

Test results for selected optimization problems

1 Performance plots

1.1 For all problems

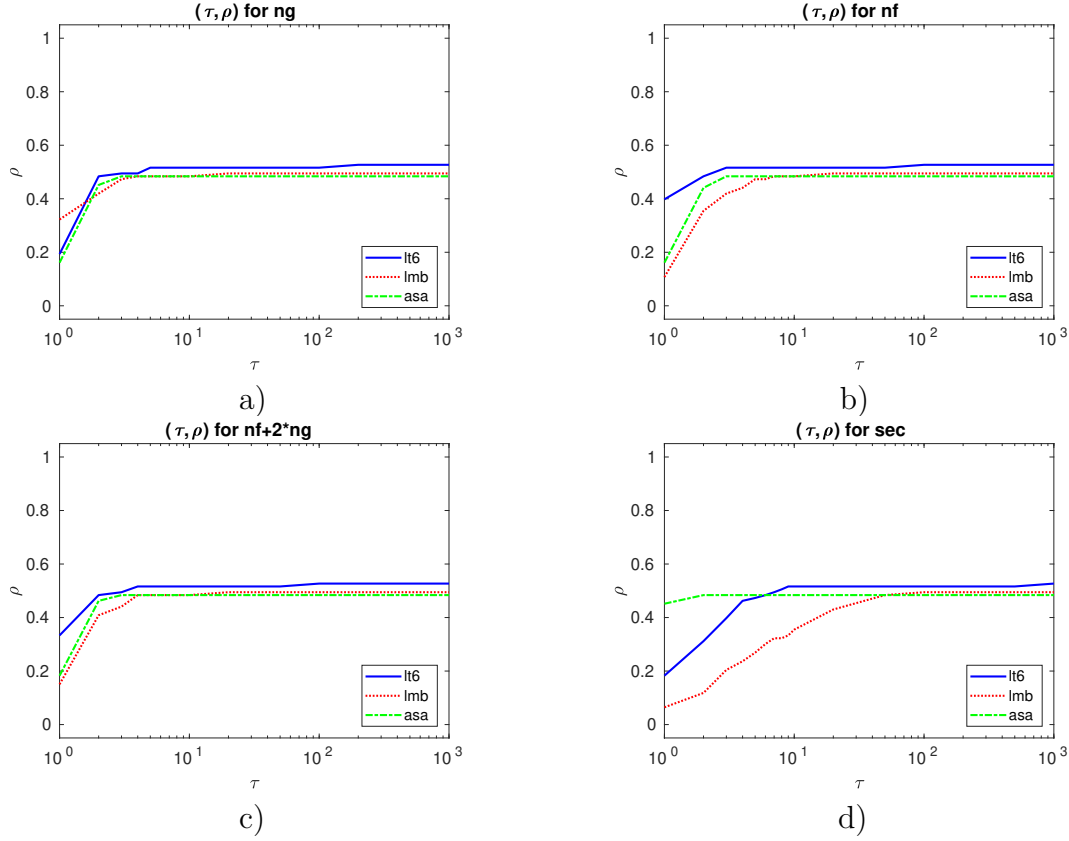


Figure 1: (a)-(e): Performance plots for $\text{ng}/(\text{best ng})$, $\text{nf}/(\text{best nf})$, $\text{nf2g}/(\text{best nf2g})$ and $\text{msec}/(\text{best msec})$, respectively. ρ designates the percentage of problems solved within a factor τ of the best solver. Problem solved by no solver are ignored.

1.2 For unconstrained problems

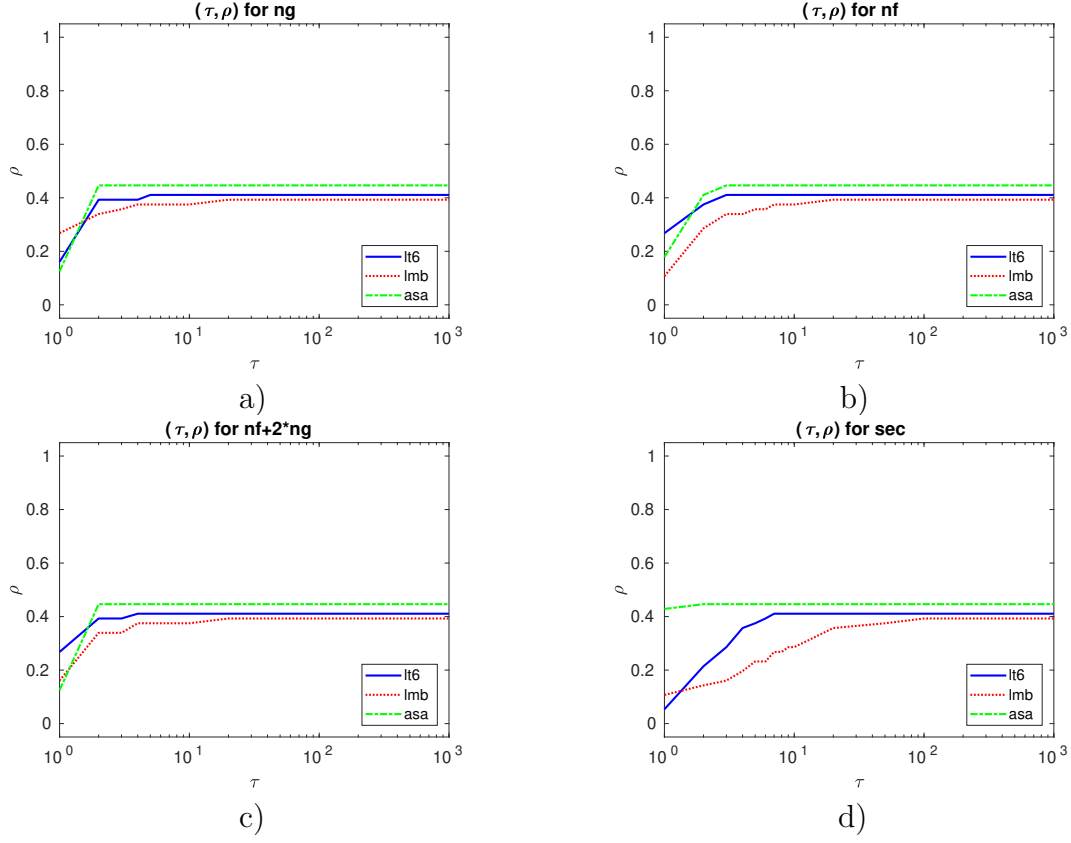


Figure 2: (a)-(e): Performance plots for $\text{ng}/(\text{best ng})$, $\text{nf}/(\text{best nf})$, $\text{nf2g}/(\text{best nf2g})$ and $\text{msec}/(\text{best msec})$, respectively. ρ designates the percentage of problems solved within a factor τ of the best solver. Problem solved by no solver are ignored.

1.3 For bound constrained problems

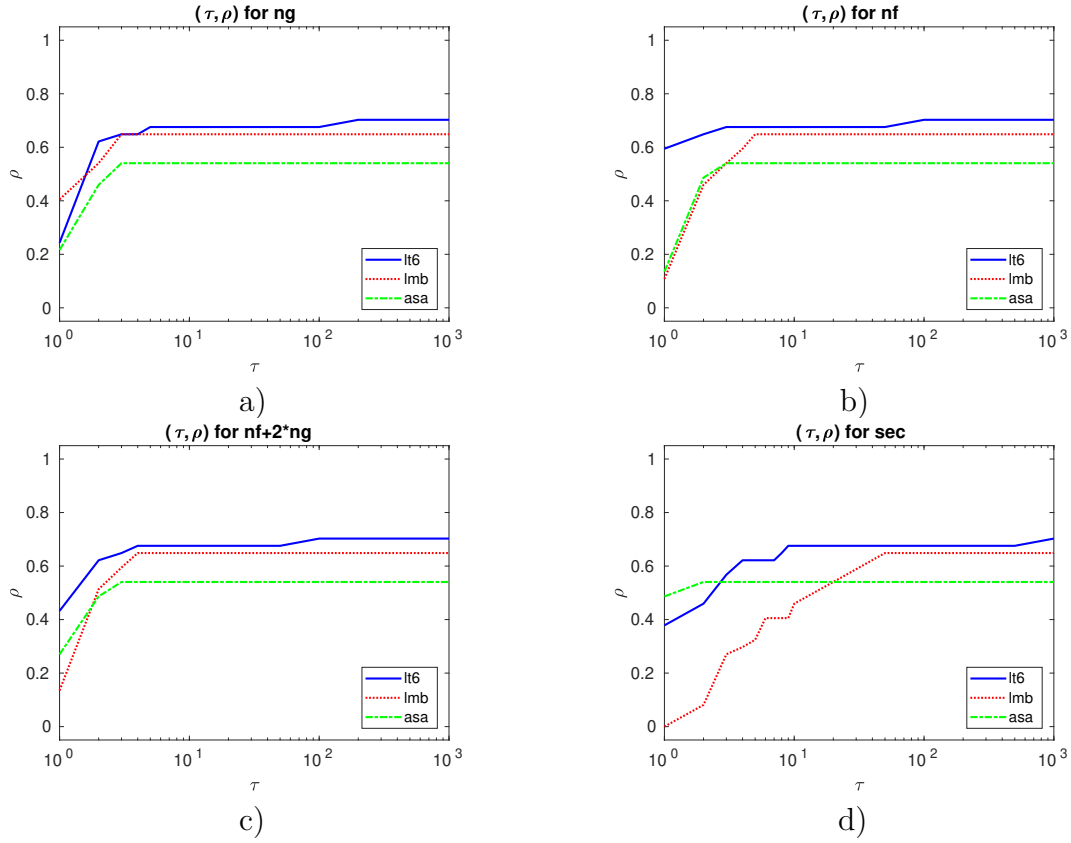


Figure 3: (a)-(e): Performance plots for $\text{ng}/(\text{best ng})$, $\text{nf}/(\text{best nf})$, $\text{nf2g}/(\text{best nf2g})$ and $\text{msec}/(\text{best msec})$, respectively. ρ designates the percentage of problems solved within a factor τ of the best solver. Problem solved by no solver are ignored.

2 Choices

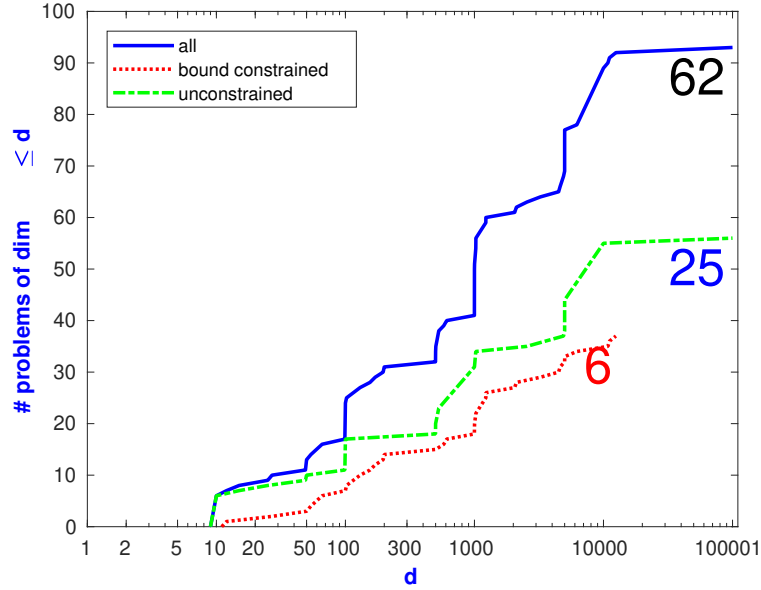


Figure 4: The number of problems with at most d variables solved by at least one solver.

2.1 Solvers compared

lt6, lmbopt3 and asa

2.2 Solver type, stopping tests and resdir

`nf`, `ng`, `sec`, `nact` and `resdir` denote the number of function evaluations, the number of gradients evaluations, the time in seconds, the number of active variables, and directory containing result files, respectively.

- `fist-order`
- gradient accuracy: $\|g(x_*)\|_\infty \leq 1e-06$
- $nf + 2 * ng \leq 50 * n + 200000$
- $sec \leq 3600$
- `resdir`: `resG1 - 6resN - 50 * n + 200000 - resS3600E`

2.3 Parameters used for problem selection

`name`, `dim` and `con` denote the name, the dimension, and the type of constraints of test problems, respectively.

- Selected range of `name`: A-S
- Selected range of `dim`: [1,100001]
- Selected kind of `con`: unconstrained and bound constrained
- Sorted by `dim`, `name` and `nact` (DNE)
- Sorted in increasing order

3 Summarizing tables

For a given collection S of solvers, the strength of a solver $so \in S$ – relative to an ideal solver that matches on each problem the best solver – is measured, for any given cost measure c_s by the number, q_{so} defined by

$$q_{so} := \begin{cases} \frac{\min_{s \in S} c_s}{c_{so}}, & \text{if } so \text{ solved by the problem,} \\ 0, & \text{otherwise,} \end{cases}$$

called the **efficiency** of the solver so with respect to this cost measure. In the tables, efficiencies are given in percent. Larger efficiencies in the table imply a better average behavior; a zero efficiency indicates failure. All values are rounded (towards zero) to integers. Mean efficiencies are taken over the 62 problems tried by all solvers and solved by at least one of them, from a total of 93 problems. In the following tables, #100 and !100 count the number of times we have for nf2g efficiency 100 % or unique efficiency 100 % . T_{mean} is defined by

$$T_{mean} := \frac{\sum \text{ solved}}{\# \text{ solved}} \quad (\text{in msec}).$$

In tables not recording efficiencies, a sign

- n indicates that `nf2g` ≥ 5200050 was reached.
- t indicates that `sec` ≥ 3600 was reached.
- f indicates that the `algorithm` failed for other reasons.

In times, the (for some problems significant) setup time for CUTEST is not included. Although running times are reported the comparison of times is not very reliable for several reasons:

- (i) The times were obtained under different conditions (solver source code Fortran, C and Matlab).
- (ii) In unsuccessful runs, the actual running time depends a lot on when and why the solver was stopped.
- (iii) Function and gradient evaluation includes times for computing various statistics and the interface to CUTEST; cf. Figures 5.

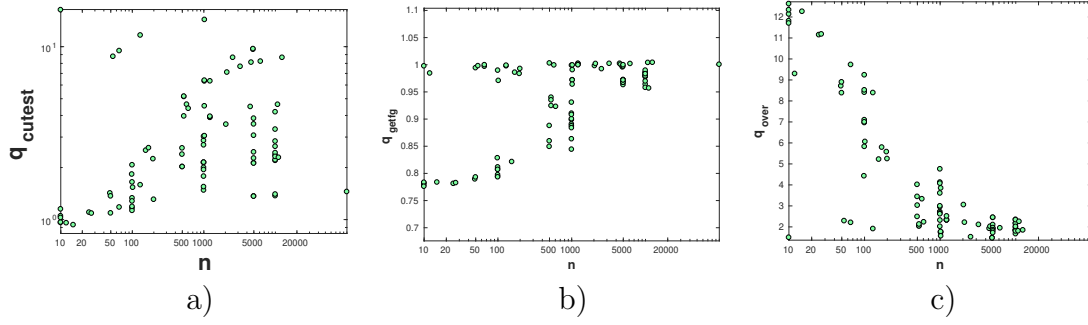


Figure 5: Comparison of $q_{cutest} := \frac{t_g(cutest)}{t_f(cutest)}$, $q_{getfg} := \frac{t_g(getfg)}{t_f(getfg)}$ and $q_{over} := \frac{t_{f2g}(getfg)}{t_{f2g}(cutest)}$ versus dimensions, respectively, where t_f and t_g are considered the time to compute f and g by *cutest* or *getfg* and $t_{f2g} := t_f + 2t_g$.

3.1 Summary for all problems

stopping test: $\ g\ _\infty \leq 1e-06$, $sec \leq 3600$, $nf + 2 * ng \leq 50 * n + 200000$												
62 of 93 problems solved									mean efficiency in %			
dim $\in[1,100001]$						# of anomalies			for cost measure			
solver		solved	#100	!100	T_{mean}	#n	#t	#f	nf2g	ng	nf	msec
<i>LMBFG-EIG-MS</i>	<i>lt6</i>	49	31	31	152667	28	6	10	47	42	48	33
<i>LMBOPT</i>	<i>lmb</i>	46	15	14	179457	35	12	0	38	42	30	17
<i>ASACG</i>	<i>asa</i>	45	17	16	120625	32	0	16	40	40	36	47

3.2 Classified by constraints

stopping test: $\ g\ _\infty \leq 1e-06$, $sec \leq 3600$, $nf + 2 * ng \leq 50 * n + 200000$												
31 of 56 problems without bounds solved									mean efficiency in %			
dim $\in[1,100001]$						# of anomalies			for cost measure			
solver		solved	#100	!100	T_{mean}	#n	#t	#f	nf2g	ng	nf	msec
<i>ASACG</i>	<i>asa</i>	25	7	7	182304	23	0	8	37	35	34	43
<i>LMBFG-EIG-MS</i>	<i>lt6</i>	23	15	15	265649	21	6	6	37	34	38	21
<i>LMBOPT</i>	<i>lmb</i>	22	9	9	208808	23	11	0	31	34	25	16

stopping test: $\ g\ _\infty \leq 1e-06$, $sec \leq 3600$, $nf + 2 * ng \leq 50 * n + 200000$												
31 of 37 problems with bounds solved									mean efficiency in %			
dim $\in[1,100001]$						# of anomalies			for cost measure			
solver		solved	#100	!100	T_{mean}	#n	#t	#f	nf2g	ng	nf	msec
<i>LMBFG-EIG-MS</i>	<i>lt6</i>	26	16	16	52721	7	0	4	61	55	65	50
<i>LMBOPT</i>	<i>lmb</i>	24	6	5	152552	12	1	0	48	55	38	17
<i>ASACG</i>	<i>asa</i>	20	10	9	43528	9	0	8	44	43	40	53

3.3 Classified by time

stopping test: $\ g\ _{\infty} \leq 1e-06$, $sec \leq 3600$, $nf + 2 * ng \leq 50 * n + 200000$												
28 of 28 problems solved								mean efficiency in %				
dim $\in[1,100001]$, best time ≤ 1 sec					# of anomalies			for cost measure				
solver		solved	#100	!100	T_{mean}	#n	#t	#f	nf2g	ng	nf	msec
<i>LMBFG-EIG-MS</i>	<i>lt6</i>	23	17	17	1148	2	0	3	73	67	75	61
<i>LMBOPT</i>	<i>lmb</i>	22	3	3	1641	5	1	0	55	64	42	21
<i>ASACG</i>	<i>asa</i>	20	8	8	262	5	0	3	57	60	49	69

stopping test: $\ g\ _{\infty} \leq 1e-06$, $sec \leq 3600$, $nf + 2 * ng \leq 50 * n + 200000$												
18 of 18 problems solved								mean efficiency in %				
dim $\in[1,100001]$, best time > 1 sec					# of anomalies			for cost measure				
solver		solved	#100	!100	T_{mean}	#n	#t	#f	nf2g	ng	nf	msec
<i>LMBFG-EIG-MS</i>	<i>lt6</i>	16	8	8	14201	2	0	0	76	66	82	43
<i>LMBOPT</i>	<i>lmb</i>	14	5	4	33534	4	0	0	67	72	51	22
<i>ASACG</i>	<i>asa</i>	13	6	5	3758	1	0	4	63	62	54	72

3.4 Failure analysis

31 test problems unsolved by all solvers used for dim $\in [1,100001]$			
OSCIPATH:10	SCOND1LS	ANTWERP	HYDC20LS
FLETCHBV:100	NONMSQRT:100	SBRYBND:100	SCOSINE:100
SCURLY10:100	PENALTY2:500	SCOND1LS:502	NONMSQRT:529
FLETCHBV:1000	PENALTY2:1000	SCOSINE	SCURLY10
SSCOSINE	SCOND1LS:1002	NONMSQRT:1024	FLETCHBV3:5000
FLETCHBV:5000	SBRYBND:5000	SCOSINE:5000	SCOND1LS:5002
BRATU1D:5003	FLETCHBV3:10000	FLETCHBV:10000	NONCVXUN:10000
SCOSINE:10000	SCURLY10:10000	SSCOSINE:100000	

solver	dim $\in[1,100001]$	problem	error message	# same error
lt6	10	OSCIGRAD	nf2gmax reached	28
	50	HS110	line search failed	6
	500	PENALTY2	TR radius too small	4
	10000	FLETCHBV3	secmax reached	6
lmb	10	OSCIGRAD	nf2gmax reached	35
	10000	CURLY10	secmax reached	12
Continued on next page				

asa	10	OSCIPATH	nf2gmax reached	32
	10	STRATEC	cg: too many secant iterates	10
	10	SCOSINE	cg: Wolfe conditions never satisfied	3
	27	ANTWERP	cg: function nan or inf	1
	54	RAYBENDS	unrecognized exit flag	13
	100	FLETCHBV	cg: no cost or gradient improvement	1
	6218	GRIDGENA	cbb: line search failed	1

kind of anomalies	32 test problems unsolved by lt6 for dim $\in [1,100001]$		
n	OSCIGRAD:10 SCOSINE:10 NONMSQRT:49 FLETCHBV:100 SCURLY10:100 NONMSQRT:529 FLETCHBV:1000 SCOND1LS:1002 SBRYBND:5000 SCURLY10:10000	OSCIPATH:10 SCOND1LS SBRYBND:50 NONMSQRT:100 SBRYBND:500 QR3DLS:610 SBRYBND NONMSQRT:1024 SCOSINE:5000	SBRYBND:10 ANTWERP HYDC20LS SBRYBND:100 SCOND1LS:502 CHENHARK SCURLY10 FLETCHBV3:5000 SCOND1LS:5002
t	FLETCHBV3:10000 SCOSINE:10000	FLETCHBV:10000 SSCOSINE:10000	NONCVXUN:10000 SSCOSINE:100000
f	HS110:50 HS110:200 SCOSINE BRATU1D:5003	HS110:100 PENALTY2:500 SSCOSINE	SCOSINE:100 PENALTY2:1000 FLETCHBV:5000

kind of anomalies	32 test problems unsolved by lmbpt3 for dim $\in [1,100001]$		
n	OSCIGRAD:10 SCOND1LS	OSCIPATH:10 ANTWERP	SCURLY10:10 HYDC20LS
	Continued on next page		

	FLETCHBV:100	NONMSQRT:100	SBRYBND:100
	SCOSINE:100	SCURLY10:100	SCOND1LS:102
	PENALTY2:500	SCOND1LS:502	NONMSQRT:529
	CURLY20	FLETCHBV:1000	PENALTY2:1000
	SCOSINE	SCURLY10	SSCOSINE
	SCOND1LS:1002	NONMSQRT:1024	DRCV1LQ:1225
	DRCV2LQ:1225	DRCV3LQ:1225	DRCV3LQ:4489
	FLETCHBV3:5000	FLETCHBV:5000	SBRYBND:5000
	SCOSINE:5000	SSCOSINE:5000	SCOND1LS:5002
	BRATU1D:5003	GRIDGENA:6218	
t	CURLY10:10000	CURLY20:10000	CURLY30:10000
	FLETCHBV3:10000	FLETCHBV:10000	NONCVXUN:10000
	SCOSINE:10000	SCURLY10:10000	SPARSINE:10000
	SSCOSINE:10000	DRCV3LQ:10816	SSCOSINE:100000

kind of anomalies	32 test problems unsolved by asa for $\dim \in [1,100001]$		
n	OSCIPATH:10	NONMSQRT:49	SBRYBND:50
	HYDC20LS	NONMSQRT:100	SBRYBND:100
	SCURLY10:100	SCOND1LS:102	SBRYBND:500
	SCOND1LS:502	NONMSQRT:529	FLETCHBV:1000
	SBRYBND	SCOSINE	SCURLY10
	SSCOSINE	SCOND1LS:1002	NONMSQRT:1024
	DRCV1LQ:1225	DRCV2LQ:1225	DRCV3LQ:1225
	DRCV3LQ:4489	FLETCHBV3:5000	FLETCHBV:5000
	SBRYBND:5000	SCOSINE:5000	SCOND1LS:5002
	FLETCHBV3:10000	FLETCHBV:10000	NONCVXUN:10000
	SCURLY10:10000	DRCV3LQ:10816	
f	STRATEC	SCOSINE:10	SCOND1LS
	ANTWERP	RAYBENDS	RAYBENDL:66
	RAYBENDS:66	FLETCHBV:100	SCOSINE:100
	RAYBENDL:130	RAYBENDS:130	GRIDGENA:170
	DRCV1LQ	PENALTY2:500	GRIDGENA
	Continued on next page		

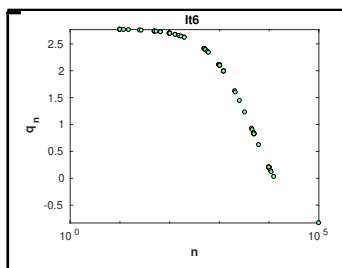
LINVERSE:999	PENALTY2:1000	RAYBENDL:1026
RAYBENDS:1026	GRIDGENA:1226	RAYBENDL:2050
GRIDGENA:2114	GRIDGENA:3242	GRIDGENA:4610
BRATU1D:5003	GRIDGENA:6218	SCOSINE:10000
GRIDGENA:12482	SSCOSINE:100000	

3.5 Timing analysis

$x_i \geq 0$, for $i = 1, 2, 3, 4$, are obtained by at least squares fit of

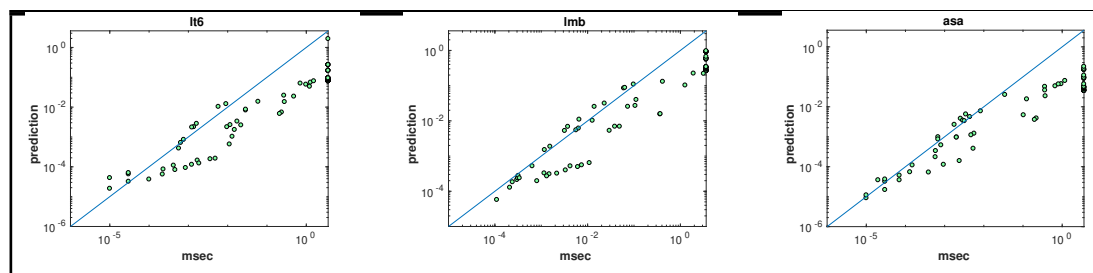
$$msec = (x_1 + x_2 * dim) * nf + (x_3 + x_4 * dim) * ng.$$

Comparison of $q_n := \frac{x_3 + dim * x_4}{x_1 + dim * x_2}$ versus dimension:



solver	x_1	x_2	x_3	x_4
lt6	0	0	7.4754e-07	0
lmb	0	0	2.6154e-06	0
asa	7.1643e-08	1.5305e-11	2.7036e-07	0

Comparison of predicted time versus actual time used:



3.6 nf2g efficiency for accuracy 1e-06

problem	dim	nact	nf+2*ng best	nf+2*ng efficiency for solver		
				lt6	lmbopt3	asa
OSCIGRAD:10	10	—	24037	—	—	100
STRATEC	10	—	797	33	100	—
SBRYBND:10	10	—	1052	—	6	100
SCOSINE:10	10	—	351	—	100	—
SCURLY10:10	10	—	80	54	—	100
OSCIGRAD:15	15	—	172	100	61	52
OSCIGRAD:25	25	—	231	100	63	77
NONMSQRT:49	49	—	140037	—	100	—
HS110:50	50	50	4	—	44	100
SBRYBND:50	50	—	48736	—	100	—
RAYBENDS	54	4	2301	69	100	45
RAYBENDL:66	66	4	9416	83	90	100
RAYBENDS:66	66	4	2610	100	91	80
HS110:100	100	100	4	—	33	100
OSCIGRAD:100	100	—	255	100	59	71
SCOND1LS:102	102	2	8852	100	—	—
RAYBENDL:130	130	4	38669	92	100	100
RAYBENDS:130	130	4	796	47	100	40
QR3DLS	155	—	16821	32	100	50
GRIDGENA:170	170	94	76	100	84	73
DRCV1LQ	196	96	7901	93	99	100
HS110:200	200	200	4	—	27	100
SPMSRTLS:499	499	—	339	100	93	71

problem	dim	nact	nf+2*ng best	nf+2*ng efficiency for solver		
				lt6	lmbopt3	asa
SBRYBND:500	500	—	134247	—	100	—
MSQRTALS:529	529	—	8966	87	96	100
MSQRTBLS:529	529	—	8366	96	100	94
GRIDGENA	578	188	155	100	78	—
QR3DLS:610	610	—	167135	—	100	76
LINVERSE:999	999	500	149	1	29	100
CURLY20	1000	—	31723	100	—	82
CHENHARK	1000	300	44995	—	74	100
SBRYBND	1000	—	199838	—	100	—
SPMSRTLS:1000	1000	—	453	100	90	76
MSQRTALS:1024	1024	—	10086	100	95	87
MSQRTBLS:1024	1024	—	7074	100	87	71
RAYBENDL:1026	1026	4	30021	89	77	100
RAYBENDS:1026	1026	4	3611	86	34	100
DRCV1LQ:1225	1225	264	3	100	—	—
DRCV2LQ:1225	1225	264	3	100	—	—
DRCV3LQ:1225	1225	264	3	100	—	—
GRIDGENA:1226	1226	282	227	100	75	74
RAYBENDL:2050	2050	4	41192	66	100	70
GRIDGENA:2114	2114	376	321	100	77	—
EIGENALS:2550	2550	—	42493	70	27	100
GRIDGENA:3242	3242	470	375	100	76	75

problem	dim	nact	nf+2*ng best	nf+2*ng efficiency for solver		
				lt6	lmbopt3	asa
DRCV3LQ:4489	4489	520	3	100	—	—
GRIDGENA:4610	4610	564	480	100	79	—
MSQRTALS:4900	4900	—	23692	87	100	80
MSQRTBLS:4900	4900	—	24090	99	100	91
SPMSRTLS:4999	4999	—	666	100	83	80
SPARSINE:5000	5000	—	99172	100	29	76
SSCOSINE:5000	5000	—	253105	100	—	75
GRIDGENA:6218	6218	658	530	100	—	—
CURLY10:10000	10000	—	219578	95	—	100
CURLY20:10000	10000	—	270744	100	—	89
CURLY30:10000	10000	—	300755	100	—	83
SPARSINE:10000	10000	—	92209	100	—	62
SPMSRTLS:10000	10000	—	742	100	87	85
SSCOSINE:10000	10000	—	432983	—	—	100
DRCV3LQ:10816	10816	816	3	100	—	—
ODNAMUR	11130	5618	199625	100	53	62
GRIDGENA:12482	12482	940	773	100	78	—

3.7 Time in milliseconds, 1e-06

problem	dim	nact	nf+2*ng best	time in milliseconds for solver		
				lt6	lmbopt3	asa
OSCIGRAD:10	10	—	24037	—	—	1770
STRATEC	10	—	797	11120	6130	—
SBRYBND:10	10	—	1052	—	12700	150
SCOSINE:10	10	—	351	—	300	—
SCURLY10:10	10	—	80	30	—	10
OSCIGRAD:15	15	—	172	10	240	20
OSCIGRAD:25	25	—	231	30	310	30
NONMSQRT:49	49	—	140037	—	60170	—
HS110:50	50	50	4	—	10	1
SBRYBND:50	50	—	48736	—	23070	—
RAYBENDS	54	4	2301	760	1180	810
RAYBENDL:66	66	4	9416	1620	3750	680
RAYBENDS:66	66	4	2610	640	1550	590
HS110:100	100	100	4	—	20	10
OSCIGRAD:100	100	—	255	30	320	30
SCOND1LS:102	102	2	8852	1380	—	—
RAYBENDL:130	130	4	38669	5790	13990	2550
RAYBENDS:130	130	4	796	570	640	580
QR3DLS	155	—	16821	9110	6580	2910
GRIDGENA:170	170	94	76	10	110	10
DRCV1LQ	196	96	7901	1230	3200	680
HS110:200	200	200	4	—	30	1
SPMSRTL:499	499	—	339	230	340	70

problem	dim	nact	nf+2*ng best	time in milliseconds for solver		
				lt6	lmbopt3	asa
SBRYBND:500	500	—	134247	—	63770	—
MSQRTALS:529	529	—	8966	11620	6380	2020
MSQRTBLS:529	529	—	8366	9610	5640	2010
GRIDGENA	578	188	155	100	210	—
QR3DLS:610	610	—	167135	—	97820	34600
LINVERSE:999	999	500	149	17450	1490	30
CURLY20	1000	—	31723	28710	—	4410
CHENHARK	1000	300	44995	—	111770	3480
SBRYBND	1000	—	199838	—	415640	—
SPMSRTLS:1000	1000	—	453	420	1160	130
MSQRTALS:1024	1024	—	10086	21880	38650	5670
MSQRTBLS:1024	1024	—	7074	14970	29540	4750
RAYBENDL:1026	1026	4	30021	28790	73680	3200
RAYBENDS:1026	1026	4	3611	13100	48940	5390
DRCV1LQ:1225	1225	264	3	10	—	—
DRCV2LQ:1225	1225	264	3	10	—	—
DRCV3LQ:1225	1225	264	3	1	—	—
GRIDGENA:1226	1226	282	227	220	810	70
RAYBENDL:2050	2050	4	41192	59580	106430	8300
GRIDGENA:2114	2114	376	321	460	1320	—
EIGENALS:2550	2550	—	42493	280110	1268310	102930
GRIDGENA:3242	3242	470	375	850	2180	390

problem	dim	nact	nf+2*ng best	time in milliseconds for solver		
				lt6	lmbopt3	asa
DRCV3LQ:4489	4489	520	3	10	—	—
GRIDGENA:4610	4610	564	480	1220	3340	—
MSQRTALS:4900	4900	—	23692	236400	364710	219800
MSQRTBLS:4900	4900	—	24090	210460	370120	198190
SPMSRTLS:4999	4999	—	666	1700	4230	940
SPARSINE:5000	5000	—	99172	270730	1914590	124840
SSCOSINE:5000	5000	—	253105	706190	—	361410
GRIDGENA:6218	6218	658	530	1870	—	—
CURLY10:10000	10000	—	219578	981700	—	363060
CURLY20:10000	10000	—	270744	1282660	—	664210
CURLY30:10000	10000	—	300755	1553420	—	945590
SPARSINE:10000	10000	—	92209	484300	—	372270
SPMSRTLS:10000	10000	—	742	3600	7460	2390
SSCOSINE:10000	10000	—	432983	—	—	1180890
DRCV3LQ:10816	10816	816	3	20	—	—
ODNAMUR	11130	5618	199625	1221080	3171250	806270
GRIDGENA:12482	12482	940	773	4860	10940	—

3.8 Effort $n_f + 2n_g$ for accuracy 1e-06

problem	dim	nact	nf+2*ng best	nf+2*ng for solver		
				lt6	lmbopt3	asa
OSCIGRAD:10	10	—	24037	—	—	24037
STRATEC	10	—	797	2393	797	—
SBRYBND:10	10	—	1052	—	16438	1052
SCOSINE:10	10	—	351	—	351	—
SCURLY10:10	10	—	80	148	—	80
OSCIGRAD:15	15	—	172	172	282	333
OSCIGRAD:25	25	—	231	231	365	300
NONMSQRT:49	49	—	140037	—	140037	—
HS110:50	50	50	4	—	9	4
SBRYBND:50	50	—	48736	—	48736	—
RAYBENDS	54	4	2301	3322	2301	5062
RAYBENDL:66	66	4	9416	11340	10497	9416
RAYBENDS:66	66	4	2610	2610	2860	3256
HS110:100	100	100	4	—	12	4
OSCIGRAD:100	100	—	255	255	430	358
SCOND1LS:102	102	2	8852	8852	—	—
RAYBENDL:130	130	4	38669	42147	38772	38669
RAYBENDS:130	130	4	796	1695	796	2009
QR3DLS	155	—	16821	52821	16821	33313
GRIDGENA:170	170	94	76	76	91	104
DRCV1LQ	196	96	7901	8537	8020	7901
HS110:200	200	200	4	—	15	4
SPMSRTLS:499	499	—	339	339	365	478

problem	dim	nact	nf+2*ng best	nf+2*ng for solver		
				lt6	lmbopt3	asa
SBRYBND:500	500	—	134247	—	134247	—
MSQRTALS:529	529	—	8966	10302	9379	8966
MSQRTBLS:529	529	—	8366	8754	8366	8889
GRIDGENA	578	188	155	155	198	—
QR3DLS:610	610	—	167135	—	167135	221230
LINVERSE:999	999	500	149	13991	519	149
CURLY20	1000	—	31723	31723	—	38730
CHENHARK	1000	300	44995	—	60923	44995
SBRYBND	1000	—	199838	—	199838	—
SPMSRTLS:1000	1000	—	453	453	503	597
MSQRTALS:1024	1024	—	10086	10086	10593	11582
MSQRTBLS:1024	1024	—	7074	7074	8098	9991
RAYBENDL:1026	1026	4	30021	33824	38892	30021
RAYBENDS:1026	1026	4	3611	4184	10618	3611
DRCV1LQ:1225	1225	264	3	3	—	—
DRCV2LQ:1225	1225	264	3	3	—	—
DRCV3LQ:1225	1225	264	3	3	—	—
GRIDGENA:1226	1226	282	227	227	303	306
RAYBENDL:2050	2050	4	41192	62022	41192	58622
GRIDGENA:2114	2114	376	321	321	417	—
EIGENALS:2550	2550	—	42493	60919	156944	42493
GRIDGENA:3242	3242	470	375	375	494	502

problem	dim	nact	nf+2*ng best	nf+2*ng for solver		
				lt6	lmbopt3	asa
DRCV3LQ:4489	4489	520	3	3	—	—
GRIDGENA:4610	4610	564	480	480	610	—
MSQRTALS:4900	4900	—	23692	27233	23692	29562
MSQRTBLS:4900	4900	—	24090	24330	24090	26465
SPMSRTLS:4999	4999	—	666	666	798	832
SPARSINE:5000	5000	—	99172	99172	341419	130681
SSCOSINE:5000	5000	—	253105	253105	—	336144
GRIDGENA:6218	6218	658	530	530	—	—
CURLY10:10000	10000	—	219578	231537	—	219578
CURLY20:10000	10000	—	270744	270744	—	305170
CURLY30:10000	10000	—	300755	300755	—	361427
SPARSINE:10000	10000	—	92209	92209	—	148814
SPMSRTLS:10000	10000	—	742	742	852	874
SSCOSINE:10000	10000	—	432983	—	—	432983
DRCV3LQ:10816	10816	816	3	3	—	—
ODNAMUR	11130	5618	199625	199625	373295	323500
GRIDGENA:12482	12482	940	773	773	988	—

3.9 Number of gradients evaluations, accuracy 1e-06

problem	dim	nact	nf+2*ng best	ng for solver		
				lt6	lmbopt3	asa
OSCIGRAD:10	10	—	24037	—	—	6456
STRATEC	10	—	797	764	189	—
SBRYBND:10	10	—	1052	—	3909	291
SCOSINE:10	10	—	351	—	81	—
SCURLY10:10	10	—	80	43	—	26
OSCIGRAD:15	15	—	172	57	70	95
OSCIGRAD:25	25	—	231	76	91	83
NONMSQRT:49	49	—	140037	—	32423	—
HS110:50	50	50	4	—	2	1
SBRYBND:50	50	—	48736	—	12027	—
RAYBENDS	54	4	2301	1089	575	1272
RAYBENDL:66	66	4	9416	3743	2624	2372
RAYBENDS:66	66	4	2610	860	715	816
HS110:100	100	100	4	—	3	1
OSCIGRAD:100	100	—	255	84	106	96
SCOND1LS:102	102	2	8852	2899	—	—
RAYBENDL:130	130	4	38669	13901	9693	9807
RAYBENDS:130	130	4	796	558	199	514
QR3DLS	155	—	16821	17157	4196	8487
GRIDGENA:170	170	94	76	25	22	29
DRCV1LQ	196	96	7901	2827	2005	1976
HS110:200	200	200	4	—	3	1
SPMSRTL:499	499	—	339	111	91	121

problem	dim	nact	nf+2*ng best	ng for solver		
				lt6	lmbopt3	asa
SBRYBND:500	500	—	134247	—	33513	—
MSQRTALS:529	529	—	8966	3399	2344	2244
MSQRTBLS:529	529	—	8366	2895	2091	2224
GRIDGENA	578	188	155	51	49	—
QR3DLS:610	610	—	167135	—	41742	67946
LINVERSE:999	999	500	149	4465	118	42
CURLY20	1000	—	31723	10531	—	12889
CHENHARK	1000	300	44995	—	15226	17993
SBRYBND	1000	—	199838	—	49914	—
SPMSRTLS:1000	1000	—	453	149	125	151
MSQRTALS:1024	1024	—	10086	3328	2648	2897
MSQRTBLS:1024	1024	—	7074	2341	2023	2774
RAYBENDL:1026	1026	4	30021	11217	9722	7869
RAYBENDS:1026	1026	4	3611	1386	2647	935
DRCV1LQ:1225	1225	264	3	1	—	—
DRCV2LQ:1225	1225	264	3	1	—	—
DRCV3LQ:1225	1225	264	3	1	—	—
GRIDGENA:1226	1226	282	227	75	75	91
RAYBENDL:2050	2050	4	41192	20558	10298	17810
GRIDGENA:2114	2114	376	321	106	103	—
EIGENALS:2550	2550	—	42493	20108	39205	12294
GRIDGENA:3242	3242	470	375	124	123	154

problem	dim	nact	nf+2*ng best	ng for solver		
				lt6	lmbopt3	asa
DRCV3LQ:4489	4489	520	3	1	—	—
GRIDGENA:4610	4610	564	480	159	152	—
MSQRTALS:4900	4900	—	23692	8986	5923	8224
MSQRTBLS:4900	4900	—	24090	8031	6022	7194
SPMSRTLS:4999	4999	—	666	220	198	210
SPARSINE:5000	5000	—	99172	32965	85353	52100
SSCOSINE:5000	5000	—	253105	83737	—	105651
GRIDGENA:6218	6218	658	530	176	—	—
CURLY10:10000	10000	—	219578	77073	—	76143
CURLY20:10000	10000	—	270744	90088	—	108475
CURLY30:10000	10000	—	300755	100075	—	130508
SPARSINE:10000	10000	—	92209	30612	—	59346
SPMSRTLS:10000	10000	—	742	244	212	220
SSCOSINE:10000	10000	—	432983	—	—	129864
DRCV3LQ:10816	10816	816	3	1	—	—
ODNAMUR	11130	5618	199625	65610	84059	100258
GRIDGENA:12482	12482	940	773	255	245	—

3.10 Number of functions evaluations, accuracy 1e-06

problem	dim	nact	nf+2*ng best	nf for solver		
				lt6	lmbopt3	asa
OSCIGRAD:10	10	—	24037	—	—	11125
STRATEC	10	—	797	865	419	—
SBRYBND:10	10	—	1052	—	8620	470
SCOSINE:10	10	—	351	—	189	—
SCURLY10:10	10	—	80	62	—	28
OSCIGRAD:15	15	—	172	58	142	143
OSCIGRAD:25	25	—	231	79	183	134
NONMSQRT:49	49	—	140037	—	75191	—
HS110:50	50	50	4	—	5	2
SBRYBND:50	50	—	48736	—	24682	—
RAYBENDS	54	4	2301	1144	1151	2518
RAYBENDL:66	66	4	9416	3854	5249	4672
RAYBENDS:66	66	4	2610	890	1430	1624
HS110:100	100	100	4	—	6	2
OSCIGRAD:100	100	—	255	87	218	166
SCOND1LS:102	102	2	8852	3054	—	—
RAYBENDL:130	130	4	38669	14345	19386	19055
RAYBENDS:130	130	4	796	579	398	981
QR3DLS	155	—	16821	18507	8429	16339
GRIDGENA:170	170	94	76	26	47	46
DRCV1LQ	196	96	7901	2883	4010	3949
HS110:200	200	200	4	—	9	2
SPMSRTL:499	499	—	339	117	183	236

problem	dim	nact	nf+2*ng best	nf for solver		
				lt6	lmbopt3	asa
SBRYBND:500	500	—	134247	—	67221	—
MSQRTALS:529	529	—	8966	3504	4691	4478
MSQRTBLS:529	529	—	8366	2964	4184	4441
GRIDGENA	578	188	155	53	100	—
QR3DLS:610	610	—	167135	—	83651	85338
LINVERSE:999	999	500	149	5061	283	65
CURLY20	1000	—	31723	10661	—	12952
CHENHARK	1000	300	44995	—	30471	9009
SBRYBND	1000	—	199838	—	100010	—
SPMSRTLS:1000	1000	—	453	155	253	295
MSQRTALS:1024	1024	—	10086	3430	5297	5788
MSQRTBLS:1024	1024	—	7074	2392	4052	4443
RAYBENDL:1026	1026	4	30021	11390	19448	14283
RAYBENDS:1026	1026	4	3611	1412	5324	1741
DRCV1LQ:1225	1225	264	3	1	—	—
DRCV2LQ:1225	1225	264	3	1	—	—
DRCV3LQ:1225	1225	264	3	1	—	—
GRIDGENA:1226	1226	282	227	77	153	124
RAYBENDL:2050	2050	4	41192	20906	20596	23002
GRIDGENA:2114	2114	376	321	109	211	—
EIGENALS:2550	2550	—	42493	20703	78534	17905
GRIDGENA:3242	3242	470	375	127	248	194

problem	dim	nact	nf+2*ng best	nf for solver		
				lt6	lmbopt3	asa
DRCV3LQ:4489	4489	520	3	1	—	—
GRIDGENA:4610	4610	564	480	162	306	—
MSQRTALS:4900	4900	—	23692	9261	11846	13114
MSQRTBLS:4900	4900	—	24090	8268	12046	12077
SPMSRTLS:4999	4999	—	666	226	402	412
SPARSINE:5000	5000	—	99172	33242	170713	26481
SSCOSINE:5000	5000	—	253105	85631	—	124842
GRIDGENA:6218	6218	658	530	178	—	—
CURLY10:10000	10000	—	219578	77391	—	67292
CURLY20:10000	10000	—	270744	90568	—	88220
CURLY30:10000	10000	—	300755	100605	—	100411
SPARSINE:10000	10000	—	92209	30985	—	30122
SPMSRTLS:10000	10000	—	742	254	428	434
SSCOSINE:10000	10000	—	432983	—	—	173255
DRCV3LQ:10816	10816	816	3	1	—	—
ODNAMUR	11130	5618	199625	68405	205177	122984
GRIDGENA:12482	12482	940	773	263	498	—