-01| 0:0:00| lu 15✓
^30
31|1.000|1.000|1.4e-08|2.0e-10|4.3e-07|-5.927041e-01 -5.927046e-01| 0:0:00| lu 19 ^✓
6
32|0.271|0.287|1.3e-08|4.5e-10|3.5e-07|-5.927035e-01 -5.927046e-01| 0:0:00|
stop: progress is too slow
stop: progress is bad*

```

```

-----
number of iterations    = 32
primal objective value  = -5.92703525e-01
dual   objective value  = -5.92704606e-01
gap := trace(XZ)        = 3.48e-07
relative gap           = 1.59e-07
actual relative gap     = 4.95e-07
rel. primal infeas      = 1.35e-08
rel. dual   infeas      = 4.49e-10
norm(X), norm(y), norm(Z) = 3.8e+01, 1.0e+02, 7.7e+01
norm(A), norm(b), norm(C) = 3.0e+03, 3.4e+03, 7.8e+01
Total CPU time (secs)   = 0.46
CPU time per iteration  = 0.01
termination code        = -5
DIMACS errors: 3.3e-08  0.0e+00  6.5e-10  0.0e+00  4.9e-07  1.6e-07
-----

```

ans =

0.5927

Iteration 8 Total error is: 0.0031015

The total representation error of the testing signals is: 0.0298

>>