Comparison tables: BBOB 2009 function testbed

The BBOBies

November 20, 2009

Abstract

This document provides tabular results of the workshop for Black-Box Optimization Benchmarking at GECCO 2009, see `http://coco.gforge.inria.fr/doku.php?id=bbob-2009`. More than 30 algorithms have been tested on 24 benchmark functions in dimensions between 2 and 40. A description of the used objective functions can be found in [14, 9]. The experimental set-up is described in [13].

The performance measure provided in the following tables is the expected number of objective function evaluations to reach a given target function value (ERT, expected running time), divided by the respective value for the best algorithm. Consequently, the best (smallest) value is 1 and the value 1 appears in each column at least once. See [13] for details on how ERT is obtained. All numbers are computed with no more than two digits of precision.

Table 1: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_1, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	0.9	2.83	2.83	3	3	3	3	3	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**2.8**	9.7	56	170	290	440	640	970	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	**2.1**	4.4	11	14	23	28	32	46	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**1.9**	**1.1**	**1.1**	**1**	**1**	**1**	**1**	**1**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.9**	4.2	18	79	110	140	160	210	BayEDAcG [10]
BFGS	**1**	**1**	3.3	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	BFGS [30]
Cauchy EDA	**1**	**1**	19	15	27	39	50	63	75	100	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	3.3	3.8	8.5	13	19	24	29	39	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	3.3	3.6	7.6	11	14	18	22	29	(1+1)-CMA-ES [2]
DASA	**1**	**1**	39	23	44	52	62	76	95	120	DASA [19]
DEPSO	**1**	**1**	**2.1**	12	27	46	51	96	120	170	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1.4**	**2.5**	9.4	15	20	32	56	DIRECT [25]
EDA-PSO	**1**	**1**	**1.9**	5	20	34	53	80	110	210	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.7**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.9**	6	17	19	24	29	34	46	G3-PCX [26]
simple GA	**1**	**1**	**2.7**	7.2	62	310	1100	1800	2600	4500	simple GA [22]
GLOBAL	**1**	**1**	**1.9**	5.7	39	50	54	55	56	58	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.3**	3.8	6.7	12	14	19	22	31	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	7.8	3.2	3.6	4.1	4.1	4.1	4.1	4.1	LSfminbnd [28]
LSstep	**1**	**1**	46	34	62	63	68	68	69	69	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.4**	7.4	26	40	67	85	92	100	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1.5**	**2.2**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**2.1**	**1.3**	**3**	3.9	5.1	6.3	7.4	9.8	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1**	**1.5**	**2.9**	4.1	5.3	6.5	7.6	10	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.8**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.5	**2.8**	6.7	10	14	18	23	30	(1+1)-ES [1]
POEMS	**1**	**1**	170	80	110	400	680	1100	1300	2100	POEMS [20]
PSO	**1**	**1**	**2.1**	5.3	20	59	120	200	250	470	PSO [7]
PSO_Bounds	**1**	**1.1**	**2.4**	6	26	89	270	460	770	1200	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.5**	9.7	49	540	5900	4.8e4	6.8e5	*11e-6/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**1**	5.6	3.1	3.9	4.9	6.2	7.6	8.8	11	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	3.9	5.9	9.5	14	18	24	28	38	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.6**	8.9	25	33	37	43	48	60	VNS (Garcia) [11]

Table 2: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.93	6.23	8.2	9.47	12.3	12.7	12.9	13.6	14	14.3	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	11	24	58	120	130	160	200	230	260	330	ALPS [17]
AMaLGaM IDEA	4.9	4.8	6.2	7.6	7.5	9.1	10	11	13	16	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**1.1**	**1.9**	5.6	8.5	10	14	17	20	27	avg NEWUOA [31]
BayEDAcG	37	62	80	78	82	87	110	110	140	140	BayEDAcG [10]
BFGS	**1.7**	**1.6**	**2.5**	4	3.7	3.9	4.1	4.1	4.1	4.4	BFGS [30]
Cauchy EDA	13	17	18	18	18	20	23	24	25	29	Cauchy EDA [24]
BIPOP-CMA-ES	4	5.4	13	19	18	18	20	20	20	22	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.1	5.1	10	13	13	13	14	14	15	16	(1+1)-CMA-ES [2]
DASA	21	19	19	22	21	21	23	25	26	31	DASA [19]
DEPSO	10	16	18	26	27	31	35	40	45	53	DEPSO [12]
DIRECT	5.9	5.1	7.5	8	7.1	8.5	9.4	12	13	46	DIRECT [25]
EDA-PSO	8.8	11	13	19	20	26	39	49	65	88	EDA-PSO [6]
full NEWUOA	**1.2**	**1.2**	**2.4**	5.8	8.3	10	13	15	18	23	full NEWUOA [31]
G3-PCX	8.6	8.4	14	64	69	76	83	82	82	82	G3-PCX [26]
simple GA	11	44	130	320	420	540	780	990	1300	1900	simple GA [22]
GLOBAL	11	19	19	17	13	13	13	13	13	13	GLOBAL [23]
iAMaLGaM IDEA	**2.6**	3.8	5.1	9.2	9.1	10	11	12	12	14	iAMaLGaM IDEA [4]
LSfminbnd	**1.4**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	14	12	9.5	9.9	7.9	7.9	7.8	7.5	7.3	7.3	LSstep [28]
MA-LS-Chain	12	14	17	22	20	24	28	28	29	34	MA-LS-Chain [21]
MCS (Neum)	**1.5**	**1.6**	**1.4**	**1.8**	**1.7**	**2.6**	3.2	3.3	3.7	23	MCS (Neum) [18]
NELDER (Han)	**1.9**	**1.8**	**1.7**	**1.8**	**1.8**	**2**	**2.2**	**2.4**	**2.6**	**3**	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**1.7**	**1.6**	**1.9**	**1.7**	**1.9**	**2.2**	**2.3**	**2.5**	**3**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.2**	8.8	12	15	19	23	26	35	NEWUOA [31]
(1+1)-ES	3.2	2400	8700	4.7e4	1.2e5	3.8e5	*74e-3/1e6*	.	.	.	(1+1)-ES [1]
POEMS	140	250	380	420	400	460	510	570	630	780	POEMS [20]
PSO	7.5	14	56	83	83	98	120	130	160	200	PSO [7]
PSO_Bounds	6.9	24	54	170	310	360	400	440	530	780	PSO_Bounds [8]
Monte Carlo	21	50	240	1200	5600	1e5	*94e-4/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	**2.6**	3.1	**2.5**	3.7	4.4	5.4	6.3	6.5	6.9	7.9	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.5	5.4	14	19	16	17	18	18	18	20	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	8.4	15	22	27	24	25	26	26	26	29	VNS (Garcia) [11]

Table 3: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.7	7.33	135	222	223	225	226	227	232	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.1**	**1.6**	9.2	6.7	6.4	11	12	15	19	23	ALPS [17]
AMaLGaM IDEA	**1.1**	**1.1**	3.7	4.6	12	12	12	12	13	13	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**2.7**	5.1	**1.6**	3.2	3.2	3.2	3.2	3.2	3.1	avg NEWUOA [31]
BayEDAcG	**1.1**	**1.2**	4.4	4	9.7	18	41	65	65	64	BayEDAcG [10]
BFGS	**1.2**	18	14	3.1	10	10	10	10	10	10	BFGS [30]
Cauchy EDA	**1.1**	9.6	9.6	3.3	8.4	33	43	43	43	43	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.2**	3.5	3.5	5.2	6.2	6.4	6.5	6.5	6.7	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.9**	6.9	3.8	7.9	7.9	7.9	7.9	7.9	7.8	(1+1)-CMA-ES [2]
DASA	6.3	22	18	**1.8**	6.9	7	7.1	7.2	7.4	7.6	DASA [19]
DEPSO	**1.8**	**2**	5.7	**2.3**	**2.7**	4	4.5	5	5.4	6.4	DEPSO [12]
DIRECT	**1**	**1.1**	**2.7**	**1**	**2.4**	**2.4**	**2.5**	**2.6**	**2.7**	**3**	DIRECT [25]
EDA-PSO	**1.2**	**1.4**	4.8	6.4	14	19	20	20	21	22	EDA-PSO [6]
full NEWUOA	**1**	4	**2.3**	**1.8**	**2.2**	**2.2**	**2.2**	**2.1**	**2.1**	**2.1**	full NEWUOA [31]
G3-PCX	**1.1**	**2**	4.1	7.8	40	40	39	39	39	39	G3-PCX [26]
simple GA	**1**	**2**	8.3	13	19	27	40	55	70	110	simple GA [22]
GLOBAL	**1.1**	**1.6**	7	**1.8**	3.1	3.1	3.1	3.1	3.1	3.1	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.4**	**1.8**	6.3	17	17	17	17	17	17	iAMaLGaM IDEA [4]
LSfminbnd	**2.1**	4.7	17	32	43	64	63	63	63	61	LSfminbnd [28]
LSstep	28	120	24	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**1.5**	5.7	**1.7**	**2.5**	**2.6**	**2.7**	**2.7**	**2.8**	**2.9**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.1**	**1.5**	**1.1**	**1.5**	**1.6**	**1.6**	**2.6**	**2.6**	**2.6**	MCS (Neum) [18]
NELDER (Han)	**1.2**	**1.8**	**1.4**	4	13	13	13	13	12	12	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1**	**1**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	NELDER (Doe) [5]
NEWUOA	**1.5**	**2.4**	4.8	**1.5**	4.2	4.2	4.2	4.1	4.1	4.1	NEWUOA [31]
(1+1)-ES	**1.1**	**2.4**	12	5	15	15	15	15	15	14	(1+1)-ES [1]
POEMS	31	200	42	11	14	20	24	29	32	41	POEMS [20]
PSO	**1.1**	**1.6**	5.1	3.3	3.4	4.7	6	7.2	8.8	11	PSO [7]
PSO_Bounds	**1.1**	**1.8**	4.8	5.3	8.3	14	18	22	26	34	PSO_Bounds [8]
Monte Carlo	**1.1**	**1.5**	14	67	460	3100	2.1e4	*39e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	16	45	15	26	26	26	26	26	25	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.5**	**2.3**	3.4	7.6	8.4	9.2	9.4	9.6	9.8	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.9**	8.8	**2.9**	4.1	4.2	4.2	4.5	4.7	7.7	VNS (Garcia) [11]

Table 4: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_4, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	10.9	172	230	248	261	270	272	283	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**2.5**	9	7.1	8.3	9.7	12	15	17	20	ALPS [17]
AMaLGaM IDEA	**1**	**2.2**	**2.6**	5.6	51	48	48	46	47	45	AMaLGaM IDEA [4]
avg NEWUOA	**1**	4.5	6.2	4	14	13	12	12	12	11	avg NEWUOA [31]
BayEDAcG	**1**	**2.3**	4.5	13	62	120	110	*10e-1/2e3*	.	.	BayEDAcG [10]
BFGS	**1**	13	11	5.7	12	11	11	10	10	9.8	BFGS [30]
Cauchy EDA	**1**	19	6.8	13	75	410	470	450	450	430	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	3.8	**2.6**	6.9	55	97	99	98	99	110	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**2.4**	5.2	5.5	27	25	24	23	23	22	(1+1)-CMA-ES [2]
DASA	**1**	82	15	**2**	3.6	3.4	3.3	3.3	3.4	3.4	DASA [19]
DEPSO	**1**	**2.4**	7.2	4.2	6.5	11	17	17	17	35	DEPSO [12]
DIRECT	**1**	**1**	**1.8**	**1.8**	6.6	6.1	14	14	16	16	DIRECT [25]
EDA-PSO	**1**	**2.6**	4.2	9.9	18	19	19	19	19	20	EDA-PSO [6]
full NEWUOA	**1**	3.8	5.4	3.9	15	14	13	13	13	12	full NEWUOA [31]
G3-PCX	**1**	**2.1**	20	17	76	70	67	65	64	62	G3-PCX [26]
simple GA	**1**	**2.6**	10	16	22	28	37	49	60	100	simple GA [22]
GLOBAL	**1**	**2.4**	8.5	**1.2**	5.2	4.8	4.6	4.5	4.5	4.3	GLOBAL [23]
iAMaLGaM IDEA	**1**	3.8	**2.5**	9.5	61	57	56	55	55	54	iAMaLGaM IDEA [4]
LSfminbnd	**1**	4.6	**1**	45	120	230	*10e-1/4e3*	.	.	.	LSfminbnd [28]
LSstep	**1**	220	19	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**2.3**	5.6	**1.8**	4.4	4.2	4.1	4	4.1	4.1	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2**	**1**	**2.9**	**2.7**	**2.7**	**2.7**	**2.7**	**2.6**	MCS (Neum) [18]
NELDER (Han)	**1**	3.1	5	5.3	27	25	24	23	23	22	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.1**	**1.9**	**1.4**	**3.5**	**3.2**	**3.1**	**3**	**3**	**3**	NELDER (Doe) [5]
NEWUOA	**1**	3	5	4.5	18	16	16	15	15	14	NEWUOA [31]
(1+1)-ES	**1**	3.1	4.5	5.5	23	21	20	20	20	19	(1+1)-ES [1]
POEMS	**1**	240	36	9.8	22	23	29	32	35	41	POEMS [20]
PSO	**1.1**	3.2	4	3.3	4.6	5.6	6.4	7.4	8.7	11	PSO [7]
PSO_Bounds	**1**	3.3	4.4	6.3	9.6	17	21	24	27	33	PSO_Bounds [8]
Monte Carlo	**1**	3.3	8.6	67	620	8200	2.8e4	5.5e4	*11e-3/1e6*	.	Monte Carlo [3]
Rosenbrock	**1**	71	27	15	52	48	46	44	44	42	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	3.5	**3**	8.7	75	180	270	260	260	250	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**2.6**	5.1	4.1	8.8	8.2	7.9	8.3	8.8	17	VNS (Garcia) [11]

Table 5: 02-D, running time excess ERT/ERT_{best} on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.5	0.5	1.83	2.2	2.2	2.2	2.2	2.2	2.2	2.2	ERT_{best}/D
ALPS	**1**	**1.1**	8.8	76	100	100	100	100	100	100	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	5.3	16	18	18	18	18	18	18	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.2**	**1.1**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	3.3	92	100	100	100	100	100	100	BayEDAcG [10]
BFGS	**1**	**1**	**1.5**	**2.8**	**2.8**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	BFGS [30]
Cauchy EDA	**1**	**1**	16	17	17	17	17	17	17	17	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	3.4	5.3	5.7	5.8	5.8	5.8	5.8	5.8	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**1.9**	3.1	3.4	3.4	3.4	3.4	3.4	3.4	(1+1)-CMA-ES [2]
DASA	**1**	**1.9**	19	32	40	46	53	60	66	80	DASA [19]
DEPSO	**1**	**1**	6.1	34	35	36	36	36	36	36	DEPSO [12]
DIRECT	**1**	**1**	3.4	**2.8**	4.2	4.2	4.2	4.2	4.2	4.2	DIRECT [25]
EDA-PSO	**1**	**1**	5	15	16	17	17	17	17	17	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	**1**	**1.2**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	full NEWUOA [31]
G3-PCX	**1**	**1.1**	4.1	29	31	31	31	31	31	31	G3-PCX [26]
simple GA	**1**	**1**	4.2	310	2e3	4200	6300	9800	1.5e4	6.8e5	simple GA [22]
GLOBAL	**1**	**1.1**	4.4	69	70	70	70	70	70	70	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	4.6	12	13	13	13	13	13	13	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	4.9	7.3	8.5	9.1	9.1	9.1	9.1	9.1	LSfminbnd [28]
LSstep	**1**	**1.2**	59	79	91	91	91	91	91	91	LSstep [28]
MA-LS-Chain	**1**	**1.1**	4.7	81	120	130	130	130	130	130	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1.8**	**2.1**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.3**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.1**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	NEWUOA [31]
(1+1)-ES	**1**	**1**	**1.9**	**2.4**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	(1+1)-ES [1]
POEMS	**1**	**1**	140	150	170	180	190	190	190	190	POEMS [20]
PSO	**1**	**1.1**	4.2	18	20	21	21	21	21	21	PSO [7]
PSO_Bounds	**1**	**1**	6.1	13	16	16	16	16	16	16	PSO_Bounds [8]
Monte Carlo	**1**	**1**	4.4	530	4.9e4	*22e-3 / 1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	3.5	3.4	3.5	3.5	3.5	3.5	3.5	3.5	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	4	6.6	7.1	7.1	7.1	7.1	7.1	7.1	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	6.3	27	27	27	27	27	27	27	VNS (Garcia) [11]

Table 6: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_6, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.833	1.4	6.33	11.4	20.5	26.9	33.5	39.9	47.3	62.2	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	3.2	3.2	**2.2**	12	31	50	62	73	80	83	ALPS [17]
AMaLGaM IDEA	**1.1**	**1.4**	**2.1**	4.5	4.9	5.5	6.2	6.5	6.7	7	AMaLGaM IDEA [4]
avg NEWUOA	**1.4**	**2.1**	3.1	4.7	3.9	4.4	4.4	4.5	4.7	4.6	avg NEWUOA [31]
BayEDAcG	**2.8**	**1.9**	**1.5**	160	640	*72e-2/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	4.3	4.4	4.2	3.4	**2.7**	**2.4**	**2**	**1.9**	**1.7**	**1.6**	BFGS [30]
Cauchy EDA	11	10	16	18	17	17	17	17	16	16	Cauchy EDA [24]
BIPOP-CMA-ES	3.9	**3**	**2**	**2.8**	3.6	3.9	4.2	4.2	4.1	4.3	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.2	3.3	**2.1**	**3**	**2.3**	**2.2**	**2.2**	**2.3**	**2.2**	**2.1**	(1+1)-CMA-ES [2]
DASA	30	29	23	22	18	19	19	18	18	18	DASA [19]
DEPSO	**1.7**	**1.7**	3.8	11	12	14	14	15	16	17	DEPSO [12]
DIRECT	**1.4**	**1**	**1.4**	7.6	5.8	120	800	1500	1200	970	DIRECT [25]
EDA-PSO	3.4	**2.4**	3.1	12	12	15	19	27	29	34	EDA-PSO [6]
full NEWUOA	**1**	**2.2**	3.4	3.7	3.2	3.5	3.7	3.7	4.1	4.5	full NEWUOA [31]
G3-PCX	**2.3**	**1.5**	**2.3**	4.5	3.7	3.9	3.9	3.8	3.8	4.1	G3-PCX [26]
simple GA	4.8	3.4	3.5	14	85	1e3	3100	4100	3600	4900	simple GA [22]
GLOBAL	3.7	**2.9**	**2.3**	8.8	7.4	6.2	5.2	4.5	3.9	3.2	GLOBAL [23]
iAMaLGaM IDEA	**2.7**	**1.9**	**2.4**	3.6	3.8	4	4.1	4.2	4.3	4.4	iAMaLGaM IDEA [4]
LSfminbnd	19	190	280	370	290	260	210	180	150	120	LSfminbnd [28]
LSstep	53	330	910	580	380	330	710	1200	*17e-4/1e4*	.	LSstep [28]
MA-LS-Chain	4.4	**2.9**	**2.2**	13	14	14	12	12	10	10	MA-LS-Chain [21]
MCS (Neum)	**1.4**	190	52	29	19	42	100	110	100	120	MCS (Neum) [18]
NELDER (Han)	**2.1**	**1.5**	**1**	**1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**2**	**1.3**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.2**	**2.4**	4.4	4.7	3.9	4.4	4.7	4.8	5	4.9	NEWUOA [31]
(1+1)-ES	**2.4**	**2.2**	**2.5**	3.7	3.6	3.6	3.4	3.4	3.3	3.2	(1+1)-ES [1]
POEMS	200	160	99	130	120	140	130	140	180	180	POEMS [20]
PSO	**1.5**	**1.1**	**2.1**	4.6	7.9	18	23	29	32	36	PSO [7]
PSO_Bounds	**2.2**	**1.5**	**2.6**	7	37	77	130	140	140	170	PSO_Bounds [8]
Monte Carlo	3	**2.3**	**2.7**	16	53	780	1.3e4	8.1e4	1.5e5	*28e-5/1e6*	Monte Carlo [3]
Rosenbrock	4	3	**2.2**	**2.1**	**1.8**	**1.8**	**1.8**	**1.8**	**1.7**	**1.5**	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.7	3.1	**1.7**	4.1	3.8	4.5	4.6	4.7	4.6	4.4	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**2.6**	**2.7**	**1.9**	7.2	6.9	6.7	6.3	6.3	6.1	5.7	VNS (Garcia) [11]

Table 7: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	1	1.6	10.7	30.2	96.7	108	108	108	121	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.1**	**1.4**	4.1	4.7	12	9.5	11	11	11	13	ALPS [17]
AMaLGaM IDEA	**1.1**	**1.5**	3.4	20	8.1	**2.7**	**2.5**	**2.5**	**2.5**	**2.4**	AMaLGaM IDEA [4]
avg NEWUOA	**1.7**	**2.7**	4	3.7	6.8	5	10	10	10	9	avg NEWUOA [31]
BayEDAcG	**1.5**	**1.7**	4.2	3.1	79	85	76	76	76	110	BayEDAcG [10]
BFGS	**1.6**	3.7	10	19	34	*76e-2/200*	.	.	.	.	BFGS [30]
Cauchy EDA	5.5	8.4	19	7.6	5.3	**2**	**1.9**	**1.9**	**1.9**	**2.1**	Cauchy EDA [24]
BIPOP-CMA-ES	**1.9**	**1.9**	3.2	**2.6**	3.4	**1.5**	**1.5**	**1.5**	**1.5**	**1.6**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.5**	**1.4**	**2.7**	**1.8**	**2.8**	**1**	**1**	**1**	**1**	**1**	(1+1)-CMA-ES [2]
DASA	30	59	170	170	310	240	440	440	440	390	DASA [19]
DEPSO	**1.7**	**1.7**	6.5	4.8	4.9	**2.6**	3.1	3.1	3.1	3.6	DEPSO [12]
DIRECT	**1.4**	**1**	**2.1**	**1.3**	**1**	**2.7**	**3**	**3**	**3**	**2.7**	DIRECT [25]
EDA-PSO	**1.5**	**1.8**	3.7	3.1	6.2	6.2	9	9	9	14	EDA-PSO [6]
full NEWUOA	**1.9**	**2.7**	**2**	3.7	3.7	**1.7**	**2.9**	**2.9**	**2.9**	**2.7**	full NEWUOA [31]
G3-PCX	**1.3**	**1.5**	4.5	12	35	19	21	21	21	19	G3-PCX [26]
simple GA	**1.6**	**1.6**	5.2	3.9	22	24	47	47	47	67	simple GA [22]
GLOBAL	**1.2**	**1.8**	6.8	4.1	7.5	**2.7**	4.4	4.4	4.4	3.9	GLOBAL [23]
iAMaLGaM IDEA	**1.8**	**1.8**	3.9	12	4.7	**2.8**	**2.5**	**2.5**	**2.5**	**2.4**	iAMaLGaM IDEA [4]
LSfminbnd	**1.3**	**1.1**	6.3	11	66	55	500	500	500	960	LSfminbnd [28]
LSstep	28	28	260	250	460	1500	*29e-3/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.7**	**2.3**	5.8	3.4	4.7	3.6	4.6	4.6	4.6	4.7	MA-LS-Chain [21]
MCS (Neum)	**1.4**	**1.4**	**1**	4.1	4.5	**2.2**	6.5	6.5	6.5	6	MCS (Neum) [18]
NELDER (Han)	**1.5**	**1.3**	**2.5**	25	18	6.6	6.5	6.5	6.5	5.9	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**1.6**	**2.6**	**1**	8.5	5.4	5.2	5.2	5.2	5.4	NELDER (Doe) [5]
NEWUOA	**1.7**	**2**	**2.5**	9.3	9.3	6	14	14	14	12	NEWUOA [31]
(1+1)-ES	**2.3**	3.3	5.6	4.1	4.3	**1.8**	3.3	3.3	3.3	3	(1+1)-ES [1]
POEMS	220	210	180	45	41	21	23	23	23	28	POEMS [20]
PSO	**1.5**	**1.3**	4.1	3.5	4.8	3.2	3.6	3.6	3.6	4.4	PSO [7]
PSO_Bounds	**1.3**	**1.6**	6.2	3.4	5.8	5	6.7	6.7	6.7	14	PSO_Bounds [8]
Monte Carlo	**1.7**	**1.5**	4.6	4.5	43	87	150	150	150	950	Monte Carlo [3]
Rosenbrock	16	42	150	120	170	78	190	190	190	170	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**2.1**	5.5	**2.7**	**2.8**	**1.2**	**1.3**	**1.3**	**1.3**	**1.5**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**2.4**	3.9	3.8	5.1	**2.1**	**2**	**2**	**2**	**2**	VNS (Garcia) [11]

Table 8: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.6	1.6	2.7	6	18.3	23.1	43.2	46.1	47	56	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**2.9**	**2.8**	4.7	19	31	66	54	74	94	130	ALPS [17]
AMaLGaM IDEA	**2.4**	4.1	6.2	10	6.8	7	4.4	4.7	5.1	5	AMaLGaM IDEA [4]
avg NEWUOA	3.9	**2.5**	**2.6**	**4.6**	**2.4**	**2.4**	**1.4**	**1.4**	**1.4**	**1.3**	avg NEWUOA [31]
BayEDAcG	**2.3**	**2.9**	5.6	11	48	350	*53e-3/2e3*	.	.	.	BayEDAcG [10]
BFGS	7.5	4.9	4.1	5.1	**2.4**	**2.2**	**1.3**	**1.3**	**1.3**	**1.1**	BFGS [30]
Cauchy EDA	15	11	10	24	19	21	12	13	14	13	Cauchy EDA [24]
BIPOP-CMA-ES	3.1	3.3	3.5	7.1	9.2	11	6.4	6.5	6.7	6.2	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	6.4	4.3	3.8	11	6.9	7	4.2	4.1	4.3	4	(1+1)-CMA-ES [2]
DASA	31	33	110	520	480	680	520	580	700	820	DASA [19]
DEPSO	4	3.3	3.6	14	15	25	28	42	65	*76e-7/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1.4**	5	4.4	8.7	10	16	17	21	DIRECT [25]
EDA-PSO	**1.9**	**3**	5.4	11	50	98	97	140	180	220	EDA-PSO [6]
full NEWUOA	6.6	3.9	7	7	3.2	**2.8**	**1.6**	**1.5**	**1.5**	**1.3**	full NEWUOA [31]
G3-PCX	**2.8**	4	5	24	16	18	11	11	11	9.6	G3-PCX [26]
simple GA	**2**	**2.9**	8.4	34	87	170	1300	8900	*61e-5/1e5*	.	simple GA [22]
GLOBAL	4.4	4.5	14	19	8.2	7.2	4.1	3.9	3.9	3.4	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**2.8**	4.4	12	8	8.4	5	5.2	5.5	5.2	iAMaLGaM IDEA [4]
LSfminbnd	16	7	420	1500	2300	6300	*90e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	67	51	37	1500	3600	6100	*32e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**2.7**	3.6	7.2	16	10	15	9	8.8	9	8.5	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1.9**	**1.4**	**2.1**	**3.7**	**2**	**2**	**1.1**	**1.2**	**1.2**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	3	3.2	4.6	6.2	**2.9**	**2.7**	**1.6**	**1.5**	**1.6**	**1.5**	NELDER (Doe) [5]
NEWUOA	3.8	**2.8**	4.3	7	3.5	3.2	**1.9**	**1.8**	**1.8**	**1.6**	NEWUOA [31]
(1+1)-ES	**2.3**	**2.2**	47	59	23	34	35	51	70	95	(1+1)-ES [1]
POEMS	230	110	120	110	76	110	74	91	120	130	POEMS [20]
PSO	**2.7**	**2.6**	6.5	11	16	27	26	37	49	67	PSO [7]
PSO_Bounds	3.7	4.3	6	19	24	61	69	120	150	200	PSO_Bounds [8]
Monte Carlo	**2.7**	3.2	5.8	19	72	670	2200	3.9e4	3.1e5	*17e-5/1e6*	Monte Carlo [3]
Rosenbrock	5.8	3.4	4.9	10	5.2	4.8	**2.8**	**2.7**	**2.8**	**2.5**	Rosenbrock [27]
IPOP-SEP-CMA-ES	6.4	3.9	5.2	19	17	17	9.5	9.3	9.6	8.7	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	9.5	4.8	8.1	16	10	11	6.9	6.8	7.2	6.7	VNS (Garcia) [11]

Table 9: 02-D, running time excess ERT/ERT_{best} on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.5	0.5	0.5	8.9	15	21.9	33.8	38.5	40.7	46.2	ERT_{best}/D
ALPS	3.3	7.2	33	19	41	62	64	81	100	140	ALPS [17]
AMaLGaM IDEA	4.2	13	22	6.3	9.5	9.5	7.5	7.4	7.7	7.6	AMaLGaM IDEA [4]
avg NEWUOA	7.7	10	22	4.7	4	3.2	**2.3**	**2.1**	**2**	**1.9**	avg NEWUOA [31]
BayEDAcG	3.8	11	29	10	99	600	*66e-3/2e3*	.	.	.	BayEDAcG [10]
BFGS	4.2	9.2	16	**2.4**	**2.3**	**1.9**	**1.4**	**1.3**	**1.2**	**1.1**	BFGS [30]
Cauchy EDA	16	37	59	14	20	19	14	14	14	14	Cauchy EDA [24]
BIPOP-CMA-ES	**2.6**	10	19	4.6	7.1	7.5	5.8	5.6	5.8	5.9	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.5	9.9	26	8.8	8	7.3	5.4	5	5	4.9	(1+1)-CMA-ES [2]
DASA	65	110	320	250	290	330	320	380	550	740	DASA [19]
DEPSO	**2.7**	12	58	12	12	20	19	25	45	97	DEPSO [12]
DIRECT	**1**	**1**	**1**	**2**	5	5.8	8.3	14	18	25	DIRECT [25]
EDA-PSO	3.8	12	47	8.5	27	51	78	120	150	200	EDA-PSO [6]
full NEWUOA	7.1	12	24	**2.7**	**2.2**	**1.8**	**1.3**	**1.2**	**1.1**	**1.1**	full NEWUOA [31]
G3-PCX	4.1	10	28	15	20	18	14	13	13	11	G3-PCX [26]
simple GA	5	15	44	22	90	190	2200	2200	1e4	1.5e4	simple GA [22]
GLOBAL	3.5	11	30	9.1	11	7.9	5.2	4.7	4.5	4.2	GLOBAL [23]
iAMaLGaM IDEA	3.1	7.9	29	6	7.2	6.9	5.3	5.1	5.3	5.3	iAMaLGaM IDEA [4]
LSfminbnd	6.2	15	20	210	670	3100	4100	3600	3400	*76e-3/1e4*	LSfminbnd [28]
LSstep	270	610	750	230	670	1800	2100	3800	*76e-3/1e4*	.	LSstep [28]
MA-LS-Chain	5	9.5	35	8.6	13	13	11	10	10	11	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**2.7**	**3.6**	**10**	**1.6**	**2**	**1.8**	**1.3**	**1.2**	**1.2**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	4.1	6.9	11	**2.3**	**2.6**	**2.1**	**1.5**	**1.4**	**1.4**	**1.4**	NELDER (Doe) [5]
NEWUOA	5.2	8.3	24	3.6	3.3	**2.7**	**1.9**	**1.8**	**1.8**	**1.7**	NEWUOA [31]
(1+1)-ES	4.4	8.1	19	81	120	120	100	110	130	160	(1+1)-ES [1]
POEMS	360	450	560	65	78	110	98	110	130	160	POEMS [20]
PSO	4	15	37	8.7	12	24	28	38	49	67	PSO [7]
PSO_Bounds	3.9	9	48	11	27	96	120	160	200	240	PSO_Bounds [8]
Monte Carlo	3	10	47	17	110	900	3600	6.9e4	3.7e5	*16e-5/1e6*	Monte Carlo [3]
Rosenbrock	8.9	12	22	**2.6**	3.1	**2.9**	**2.2**	**2.2**	**2.2**	**2.2**	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.1	9.5	16	7.6	15	14	10	9.3	9.4	9	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	4.8	21	45	14	15	12	9.8	9.4	9.8	10	VNS (Garcia) [11]

Table 10: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.9	5.7	14.9	22.9	26.9	30.4	34.2	37.9	40.9	48.8	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	22	25	47	69	160	350	780	1600	2100	3200	ALPS [17]
AMaLGaM IDEA	6.7	5.7	3	3	3.8	4	4.1	4.1	4.3	4.4	AMaLGaM IDEA [4]
avg NEWUOA	**2.6**	3.6	3.8	4.8	6.9	7.6	8.8	9.5	9.9	11	avg NEWUOA [31]
BayEDAcG	17	13	60	190	310	*33e-1/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**2.3**	**1.5**	**1**	**1.4**	**1.4**	**1.4**	**1.4**	**2.6**	6.3	24	BFGS [30]
Cauchy EDA	14	13	7.4	6.4	7	7	7.4	7.7	8	8.4	Cauchy EDA [24]
BIPOP-CMA-ES	12	12	7.9	9	8.5	7.9	7.7	7.4	7.3	6.8	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	7.3	5.8	7.2	6.6	6.3	5.8	5.5	5.3	5.2	4.8	(1+1)-CMA-ES [2]
DASA	22	15	8900	5.2e4	6.1e4	9.5e4	1.2e5	1.1e5	1e5	8.6e4	DASA [19]
DEPSO	16	26	80	110	330	310	*51e-2/2e3*	.	.	.	DEPSO [12]
DIRECT	3.9	4.3	3.9	9.5	20	68	120	190	220	460	DIRECT [25]
EDA-PSO	17	26	43	140	330	640	1100	2100	3e3	8600	EDA-PSO [6]
full NEWUOA	**2**	**3**	3.8	4.5	6	6.4	7.1	7.7	8.2	9	full NEWUOA [31]
G3-PCX	11	9.5	26	39	39	37	34	31	29	25	G3-PCX [26]
simple GA	27	51	77	700	2800	4300	4.2e4	3.8e4	*23e-3/1e5*	.	simple GA [22]
GLOBAL	18	19	11	7.4	6.4	5.8	5.3	4.9	4.6	4	GLOBAL [23]
iAMaLGaM IDEA	5.5	4	3.3	3.7	4.1	4.1	4	4.1	4.2	4.1	iAMaLGaM IDEA [4]
LSfminbnd	**1.8**	**1**	770	6300	*15e+0/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**2.1**	**1.2**	770	2800	*15e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	16	20	13	18	19	20	19	18	18	17	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.2**	**1.7**	8.7	47	130	520	1100	1300	3700	MCS (Neum) [18]
NELDER (Han)	**3**	**2.2**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1**	NELDER (Han) [16]
NELDER (Doe)	3.2	**2.2**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**2.3**	**1.9**	3.1	4.3	6.5	7.3	8.5	9.6	10	11	NEWUOA [31]
(1+1)-ES	6.3	5.3	8700	2.4e4	7.7e4	1.5e5	4.3e5	*13e-2/1e6*	.	.	(1+1)-ES [1]
POEMS	110	90	300	540	1400	2100	2400	3200	3700	6400	POEMS [20]
PSO	23	26	180	280	480	650	850	990	1100	1900	PSO [7]
PSO_Bounds	21	24	530	770	740	830	1500	1900	1900	2100	PSO_Bounds [8]
Monte Carlo	23	55	110	690	3900	4.4e4	1.3e5	3.8e5	*61e-4/1e6*	.	Monte Carlo [3]
Rosenbrock	4.8	**2.8**	3.1	3.4	3.2	3	**2.9**	**2.8**	**3.2**	**3**	Rosenbrock [27]
IPOP-SEP-CMA-ES	8.3	12	16	14	16	15	13	12	12	11	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	22	25	17	12	12	11	10	9.4	9.1	8.3	VNS (Garcia) [11]

Table 11: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.7	5.67	17.6	22.5	25.2	30.8	33.7	37.6	40.7	48.5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	17	40	35	80	200	410	880	1200	1700	3400	ALPS [17]
AMaLGaM IDEA	4.8	5.4	**3**	3.5	4.2	3.9	4.2	4.4	4.4	4.6	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	**1.5**	**1.5**	3.3	5.1	5.4	6.8	7.3	8	8.8	avg NEWUOA [31]
BayEDAcG	9.3	18	31	150	1100	*14e-1/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1.6**	**1.7**	**1.2**	**1.6**	**2**	**1.7**	**1.9**	**2.7**	5.7	36	BFGS [30]
Cauchy EDA	13	15	6.7	7.4	8.1	8	8.3	8.1	8.9	9	Cauchy EDA [24]
BIPOP-CMA-ES	4.7	8.7	7.9	8.8	9.2	8.2	8	7.6	7.5	6.8	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.8	5.9	5.8	6.4	6.6	5.7	5.6	5.4	5.1	4.7	(1+1)-CMA-ES [2]
DASA	15	15	9e3	4e4	5.4e4	5.7e4	5.3e4	5e4	4.7e4	4.2e4	DASA [19]
DEPSO	24	34	34	110	*45e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	3.3	5.1	**2.6**	5.2	28	49	58	190	270	460	DIRECT [25]
EDA-PSO	8.6	27	96	260	460	990	1900	2900	6500	*36e-6/1e5*	EDA-PSO [6]
full NEWUOA	**1.6**	3.5	**2.7**	4.4	6.2	6.2	7	7.7	8	8.6	full NEWUOA [31]
G3-PCX	9.5	9.1	9.7	25	28	36	35	33	32	27	G3-PCX [26]
simple GA	20	57	53	220	5e3	4.6e4	*14e-2/1e5*	.	.	.	simple GA [22]
GLOBAL	17	23	9.2	7.5	6.9	5.8	5.4	4.9	4.6	4	GLOBAL [23]
iAMaLGaM IDEA	4.5	6	**2.8**	3.3	4	3.8	4	3.9	3.9	4	iAMaLGaM IDEA [4]
LSfminbnd	**2.1**	**1.8**	500	2900	5500	*96e-1/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	380	1800	2600	*81e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	12	15	11	18	23	21	20	20	20	17	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.1**	87	120	170	300	920	1300	2e3	*91e-5/3e4*	MCS (Neum) [18]
NELDER (Han)	**2**	**2.1**	**1**	**1.1**	**1.1**	**1**	**1.1**	**1.1**	**1.1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**2.2**	**2.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.2**	**1.5**	**1.5**	3.2	5.5	6.1	6.9	7.7	8.4	11	NEWUOA [31]
(1+1)-ES	4.2	850	7700	2.1e4	6e4	2.3e5	4.4e5	*63e-3/1e6*	.	.	(1+1)-ES [1]
POEMS	55	83	1e3	1400	2100	2800	4e3	6500	7900	7100	POEMS [20]
PSO	10	23	480	530	660	670	860	1e3	1300	1900	PSO [7]
PSO_Bounds	11	21	3200	5200	6300	5500	6700	6300	6100	5500	PSO_Bounds [8]
Monte Carlo	16	51	94	870	6300	4.3e4	2.1e5	*97e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**2.3**	**2.9**	**2.4**	**2.7**	3	**2.7**	**2.6**	**2.5**	**2.6**	**2.5**	Rosenbrock [27]
IPOP-SEP-CMA-ES	5.4	6.9	13	17	17	14	13	13	12	11	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	8.4	14	12	12	12	11	10	9.7	9.4	8.6	VNS (Garcia) [11]

Table 12: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	5	9.17	16.9	23	37.6	47	52.4	62.7	76.3	97.4	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	19	37	40	51	76	94	130	210	230	370	ALPS [17]
AMaLGaM IDEA	5.4	4.1	5.8	13	17	17	17	18	16	15	AMaLGaM IDEA [4]
avg NEWUOA	**1.7**	**1.1**	**1**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.4**	**1.4**	avg NEWUOA [31]
BayEDAcG	40	26	69	87	*67e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.8**	**1.1**	**1.2**	3.2	3.1	**2.9**	**2.8**	**2.6**	**2.4**	4.2	BFGS [30]
Cauchy EDA	11	9.9	14	24	19	18	18	17	15	14	Cauchy EDA [24]
BIPOP-CMA-ES	6	6.1	7.9	12	9.9	9.1	9	11	9.6	8.2	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.9	7	9.4	13	10	8.9	8.7	7.6	6.5	5.6	(1+1)-CMA-ES [2]
DASA	16	64	2700	6800	6100	8800	1.4e4	1.2e4	9700	7900	DASA [19]
DEPSO	17	16	41	55	51	48	45	40	35	45	DEPSO [12]
DIRECT	3	3.3	6.2	35	80	70	160	270	250	290	DIRECT [25]
EDA-PSO	11	24	40	98	160	300	790	1e3	1e3	820	EDA-PSO [6]
full NEWUOA	**1.4**	**1.9**	4.6	5.2	3.8	3.4	3.3	3	**2.7**	**2.4**	full NEWUOA [31]
G3-PCX	9.1	6.1	12	29	34	34	32	31	29	28	G3-PCX [26]
simple GA	23	39	93	170	580	1e3	2400	2700	2200	1900	simple GA [22]
GLOBAL	11	11	8.1	8.3	7.2	6.3	6.4	5.9	5	4.4	GLOBAL [23]
iAMaLGaM IDEA	4.1	**2.5**	4.5	7	6.4	6.4	6.4	6	5.8	5.4	iAMaLGaM IDEA [4]
LSfminbnd	**1.7**	**1**	590	1200	770	630	570	490	410	330	LSfminbnd [28]
LSstep	500	280	300	230	230	350	720	600	820	640	LSstep [28]
MA-LS-Chain	13	13	12	15	13	12	13	13	12	10	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.1**	62	49	32	26	24	28	39	30	MCS (Neum) [18]
NELDER (Han)	**1.9**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**2**	**1.4**	**1.1**	**1.6**	**1.6**	**1.7**	**1.7**	**1.6**	**1.4**	**1.3**	NELDER (Doe) [5]
NEWUOA	**1.5**	**1.1**	**1.9**	**2.9**	**2.3**	**2.1**	**2**	**1.8**	**1.6**	**1.4**	NEWUOA [31]
(1+1)-ES	3.8	1500	6800	1.7e4	2.3e4	5.5e4	1.3e5	2.3e5	1.9e5	*25e-3/1e6*	(1+1)-ES [1]
POEMS	64	79	83	650	1100	1200	1600	2100	2900	1.5e4	POEMS [20]
PSO	11	12	19	57	110	130	160	180	220	300	PSO [7]
PSO_Bounds	12	19	230	440	390	510	690	630	560	560	PSO_Bounds [8]
Monte Carlo	18	27	97	580	3200	1.6e4	1.4e5	*38e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	3.3	**2.9**	**2.5**	3.6	**3**	5.4	5.1	4.5	3.9	3.3	Rosenbrock [27]
IPOP-SEP-CMA-ES	7.4	9.2	7.6	9.5	9.6	8.8	8.5	8.1	7	6.3	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	17	17	15	13	8.8	7.5	7.1	6.4	5.6	4.9	VNS (Garcia) [11]

Table 13: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{13}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	2.3	11.3	17.6	23.2	30	35.4	41.5	47.4	61.1	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.3**	3.2	13	47	100	170	300	1300	3700	2.9e4	ALPS [17]
AMaLGaM IDEA	**1.1**	3.4	**2.6**	3.2	3.6	3.7	3.9	4	3.9	4.1	AMaLGaM IDEA [4]
avg NEWUOA	**1.8**	6.7	6.7	17	38	54	73	130	140	770	avg NEWUOA [31]
BayEDAcG	**1.4**	**2.4**	52	140	570	950	*11e-1/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1.2**	5	6.8	15	45	74	160	660	580	*67e-5/5e3*	BFGS [30]
Cauchy EDA	4.1	15	7.3	7.7	7.7	8.2	8.5	8.6	8.5	8.5	Cauchy EDA [24]
BIPOP-CMA-ES	**1.3**	4.3	3.2	5.4	5.7	5.9	6.4	6.1	6.6	7	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.1**	4.4	5.2	7.3	7	7.3	8.1	7.6	7.9	7.6	(1+1)-CMA-ES [2]
DASA	13	90	540	850	2600	4900	1.6e4	4.7e4	1.4e5	*62e-5/1e6*	DASA [19]
DEPSO	**1.1**	6.1	8.4	25	63	120	*18e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	4.2	5.1	8.7	24	49	74	120	DIRECT [25]
EDA-PSO	**1.4**	3.5	6.4	42	180	270	710	4e3	3.1e4	*27e-5/1e5*	EDA-PSO [6]
full NEWUOA	**1.5**	5.2	8.5	12	31	76	140	290	760	1800	full NEWUOA [31]
G3-PCX	**1.2**	3.9	13	30	36	47	50	55	70	61	G3-PCX [26]
simple GA	**1.3**	3.7	25	170	1100	2.2e4	*25e-3/1e5*	.	.	.	simple GA [22]
GLOBAL	**1.3**	**2.8**	9.2	9.3	7.3	6	13	*67e-5/400*	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	3.3	**2.6**	**3.1**	**3.6**	**3.3**	**3.6**	**3.6**	**3.6**	**3.7**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	16	52	110	170	470	850	*13e-3/1e4*	.	.	LSfminbnd [28]
LSstep	28	420	280	570	1e3	1500	*35e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	3.3	8.7	17	18	21	23	21	19	22	MA-LS-Chain [21]
MCS (Neum)	**1**	4.7	23	20	170	960	2200	2500	*75e-4/3e4*	.	MCS (Neum) [18]
NELDER (Han)	**1.7**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1.3**	**2.2**	**1.1**	**1.1**	**1**	**1**	**1**	**1**	**1.1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.6**	**2.8**	6.3	10	22	25	72	62	91	150	NEWUOA [31]
(1+1)-ES	**1.9**	31	37	94	210	370	790	4200	8100	3.7e4	(1+1)-ES [1]
POEMS	170	110	48	93	140	330	1100	2300	6300	2.4e4	POEMS [20]
PSO	**1.6**	3.3	9	27	76	140	330	1100	2900	1.1e4	PSO [7]
PSO_Bounds	**1.1**	3.8	9.2	43	120	260	620	1200	3e3	*93e-7/1e5*	PSO_Bounds [8]
Monte Carlo	**1.6**	5.4	18	280	1.2e4	1.1e5	*32e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	3.2	4.8	5.6	7	7.5	18	28	43	70	170	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.1**	3.7	13	20	18	15	14	14	13	11	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.4**	3.9	8.8	9.7	9.6	8.8	9.2	9.1	8.6	8.4	VNS (Garcia) [11]

Table 14: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{14}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	0.7	3.7	8.1	12.2	18.9	27.8	33.7	45.1	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.6**	**2.4**	14	60	75	83	130	530	ALPS [17]
AMaLGaM IDEA	**1**	**1.2**	**1.6**	3.3	3.9	4.7	4.2	3.9	3.8	4.2	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.4**	3.4	**2.2**	**1.4**	**1.3**	**1.6**	**1.8**	**2.2**	6.8	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.9**	**1.8**	10	25	67	98	180	*12e-5/2e3*	BayEDAcG [10]
BFGS	**1**	**1.4**	**2.1**	**2.8**	**1.8**	**1.7**	**1.4**	**1.1**	**1**	6	BFGS [30]
Cauchy EDA	**1**	4.6	13	13	12	11	10	8.6	8.9	8.5	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.1**	**1.9**	**2.5**	3	4.2	4.6	5.3	5.5	7.1	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.4**	**1.7**	3.1	3.4	3.6	4	3.9	4.4	4.7	(1+1)-CMA-ES [2]
DASA	**1**	18	22	22	16	18	33	590	9300	3.1e5	DASA [19]
DEPSO	**1**	**1**	**1.4**	5.2	10	16	17	18	55	*17e-7/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1.3**	**2.1**	**2.8**	6	8.6	12	32	DIRECT [25]
EDA-PSO	**1**	**1.2**	**1.4**	**2.9**	8.2	12	15	74	160	1100	EDA-PSO [6]
full NEWUOA	**1**	**1.4**	3.2	**1.4**	**1**	**1**	**1**	**1.1**	**1.5**	3.7	full NEWUOA [31]
G3-PCX	**1**	**1.2**	**1.8**	6.3	6.3	5.9	6.6	7.6	9.1	11	G3-PCX [26]
simple GA	**1**	**1.1**	**1**	4	41	200	280	630	3200	*58e-7/1e5*	simple GA [22]
GLOBAL	**1**	**1.1**	**1.7**	5.5	13	13	8.8	6.2	8.2	*34e-7/300*	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.5**	**1.6**	3.7	3.9	4	3.9	3.4	3.5	3.6	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.3**	4.7	5.4	**3**	6.2	76	1500	*23e-5/1e4*	.	LSfminbnd [28]
LSstep	**1**	55	40	73	50	120	1600	5100	*23e-4/1e4*	.	LSstep [28]
MA-LS-Chain	**1**	**1.3**	**1.7**	3.1	9.6	15	13	12	12	17	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1.4**	**1.7**	**2.8**	3.1	23	8200	MCS (Neum) [18]
NELDER (Han)	**1**	**1.5**	**2.1**	**1.4**	**1.4**	**1.4**	**1.2**	**1**	**1**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.3**	**1.4**	**1.3**	**1.3**	**1.1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	3.7	**2.4**	**1.6**	**1.5**	**1.6**	**1.8**	**2.1**	5.4	NEWUOA [31]
(1+1)-ES	**1**	**1.7**	**2.3**	**2.5**	**2.5**	3.4	9.2	160	3400	*22e-7/1e6*	(1+1)-ES [1]
POEMS	**1**	140	190	86	73	160	180	180	330	3300	POEMS [20]
PSO	**1**	**1.1**	**1.4**	4.8	13	25	36	48	85	1700	PSO [7]
PSO_Bounds	**1**	**1.1**	**1.5**	**2.7**	14	45	72	110	180	1200	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.8**	**2.6**	31	560	7200	1.1e5	4.2e5	*15e-5/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**2.2**	4	**1.9**	**1.6**	**1.6**	**1.9**	**1.8**	**2.4**	**3**	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.2**	**1.6**	**1.8**	4.4	4.9	7.4	9.7	10	11	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.1**	6.2	10	9.4	9	8.1	8.6	9.3	VNS (Garcia) [11]

Table 15: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.6	18.6	146	517	533	556	582	616	706	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.1**	**1.6**	**2.7**	6.8	3.4	4.8	5.7	7.1	7.9	9.1	ALPS [17]
AMaLGaM IDEA	**1.1**	**2.8**	**1.1**	4.3	**2.7**	**2.8**	**2.8**	**2.7**	**2.6**	**2.3**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**2.6**	**2.5**	**2.5**	3.3	3.2	3.1	**2.9**	**2.8**	**2.4**	avg NEWUOA [31]
BayEDAcG	**1**	**2.2**	**2.1**	8.2	7.6	26	*16e-2/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1.2**	17	4.2	4.6	7.9	7.7	7.3	7	6.6	5.8	BFGS [30]
Cauchy EDA	9.1	38	4.9	**2.9**	3.2	11	14	14	13	12	Cauchy EDA [24]
BIPOP-CMA-ES	**1.2**	**2.9**	**1.1**	**1.8**	**2.1**	**2.2**	**2.2**	**2.1**	**2.1**	**1.9**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.2**	**2.8**	22	7.7	7.6	7.4	7.1	6.8	6.5	5.7	(1+1)-CMA-ES [2]
DASA	4.6	22	64	84	64	62	60	57	54	48	DASA [19]
DEPSO	**1.1**	**1.6**	**2.9**	3.8	**1.7**	**2.2**	**2.5**	**2.6**	3	6.3	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	DIRECT [25]
EDA-PSO	**1**	3.3	**2**	9.3	6.1	8.3	8.3	8.5	8.4	8.1	EDA-PSO [6]
full NEWUOA	**1.2**	3.1	**1.5**	**1.4**	3.5	3.4	3.3	3.1	**3**	**2.6**	full NEWUOA [31]
G3-PCX	**1.1**	**2.3**	7.8	13	22	21	20	19	18	16	G3-PCX [26]
simple GA	**1.2**	**2.3**	4.2	18	13	34	96	98	100	120	simple GA [22]
GLOBAL	**1.1**	**2.6**	**3**	**1.6**	**2.6**	**2.5**	**2.4**	**2.3**	**2.2**	**2**	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**2.5**	**1**	4.2	5.1	5.1	5	4.8	4.6	4.1	iAMaLGaM IDEA [4]
LSfminbnd	**1.1**	6.2	3.7	20	36	51	66	210	*71e-2/9e3*	.	LSfminbnd [28]
LSstep	**1.1**	47	170	200	80	79	77	74	71	63	LSstep [28]
MA-LS-Chain	**1.1**	**2**	**1.7**	**1.9**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	**1.3**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2.1**	3.5	**1.4**	**1.4**	**1.3**	**1.3**	**1.2**	**1.1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1.9**	8.4	7.3	9.7	9.4	9	8.6	8.2	7.1	NELDER (Han) [16]
NELDER (Doe)	**1**	3.2	**1.1**	**1.3**	**1.4**	**1.3**	**1.3**	**1.2**	**1.2**	**1**	NELDER (Doe) [5]
NEWUOA	**1.1**	11	4.1	3.4	3.3	3.2	3	**2.9**	**2.7**	**2.4**	NEWUOA [31]
(1+1)-ES	**1.4**	3.7	**1.1**	5.3	8.4	8.2	7.9	7.5	7.1	6.3	(1+1)-ES [1]
POEMS	28	120	16	19	18	20	21	21	22	22	POEMS [20]
PSO	**1.1**	**2.4**	**1.9**	4.1	16	16	16	16	16	15	PSO [7]
PSO_Bounds	**1.2**	**2.3**	**1.7**	6.6	3.9	7.3	9.2	11	11	12	PSO_Bounds [8]
Monte Carlo	**1.1**	**2.1**	**2.4**	64	150	1500	5800	1.2e4	*50e-4/1e6*	.	Monte Carlo [3]
Rosenbrock	**1.3**	19	15	9.7	9.5	9.2	8.9	8.5	8	7	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	3.8	**1.5**	**2.9**	**2.1**	**2.2**	**2.2**	**2.1**	**2.1**	**1.9**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	3.3	3.4	**1.9**	**2.4**	**2.4**	**2.3**	**2.4**	**2.7**	3.7	VNS (Garcia) [11]

Table 16: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.567	4.57	25	87.2	163	179	195	205	269	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.3**	**2.7**	5.6	9.1	14	19	25	34	37	ALPS [17]
AMaLGaM IDEA	**1**	**1.2**	3.2	**3.4**	5.1	4.6	4.5	4.2	4.1	3.3	AMaLGaM IDEA [4]
avg NEWUOA	**1**	12	15	9.1	5.5	6.8	13	21	37	73	avg NEWUOA [31]
BayEDAcG	**1**	**1.4**	**1.5**	9.8	24	39	76	71	68	110	BayEDAcG [10]
BFGS	**1**	11	40	150	170	270	*27e-2/6e3*	.	.	.	BFGS [30]
Cauchy EDA	**1**	4.2	4.5	4.4	6.1	15	29	31	35	27	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	3.1	3.5	3.5	**2.5**	**2.4**	**2.3**	**2.3**	**1.9**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.2**	6	**2.3**	**2.3**	5.2	8.8	12	11	12	(1+1)-CMA-ES [2]
DASA	**1**	9	29	150	180	130	210	250	340	530	DASA [19]
DEPSO	**1**	**1.5**	3.9	10	10	9.6	26	38	72	*16e-4/2e3*	DEPSO [12]
DIRECT	**1**	**1.4**	**1.6**	**1**	**1**	**1**	**1**	**1.5**	**2**	**1.9**	DIRECT [25]
EDA-PSO	**1**	**1.8**	**2.6**	4.8	15	200	290	370	410	320	EDA-PSO [6]
full NEWUOA	**1**	**2.5**	8.1	5.9	3.9	3.2	5.5	7.6	10	16	full NEWUOA [31]
G3-PCX	**1**	**1.4**	**2.8**	8.9	3.1	4.5	4.8	5	5.3	11	G3-PCX [26]
simple GA	**1**	**1.2**	**2**	4.1	16	42	180	450	690	690	simple GA [22]
GLOBAL	**1**	**1.7**	3.9	5.1	**2.4**	**1.4**	**1.5**	**1.4**	**1.7**	**1.5**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	**1**	6.9	7.4	9.1	9.2	8.6	8.3	7	iAMaLGaM IDEA [4]
LSfminbnd	**1**	3.6	5.6	5.7	5.4	8.3	14	33	38	110	LSfminbnd [28]
LSstep	**1**	**1.5**	**1.6**	11	23	63	70	150	200	150	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**1.3**	3.6	4.2	6.4	10	11	10	8.3	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.1**	5.1	6.7	**2.7**	4.3	6.8	10	29	120	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	**1.2**	7.6	4.4	4.7	4.3	4	3.8	**2.9**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.6**	3.5	**1.8**	**1.1**	**1.1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1**	**2.4**	9	10	6.8	6.9	22	37	44	77	NEWUOA [31]
(1+1)-ES	**1**	**1.7**	35	38	35	33	56	73	84	120	(1+1)-ES [1]
POEMS	**1**	98	71	650	200	110	110	110	110	88	POEMS [20]
PSO	**1**	**1.7**	**2.5**	3.8	6.1	100	94	88	86	69	PSO [7]
PSO_Bounds	**1**	**1.2**	**2.8**	6.4	11	110	120	120	120	100	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	**2.3**	5	20	140	1200	2.4e4	7.2e4	*18e-5/1e6*	Monte Carlo [3]
Rosenbrock	**1**	10	33	36	33	27	79	290	*19e-4/8e3*	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.8**	3.2	4.1	**2.4**	**2.9**	4	3.8	3.9	3.3	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.2**	4.6	5	4.8	4.9	4.7	4.7	5.6	6.8	VNS (Garcia) [11]

Table 17: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	1.33	30.4	66.5	138	198	372	543	828	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.2**	**1.5**	**2.8**	16	15	17	12	12	11	ALPS [17]
AMaLGaM IDEA	**1**	**1.5**	**1.5**	**1.3**	4.8	**2.7**	4.5	3.3	**2.9**	**2.1**	AMaLGaM IDEA [4]
avg NEWUOA	**1.1**	**1.3**	12	4.6	13	33	120	*75e-4/5e3*	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.1**	**1**	**2**	8	7	8.7	8.8	27	*87e-6/2e3*	BayEDAcG [10]
BFGS	**1**	6.4	15	16	90	*24e-2/2e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	7.9	18	120	56	28	20	11	16	13	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.2**	4.1	**1.8**	**1.5**	**1**	**1**	**1**	**1.3**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	12	3.1	5.9	14	14	14	16	10	(1+1)-CMA-ES [2]
DASA	**1**	**1**	21	29	37	52	93	230	340	220	DASA [19]
DEPSO	**1**	**1.3**	**2.7**	**1.1**	4.3	3.7	3.7	**2.8**	**2.4**	**2.8**	DEPSO [12]
DIRECT	**1**	**1**	**1.4**	**1**	**1**	**1**	**1.4**	**1.2**	**1**	**1**	DIRECT [25]
EDA-PSO	**1.1**	**1.1**	**2.6**	**2**	3.9	7.4	9.9	8.2	8	7.1	EDA-PSO [6]
full NEWUOA	**1**	**1.4**	8.2	4.4	14	21	53	48	*30e-4/6e3*	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**2.5**	4.5	6.2	3.9	3.2	**2.6**	4.4	**3**	G3-PCX [26]
simple GA	**1**	**1.2**	**2.1**	5.1	47	61	91	120	150	*69e-8/1e5*	simple GA [22]
GLOBAL	**1**	**1.2**	**2.6**	4	4.1	3.9	4.4	9.6	*75e-4/500*	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	**1.3**	8.8	6.2	4.2	5.1	4.2	4	**2.8**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.2**	5.4	**1.2**	7.3	55	*16e-3/5e3*	.	.	.	LSfminbnd [28]
LSstep	**1.1**	**2**	42	40	35	44	82	390	*10e-4/1e4*	.	LSstep [28]
MA-LS-Chain	**1.1**	**1.3**	**1.3**	**2.2**	5.3	4.3	4.8	**2.8**	3.1	**2.9**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.3**	4.3	4.8	5.4	9.2	44	140	130	MCS (Neum) [18]
NELDER (Han)	**1**	**1.5**	130	28	20	14	11	12	9.6	6.3	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.5**	**1.4**	**1.5**	3.3	**3**	3.1	7	5.9	4	NELDER (Doe) [5]
NEWUOA	**1**	**1.9**	7.7	6.8	18	33	120	*75e-4/5e3*	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	**2.7**	5.9	6.7	4.8	8.5	13	23	15	(1+1)-ES [1]
POEMS	4.5	110	110	18	35	31	32	23	24	21	POEMS [20]
PSO	**1.1**	**1.2**	**1.9**	**1.6**	5	6.2	8.1	6.2	5.5	5.5	PSO [7]
PSO_Bounds	**1**	**1.3**	**1.9**	**1.3**	13	15	22	15	21	30	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	**1.7**	5.2	220	4900	7.4e4	*73e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	20	45	83	140	500	350	*24e-2/5e3*	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.9**	4	**2.2**	**2.8**	**2.3**	**1.8**	**1.6**	**1.5**	**1.4**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.5**	5.7	4.7	**2.7**	**2.9**	**2.6**	6.7	32	VNS (Garcia) [11]

Table 18: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	1.6	9.5	66.9	333	625	854	1040	1220	1430	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.1**	**1.3**	**1.6**	6.6	5.5	5.4	6.7	8.1	9.6	13	ALPS [17]
AMaLGaM IDEA	**1.1**	**1.3**	**1.3**	4.1	**1**	**1**	**1.1**	**1.2**	**1.1**	**1.1**	AMaLGaM IDEA [4]
avg NEWUOA	**1.7**	7.9	5.4	9	6.1	62	*58e-3/6e3*	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.4**	**1.5**	**2.3**	19	19	48	*53e-2/2e3*	.	.	.	BayEDAcG [10]
BFGS	5.4	11	14	30	110	*74e-2/2e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**2.6**	2200	380	55	11	6.4	5	7	7.4	6.7	Cauchy EDA [24]
BIPOP-CMA-ES	**1.6**	**2.4**	**2.2**	6.5	**1.9**	**1.1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	22	6.6	13	17	38	83	140	*32e-3/1e4*	.	(1+1)-CMA-ES [2]
DASA	3.3	27	26	91	86	740	1800	4200	5900	5e3	DASA [19]
DEPSO	**1.3**	**1**	**2.7**	3.1	**2.1**	3.3	11	9.4	8.3	*75e-4/2e3*	DEPSO [12]
DIRECT	**1.4**	**1.9**	**1**	**1**	**1.1**	**1.2**	3.4	4.8	4.9	11	DIRECT [25]
EDA-PSO	**1.3**	**1.3**	**2.4**	5.4	7.1	9.1	11	12	13	15	EDA-PSO [6]
full NEWUOA	**1.2**	5	**3**	16	19	71	*58e-3/6e3*	.	.	.	full NEWUOA [31]
G3-PCX	**1.9**	**1.1**	**2**	10	21	41	48	72	99	85	G3-PCX [26]
simple GA	**1.1**	**1.5**	4.3	15	23	110	280	680	1200	*24e-4/1e5*	simple GA [22]
GLOBAL	**1.3**	**1.2**	**2**	3.1	**2.2**	4.8	7.6	*58e-3/1e3*	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**1.8**	**1.4**	12	**2.9**	**1.8**	**2.3**	**2**	**2**	**1.8**	iAMaLGaM IDEA [4]
LSfminbnd	**2.1**	3.6	**1.3**	**2.1**	7	33	*58e-3/4e3*	.	.	.	LSfminbnd [28]
LSstep	28	18	12	79	60	110	*24e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.7**	**1.5**	**1.6**	3.2	**2.5**	3.2	4	3.9	5.8	7	MA-LS-Chain [21]
MCS (Neum)	**1.4**	**3**	**1.3**	**2.8**	**1.7**	8.4	140	350	*30e-4/3e4*	.	MCS (Neum) [18]
NELDER (Han)	**1.2**	**1.3**	21	44	18	20	38	47	40	34	NELDER (Han) [16]
NELDER (Doe)	**1.3**	**1.3**	**1.2**	3.1	**2.4**	4.3	5.8	8.7	25	21	NELDER (Doe) [5]
NEWUOA	**1.3**	13	5.6	12	14	62	*98e-3/6e3*	.	.	.	NEWUOA [31]
(1+1)-ES	**1.5**	**2.4**	63	230	620	1500	4900	1.4e4	*75e-4/1e6*	.	(1+1)-ES [1]
POEMS	100	72	28	120	29	28	23	31	45	42	POEMS [20]
PSO	**1.3**	**1.3**	**1.7**	3.4	**2.8**	3.2	3.5	5.6	6.5	7.2	PSO [7]
PSO_Bounds	**1.4**	**1.5**	**1.5**	5.3	6.7	8.8	10	12	17	23	PSO_Bounds [8]
Monte Carlo	**1.1**	**1.2**	**2.2**	21	270	1.1e4	*24e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	26	54	61	56	200	*53e-2/5e3*	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.5**	4.9	**2.1**	6.2	**2.1**	**1.3**	**1.1**	**1**	**1.1**	**1.1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.6**	3.8	16	5.4	3.6	4.8	8.1	18	150	VNS (Garcia) [11]

Table 19: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	0.5	0.5	13.2	108	114	120	126	138	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	5.5	55	17	12	22	30	41	54	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	6.3	40	**6.2**	18	18	17	17	16	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.3**	8	110	13	22	21	20	19	18	avg NEWUOA [31]
BayEDAcG	**1**	**1.1**	3.9	44	9.9	13	57	*35e-4/2e3*	.	.	BayEDAcG [10]
BFGS	**1**	11	37	310	61	30	29	27	26	24	BFGS [30]
Cauchy EDA	**1**	**1.1**	16	110	51	170	860	1300	2800	*18e-4/5e4*	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	6	31	10	12	12	15	14	14	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	5.6	87	33	32	31	29	28	26	(1+1)-CMA-ES [2]
DASA	**1**	7.5	42	760	97	250	250	250	260	270	DASA [19]
DEPSO	**1**	**1**	4.4	59	17	18	35	36	69	67	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**4.6**	10	9.6	9.1	**8.9**	59	DIRECT [25]
EDA-PSO	**1**	**1.1**	5.2	37	13	17	30	57	62	72	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	6.7	88	17	17	17	16	15	14	full NEWUOA [31]
G3-PCX	**1**	**1**	5.3	52	37	49	47	45	43	40	G3-PCX [26]
simple GA	**1**	**1.2**	4.5	51	20	21	110	360	640	4900	simple GA [22]
GLOBAL	**1**	**1.3**	4.3	50	9.4	11	10	10	9.6	**8.8**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	5.5	**25**	63	50	48	48	46	42	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.1**	9.4	49	10	29	70	120	310	*59e-5/5e3*	LSfminbnd [28]
LSstep	**1**	**1.9**	140	440	27	63	140	580	*11e-4/1e4*	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	6.7	60	7.2	15	15	14	14	13	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	3.1	380	64	32	30	29	27	25	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	4.6	52	10	**8.1**	**7.8**	**7.4**	**7.1**	**6.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1.5**	6.2	130	16	27	26	25	24	22	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	6.2	100	22	23	25	27	30	38	(1+1)-ES [1]
POEMS	**1**	130	340	550	57	210	200	200	190	190	POEMS [20]
PSO	**1**	**1.1**	5.3	34	9.1	**4.7**	**6**	**8.7**	9.9	16	PSO [7]
PSO_Bounds	**1**	**1.5**	5.1	40	7.8	11	20	36	47	71	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	4.5	64	16	36	110	310	720	3.2e4	Monte Carlo [3]
Rosenbrock	**1**	6.9	42	160	34	30	29	28	26	24	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.5**	4.3	29	6.8	19	20	19	19	18	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.2**	**2.2**	43	12	19	19	20	20	21	VNS (Garcia) [11]

Table 20: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.1	1.6	1.87	30.3	182	183	183	184	185	188	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**2.1**	**2.8**	3.1	14	6.2	9.2	12	16	20	26	ALPS [17]
AMaLGaM IDEA	**2.2**	**2.5**	**2.6**	26	37	38	38	38	38	38	AMaLGaM IDEA [4]
avg NEWUOA	**3**	**2.2**	**2.1**	9.8	4	4	4	4	4	3.9	avg NEWUOA [31]
BayEDAcG	3.2	4	3.6	9.2	32	*25e-2/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**2.5**	**2.2**	**2.1**	6	**2.7**	**2.7**	**2.7**	**2.7**	**2.7**	**2.6**	BFGS [30]
Cauchy EDA	26	20	18	9.9	31	150	1300	2e3	2e3	1900	Cauchy EDA [24]
BIPOP-CMA-ES	**2.9**	**2.8**	**2.7**	13	9.9	10	11	11	11	11	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.2**	**2**	**2.1**	7.5	8.5	8.6	8.6	8.6	8.6	8.6	(1+1)-CMA-ES [2]
DASA	59	52	49	81	44	45	45	45	45	45	DASA [19]
DEPSO	**1.4**	**1**	**1**	9.9	4.9	5.6	6.4	6.8	8	9.2	DEPSO [12]
DIRECT	5.7	5.9	6.1	**1**	**2.9**	3	3.1	3.3	3.7	3.9	DIRECT [25]
EDA-PSO	**1.7**	3.3	3.2	9	13	21	25	25	26	27	EDA-PSO [6]
full NEWUOA	**2.9**	**2.1**	**1.8**	18	8.3	8.3	8.3	8.3	8.2	8.1	full NEWUOA [31]
G3-PCX	**2.9**	**2.8**	**2.9**	38	7.8	7.8	8	8.1	8.1	8.2	G3-PCX [26]
simple GA	**2.7**	**2.4**	**2.8**	14	15	27	45	65	85	130	simple GA [22]
GLOBAL	**1.8**	**1.9**	**2.4**	11	4.5	4.5	4.5	4.5	4.5	4.5	GLOBAL [23]
iAMaLGaM IDEA	**2.1**	**2.4**	**2.2**	51	26	26	27	27	27	27	iAMaLGaM IDEA [4]
LSfminbnd	6.5	6.7	6.6	150	*68e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	94	210	180	120	25	27	30	37	40	50	LSstep [28]
MA-LS-Chain	**1.5**	**1.9**	**2.4**	4.2	**1.8**	**2**	**2.1**	**2.2**	**2.3**	**2.4**	MA-LS-Chain [21]
MCS (Neum)	**2.9**	6.2	5.7	**2.2**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1.5**	**1.3**	**1.3**	36	28	28	28	28	28	27	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**1.7**	**1.5**	**3.9**	**2.8**	**2.8**	**2.9**	**2.9**	**2.9**	**2.9**	NELDER (Doe) [5]
NEWUOA	**3**	**2.2**	**2.1**	7	5.9	5.9	5.9	5.9	5.8	5.8	NEWUOA [31]
(1+1)-ES	4.1	3.7	3.3	13	9	9.1	9.2	9.2	9.2	9.2	(1+1)-ES [1]
POEMS	190	140	130	25	30	35	42	46	52	61	POEMS [20]
PSO	**2.5**	**2.2**	**2.5**	8.3	5	6.3	8.7	10	12	15	PSO [7]
PSO_Bounds	**2.5**	**2.9**	3.7	11	6	13	20	25	30	36	PSO_Bounds [8]
Monte Carlo	**2.2**	**2.8**	3.6	21	67	680	5800	8.2e4	*80e-5/1e6*	.	Monte Carlo [3]
Rosenbrock	5	4	4	6.8	4.1	4.2	4.2	4.2	4.2	4.2	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.6**	**1.8**	**1.8**	9.4	15	16	17	18	18	18	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	3.8	4.3	18	9.3	9.6	9.7	9.9	10	13	VNS (Garcia) [11]

Table 21: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{21}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	0.833	25.3	87.2	138	145	153	162	165	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.2**	**2.2**	**1.8**	**2.6**	4.9	6.4	7.8	12	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.3**	28	17	11	11	10	10	10	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	6.1	6.5	4.6	**2.9**	**2.8**	**2.7**	**2.6**	**2.7**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.7**	**1.6**	9.3	14	39	57	86	85	BayEDAcG [10]
BFGS	**1**	**1**	**2.6**	4.8	3	**2**	**1.9**	**1.8**	**1.7**	**1.8**	BFGS [30]
Cauchy EDA	**1**	**1**	6	310	93	62	65	62	81	80	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1.4**	11	10	8.2	9.7	9.3	8.9	8.9	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**1.2**	12	9.6	6.1	5.9	5.6	5.3	5.3	(1+1)-CMA-ES [2]
DASA	**1**	**1**	13	150	140	88	84	80	77	76	DASA [19]
DEPSO	**1**	**1**	**2.1**	**2.5**	**1.5**	**1.8**	**2.4**	**2.6**	**2.9**	5.6	DEPSO [12]
DIRECT	**1**	**1**	**1.3**	**1**	**1**	**1**	**1**	**2**	**2**	**2.3**	DIRECT [25]
EDA-PSO	**1**	**1**	**1**	**1.8**	83	54	53	52	51	52	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.2**	3.6	**3**	**1.9**	**1.8**	**1.7**	**1.7**	**1.7**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.4**	**2.7**	**2.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.8**	G3-PCX [26]
simple GA	**1**	**1**	**1.4**	**1**	**1.7**	4.1	7.7	18	120	270	simple GA [22]
GLOBAL	**1**	**1**	**1.5**	**1.1**	**1.1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	21	12	7.9	7.8	7.5	7.2	7.1	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**2.1**	39	20	26	46	60	73	170	LSfminbnd [28]
LSstep	**1**	**1**	18	370	150	100	100	100	120	190	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.4**	**1.1**	**1.5**	**1.5**	**1.7**	**1.9**	**1.9**	**2**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.6**	22	14	8.8	8.4	8	7.6	7.5	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1.8**	19	20	13	12	12	11	11	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.4**	**2.6**	**2.6**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	3.5	3.9	4	**2.5**	**2.4**	**2.3**	**2.2**	**2.3**	NEWUOA [31]
(1+1)-ES	**1**	**1**	**2.8**	14	19	12	11	11	10	10	(1+1)-ES [1]
POEMS	**1**	**1**	130	93	890	560	540	520	490	490	POEMS [20]
PSO	**1**	**1**	**1.2**	**1.4**	83	53	51	48	46	47	PSO [7]
PSO_Bounds	**1**	**1**	**1.5**	33	300	190	180	170	170	170	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2**	**1.8**	**1.2**	3.5	8.8	28	42	640	Monte Carlo [3]
Rosenbrock	**1**	**1**	**2.3**	5.5	3.9	**2.5**	**2.4**	**2.3**	**2.2**	**2.1**	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1.3**	9.6	6.4	6.3	8.5	8.7	8.6	9.2	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1.1**	6.1	14	9.1	8.8	8.5	8.4	8.4	VNS (Garcia) [11]

Table 22: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{22}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	2.53	13.4	83.9	109	125	142	144	153	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.2**	**1.3**	**1**	**3**	5.2	7.1	9.2	15	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.3**	51	18	19	17	15	15	15	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**3**	3.8	**1.3**	**1.1**	**1.1**	**1.1**	**1.1**	**1.3**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.3**	3.3	7.6	11	34	59	200	*37e-4 /2e3*	BayEDAcG [10]
BFGS	**1**	**1**	5.4	5	**1.5**	**1.2**	**1.1**	**1**	**1**	**1**	BFGS [30]
Cauchy EDA	**1**	**1**	27	610	190	270	390	450	540	510	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1**	7.3	11	8.7	10	9.2	9.1	8.7	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	14	26	7.2	5.7	5	4.5	4.4	4.3	(1+1)-CMA-ES [2]
DASA	**1**	**1**	11	80	22	21	22	28	40	63	DASA [19]
DEPSO	**1**	**1**	**2.3**	4.7	**2.4**	4	4.6	5	6.6	9.8	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	**2.1**	**1.3**	**1.3**	**1.4**	**2.2**	4.8	5.1	DIRECT [25]
EDA-PSO	**1**	**1**	**1.1**	4	**1.7**	4.2	4.9	8.4	11	25	EDA-PSO [6]
full NEWUOA	**1**	**1**	6.5	6.8	**1.5**	**1.2**	**1.1**	**1.1**	**1.1**	**1.2**	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.1**	**2.2**	**1.1**	**1.1**	**1.1**	**1.3**	**1.4**	**1.6**	G3-PCX [26]
simple GA	**1**	**1**	**1.2**	**3**	**1.3**	3.3	7.1	17	280	1900	simple GA [22]
GLOBAL	**1**	**1**	**1.7**	**2.9**	**1.3**	**1.5**	**1.5**	**1.3**	**1.4**	**1.3**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.5**	14	9.9	8.9	8	7.2	7.1	7.3	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**1.4**	4.7	5.1	53	49	61	69	460	LSfminbnd [28]
LSstep	**1**	**1**	**1**	80	140	140	150	280	970	920	LSstep [28]
MA-LS-Chain	**1**	**1**	**1**	**2.8**	**1.6**	**1.9**	**2.2**	**2.3**	**2.4**	**2.4**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2.4**	40	7.4	6	5.3	4.7	4.8	5.2	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	7.7	39	9.8	7.6	6.6	5.9	5.8	5.5	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.3**	8.1	**1.8**	**1.4**	**1.2**	**1.1**	**1.1**	**1.1**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.9**	6.3	**1.2**	**1**	**1**	**1**	**1**	**1.1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	**1.6**	46	11	9.8	9.4	9.4	10	12	(1+1)-ES [1]
POEMS	**1**	**1**	64	940	230	190	160	150	150	150	POEMS [20]
PSO	**1**	**1**	**1.5**	**2.7**	**1**	**1.8**	**1.9**	**2.3**	3.8	6.5	PSO [7]
PSO_Bounds	**1**	**1**	**1.2**	540	87	67	60	56	58	64	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.3**	**2.8**	**1.5**	3.1	7.2	24	93	760	Monte Carlo [3]
Rosenbrock	**1**	**1**	12	17	4.5	3.5	3.1	**2.7**	**2.7**	**2.6**	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1**	7.7	4.4	4.1	3.9	3.6	3.8	3.8	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2**	**1**	**2.8**	3.8	4.8	4.7	5	5.3	VNS (Garcia) [11]

Table 23: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	3.9	96.5	117	131	150	157	174	190	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.4**	14	86	140	200	640	4100	2.8e4	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.3**	7.5	10	9.8	9	8.9	8.4	8.1	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	4.2	6.7	25	100	260	*49e-3/6e3*	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**2**	11	*56e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	4.8	4.9	28	120	480	460	410	*73e-3/5e3*	BFGS [30]
Cauchy EDA	**1**	**1**	**1.8**	16	860	*14e-2/5e4*	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1.8**	8.3	15	14	13	13	12	12	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**2.1**	5.1	8.4	8.6	7.7	7.6	6.9	6.6	(1+1)-CMA-ES [2]
DASA	**1**	**1**	5.7	17	170	1800	8600	9600	8700	7900	DASA [19]
DEPSO	**1**	**1**	**2.2**	24	*96e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	4.2	290	270	240	230	210	200	DIRECT [25]
EDA-PSO	**1**	**1**	**2.3**	18	1400	*13e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	6	**1.5**	24	46	81	79	71	65	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.9**	**1.6**	6.1	6	5.8	5.8	5.5	7.4	G3-PCX [26]
simple GA	**1**	**1**	**1.4**	6.6	330	840	3300	*41e-4/1e5*	.	.	simple GA [22]
GLOBAL	**1**	**1**	**1**	**2.6**	97	*21e-2/2e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.3**	5.3	**5.5**	**5.3**	**4.9**	**5**	**4.7**	**4.6**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**1.3**	**2.1**	30	120	200	190	*25e-3/7e3*	.	LSfminbnd [28]
LSstep	**1**	**1**	**2.6**	18	1300	*24e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.8**	5.5	7.4	7.1	6.6	6.7	6.4	7	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	3.4	**2.8**	6.3	23	210	500	1e3	1900	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1.3**	**1.6**	**2.2**	**2.2**	**2**	**1.9**	**1.8**	**1.7**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	4.7	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	7.8	3.2	32	89	130	170	500	460	NEWUOA [31]
(1+1)-ES	**1**	**1**	**2.6**	3.7	19	55	240	1e3	2100	6700	(1+1)-ES [1]
POEMS	**1**	**1**	14	28	190	180	180	190	180	190	POEMS [20]
PSO	**1**	**1**	**1.3**	9	42	59	73	79	88	95	PSO [7]
PSO_Bounds	**1**	**1**	**1.7**	9.4	260	460	500	690	660	860	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.5**	8	1900	*46e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.9**	**2.2**	9.9	15	17	23	29	*66e-7/5e3*	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**2.6**	8.1	14	16	14	14	13	12	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1.8**	8.3	38	67	65	62	56	52	VNS (Garcia) [11]

Table 24: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.5	0.5	9.13	429	4260	11700	12100	12400	12400	12400	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1**	6.5	4	**2.8**	**2.9**	**2.9**	3	3.2	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.2**	35	11	6.7	6.7	6.6	6.6	6.7	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	3.3	**1.9**	**1.4**	6.2	6	5.9	5.9	5.9	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.9**	68	*22e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	3.4	5.1	**2.9**	*42e-2/3e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	3.9	33	170	*49e-2/5e4*	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	4.6	19	17	13	22	22	22	22	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**2.7**	6.1	4.8	**2.9**	**2.8**	**2.7**	**2.7**	3.6	(1+1)-CMA-ES [2]
DASA	**1**	**1**	10	140	110	61	59	58	58	58	DASA [19]
DEPSO	**1**	**1**	3.3	67	*24e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.9**	79	8.7	5	4.9	4.7	4.7	4.8	DIRECT [25]
EDA-PSO	**1**	**1**	**1.6**	100	12	9	9	8.8	8.8	8.9	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.8**	**1**	**1**	**1.1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.2**	37	20	*10e-2/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.6**	67	*79e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**2.7**	3.3	7	*51e-2/2e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.4**	28	9.1	5.4	5.3	5.2	5.3	5.3	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**2.8**	8.3	*37e-2/8e3*	.	.	.	.	.	LSfminbnd [28]
LSstep	3	3	4.8	29	33	12	12	*11e-1/1e4*	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.5**	31	34	*11e-1/1e4*	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2.5**	5.7	**1.6**	**2.7**	**2.7**	**2.6**	**2.6**	**2.6**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	16	7.4	5	6.6	6.4	6.2	6.2	6.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.5**	**1.9**	**1.5**	3.2	3.1	3	3	3	NELDER (Doe) [5]
NEWUOA	**1**	**1**	3.1	**2.8**	**1.9**	**2**	**1.9**	**1.9**	**1.9**	**1.9**	NEWUOA [31]
(1+1)-ES	**1**	**1**	8	12	11	21	20	19	19	19	(1+1)-ES [1]
POEMS	**1**	**1**	28	1500	170	*20e-1/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1**	**2.4**	470	49	18	17	17	17	17	PSO [7]
PSO_Bounds	**1**	**1**	**1.3**	1500	150	57	55	54	54	54	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.5**	14	150	570	*49e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	19	35	15	11	11	11	11	11	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1.7**	7.2	3.9	3.7	3.7	3.6	3.6	3.6	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1.2**	5.3	**1.7**	**1**	**1**	**1.1**	**1.9**	4.7	VNS (Garcia) [11]

Table 25: 03-D, running time excess ERT/ERT_{best} on f_1, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.333	0.333	1.2	2.67	2.67	2.67	2.67	2.67	2.67	2.67	ERT_{best}/D
ALPS	**1**	**1**	**2.6**	31	160	280	450	660	860	1200	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	3.1	7.4	16	26	37	45	54	73	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.3**	**2.4**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**2.4**	9.2	96	120	160	180	280	420	BayEDAcG [10]
BFGS	**1**	**1**	**2.4**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	BFGS [30]
Cauchy EDA	**1**	**1.1**	40	36	58	91	110	140	160	210	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**2.8**	5.1	11	18	23	29	34	47	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**1.8**	5.2	8.8	12	15	19	23	30	(1+1)-CMA-ES [2]
DASA	**1**	3.1	37	37	49	63	76	89	100	130	DASA [19]
DEPSO	**1**	**1**	**2.9**	15	36	65	96	120	150	200	DEPSO [12]
DIRECT	**1**	**1**	**1.2**	**2**	5.7	15	27	38	52	95	DIRECT [25]
EDA-PSO	**1**	**1.1**	**2.8**	10	28	56	120	280	390	690	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	**2.9**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	full NEWUOA [31]
G3-PCX	**1**	**1.3**	**1.9**	12	15	19	24	29	34	47	G3-PCX [26]
simple GA	**1**	**1.1**	3.1	26	440	1200	2100	3200	4200	6800	simple GA [22]
GLOBAL	**1**	**1.1**	3.1	22	38	41	42	44	45	48	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	**2.4**	5.5	12	18	24	30	36	49	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**2.5**	5.5	4.1	5.3	5.6	5.6	5.8	5.9	5.9	LSfminbnd [28]
LSstep	**1**	**1.2**	130	94	100	100	100	100	100	100	LSstep [28]
MA-LS-Chain	**1**	**1.1**	**2.5**	14	36	57	70	75	82	96	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1.6**	**2**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	MCS (Neum) [18]
NELDER (Han)	**1**	**1.5**	**1.9**	**1.8**	3.4	5.3	6.7	8.3	9.8	13	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2**	**2.4**	3.9	5.4	6.9	8.7	10	14	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.8**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1.3**	3.4	4.1	7	11	14	18	22	29	(1+1)-ES [1]
POEMS	**1**	23	170	110	180	390	1e3	1300	1700	2400	POEMS [20]
PSO	**1**	**1.1**	3.2	9.9	44	86	160	230	310	500	PSO [7]
PSO_Bounds	**1**	**1**	3.1	13	58	230	430	650	850	1500	PSO_Bounds [8]
Monte Carlo	**1**	**1**	3.8	35	1400	3.3e4	1.3e6	*15e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.7**	4.5	3.3	4.8	5.9	7.5	8.5	10	13	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	3.5	5.3	10	14	20	26	31	41	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.6**	13	24	31	37	46	50	62	VNS (Garcia) [11]

Table 26: 03-D, running time excess ERT/ERT_{best} on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	6.04	9.82	12.7	13.8	14.4	14.6	14.8	15.3	15.6	16	ERT_{best}/D
ALPS	43	49	66	100	130	160	190	220	250	310	ALPS [17]
AMaLGaM IDEA	5.9	5.6	6	8.1	10	12	14	16	17	20	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**1.7**	8.2	14	21	30	36	43	57	avg NEWUOA [31]
BayEDAcG	15	15	19	26	29	46	48	55	70	93	BayEDAcG [10]
BFGS	3.4	**2.3**	3.1	4	4.7	4.9	5	5	5.1	**5.2**	BFGS [30]
Cauchy EDA	15	17	18	21	25	29	34	36	40	48	Cauchy EDA [24]
BIPOP-CMA-ES	8.9	9.5	13	17	20	21	22	22	23	24	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	6	6.4	8.4	11	12	13	13	13	14	14	(1+1)-CMA-ES [2]
DASA	15	12	11	14	15	18	19	21	23	28	DASA [19]
DEPSO	18	14	15	18	24	29	33	36	40	47	DEPSO [12]
DIRECT	5	4.6	4.5	7.3	8.9	10	12	14	33	38	DIRECT [25]
EDA-PSO	7.8	9.9	13	31	58	84	110	130	150	200	EDA-PSO [6]
full NEWUOA	**1**	**1.1**	**1.7**	4.2	8.2	12	16	19	22	29	full NEWUOA [31]
G3-PCX	16	11	43	87	120	130	170	180	200	230	G3-PCX [26]
simple GA	70	160	280	410	570	780	950	1200	1400	1900	simple GA [22]
GLOBAL	16	11	9	8.9	9	9.3	9.4	9.4	9.5	9.7	GLOBAL [23]
iAMaLGaM IDEA	3.2	3.7	4.4	6.1	7.6	8.9	9.9	11	12	14	iAMaLGaM IDEA [4]
LSfminbnd	**1.9**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	28	17	15	14	14	14	14	13	13	13	LSstep [28]
MA-LS-Chain	12	12	14	19	22	26	30	33	38	44	MA-LS-Chain [21]
MCS (Neum)	**1.9**	**1.1**	**1.8**	**1.9**	**2.2**	**3.7**	**4.4**	5	5.2	6.9	MCS (Neum) [18]
NELDER (Han)	**2.4**	**2**	**2.2**	3.3	4.3	4.6	4.8	**4.9**	**5.1**	5.4	NELDER (Han) [16]
NELDER (Doe)	**1.9**	**1.8**	**2.3**	**2.8**	**3.2**	**3.6**	**3.8**	**3.9**	**4.2**	**4.6**	NELDER (Doe) [5]
NEWUOA	**1**	**1.3**	3.4	14	25	33	42	49	56	72	NEWUOA [31]
(1+1)-ES	60	270	5800	2e4	4.1e4	6.6e4	3.2e5	4.8e5	*36e-4/1e6*	.	(1+1)-ES [1]
POEMS	270	250	280	320	360	450	500	510	620	720	POEMS [20]
PSO	20	25	46	56	65	83	95	100	120	140	PSO [7]
PSO_Bounds	16	47	150	300	340	510	560	580	640	920	PSO_Bounds [8]
Monte Carlo	66	420	6e3	1.8e5	*14e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.9**	3.2	4.9	16	20	22	24	24	24	26	Rosenbrock [27]
IPOP-SEP-CMA-ES	9	8	9.5	12	13	14	15	15	16	17	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	17	17	21	26	26	27	28	29	29	30	VNS (Garcia) [11]

Table 27: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.333	0.733	12.6	274	277	278	281	282	282	284	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	**1**	**1**	25	6.2	8.9	11	13	15	17	21	ALPS [17]
AMaLGaM IDEA	**1**	**2**	3.6	4.2	14	15	15	15	15	15	AMaLGaM IDEA [4]
avg NEWUOA	**1**	4.4	9.4	5	33	33	33	33	33	32	avg NEWUOA [31]
BayEDAcG	**1.1**	**1.5**	32	9.7	*70e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.3**	29	42	25	160	150	150	150	150	150	BFGS [30]
Cauchy EDA	**1.1**	41	14	7.6	250	2600	*10e-2/5e4*	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	3.5	**3.2**	4.7	25	25	26	26	26	26	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.8**	8.1	4	38	38	37	37	37	37	(1+1)-CMA-ES [2]
DASA	**1.3**	32	14	**1.4**	12	12	12	12	12	12	DASA [19]
DEPSO	**1**	**2.4**	11	**2.7**	**4.1**	**4.8**	**5.6**	**5.9**	**7.3**	8.6	DEPSO [12]
DIRECT	**1**	**1**	4.8	4.1	17	17	17	17	17	17	DIRECT [25]
EDA-PSO	**1**	**1.6**	5.6	13	42	44	44	45	46	49	EDA-PSO [6]
full NEWUOA	**1**	4.5	4.9	3.3	15	15	15	15	15	15	full NEWUOA [31]
G3-PCX	**1.1**	**1.9**	73	58	330	330	330	330	330	320	G3-PCX [26]
simple GA	**1**	**2.2**	52	15	23	31	41	56	69	100	simple GA [22]
GLOBAL	**1.1**	**2.5**	8.2	3.6	12	12	12	12	12	12	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.9**	12	12	39	39	39	39	39	39	iAMaLGaM IDEA [4]
LSfminbnd	**1**	6.9	**1**	38	54	54	53	53	53	52	LSfminbnd [28]
LSstep	28	150	21	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**2.3**	6.7	**2.3**	8.3	8.4	8.4	8.4	8.4	**8.5**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	6.8	**1.2**	10	11	11	12	12	12	MCS (Neum) [18]
NELDER (Han)	**1**	**1.8**	25	17	100	100	100	100	100	100	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.7**	**3**	**1.5**	8.4	8.4	8.3	**8.3**	**8.3**	**8.3**	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	5.7	5	55	54	54	54	53	53	NEWUOA [31]
(1+1)-ES	**1**	4.3	14	12	69	68	68	67	67	67	(1+1)-ES [1]
POEMS	16	210	26	8.2	23	27	31	35	37	45	POEMS [20]
PSO	**1**	**1.5**	7.3	3.5	**6.1**	**7**	7.9	8.5	9.6	11	PSO [7]
PSO_Bounds	**1**	**2.2**	15	8.6	18	22	25	27	29	41	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	110	5500	5.1e4	*10e-1/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	42	41	27	410	410	400	400	400	400	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**2.8**	3.4	3.7	14	17	17	17	17	17	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.7**	8.4	3.8	7.4	7.4	**7.6**	8.6	11	17	VNS (Garcia) [11]

Table 28: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_4, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	1.8	13.5	269	289	307	317	330	338	348	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.5**	**1.7**	37	9.6	**16**	**18**	**19**	21	23	**27**	ALPS [17]
AMaLGaM IDEA	**1.3**	**1.2**	23	110	970	950	930	900	880	870	AMaLGaM IDEA [4]
avg NEWUOA	**2.9**	9.2	11	14	160	150	150	140	140	130	avg NEWUOA [31]
BayEDAcG	**1.3**	**1.3**	33	*47e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.8**	20	48	54	*30e-1/3e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	5.9	20	23	1300	*13e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1.1**	**1.4**	9.5	260	3300	4e3	3900	3800	3700	3600	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2**	**1.8**	13	21	150	140	140	130	130	130	(1+1)-CMA-ES [2]
DASA	17	29	12	**1.2**	**2**	**2**	**2**	**2.1**	**2.1**	**2.3**	DASA [19]
DEPSO	**2.5**	**1.5**	13	6.8	18	47	46	45	44	43	DEPSO [12]
DIRECT	**1**	**1**	**4.8**	20	26	44	83	170	180	180	DIRECT [25]
EDA-PSO	**1.5**	**1.2**	16	24	110	110	100	100	100	100	EDA-PSO [6]
full NEWUOA	**2.7**	3.5	11	25	170	160	150	140	140	140	full NEWUOA [31]
G3-PCX	**1.8**	**1.3**	130	62	430	400	390	380	370	360	G3-PCX [26]
simple GA	**1.3**	**1.4**	90	19	24	34	42	54	63	110	simple GA [22]
GLOBAL	**1.3**	**1.7**	12	7.9	51	48	46	44	43	42	GLOBAL [23]
iAMaLGaM IDEA	**1.3**	**1.6**	12	130	860	820	800	770	760	740	iAMaLGaM IDEA [4]
LSfminbnd	**2.1**	3.4	**1**	*20e-1/4e3*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	54	70	17	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1.4**	**2.1**	9.6	**5.6**	60	56	55	53	52	51	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.2**	5.9	10	67	63	61	59	57	56	MCS (Neum) [18]
NELDER (Han)	**2.3**	**1.4**	33	72	320	300	290	280	270	270	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**1**	**4.5**	7.8	43	40	39	37	37	36	NELDER (Doe) [5]
NEWUOA	**2.3**	**2.2**	24	21	300	280	280	260	260	250	NEWUOA [31]
(1+1)-ES	**2.5**	**1.8**	31	33	230	210	210	200	190	190	(1+1)-ES [1]
POEMS	89	100	48	13	46	47	48	51	53	57	POEMS [20]
PSO	**1.3**	**1.3**	15	6	98	93	91	89	87	87	PSO [7]
PSO_Bounds	**1.5**	**1.1**	28	21	28	36	36	38	39	51	PSO_Bounds [8]
Monte Carlo	**1.3**	**1.7**	220	1.6e4	*14e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	36	43	44	140	130	130	120	120	120	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.9**	6.3	83	*14e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**2.2**	**1.8**	19	7.6	20	19	19	**20**	**22**	50	VNS (Garcia) [11]

Table 29: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.3**	27	90	98	100	110	110	110	110	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	11	20	21	21	21	21	21	21	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.5**	**1.3**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	avg NEWUOA [31]
BayEDAcG	**1**	**1.3**	22	360	370	370	370	370	370	370	BayEDAcG [10]
BFGS	**1**	**2.6**	**1.6**	**2.4**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	BFGS [30]
Cauchy EDA	**1**	13	20	22	23	23	23	23	23	23	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.5**	3.6	5.4	5.7	5.8	5.8	5.8	5.8	5.8	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	**2.1**	**2.7**	**2.8**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	(1+1)-CMA-ES [2]
DASA	**1**	21	19	31	36	40	44	49	53	62	DASA [19]
DEPSO	**1**	**1.4**	15	35	39	39	39	39	39	39	DEPSO [12]
DIRECT	**1**	**1**	3.7	4.6	6.2	6.2	6.2	6.2	6.2	6.2	DIRECT [25]
EDA-PSO	**1**	**1.3**	8.5	16	17	17	17	17	17	17	EDA-PSO [6]
full NEWUOA	**1**	**2**	**1.2**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	full NEWUOA [31]
G3-PCX	**1**	**1.5**	9.4	22	25	25	25	25	25	25	G3-PCX [26]
simple GA	**1**	**1.2**	14	1100	3e3	4800	7500	1.1e4	1.5e4	*22e-8/1e5*	simple GA [22]
GLOBAL	**1**	**1.3**	31	47	47	48	48	48	48	48	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	3.5	8.3	8.8	8.8	8.8	8.8	8.8	8.8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.1**	7.5	11	11	11	11	11	11	11	LSfminbnd [28]
LSstep	**1**	28	93	120	120	120	120	120	120	120	LSstep [28]
MA-LS-Chain	**1**	**1.3**	25	88	92	92	93	93	93	93	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	**1.6**	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.5**	**1.4**	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	**1.1**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	**2.3**	**3**	3.1	3.1	3.1	3.1	3.1	3.1	(1+1)-ES [1]
POEMS	**1**	59	120	150	170	180	180	180	180	180	POEMS [20]
PSO	**1**	**1.1**	8.2	16	18	18	18	18	18	18	PSO [7]
PSO_Bounds	**1**	**1.3**	6.3	14	15	15	15	15	15	15	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	34	1.8e4	6.5e6	*32e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	5	3.3	3.6	3.6	3.6	3.6	3.6	3.6	3.6	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.3**	4.1	6.7	7	7.1	7.1	7.1	7.1	7.1	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	18	20	20	20	20	20	20	20	VNS (Garcia) [11]

Table 30: 03-D, running time excess ERT/ERT_{best} on f_6, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	1.38	2.53	11.2	18.7	30.1	38.9	49.7	61.3	71.6	88.2	ERT_{best}/D
ALPS	4.9	3.3	9.2	35	46	53	58	61	64	72	ALPS [17]
AMaLGaM IDEA	4.8	4.3	3.7	5.5	5.5	6.3	6.4	6.6	6.9	7.5	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**2.3**	**2.6**	**2.9**	**2.9**	3.8	3.9	4.1	4.3	4.7	avg NEWUOA [31]
BayEDAcG	4.2	10	130	*66e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	3.3	**2.2**	3.5	3.4	**2.9**	**2.4**	**2**	**1.8**	**1.9**	3.1	BFGS [30]
Cauchy EDA	24	33	28	31	28	27	26	25	24	25	Cauchy EDA [24]
BIPOP-CMA-ES	**1.6**	**1.6**	**2.4**	3.2	3.1	3.2	3.2	3.1	3	3.2	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.4**	**1.6**	**1.3**	**1.6**	**1.8**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	(1+1)-CMA-ES [2]
DASA	33	58	30	32	30	36	55	56	54	66	DASA [19]
DEPSO	**2.4**	3.3	6	11	11	13	14	13	13	14	DEPSO [12]
DIRECT	**1.4**	**1.1**	**3**	33	440	1300	2700	*23e-3/3e4*	.	.	DIRECT [25]
EDA-PSO	3.9	3.4	**2.7**	13	28	42	59	62	66	76	EDA-PSO [6]
full NEWUOA	**1.5**	3.7	4	5.1	5.1	5.4	5.7	6	6.1	6.9	full NEWUOA [31]
G3-PCX	**3**	3.2	3.5	3.3	**2.9**	3.2	3.2	3.5	4.3	4.8	G3-PCX [26]
simple GA	**2.4**	**2.7**	9	100	270	4200	4400	3800	4400	1.6e4	simple GA [22]
GLOBAL	**2.5**	3.7	5.2	5.5	4	3.3	**2.8**	**2.4**	**2.3**	**2.3**	GLOBAL [23]
iAMaLGaM IDEA	**2.4**	**2**	**2.1**	**2.9**	3.1	3.7	4.1	4.2	4.3	4.8	iAMaLGaM IDEA [4]
LSfminbnd	14	220	490	810	510	400	310	260	220	190	LSfminbnd [28]
LSstep	240	690	1200	990	1e3	820	670	760	670	1700	LSstep [28]
MA-LS-Chain	3.8	4.6	4.3	10	10	9.6	9.1	8.9	8.3	8.1	MA-LS-Chain [21]
MCS (Neum)	**2.1**	**1.5**	3	160	120	140	140	130	150	210	MCS (Neum) [18]
NELDER (Han)	**1.6**	**1.2**	**1.7**	**1.5**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	**1.3**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.4**	**1.9**	**2.1**	3.4	3.8	4	4.1	4	4.1	4.8	NEWUOA [31]
(1+1)-ES	**2.1**	3.2	**1.7**	**2**	**1.8**	**1.8**	**2**	**2**	**2.1**	3	(1+1)-ES [1]
POEMS	160	91	31	74	83	93	100	92	99	110	POEMS [20]
PSO	3.8	4	**2.9**	8	13	17	18	22	25	28	PSO [7]
PSO_Bounds	**2.2**	**2.3**	**2.9**	12	26	100	120	130	120	120	PSO_Bounds [8]
Monte Carlo	**2.8**	**1.9**	7.7	200	8700	1.1e5	*26e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	3.9	4	**2.1**	**1.8**	**1.7**	**1.7**	**1.6**	**1.8**	**1.7**	**1.6**	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.5	3.6	**2.8**	3.7	3.3	3.5	3.6	3.6	3.6	3.6	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**2.2**	**2.3**	5.6	5.9	4.8	4.6	4.3	4	3.9	3.8	VNS (Garcia) [11]

Table 31: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.867	3.8	21.6	114	155	161	161	161	178	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.1**	**2**	6.2	10	7	8.7	9.3	9.3	9.3	11	ALPS [17]
AMaLGaM IDEA	**1.2**	**2.1**	**2.6**	**1.6**	**2.1**	3.1	3	3	3	**2.9**	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	3.5	**1.2**	6.8	4.8	19	41	41	41	37	avg NEWUOA [31]
BayEDAcG	**1.4**	**1**	3.6	52	72	85	*56e-2/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1.8**	4.1	17	86	*37e-1/100*	.	.	.	.	.	BFGS [30]
Cauchy EDA	7.1	16	14	6.1	**1.9**	**1.8**	**1.9**	**1.9**	**1.9**	**2**	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2**	3.3	**2.8**	**1.1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.4**	3.5	**2.7**	**2.1**	**1**	**1.4**	**1.4**	**1.4**	**1.4**	**1.3**	(1+1)-CMA-ES [2]
DASA	24	57	85	260	120	1300	1600	1600	1600	1500	DASA [19]
DEPSO	**1.2**	**1.7**	5.2	6.1	5.9	5.1	5.1	5.1	5.1	5.3	DEPSO [12]
DIRECT	**1**	**1.4**	**2.9**	**2.8**	**2.1**	31	34	34	34	30	DIRECT [25]
EDA-PSO	**1.3**	**1.9**	3.3	3.7	8.8	17	20	20	20	22	EDA-PSO [6]
full NEWUOA	**1.2**	3.4	**1**	**1**	**1.4**	**2.2**	6.8	6.8	6.8	6.2	full NEWUOA [31]
G3-PCX	**1.1**	**1.5**	6.2	8.3	12	16	54	54	54	48	G3-PCX [26]
simple GA	**1.3**	**2.2**	3.3	24	27	130	200	200	200	250	simple GA [22]
GLOBAL	**1.3**	**2.2**	6.2	5.4	4.6	8.8	51	51	51	46	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	3.3	**2.6**	15	8.1	6.1	6	6	6	5.4	iAMaLGaM IDEA [4]
LSfminbnd	8.7	19	46	68	33	100	290	290	290	260	LSfminbnd [28]
LSstep	**1.6**	210	300	320	390	930	*22e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.3**	**2.1**	6.1	4.3	**2.2**	3.1	3.9	3.9	3.9	3.9	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.1**	**1**	5.7	**2.4**	4.2	4.1	4.1	4.1	8.8	MCS (Neum) [18]
NELDER (Han)	**1.7**	**3**	8	28	20	23	30	30	30	27	NELDER (Han) [16]
NELDER (Doe)	**1.1**	**1.9**	7.5	4.2	4.3	4.2	8.8	8.8	8.8	8.8	NELDER (Doe) [5]
NEWUOA	**1.3**	**2.6**	11	12	10	14	39	39	39	35	NEWUOA [31]
(1+1)-ES	**1.1**	**2.3**	**2**	3.6	3.9	7.7	9.3	9.3	9.3	8.4	(1+1)-ES [1]
POEMS	170	270	81	29	12	18	21	21	21	20	POEMS [20]
PSO	**1.1**	**2.2**	3.5	5.3	3.1	4.4	5.1	5.1	5.1	5.1	PSO [7]
PSO_Bounds	**1.3**	**2**	4.1	7.3	4.8	9.3	12	12	12	13	PSO_Bounds [8]
Monte Carlo	**1.3**	**2**	5	30	130	3900	1.6e4	1.6e4	1.6e4	*55e-4/1e6*	Monte Carlo [3]
Rosenbrock	41	140	97	150	370	*79e-2/3e3*	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.2	3.3	**2.7**	**2.9**	**1.4**	**1.3**	**1.3**	**1.3**	**1.3**	**1.4**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	3.2	7.5	4.2	**2.6**	3	4.1	4.1	4.1	3.9	VNS (Garcia) [11]

Table 32: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.4	4.87	9.07	14.9	50.5	58.5	61.6	64.7	65.9	69.4	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**2.8**	8.5	23	46	33	65	93	120	150	210	ALPS [17]
AMaLGaM IDEA	5.1	**2.9**	3.8	9.9	5.8	6.3	7	7.5	7.8	8.3	AMaLGaM IDEA [4]
avg NEWUOA	3.1	**1.9**	**1.9**	**2.6**	**1**	**1**	**1**	**1**	**1**	**1**	avg NEWUOA [31]
BayEDAcG	3.7	4.7	11	110	560	*73e-2/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	3.3	**2.1**	**1.4**	**2.7**	**1.1**	**1.1**	**1.1**	**1**	**1**	**1**	BFGS [30]
Cauchy EDA	24	18	21	28	14	14	15	15	16	17	Cauchy EDA [24]
BIPOP-CMA-ES	4.8	3.8	3.5	8	4.5	4.9	5.2	5.2	5.4	5.6	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.7**	**1.6**	**1.9**	6.3	**2.8**	**2.8**	3	3.1	3.2	3.4	(1+1)-CMA-ES [2]
DASA	38	22	15	470	470	750	1200	1500	2e3	2800	DASA [19]
DEPSO	6.7	8.1	7.7	14	11	24	64	*62e-4/2e3*	.	.	DEPSO [12]
DIRECT	**1.5**	**1.4**	**2**	5	3.5	9.2	15	22	29	42	DIRECT [25]
EDA-PSO	**2.9**	4	6.8	74	70	110	160	210	260	370	EDA-PSO [6]
full NEWUOA	3.7	**1.9**	**1.4**	**2.8**	**1.1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	**2.5**	4.3	4.2	16	9	9.3	9.3	9.1	9.1	9	G3-PCX [26]
simple GA	**2.5**	3.4	47	170	400	*49e-3/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**2.6**	9.2	11	8.2	**2.8**	**2.6**	**2.5**	**2.5**	**2.5**	**2.5**	GLOBAL [23]
iAMaLGaM IDEA	**2.6**	**2.4**	**2.2**	8.1	4.5	5	5.1	5.3	5.6	5.9	iAMaLGaM IDEA [4]
LSfminbnd	10	4.4	24	810	2800	2400	2300	2200	*96e-2/1e4*	.	LSfminbnd [28]
LSstep	150	70	51	680	2800	2400	2300	2200	2100	*73e-2/1e4*	LSstep [28]
MA-LS-Chain	4.7	4.5	6.6	14	7.7	9.9	11	11	12	12	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	7.2	6.3	6.2	6	5.9	5.7	MCS (Neum) [18]
NELDER (Han)	**1.6**	**1**	**1**	**2.1**	**1**	**1**	**1.1**	**1.1**	**1.1**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	**2.1**	**2.1**	**1.6**	4	**1.5**	**1.4**	**1.4**	**1.4**	**1.5**	**1.5**	NELDER (Doe) [5]
NEWUOA	3.1	**1.5**	**1.4**	**2.8**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	NEWUOA [31]
(1+1)-ES	4.5	3.3	**2.8**	45	20	39	65	91	120	170	(1+1)-ES [1]
POEMS	140	50	37	94	48	69	170	290	330	410	POEMS [20]
PSO	**2.9**	4.4	9.8	46	52	93	150	210	260	380	PSO [7]
PSO_Bounds	**2.5**	4	17	60	160	590	740	840	920	1e3	PSO_Bounds [8]
Monte Carlo	**2.7**	6.9	43	1e3	1e4	1.2e5	*38e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	4.2	**1.8**	**1.7**	6.9	**3**	3.1	3.1	3	3.1	3	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.8	**1.9**	3	8.3	6.2	6.7	7	7	7.1	7.2	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**2.5**	9.9	7.7	9.4	5.1	5.4	5.7	5.7	5.9	6.1	VNS (Garcia) [11]

Table 33: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	6.93	21.8	42.4	49.7	53.2	54.9	56.3	59.4	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	7.9	130	30	30	48	83	100	130	170	220	ALPS [17]
AMaLGaM IDEA	15	40	5.4	6.2	6	6.5	7.1	7.7	8.1	8.6	AMaLGaM IDEA [4]
avg NEWUOA	11	20	**1.7**	**1.7**	**1.2**	**1.1**	**1.1**	**1.1**	**1.2**	**1.2**	avg NEWUOA [31]
BayEDAcG	15	60	12	110	*12e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	9.3	20	**1.5**	**1.5**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1**	BFGS [30]
Cauchy EDA	140	290	24	17	16	17	17	18	19	20	Cauchy EDA [24]
BIPOP-CMA-ES	9.9	30	3.9	4.6	4.4	4.7	4.9	5.1	5.3	5.6	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	8.2	36	**2.7**	4.5	3.6	3.6	3.7	3.8	3.9	4.1	(1+1)-CMA-ES [2]
DASA	200	390	24	790	720	980	1400	1900	2500	3600	DASA [19]
DEPSO	8	77	15	19	27	55	560	*46e-4/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	**1.7**	6.2	9.1	18	27	29	38	DIRECT [25]
EDA-PSO	7	42	7.5	49	69	120	190	260	350	490	EDA-PSO [6]
full NEWUOA	9.4	18	**1.6**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	11	53	5.4	14	12	12	12	12	12	12	G3-PCX [26]
simple GA	8.4	130	49	100	3800	2.8e4	*11e-2/1e5*	.	.	.	simple GA [22]
GLOBAL	10	100	14	6.2	3.5	3.2	3.1	3.1	3.1	3.1	GLOBAL [23]
iAMaLGaM IDEA	12	28	3.3	5	4.9	5	5.4	5.8	6	6.4	iAMaLGaM IDEA [4]
LSfminbnd	25	61	4.7	180	310	870	1300	2600	2600	*71e-3/1e4*	LSfminbnd [28]
LSstep	390	3e3	180	400	3300	2800	*56e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	12	73	11	9.9	8.7	9.9	11	11	12	13	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**	MCS (Neum) [18]
NELDER (Han)	**5.2**	**12**	**1.2**	**1.2**	**1**	**1**	**1.1**	**1.1**	**1.2**	**1.3**	NELDER (Han) [16]
NELDER (Doe)	6.9	18	**1.5**	**1.4**	**1.1**	**1.1**	**1.1**	**1.1**	**1.2**	**1.3**	NELDER (Doe) [5]
NEWUOA	7.7	22	**1.7**	**1.7**	**1.2**	**1.2**	**1.2**	**1.2**	**1.3**	**1.3**	NEWUOA [31]
(1+1)-ES	11	32	**2.6**	79	71	88	120	150	180	240	(1+1)-ES [1]
POEMS	650	780	66	69	68	150	250	380	500	910	POEMS [20]
PSO	9.3	75	11	17	34	66	130	200	270	440	PSO [7]
PSO_Bounds	11	59	13	77	370	530	670	780	880	1e3	PSO_Bounds [8]
Monte Carlo	12	71	43	670	1e4	2.9e5	*43e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	13	23	**1.6**	**2.6**	**2.7**	**2.6**	**2.7**	**2.8**	**2.9**	**2.9**	Rosenbrock [27]
IPOP-SEP-CMA-ES	10	28	3.7	5.6	7.4	8.2	8.1	8.2	8.3	8.4	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	20	140	11	6.8	6	6.2	6.3	6.5	6.7	7	VNS (Garcia) [11]

Table 34: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	9.71	18	38	50.7	55.9	60.2	64.5	68.8	72.8	80.6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	23	38	50	120	360	700	1300	1900	2600	7100	ALPS [17]
AMaLGaM IDEA	3.2	3	**2**	**2.3**	**2.7**	**2.9**	3.2	3.4	3.6	3.8	AMaLGaM IDEA [4]
avg NEWUOA	**1.1**	**1.3**	**1.9**	3.4	5.8	6.9	7.9	8.8	9.5	11	avg NEWUOA [31]
BayEDAcG	88	1600	*37e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.4**	**1**	**1**	**1.2**	**1.2**	**1.2**	**1.4**	**1.5**	5.9	76	BFGS [30]
Cauchy EDA	13	9.4	6.3	6.2	6.7	7.3	7.8	8.3	8.7	9.5	Cauchy EDA [24]
BIPOP-CMA-ES	8.1	5.6	4.1	4.1	4.6	4.9	4.9	4.9	4.9	4.8	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.5	3.1	**2.7**	**2.7**	**2.7**	3	3.1	3	3	3	(1+1)-CMA-ES [2]
DASA	130	180	1.1e4	4.4e4	2.5e5	*24e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	13	35	67	110	*55e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	4.1	8.4	7.6	49	120	160	490	480	1e3	2e3	DIRECT [25]
EDA-PSO	20	66	210	2400	4200	7e3	1.1e4	*61e-2/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.6**	**1.6**	**2.6**	3.9	4.4	4.9	5.6	6	7.1	full NEWUOA [31]
G3-PCX	8.8	7.2	14	21	28	30	36	39	41	42	G3-PCX [26]
simple GA	30	90	200	2e3	1.2e4	*55e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	9.9	6	3.3	**2.8**	**2.7**	**2.6**	**2.5**	**2.4**	**2.3**	**2.2**	GLOBAL [23]
iAMaLGaM IDEA	3.3	**2.5**	**1.8**	**2.1**	**2.6**	**2.9**	**3**	3.1	3.2	3.3	iAMaLGaM IDEA [4]
LSfminbnd	340	480	1700	2800	2500	*61e+0/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	1100	2400	1700	*53e+1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	16	13	9.6	11	12	12	13	12	12	12	MA-LS-Chain [21]
MCS (Neum)	23	14	67	170	820	4100	3800	*29e-2/2e4*	.	.	MCS (Neum) [18]
NELDER (Han)	**1.8**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**2**	**1.3**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1**	**1.1**	NELDER (Doe) [5]
NEWUOA	**1.4**	**1.3**	**2.8**	5.2	8.3	10	12	13	14	16	NEWUOA [31]
(1+1)-ES	28	320	2100	6200	1.2e4	2.3e4	7.6e4	*36e-4/1e6*	.	.	(1+1)-ES [1]
POEMS	49	72	410	1600	5300	1.2e4	*51e-2/1e5*	.	.	.	POEMS [20]
PSO	9.2	12	59	1100	2400	3600	4800	6700	6500	1.8e4	PSO [7]
PSO_Bounds	13	31	2100	8e3	1.2e4	1.1e4	2.2e4	2.1e4	2e4	1.8e4	PSO_Bounds [8]
Monte Carlo	34	210	2100	6e4	2.5e5	*11e-1/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.6**	3.9	8.5	7.8	7.2	6.8	6.5	6.4	6.9	6.5	Rosenbrock [27]
IPOP-SEP-CMA-ES	22	17	11	9.8	9.6	9.2	8.8	8.5	8.2	7.8	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	9.3	7.1	5.9	6	5.9	5.8	5.7	5.6	5.5	5.3	VNS (Garcia) [11]

Table 35: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	3.13	3.87	22.4	35.1	75.7	87.7	92.5	96.3	101	109	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	19	48	31	120	250	520	1100	1800	2600	5e3	ALPS [17]
AMaLGaM IDEA	5.5	7	3.1	**3**	**1.7**	**1.9**	**2.1**	**2.3**	**2.5**	**2.8**	AMaLGaM IDEA [4]
avg NEWUOA	**1.9**	**2.6**	**2**	3.3	**2.5**	**2.7**	3.3	3.7	4.3	5	avg NEWUOA [31]
BayEDAcG	10	23	91	810	*85e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.1**	**1.9**	**1**	**1**	**1**	**1.4**	3.7	11	41	*33e-7/7e3*	BFGS [30]
Cauchy EDA	19	24	7.8	6.5	4.1	4.3	5	5.2	5.6	6.4	Cauchy EDA [24]
BIPOP-CMA-ES	5.7	14	9.5	7.5	4	3.6	3.7	3.7	3.7	3.6	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.6	9.8	5.8	4.6	**2.7**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	(1+1)-CMA-ES [2]
DASA	15	16	4600	9300	1.4e4	2.2e4	3.3e4	4.3e4	4.2e4	3.9e4	DASA [19]
DEPSO	9.8	62	130	270	*89e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	5.7	6.4	13	28	150	390	770	*24e-4/3e4*	.	.	DIRECT [25]
EDA-PSO	9.6	28	74	290	490	1100	5100	*41e-4/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**2.3**	6.9	3.2	3.6	**2.5**	**2.6**	3.1	3.5	3.9	4.7	full NEWUOA [31]
G3-PCX	8.7	10	30	93	100	140	180	210	260	320	G3-PCX [26]
simple GA	17	66	74	2100	5600	*90e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	14	23	5.4	3.9	**2**	**1.8**	**1.8**	**1.8**	**1.7**	**1.7**	GLOBAL [23]
iAMaLGaM IDEA	4.6	6.7	3.1	3.1	**1.9**	**1.9**	**2**	**2.1**	**2.2**	**2.4**	iAMaLGaM IDEA [4]
LSfminbnd	**2.1**	190	1800	*32e+0/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**2.1**	400	2900	*36e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	13	24	21	22	11	10	10	10	9.9	9.7	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	49	82	100	510	*24e-3/2e4*	.	.	.	MCS (Neum) [18]
NELDER (Han)	3	3.4	**2.2**	**2.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	3.2	3.7	**2.3**	**2**	**1.1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.7**	8.8	3.1	3.4	**2.5**	**2.6**	3.2	3.7	4	5.1	NEWUOA [31]
(1+1)-ES	3.7	1300	8400	1.5e4	1.7e4	1.7e5	*37e-3/1e6*	.	.	.	(1+1)-ES [1]
POEMS	79	100	370	1e3	830	1500	1700	2100	2100	3200	POEMS [20]
PSO	12	30	60	150	160	270	360	450	530	990	PSO [7]
PSO_Bounds	9	25	240	740	610	1e3	1600	1600	1600	1700	PSO_Bounds [8]
Monte Carlo	22	52	130	2200	6.1e4	*13e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.7**	**2.7**	17	12	5.9	5.3	5.1	5	4.9	4.7	Rosenbrock [27]
IPOP-SEP-CMA-ES	5.2	20	17	15	7.4	6.6	6.6	6.5	6.4	6.1	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	12	30	14	9.6	4.8	4.5	4.4	4.4	4.4	4.3	VNS (Garcia) [11]

Table 36: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	9.78	13.2	21.6	55.9	113	134	148	208	232	263	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	73	85	94	100	170	460	1600	3400	1.4e4	9.3e4	ALPS [17]
AMaLGaM IDEA	5.9	6.4	4.7	4.2	4.8	5.2	5.6	4.9	4.9	5.2	AMaLGaM IDEA [4]
avg NEWUOA	**1.1**	**1.9**	4.5	3.2	**2.2**	**2.2**	**2.2**	**1.8**	**1.8**	**1.9**	avg NEWUOA [31]
BayEDAcG	27	26	67	82	120	220	*38e-1/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1.9**	**1.5**	**1.7**	**1.4**	**1**	**1**	**1**	**2**	**2.3**	43	BFGS [30]
Cauchy EDA	26	26	34	26	17	16	16	13	13	13	Cauchy EDA [24]
BIPOP-CMA-ES	5.2	4.8	7.9	5.7	4.5	4.7	4.8	3.9	4	4.1	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.8	4.3	8.5	6.1	4.3	4.2	4.2	3.3	3.6	3.5	(1+1)-CMA-ES [2]
DASA	17	17	3.1e4	3.6e4	3.6e4	*81e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	24	25	80	160	260	*67e-1/2e3*	.	.	.	.	DEPSO [12]
DIRECT	4.6	4.6	7	6.5	5.7	10	58	53	49	240	DIRECT [25]
EDA-PSO	190	260	960	1700	5900	1.1e4	9500	6800	*91e-2/1e5*	.	EDA-PSO [6]
full NEWUOA	**1**	**1.9**	**2.9**	**2.2**	**1.6**	**1.7**	**1.7**	**1.4**	**1.5**	**1.6**	full NEWUOA [31]
G3-PCX	4.8	4.3	6	11	8.9	9.5	9.9	8	7.9	8.1	G3-PCX [26]
simple GA	200	380	430	2400	1.3e4	1.1e4	*11e-1/1e5*	.	.	.	simple GA [22]
GLOBAL	11	8.6	5.9	3.1	**2**	**2.4**	**2.4**	**2.2**	**2.8**	4	GLOBAL [23]
iAMaLGaM IDEA	4.1	4.4	9.6	8	6.1	6	5.9	4.7	4.7	4.6	iAMaLGaM IDEA [4]
LSfminbnd	6	6.2	700	1200	*14e+0/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	87	73	1400	790	400	*34e+0/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	16	14	25	15	10	11	11	8.8	9.1	8.9	MA-LS-Chain [21]
MCS (Neum)	**1.3**	**1.1**	**1**	**1**	**1.2**	**1.2**	**2.7**	**2.5**	4.5	18	MCS (Neum) [18]
NELDER (Han)	**1.5**	**1.4**	**2**	**1.7**	**1.3**	**1.3**	**1.3**	**1**	**1**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**1.4**	**1.8**	**1.6**	**1.3**	**1.2**	**1.3**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.2**	**1**	**2**	**1.6**	**1.2**	**1.2**	**1.3**	**1**	**1.1**	**1.2**	NEWUOA [31]
(1+1)-ES	**2.7**	7200	2.8e4	2.7e4	3.9e4	1.1e5	*12e-1/1e6*	.	.	.	(1+1)-ES [1]
POEMS	100	170	1800	1600	3800	5e3	*69e-2/1e5*	.	.	.	POEMS [20]
PSO	30	41	2400	2700	5800	1e4	*33e-1/1e5*	.	.	.	PSO [7]
PSO_Bounds	110	280	2e3	2200	2500	1.1e4	9500	*24e-1/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	1700	1.1e4	1.6e5	*26e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.6**	**1.5**	38	19	10	9.4	8.9	6.9	7.4	11	Rosenbrock [27]
IPOP-SEP-CMA-ES	5.4	5.6	10	10	8.4	9.1	8.7	6.7	7	6.8	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	9.3	9.9	13	9.5	6	5.6	5.6	4.6	4.4	4.4	VNS (Garcia) [11]

Table 37: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{13}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.533	5.6	16.4	28.3	36.2	45.3	71.7	84.9	93.8	122	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.5**	12	48	66	100	200	410	1600	5400	2.2e4	ALPS [17]
AMaLGaM IDEA	**1.4**	4.3	3.7	3.9	4.2	4.3	3.4	3.4	3.5	3.4	AMaLGaM IDEA [4]
avg NEWUOA	**2.5**	**1**	5.6	14	42	110	160	280	260	*36e-4/8e3*	avg NEWUOA [31]
BayEDAcG	**1.5**	34	45	120	*24e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	3.5	**1.5**	**1.1**	**1**	**1**	**1**	**2.1**	31	410	*25e-6/9e3*	BFGS [30]
Cauchy EDA	39	22	14	12	12	12	9.4	9.2	9.6	9.3	Cauchy EDA [24]
BIPOP-CMA-ES	**1.6**	**2.6**	3.7	3.8	5	6.1	4.5	4.4	4.8	4.6	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.9**	**2.9**	4.1	4.5	5.9	6.9	5.9	5.9	6.1	6	(1+1)-CMA-ES [2]
DASA	18	52	320	1100	1600	6100	2e4	4e4	1.5e5	*46e-5/1e6*	DASA [19]
DEPSO	**1.9**	9.5	14	60	100	210	*11e-2/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1.9**	**2.9**	6.8	6.8	16	29	31	61	160	DIRECT [25]
EDA-PSO	**1.2**	4.7	48	140	400	1400	5800	*73e-4/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**2.2**	**1**	**3**	10	38	78	120	260	680	*51e-5/9e3*	full NEWUOA [31]
G3-PCX	**1.5**	4.8	20	73	97	110	160	220	230	210	G3-PCX [26]
simple GA	**2.2**	12	150	250	3600	1.5e4	2e4	*16e-2/1e5*	.	.	simple GA [22]
GLOBAL	**1.3**	9.4	6.6	4.5	6.3	8.4	88	*35e-4/400*	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.2**	3.2	**2.9**	**2.7**	3.1	3	**2.4**	**2.5**	**2.6**	**2.5**	iAMaLGaM IDEA [4]
LSfminbnd	5.9	14	120	220	620	1500	*39e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	120	150	510	1500	*65e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**2.2**	7.9	9.7	13	17	17	13	12	12	12	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.7**	14	130	370	370	710	830	*22e-4/2e4*	.	MCS (Neum) [18]
NELDER (Han)	**1.9**	**1.2**	**1**	**1.1**	**1.2**	**1.3**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**1.3**	**1**	**1.1**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.1**	NELDER (Doe) [5]
NEWUOA	**2**	**1**	4.5	9	42	62	200	1200	*12e-4/7e3*	.	NEWUOA [31]
(1+1)-ES	**1.7**	**2.3**	16	65	120	290	1e3	1600	3300	5.7e4	(1+1)-ES [1]
POEMS	280	52	73	670	1700	4900	*19e-3/1e5*	.	.	.	POEMS [20]
PSO	**1.2**	5.8	19	220	2200	5e3	2e4	1.7e4	1.5e4	*71e-3/1e5*	PSO [7]
PSO_Bounds	**1.5**	6.6	980	1400	1200	9e3	9200	*42e-3/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	**1.7**	13	1300	1.6e5	*17e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	4.5	**2.9**	5	8.6	9.2	20	31	82	130	320	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.6**	3	8.6	15	16	13	8.9	8.5	8.3	7.1	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	9.8	7.1	6	7.8	12	8.5	7.8	7.5	7.2	VNS (Garcia) [11]

Table 38: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{14}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	0.733	5.76	9.47	14.4	23.8	30.7	36.7	64.8	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.2**	**2.3**	10	55	71	69	81	200	2500	ALPS [17]
AMaLGaM IDEA	**1**	**1.2**	**2.1**	**2.7**	4.5	5	4.5	4.5	4.7	3.6	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.2**	4.7	**1.2**	**1.1**	**1.1**	**1.2**	**1.6**	**2.7**	6.9	avg NEWUOA [31]
BayEDAcG	**1**	**1.1**	**1.6**	58	120	110	250	280	780	*28e-4/2e3*	BayEDAcG [10]
BFGS	**1**	**2.1**	3.7	**1.5**	**1.5**	**1.3**	**1.1**	**1**	**1**	29	BFGS [30]
Cauchy EDA	**1**	**1**	20	15	17	18	14	14	14	11	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.3**	3.1	**2.9**	3.5	4.2	4.4	6.4	7.1	5.9	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	**2.1**	**1.4**	**2.2**	**2.6**	**2.9**	4	4.2	3.6	(1+1)-CMA-ES [2]
DASA	**1**	13	43	24	20	23	51	400	2900	4.8e4	DASA [19]
DEPSO	**1**	**1**	**1.5**	4.9	12	16	17	26	130	*11e-6/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1.8**	**1.7**	**2.7**	5.5	17	45	110	480	DIRECT [25]
EDA-PSO	**1**	**1.1**	**1.8**	4.2	11	21	76	130	190	6500	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	6.2	**1.4**	**1.2**	**1**	**1**	**1.5**	**2.3**	4.4	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**2**	4	4.6	4.2	4.9	11	45	280	G3-PCX [26]
simple GA	**1**	**1**	**1.9**	10	160	280	320	1600	6e3	*25e-6/1e5*	simple GA [22]
GLOBAL	**1**	**1**	**2.5**	8.4	11	7.4	5.1	4.8	12	*11e-6/300*	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**2.7**	**2.4**	3.2	3.7	3.1	3.2	3.6	**3.2**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	7.2	4.4	3.5	6.1	67	600	*31e-5/1e4*	.	LSfminbnd [28]
LSstep	**1**	29	210	84	70	160	930	*22e-4/1e4*	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	**1.8**	6.7	11	12	9.8	11	15	13	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2.5**	12	11	7.9	5.7	6	50	*20e-7/2e4*	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	**1.9**	**1**	**1.2**	**1.3**	**1.2**	**1.3**	**1.3**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.7**	**1.1**	**1.4**	**1.8**	**1.5**	**1.5**	**1.6**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	4.1	**1.1**	**1**	**1**	**1.2**	**2.1**	3	17	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	**2.2**	**1.8**	**1.9**	**2.5**	5.8	110	2400	*16e-7/1e6*	(1+1)-ES [1]
POEMS	**1**	140	250	55	91	110	150	160	220	1e4	POEMS [20]
PSO	**1**	**1.1**	**1**	3.1	14	24	30	45	76	2e3	PSO [7]
PSO_Bounds	**1**	**1**	**2.7**	4	33	62	86	140	280	1100	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	**2.1**	17	430	1.9e4	6e5	*43e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.5**	5.5	**1.4**	**1.3**	**1.5**	**2**	**2.4**	3.1	14	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.1**	**2.8**	**2.6**	3.6	4.2	4.8	9.9	11	8.3	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1**	7.1	8.7	8.3	7.5	7.7	8.4	7.2	VNS (Garcia) [11]

Table 39: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.778	40.5	457	2100	2760	2810	2860	2930	3010	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.3**	3.3	7.6	5.3	3.9	4.2	4.4	4.6	4.8	5.1	ALPS [17]
AMaLGaM IDEA	**1.3**	**1.8**	**1.2**	5	3.7	3.1	3	3	**3**	**2.9**	AMaLGaM IDEA [4]
avg NEWUOA	**2**	3.4	3.2	3.7	3.1	**2.3**	**2.3**	**2.2**	**2.2**	**2.1**	avg NEWUOA [31]
BayEDAcG	**1.5**	**2.4**	3.1	11	14	*11e-1/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	5.8	27	7.3	17	22	17	16	16	16	15	BFGS [30]
Cauchy EDA	9.2	46	3.9	5.4	27	*78e-3/5e4*	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1.9**	4.4	**1.9**	**1.3**	**1.7**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.5**	3.9	**1**	5.8	9.5	7.2	7.1	6.9	6.8	6.6	(1+1)-CMA-ES [2]
DASA	9.8	36	56	200	200	150	150	140	140	140	DASA [19]
DEPSO	**1.5**	**1**	3.4	6.6	3.3	**2.6**	**2.6**	**2.6**	*10e-1/2e3*	.	DEPSO [12]
DIRECT	**1**	**1.4**	**1**	**1.5**	**1**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	DIRECT [25]
EDA-PSO	**1.2**	**1.6**	3.8	7.4	9.5	7.4	7.3	7.4	7.4	7.5	EDA-PSO [6]
full NEWUOA	**1.3**	3.3	**2.2**	**2.8**	8.8	6.7	6.5	6.4	6.3	6.1	full NEWUOA [31]
G3-PCX	**1.4**	**2.9**	40	28	39	30	29	29	28	27	G3-PCX [26]
simple GA	**1.4**	3	14	20	62	62	62	64	83	150	simple GA [22]
GLOBAL	**1.2**	**2.3**	**2.7**	3.2	3.9	**3**	**2.9**	**2.9**	**2.8**	**2.7**	GLOBAL [23]
iAMaLGaM IDEA	**1.4**	3	6.2	5.6	4.6	3.6	3.6	3.5	3.5	3.4	iAMaLGaM IDEA [4]
LSfminbnd	**1**	5.5	4.8	21	20	15	15	15	15	14	LSfminbnd [28]
LSstep	**1.2**	170	380	140	67	51	50	50	49	48	LSstep [28]
MA-LS-Chain	**1.5**	3.1	**2.6**	**1.6**	3.3	**2.5**	**2.5**	**2.5**	**2.4**	**2.4**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.4**	**1.8**	**1**	**1.8**	**1.4**	**1.3**	**1.3**	**1.6**	**1.5**	MCS (Neum) [18]
NELDER (Han)	**1.3**	**2.9**	**2.3**	4.6	9.4	7.1	7	6.9	6.7	6.5	NELDER (Han) [16]
NELDER (Doe)	**2.3**	**2.5**	**1.4**	**1**	**2.5**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	NELDER (Doe) [5]
NEWUOA	**1.3**	**2.2**	3.5	3.4	4.5	3.4	3.3	3.3	3.2	3.1	NEWUOA [31]
(1+1)-ES	**2.2**	4.5	3.4	6.2	13	10	10	9.8	9.6	9.3	(1+1)-ES [1]
POEMS	39	190	14	32	77	59	58	57	57	56	POEMS [20]
PSO	**1.5**	**2.8**	**2.7**	4	58	44	44	43	42	41	PSO [7]
PSO_Bounds	**1.3**	3.8	**2.8**	27	27	21	22	22	21	22	PSO_Bounds [8]
Monte Carlo	**1.5**	**2.2**	29	1500	*65e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.9	38	11	11	19	15	14	14	14	13	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.7**	4.4	**2.3**	**2.2**	**1.3**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.4**	**2.6**	3	**3**	3.7	**2.8**	**2.8**	**2.9**	**2.9**	4.5	VNS (Garcia) [11]

Table 40: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.4	13.6	106	194	263	621	720	1070	1120	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	**1.1**	5.9	9.1	13	9	13	10	16	ALPS [17]
AMaLGaM IDEA	**1**	**1.6**	**1.8**	5.2	9.7	11	6	5.3	3.9	3.7	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.3**	3.7	6.1	23	59	73	*19e-3/7e3*	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.4**	**1.7**	25	*98e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**2.8**	72	150	*14e-1/7e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3	5.2	28	1100	*14e-2/5e4*	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.5**	**2.1**	3.5	4.3	**3.3**	**1.7**	**1.5**	**1.1**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.2**	4.3	4.8	7.9	10	9.9	14	10	18	(1+1)-CMA-ES [2]
DASA	**1**	8.7	37	130	300	510	1e3	2200	2900	2900	DASA [19]
DEPSO	**1**	**1.3**	3.9	5.9	29	*15e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.2**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1.2**	**1.9**	DIRECT [25]
EDA-PSO	**1**	**1.3**	**1.5**	19	110	160	97	93	73	72	EDA-PSO [6]
full NEWUOA	**1**	**1.9**	3.3	4.2	9	17	13	69	99	*26e-5/8e3*	full NEWUOA [31]
G3-PCX	**1**	**1**	**1**	3.2	11	18	13	27	58	100	G3-PCX [26]
simple GA	**1**	**1.4**	**1**	6	61	340	490	940	650	1300	simple GA [22]
GLOBAL	**1**	**1.4**	**1.6**	**1.1**	**1.3**	**1.6**	**1.6**	**1.7**	**1.3**	3.4	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	**1.9**	**1.9**	10	9.2	6	5.2	3.5	3.6	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.2**	**1.6**	3.5	19	50	100	*12e-3/9e3*	.	.	LSfminbnd [28]
LSstep	**1**	**1.3**	4	8.7	94	170	240	210	140	130	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**1.6**	**1.6**	4.8	5.6	5.7	6.4	6	6.2	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.3**	4.1	**2.1**	11	33	130	*18e-4/2e4*	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	3.7	7	21	29	13	17	14	14	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.2**	**2.8**	**3.4**	3.9	3.2	3.5	**2.6**	6.3	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	4.5	6.7	12	58	150	130	*13e-3/6e3*	.	NEWUOA [31]
(1+1)-ES	**1**	**1.8**	8.6	18	40	57	120	200	230	4e3	(1+1)-ES [1]
POEMS	**1**	120	16	24	71	210	96	84	57	57	POEMS [20]
PSO	**1**	**1.6**	**1.5**	3	41	77	73	66	45	59	PSO [7]
PSO_Bounds	**1**	**1.4**	**1.8**	6.4	58	170	120	120	95	93	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	**1.8**	7.9	180	4400	2.3e4	*80e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	3	22	31	93	270	230	*23e-2/1e4*	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.4**	**2.1**	3.5	4	3.5	**1.6**	**1.4**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.8**	**2.3**	6.7	5.9	9.5	4.4	4	3	8.4	VNS (Garcia) [11]

Table 41: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	1.2	26.2	93.9	164	378	602	782	1160	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.2**	**2.4**	11	13	15	9.2	8.3	8.5	8.8	ALPS [17]
AMaLGaM IDEA	**1**	**1.3**	3.3	**1.5**	**1**	**1**	**2.6**	3.1	3.9	3	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.9**	3.3	8	13	150	*32e-3/5e3*	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.7**	**2.3**	6.7	7.6	17	9.7	16	*32e-4/2e3*	.	BayEDAcG [10]
BFGS	**1**	**2.1**	48	44	*44e-2/2e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	4.9	24	7.3	4.1	3.6	**2.2**	**1.8**	**1.8**	**1.6**	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.2**	5.3	4	**2.4**	**2.3**	**1.5**	**1.2**	**1.4**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	32	7.6	7.9	32	37	75	58	*76e-5/1e4*	(1+1)-CMA-ES [2]
DASA	**1**	15	65	49	110	480	900	990	3900	1.2e4	DASA [19]
DEPSO	**1**	**1.3**	5.1	4	3.5	3.5	**2.3**	**2.2**	**2.3**	5	DEPSO [12]
DIRECT	**1**	**1**	**1.2**	**1**	**1.2**	**1.5**	**1**	**1**	**1**	**1.2**	DIRECT [25]
EDA-PSO	**1.1**	**1.3**	**2.3**	4	17	29	20	17	17	16	EDA-PSO [6]
full NEWUOA	**1**	**1.7**	3.9	5.5	7.3	31	53	*35e-4/6e3*	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.3**	**2.6**	33	39	48	47	110	290	640	G3-PCX [26]
simple GA	**1**	**1.1**	**1.4**	30	57	72	72	65	120	*58e-8/1e5*	simple GA [22]
GLOBAL	**1**	**1.5**	**3**	4.2	7.3	21	*98e-3/400*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**2.4**	**1**	3.1	**2.7**	3.1	4.4	3.6	**3**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.2**	14	8.2	30	140	*21e-3/1e4*	.	.	.	LSfminbnd [28]
LSstep	**1**	**1.5**	71	200	100	880	*69e-3/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.4**	**2.1**	3.4	4	4.9	3.1	**2.6**	**2.3**	**2**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**2.5**	5.6	16	180	*35e-4/2e4*	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	62	22	44	95	95	110	250	400	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	**1.9**	3.7	8.5	36	69	*12e-4/2e4*	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.6**	**2.7**	9	19	140	*32e-3/5e3*	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	24	33	870	2300	4100	*12e-4/1e6*	.	.	(1+1)-ES [1]
POEMS	**1**	93	140	20	23	28	17	18	16	15	POEMS [20]
PSO	**1**	**1.1**	**2.8**	4.4	80	55	26	18	15	14	PSO [7]
PSO_Bounds	**1**	**1.3**	**2.5**	4.7	14	21	14	13	25	28	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	**2.4**	30	7200	*92e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.3**	81	2200	*20e-1/8e3*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.2**	**2.8**	**1.8**	**2.1**	**1.8**	**1.4**	**1**	**1.1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.9**	**2.9**	**1.2**	**1.7**	**1.3**	**2**	4.8	18	VNS (Garcia) [11]

Table 42: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.4	13.4	48.2	430	1030	1170	1310	1580	1840	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.3**	**2.6**	5	17	5.5	5.2	7.2	13	18	140	ALPS [17]
AMaLGaM IDEA	**1.2**	3.4	**1.6**	6.1	3.5	3.2	3.1	**2.9**	**2.5**	**2.5**	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	4.8	11	30	15	89	*76e-3/6e3*	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.1**	3	4.5	9.7	67	*20e-2/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	16	33	*29e-1/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.3**	31	280	80	9.4	4.3	4	8.5	7.3	6.6	Cauchy EDA [24]
BIPOP-CMA-ES	**1.1**	3.4	**1.4**	3.4	**1.8**	**1.1**	**1**	**1**	**1.1**	**1.3**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.2**	3.8	**2.7**	5	8.3	22	40	*16e-3/1e4*	.	.	(1+1)-CMA-ES [2]
DASA	5.6	93	91	980	460	1600	*10e-3/1e6*	.	.	.	DASA [19]
DEPSO	**1.3**	**2.4**	3.8	12	3.4	5.1	12	*18e-3/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**1.5**	**1.1**	**2.7**	**1**	**1**	**2**	**2.9**	5	8.3	DIRECT [25]
EDA-PSO	**1**	4.5	**2.4**	28	13	9.3	12	13	14	16	EDA-PSO [6]
full NEWUOA	**1.1**	4.6	4.2	16	13	*48e-3/7e3*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	3.3	**2.4**	11	18	63	*91e-4/5e4*	.	.	.	G3-PCX [26]
simple GA	**1**	3.2	6.3	63	42	420	1200	*17e-3/1e5*	.	.	simple GA [22]
GLOBAL	**1.2**	**2.7**	3.9	5.7	4.6	*21e-2/500*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.9**	**1**	**1**	**1.6**	3.3	3.7	3.9	3.4	3.8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	4.4	8.7	35	33	*10e-2/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	**1**	25	42	360	330	*12e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	**2.3**	3	4.8	5.3	12	11	13	12	11	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	4	**2.9**	20	*40e-3/2e4*	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.1**	4.2	25	27	30	45	120	550	*98e-5/1e5*	.	NELDER (Han) [16]
NELDER (Doe)	**1.1**	3.5	**1.9**	5.4	7	16	72	200	170	*63e-4/2e4*	NELDER (Doe) [5]
NEWUOA	**1**	5.1	7.2	17	34	*12e-2/6e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.8**	9	340	300	2800	1.4e4	1.2e4	*83e-3/1e6*	.	.	(1+1)-ES [1]
POEMS	42	250	25	180	25	24	50	95	100	170	POEMS [20]
PSO	**1**	**2.7**	**2**	16	57	77	99	92	110	180	PSO [7]
PSO_Bounds	**1**	**2.7**	**2**	170	65	57	67	68	69	780	PSO_Bounds [8]
Monte Carlo	**1.1**	**2.2**	4.7	450	*26e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.1**	160	220	2300	*50e-1/8e3*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.2**	4.7	**1.2**	**1.8**	**2.1**	**1**	**1.1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.2**	3.5	3.2	**2.3**	4.3	5.3	6.6	13	45	130	VNS (Garcia) [11]

Table 43: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	0.333	0.333	36.5	2250	2460	2460	2470	2480	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	11	470	46	**3**	4.6	5.2	5.5	7.1	ALPS [17]
AMaLGaM IDEA	**1**	**1.2**	13	120	36	3.8	5.9	6	6	6	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.5**	13	320	120	39	76	76	76	76	avg NEWUOA [31]
BayEDAcG	**1**	**1.1**	9.9	130	43	*64e-3/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	37	110	870	160	33	*86e-3/5e3*	.	.	.	BFGS [30]
Cauchy EDA	**1**	**2.3**	57	540	310	*53e-3/5e4*	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.5**	13	**100**	49	**2.9**	3.2	3.2	3.2	3.3	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	6.1	970	160	8.8	17	17	17	17	(1+1)-CMA-ES [2]
DASA	**1**	3.3	60	5100	520	230	460	460	460	480	DASA [19]
DEPSO	**1**	**1**	5.4	240	41	*43e-3/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1**	29	60	60	*10e-3/3e4*	.	DIRECT [25]
EDA-PSO	**1**	**1.4**	9.1	370	82	5.8	11	12	13	16	EDA-PSO [6]
full NEWUOA	**1**	**1.7**	25	370	56	11	17	17	17	17	full NEWUOA [31]
G3-PCX	**1**	**1.1**	7.6	920	640	100	95	95	95	94	G3-PCX [26]
simple GA	**1**	**1.2**	7.1	930	100	19	39	50	81	*68e-6/1e5*	simple GA [22]
GLOBAL	**1**	**1.1**	14	290	46	3.9	*94e-3/1e3*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	10	160	73	7.6	7.7	7.7	7.7	7.7	iAMaLGaM IDEA [4]
LSfminbnd	**1**	3	26	270	54	46	*38e-3/7e3*	.	.	.	LSfminbnd [28]
LSstep	**1**	**2**	8.9	650	26	63	*28e-3/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	7.6	190	20	**1.6**	**2.2**	**2.2**	**2.2**	**2.3**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**11**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**4.1**	1500	120	17	40	40	40	40	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	7.6	150	**20**	5.4	11	11	11	11	NELDER (Doe) [5]
NEWUOA	**1**	**1.5**	20	1300	280	25	54	54	54	53	NEWUOA [31]
(1+1)-ES	**1**	**2.3**	10	2.1e5	3.1e4	1800	2600	2600	2600	2600	(1+1)-ES [1]
POEMS	**1**	130	630	1400	170	40	57	58	58	59	POEMS [20]
PSO	**1**	**1.1**	10	240	24	14	24	25	25	28	PSO [7]
PSO_Bounds	**1**	**1.1**	6.7	250	91	13	26	27	30	35	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	11	1e3	810	490	2900	6100	6100	*79e-4/1e6*	Monte Carlo [3]
Rosenbrock	**1**	15	250	3100	850	32	*27e-2/1e4*	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.1**	9.1	190	54	**2.6**	**2.4**	**2.4**	**2.5**	**2.5**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.4**	23	220	36	4.8	6	6.1	6.3	10	VNS (Garcia) [11]

Table 44: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.84	2.6	2.76	128	764	799	827	842	858	925	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**2.8**	4.1	5.1	5	3.9	4.6	5.3	6.2	7.2	8.2	ALPS [17]
AMaLGaM IDEA	**2.2**	**2.2**	**2.7**	20	26	25	25	25	24	23	AMaLGaM IDEA [4]
avg NEWUOA	**1.5**	**1.3**	**1.3**	**2.3**	9.9	9.5	9.2	9	8.9	8.2	avg NEWUOA [31]
BayEDAcG	3.1	**3**	3.2	71	*13e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.8**	**1.7**	**1.9**	**1.7**	5.5	5.3	5.1	5	4.9	4.6	BFGS [30]
Cauchy EDA	17	18	20	10	460	930	*31e-2/5e4*	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**2.2**	**2.1**	**2.3**	8.2	10	10	10	10	10	9.5	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.1**	**2.6**	**2.7**	5.6	9.5	9.1	8.8	8.7	8.5	7.9	(1+1)-CMA-ES [2]
DASA	31	37	37	21	43	41	40	39	38	36	DASA [19]
DEPSO	**1.1**	4.1	5.9	**2.4**	4.9	4.8	4.8	4.9	4.8	4.7	DEPSO [12]
DIRECT	3.7	5.2	5.9	**1**	9	8.7	8.6	8.5	8.5	8.1	DIRECT [25]
EDA-PSO	**2.3**	3.4	3.6	6.7	4.5	4.9	5.1	5.3	5.6	6.1	EDA-PSO [6]
full NEWUOA	**1.9**	**1.3**	**1.2**	5.2	9.1	8.7	8.4	8.3	8.1	7.5	full NEWUOA [31]
G3-PCX	**1.5**	**2.8**	3.5	17	22	21	21	20	20	19	G3-PCX [26]
simple GA	3.2	4.3	5.1	14	7.1	10	14	17	21	29	simple GA [22]
GLOBAL	**1.3**	**2.7**	3.4	6	18	17	17	16	16	15	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**2.9**	3.7	16	19	18	18	18	17	16	iAMaLGaM IDEA [4]
LSfminbnd	6.4	6.1	6.8	9.9	*42e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	150	180	220	28	180	180	170	170	170	160	LSstep [28]
MA-LS-Chain	**2.5**	**2.3**	**2.8**	**2.5**	**1**	**1**	**1**	**1**	**1**	**1**	MA-LS-Chain [21]
MCS (Neum)	**2.9**	**2.2**	**2.3**	3.2	**3.5**	**3.4**	**3.3**	**3.2**	**3.1**	**2.9**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1**	19	25	24	23	23	23	21	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**1.5**	**1.7**	3.6	10	10	9.7	9.5	9.4	8.7	NELDER (Doe) [5]
NEWUOA	**1.6**	**1.4**	**1.3**	**1.1**	**3.9**	**3.7**	**3.6**	**3.5**	**3.4**	**3.2**	NEWUOA [31]
(1+1)-ES	**2.2**	3.1	3.1	4.7	9.5	9.1	8.8	8.7	8.5	7.9	(1+1)-ES [1]
POEMS	110	87	84	7.4	65	63	63	69	69	66	POEMS [20]
PSO	**1.4**	3.2	3.7	**2.6**	22	22	21	21	21	20	PSO [7]
PSO_Bounds	**2.1**	**2.7**	3.2	5.2	52	78	76	85	84	80	PSO_Bounds [8]
Monte Carlo	**1.3**	**2.6**	3.1	56	1600	*94e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**3**	**2.6**	**2.5**	**1.5**	10	9.5	9.2	9.1	8.9	8.3	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.7**	**2.1**	**2.8**	7.9	5.5	5.5	5.4	5.5	5.4	5.2	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	3.7	**2.8**	**2.9**	4.4	5.5	5.3	5.1	5.1	5.2	5.8	VNS (Garcia) [11]

Table 45: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{21}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	1.98	61.3	142	146	153	155	156	161	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.3**	**2.3**	3.7	5.8	7.4	8.8	11	15	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**2.2**	17	41	41	40	40	40	39	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	4	**2.5**	**2.1**	**2**	**2**	**2**	**2**	**2**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**2.1**	7.5	94	*63e-2 /2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	**2.1**	3.3	3.5	3.4	3.3	3.3	3.2	3.2	BFGS [30]
Cauchy EDA	**1**	**1**	16	11	240	240	500	650	890	860	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1.7**	6.8	6	6.1	6	6	6.1	6.1	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**1.9**	4.5	8.1	8	7.7	7.6	7.5	7.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	12	93	66	65	62	62	62	61	DASA [19]
DEPSO	**1**	**1**	**1.2**	4.1	3.5	4.6	5.3	6.6	7.1	7.5	DEPSO [12]
DIRECT	**1**	**1**	**1.9**	**1**	**1.4**	**1.4**	**1.4**	3.8	4.2	5.8	DIRECT [25]
EDA-PSO	**1**	**1**	**1.4**	3.2	54	55	58	59	62	65	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.4**	3.3	**2.8**	**2.7**	**2.6**	**2.6**	**2.6**	**2.6**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.6**	8.6	5.7	5.6	5.4	5.4	5.4	5.4	G3-PCX [26]
simple GA	**1**	**1**	**1.5**	**2.5**	5.3	18	29	43	99	230	simple GA [22]
GLOBAL	**1**	**1**	**1.8**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	28	20	19	19	18	18	18	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	6.1	21	27	26	31	38	39	46	LSfminbnd [28]
LSstep	**1**	**1**	15	210	200	190	190	200	200	220	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.7**	**1.7**	9.7	9.8	9.6	9.7	9.7	9.7	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	6.2	**2.1**	4.4	4.3	4.1	4.1	4.1	4.2	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1.6**	16	26	25	24	23	23	23	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2**	**2.8**	**2.9**	**2.8**	**2.7**	**2.7**	**2.7**	**2.6**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.6**	**2.7**	3.5	3.5	3.4	3.4	3.4	3.4	NEWUOA [31]
(1+1)-ES	**1**	**1**	**2**	15	17	17	16	16	16	16	(1+1)-ES [1]
POEMS	**1**	**1**	95	680	550	540	510	510	510	500	POEMS [20]
PSO	**1**	**1**	**1.2**	120	110	110	100	100	100	100	PSO [7]
PSO_Bounds	**1**	**1**	**1**	120	180	170	170	170	170	170	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.5**	**2.9**	8.3	34	120	980	4500	*62e-7 /1e6*	Monte Carlo [3]
Rosenbrock	**1**	**1**	17	8.1	12	11	11	11	11	11	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1**	4.6	15	17	17	17	17	17	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.1**	9.2	11	11	11	11	11	11	VNS (Garcia) [11]

Table 46: 03-D, running time excess ERT/$\mathrm{ERT_{best}}$ on f_{22}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.333	0.333	6.02	56.7	118	121	128	132	134	138	$\mathrm{ERT_{best}}$/D
ALPS	**1**	**1**	**1.8**	**2.1**	4	8.5	12	17	21	28	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.1**	21	56	61	59	58	57	57	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**2.8**	**2**	**2.9**	**2.9**	**2.8**	**2.9**	**2.9**	3.1	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**2**	11	48	*36e-2/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	3.3	**2.6**	**2.1**	**2.1**	**2**	**2**	**2**	**2**	BFGS [30]
Cauchy EDA	**1**	**1**	12	230	640	1100	2500	2500	2400	2400	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1.1**	6.4	13	14	13	13	13	13	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	3.5	6.8	11	10	9.8	9.7	9.6	9.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	20	100	69	75	79	88	98	120	DASA [19]
DEPSO	**1**	**1**	4.8	4.7	13	14	14	18	26	34	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	**1**	6.3	6.2	7.4	9.8	15	18	DIRECT [25]
EDA-PSO	**1**	**1**	**1.2**	3.9	5.4	11	16	22	29	42	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.3**	**2**	**1.8**	**1.9**	**1.9**	**1.9**	**1.9**	**2.1**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.4**	4.1	10	10	9.8	9.7	9.7	9.6	G3-PCX [26]
simple GA	**1**	**1**	**1**	3.5	6.5	27	270	950	1600	3100	simple GA [22]
GLOBAL	**1**	**1**	**1.6**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	21	43	44	43	42	43	42	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	14	13	19	66	62	70	77	150	LSfminbnd [28]
LSstep	**1**	**1**	64	48	160	240	320	*16e-2/1e4*	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.4**	3.7	**2.7**	3.3	3.4	3.5	3.8	4.3	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	3.3	**1.6**	**1.2**	**1.2**	4.6	4.6	4.5	4.6	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	5.5	10	13	13	12	12	12	12	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	4.1	**2**	**2.2**	**2.2**	**2.1**	**2**	**2**	**2**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.8**	**2.5**	5.8	5.8	5.6	5.5	5.5	5.7	NEWUOA [31]
(1+1)-ES	**1**	**1**	23	17	17	17	17	18	19	20	(1+1)-ES [1]
POEMS	**1**	**1**	42	170	450	450	420	420	410	410	POEMS [20]
PSO	**1**	**1**	**1.1**	130	130	130	120	120	120	120	PSO [7]
PSO_Bounds	**1**	**1**	**1.5**	**2.2**	64	65	67	69	76	88	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.7**	**3**	4.8	40	200	1500	7100	*30e-7/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.7**	5.6	5.2	5.3	5.1	5.1	5.1	5	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1.7**	3.9	13	31	30	30	29	29	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1.4**	10	12	13	13	14	14	15	VNS (Garcia) [11]

Table 47: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.333	0.333	0.867	136	302	405	738	751	764	798	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	3.7	12	54	200	370	890	6300	3e4	ALPS [17]
AMaLGaM IDEA	**1**	**1**	3.9	6.3	10	8.9	5.1	5.1	5.1	5.1	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	11	**2.5**	22	85	150	*46e-3/7e3*	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1**	3.2	34	*11e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	17	8.7	110	*23e-2/5e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	4.1	52	*51e-2/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	4.9	6.4	9.3	7.1	4.2	4.2	4.2	4.2	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	3.7	**2**	11	17	12	12	12	12	(1+1)-CMA-ES [2]
DASA	**1**	**1**	15	71	880	1700	1900	5400	5300	5100	DASA [19]
DEPSO	**1**	**1**	**1.9**	40	*12e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	4.7	**1.5**	31	25	15	16	18	22	DIRECT [25]
EDA-PSO	**1**	**1**	**2.9**	23	4900	3700	2e3	*31e-2/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	6.7	**2.4**	15	40	37	170	170	160	full NEWUOA [31]
G3-PCX	**1**	**1**	4.9	**2.1**	14	29	17	30	43	42	G3-PCX [26]
simple GA	**1**	**1**	4.3	16	520	3700	*88e-3/1e5*	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	3.1	**1.6**	**3.1**	*81e-3/1e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	4.4	8.4	9.7	7.5	4.3	4.3	4.3	4.3	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	3.2	7.1	420	*31e-2/9e3*	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	5.6	4.9	490	*25e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	4.1	**2.1**	6.7	**5.2**	**2.9**	**3.1**	**3.1**	**3.1**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**2.7**	12	39	330	*77e-4/2e4*	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	3.1	**1.4**	**2.3**	**1.8**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	6.7	**1**	**1**	**1**	**1.1**	**1.4**	**1.4**	**1.4**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	11	**2.7**	24	110	*68e-3/6e3*	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	21	**2.9**	13	240	510	1500	1800	3500	(1+1)-ES [1]
POEMS	**1**	**1**	18	22	130	130	73	75	76	79	POEMS [20]
PSO	**1**	**1**	3.2	11	170	360	200	200	200	190	PSO [7]
PSO_Bounds	**1**	**1**	**1.9**	15	460	570	440	450	930	890	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.6**	13	2.3e4	*13e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**2.4**	**1.9**	10	88	48	*31e-3/5e3*	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	4.6	7.1	13	11	5.9	5.9	5.9	5.8	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	4.6	6.7	27	41	23	23	24	23	VNS (Garcia) [11]

Table 48: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.333	1e+02 0.333	1e+01 32.2	1e+00 3460	1e-01 34200	1e-02 1.19e5	1e-03 1.19e5	1e-04 1.19e5	1e-05 1.19e5	1e-07 1.19e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	7.9	3.5	6.2	**2.9**	**2.9**	**3**	**3**	**3.1**	ALPS [17]
AMaLGaM IDEA	**1**	**1.2**	**1.5**	9.7	10	4.5	4.6	4.7	4.7	5.1	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**2.6**	3.7	**1.2**	**2.4**	*64e-2/6e3*	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.3**	4.3	*40e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1.8**	9.3	*41e-1/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	**1.7**	4.2	100	*31e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1.3**	7.6	7.9	3	4.1	4.9	4.9	4.9	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	9.2	3.3	*91e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	69	85	420	*37e-2/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	5.8	*48e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	39	*30e-1/3e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.2**	6.4	*30e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.7**	**2.8**	**1.2**	*76e-2/6e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	19	22	10	*10e-1/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	18	*32e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	3.4	**1.1**	*27e-1/2e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.5**	5.3	5.8	9.9	8.7	8.7	8.7	8.7	8.8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.1**	**1.9**	6.4	*12e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	3	3.1	6.5	41	*35e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	3.7	*30e-1/2e4*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	17	**2**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	20	5.2	10	6.3	6.3	6.3	6.3	6.3	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.3**	**1.5**	**3.9**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	NELDER (Doe) [5]
NEWUOA	**1**	**1.5**	**2.5**	**1**	*45e-2/6e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	23	13	40	120	120	120	120	120	(1+1)-ES [1]
POEMS	**1**	58	16	86	42	12	12	12	12	12	POEMS [20]
PSO	**1**	**1**	4.7	400	*31e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.1**	9.1	410	42	12	12	12	12	12	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	10	450	*10e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.1**	54	*36e-1/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1**	5	*13e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.6**	**2.9**	**1.6**	110	64	64	64	65	110	VNS (Garcia) [11]

Table 49: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_1, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	2.2	2.44	2.44	2.44	2.44	2.44	2.44	2.44	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.6**	9.2	140	300	490	680	850	1e3	1400	ALPS [17]
AMaLGaM IDEA	**1**	**1.5**	5.5	16	29	44	58	72	87	120	AMaLGaM IDEA [4]
avg NEWUOA	**1**	3.3	**1.5**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	avg NEWUOA [31]
BayEDAcG	**1**	**1.2**	5.2	46	92	130	170	280	390	560	BayEDAcG [10]
BFGS	**1**	3.4	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	BFGS [30]
Cauchy EDA	**1**	24	41	90	170	240	310	400	460	600	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.1**	3.2	9	15	21	27	33	40	53	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.3**	**2.3**	5.9	9.7	14	17	21	25	32	(1+1)-CMA-ES [2]
DASA	**1**	5.2	23	44	59	71	88	110	120	150	DASA [19]
DEPSO	**1**	**1.3**	8.1	26	48	77	110	130	170	220	DEPSO [12]
DIRECT	**1**	**1**	**2**	7	19	31	44	62	84	150	DIRECT [25]
EDA-PSO	**1**	**1.1**	3.2	20	320	890	1500	2100	2700	3800	EDA-PSO [6]
full NEWUOA	**1**	**2.9**	**1.9**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	full NEWUOA [31]
G3-PCX	**1**	**1.5**	5.2	12	15	19	25	31	35	45	G3-PCX [26]
simple GA	**1**	**1.5**	8.7	360	1200	2100	2900	4100	5400	8300	simple GA [22]
GLOBAL	**1**	**1.3**	6.8	26	28	30	32	33	35	39	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**2.5**	9.8	19	28	36	47	56	73	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**2.8**	6	6.3	6.7	6.7	6.8	6.8	6.8	6.8	LSfminbnd [28]
LSstep	**1**	140	92	120	130	130	130	130	130	130	LSstep [28]
MA-LS-Chain	**1**	**1.3**	7.8	25	47	60	74	90	120	140	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1.8**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	MCS (Neum) [18]
NELDER (Han)	**1**	**1.7**	**1.5**	3.3	5.4	7.2	9.2	11	13	17	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.3**	**1.5**	3.4	5.6	7.4	9.5	11	13	17	NELDER (Doe) [5]
NEWUOA	**1**	**2.4**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1.2**	**2.3**	5	8.4	11	15	18	22	28	(1+1)-ES [1]
POEMS	**1**	240	110	130	380	760	1200	1600	2100	2900	POEMS [20]
PSO	**1**	**1.3**	3.7	22	55	110	180	240	320	450	PSO [7]
PSO_Bounds	**1**	**1.2**	3.8	41	210	430	730	980	1300	1900	PSO_Bounds [8]
Monte Carlo	**1**	**1.4**	7.5	1700	6.8e5	*10e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.9**	**2.9**	4.2	5.5	6.8	8.7	10	12	15	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.5**	**2.8**	7	14	18	23	29	34	44	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.6**	7.4	18	25	31	38	45	50	64	VNS (Garcia) [11]

Table 50: 05-D, running time excess ERT/ERT_{best} on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	9.71	14.9	16.7	17.5	17.7	17.9	18	18.2	18.4	18.8	ERT_{best}/D
ALPS	45	55	73	95	120	150	170	190	210	260	ALPS [17]
AMaLGaM IDEA	5.2	5.3	7.1	10	13	15	17	19	21	24	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**2**	6.4	21	41	56	75	92	110	150	avg NEWUOA [31]
BayEDAcG	32	38	41	46	52	58	64	79	84	95	BayEDAcG [10]
BFGS	3.3	3.4	**3.8**	**5.6**	**6.2**	**6.5**	**6.6**	**6.8**	**6.9**	**7.1**	BFGS [30]
Cauchy EDA	35	35	42	49	58	71	80	91	100	120	Cauchy EDA [24]
BIPOP-CMA-ES	11	11	13	16	18	19	20	20	21	22	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	5.6	6.6	9.4	11	12	13	14	14	14	15	(1+1)-CMA-ES [2]
DASA	10	8.6	9.7	12	13	15	17	19	21	26	DASA [19]
DEPSO	11	11	13	16	21	24	28	32	37	44	DEPSO [12]
DIRECT	4.2	4.3	5.7	7.2	8.4	10	14	16	22	380	DIRECT [25]
EDA-PSO	8.6	58	140	210	290	360	420	490	550	690	EDA-PSO [6]
full NEWUOA	**1.5**	**2.7**	6.9	19	36	50	69	87	100	130	full NEWUOA [31]
G3-PCX	15	30	69	150	220	280	340	410	470	620	G3-PCX [26]
simple GA	180	230	330	460	610	770	1300	1500	2200	2500	simple GA [22]
GLOBAL	7.1	5.4	6.3	6.9	7.3	7.5	7.8	8	8.2	**8.5**	GLOBAL [23]
iAMaLGaM IDEA	4.4	4.7	6.2	8.1	10	12	13	14	15	17	iAMaLGaM IDEA [4]
LSfminbnd	**1.5**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	25	17	16	16	16	15	15	15	15	15	LSstep [28]
MA-LS-Chain	7.9	10	13	16	22	27	32	36	41	49	MA-LS-Chain [21]
MCS (Neum)	**1.3**	**1**	**1.1**	**1.5**	**2.2**	**3.2**	**4.7**	**5.7**	**6.5**	29	MCS (Neum) [18]
NELDER (Han)	**2.4**	**2.7**	5	6.8	7.4	7.7	7.9	8.1	8.3	8.6	NELDER (Han) [16]
NELDER (Doe)	**2**	**2.5**	4.9	8.1	8.9	9.3	9.6	9.8	10	10	NELDER (Doe) [5]
NEWUOA	**1**	**1.8**	5.7	22	45	60	85	100	130	170	NEWUOA [31]
(1+1)-ES	110	1600	5600	1.6e4	3e4	4.6e4	1.9e5	2.6e5	8e5	*19e-4/1e6*	(1+1)-ES [1]
POEMS	150	160	210	270	330	380	440	470	520	630	POEMS [20]
PSO	19	25	32	41	49	59	68	78	89	110	PSO [7]
PSO_Bounds	47	83	150	190	260	300	400	590	860	1200	PSO_Bounds [8]
Monte Carlo	1800	1.2e5	*11e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	8.6	13	100	140	140	150	190	190	240	Rosenbrock [27]
IPOP-SEP-CMA-ES	5.4	5.7	7.2	8.5	9.4	10	11	11	12	13	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	15	14	18	20	24	24	25	26	26	27	VNS (Garcia) [11]

Table 51: 05-D, running time excess ERT/ERT_{best} on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.2	2.92	143	324	327	328	329	330	330	331	ERT_{best}/D
ALPS	**1.5**	**2**	5.7	12	22	24	26	28	29	33	ALPS [17]
AMaLGaM IDEA	**1.5**	**2.1**	4.5	65	480	500	510	520	520	520	AMaLGaM IDEA [4]
avg NEWUOA	3.3	4.8	**3**	130	*40e-1/6e3*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.2**	**1.7**	**2.7**	*29e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	7.4	56	110	*21e+0/4e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	35	25	6.7	2200	*26e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	3.5	**1.5**	**1.4**	16	140	140	140	140	140	140	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.2**	**1.3**	9.1	440	*30e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	8.7	18	**1.2**	**1.6**	**10**	**10**	**10**	**10**	**10**	**11**	DASA [19]
DEPSO	**1.4**	**2.9**	3.7	29	30	30	30	*23e-1/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**2.6**	45	300	*30e-1/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.4**	**2.2**	12	170	860	860	860	860	870	870	EDA-PSO [6]
full NEWUOA	4.3	3.7	4.2	160	*20e-1/7e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**2**	3	84	2100	*30e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	**1.6**	19	18	25	34	43	53	110	200	simple GA [22]
GLOBAL	**1.2**	**2.4**	3.3	*50e-1/500*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**1.4**	**1.4**	33	180	180	180	190	190	190	iAMaLGaM IDEA [4]
LSfminbnd	11	**2.7**	**1**	52	*21e-1/4e3*	.	.	.	.	.	LSfminbnd [28]
LSstep	81	62	**2.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**1.3**	**1**	6.4	32	32	32	32	32	**32**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.2**	24	220	210	210	210	210	210	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	5.4	280	1500	1500	1500	1500	1500	1400	NELDER (Han) [16]
NELDER (Doe)	**2.1**	**1**	**1.5**	33	270	270	270	270	270	270	NELDER (Doe) [5]
NEWUOA	3	**1.5**	6.1	230	*40e-1/5e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.8**	**2.3**	16	310	3900	3800	3800	3800	3800	3800	(1+1)-ES [1]
POEMS	170	70	3.8	9.7	35	39	42	45	47	54	POEMS [20]
PSO	**1.4**	**1.7**	52	55	280	270	280	280	280	280	PSO [7]
PSO_Bounds	**1.5**	**1.6**	7.6	26	38	63	64	65	70	95	PSO_Bounds [8]
Monte Carlo	**1**	**2.1**	6800	*83e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.7	39	24	390	*70e-1/9e3*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.2**	**2.3**	**1.2**	12	96	96	96	97	97	97	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.6**	**2.5**	**2.5**	**5.2**	**11**	**11**	**12**	**16**	**22**	40	VNS (Garcia) [11]

Table 52: 05-D, running time excess ERT/ERT_{best} on f_4, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.2	3.77	162	327	338	352	363	370	377	381	ERT_{best}/D
ALPS	**1.1**	4.4	7.1	28	59	58	58	58	59	63	ALPS [17]
AMaLGaM IDEA	**1.8**	3.4	5.8	2e4	*20e-1/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	5.4	10	14	*50e-1/8e3*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.7**	6.3	5.8	*69e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	3	67	170	*24e+0/4e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	7.6	39	85	*78e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1.1**	**2.9**	**2.7**	*20e-1/4e5*	.	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.6**	15	460	*30e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	15	13	**1**	**1.8**	**5.9**	**5.7**	**5.6**	**5.6**	**5.7**	**5.9**	DASA [19]
DEPSO	**1.8**	5.2	3.3	*30e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.5**	190	110	250	*11e+0/2e4*	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	3.5	14	2e3	*20e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	3.9	**2.8**	12	*30e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.5**	4.6	76	2200	*50e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.9**	5	18	20	**26**	**33**	41	49	58	190	simple GA [22]
GLOBAL	**1.3**	4.9	8.3	*11e+0/600*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.7**	**2.3**	3.9	2.1e4	*20e-1/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	21	3	7.8	*42e-1/5e3*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	320	58	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1.5**	3.8	**1.7**	35	180	170	160	160	160	160	MA-LS-Chain [21]
MCS (Neum)	**1**	**2.3**	4.1	*20e-1/1e4*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	3.1	**1.4**	26	*30e-1/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.9**	**1**	7.1	900	870	840	810	790	780	770	NELDER (Doe) [5]
NEWUOA	4.1	27	27	300	*60e-1/7e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.3	**2**	25	3700	2e4	1.9e4	1.9e4	1.8e4	1.8e4	1.8e4	(1+1)-ES [1]
POEMS	210	67	4.5	17	45	47	47	**49**	**52**	**57**	POEMS [20]
PSO	**1.7**	**2.7**	**3**	140	4200	4e3	3900	3800	3700	3700	PSO [7]
PSO_Bounds	**1.6**	3.2	8	30	64	110	110	110	110	140	PSO_Bounds [8]
Monte Carlo	**1.3**	3.4	1.6e4	*12e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.1	33	57	*99e-1/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.5**	**2.1**	**1**	*37e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**2**	5.6	**2.5**	**16**	39	38	**39**	50	54	130	VNS (Garcia) [11]

Table 53: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.293	2	2	2	2	2	2	2	2	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.5**	64	130	160	160	160	160	160	160	ALPS [17]
AMaLGaM IDEA	**1**	**2**	19	28	29	29	29	29	29	29	AMaLGaM IDEA [4]
avg NEWUOA	**1**	4.1	**1.8**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	avg NEWUOA [31]
BayEDAcG	**1**	**1.7**	38	76	320	320	320	320	320	320	BayEDAcG [10]
BFGS	**1**	5.9	**1.9**	**3**	3.1	3.1	3.1	3.1	3.1	3.1	BFGS [30]
Cauchy EDA	**1**	29	39	41	41	41	41	41	41	41	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.5**	4.5	6.5	6.6	6.6	6.6	6.6	6.6	6.6	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**2**	**2.3**	3.1	3.2	3.2	3.2	3.2	3.2	3.2	(1+1)-CMA-ES [2]
DASA	**1**	45	28	36	40	43	49	52	55	63	DASA [19]
DEPSO	**1**	**2**	22	37	41	41	41	41	41	41	DEPSO [12]
DIRECT	**1**	4.5	9.2	12	13	13	13	13	13	13	DIRECT [25]
EDA-PSO	**1**	**1**	10	16	16	16	16	17	17	17	EDA-PSO [6]
full NEWUOA	**1**	**1.5**	**2.2**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	full NEWUOA [31]
G3-PCX	**1**	**1.8**	14	25	27	28	28	28	28	28	G3-PCX [26]
simple GA	**1**	**1.9**	480	2100	4e3	6300	9200	1.2e4	1.7e4	3.4e4	simple GA [22]
GLOBAL	**1**	**2.3**	32	33	34	34	34	34	34	34	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	7.1	11	12	12	12	12	12	12	iAMaLGaM IDEA [4]
LSfminbnd	**1**	18	13	14	14	14	14	14	14	14	LSfminbnd [28]
LSstep	**1**	180	140	160	160	160	160	160	160	160	LSstep [28]
MA-LS-Chain	**1**	**1.5**	53	69	70	71	71	71	71	71	MA-LS-Chain [21]
MCS (Neum)	**1**	3	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	3.9	**2.5**	4.1	4.2	4.2	4.2	4.2	4.2	4.2	NELDER (Han) [16]
NELDER (Doe)	**1**	3.1	**1.9**	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	**1.3**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	NEWUOA [31]
(1+1)-ES	**1**	3	**2**	**2.4**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	(1+1)-ES [1]
POEMS	**1**	350	150	200	210	220	220	220	220	220	POEMS [20]
PSO	**1**	**1.7**	10	14	16	16	16	16	16	16	PSO [7]
PSO_Bounds	**1**	**1.6**	9.2	15	16	16	16	16	16	16	PSO_Bounds [8]
Monte Carlo	**1**	**1.6**	4300	*37e-1 /1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	11	4	4.2	4.2	4.2	4.2	4.2	4.2	4.2	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	5.7	4.8	6.6	6.8	6.9	6.9	6.9	6.9	6.9	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**2.2**	13	15	15	15	15	15	15	15	VNS (Garcia) [11]

Table 54: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_6, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.28	3.2	22.8	42.7	56.2	80.7	116	149	208	266	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	31	32	20	28	40	41	39	39	34	37	ALPS [17]
AMaLGaM IDEA	6.6	5.7	3.2	4.3	5.7	5.7	5.2	5	4.3	4.5	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**2.6**	**1.3**	**1.6**	**2.6**	**2.6**	**2.6**	**2.6**	**2.4**	**2.5**	avg NEWUOA [31]
BayEDAcG	8.8	10	250	*13e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.9**	4.9	3	3.3	3.4	**3**	**2.5**	**2.3**	**2**	7.8	BFGS [30]
Cauchy EDA	49	230	92	69	68	58	47	43	35	34	Cauchy EDA [24]
BIPOP-CMA-ES	**2.5**	5.2	**2.3**	**2.1**	**2.2**	**1.9**	**1.7**	**1.6**	**1.3**	**1.3**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.6**	3.3	**1.4**	**1.4**	**1.6**	**1.7**	**1.6**	**1.5**	**1.6**	**1.8**	(1+1)-CMA-ES [2]
DASA	21	21	7.8	9	50	99	110	100	81	150	DASA [19]
DEPSO	6.3	8.3	5.5	6.4	8	8	7.1	7	6.3	9.7	DEPSO [12]
DIRECT	**2.5**	**2.2**	**2.3**	28	790	1200	*22e-2/2e4*	.	.	.	DIRECT [25]
EDA-PSO	5	4.9	11	51	81	85	79	75	65	68	EDA-PSO [6]
full NEWUOA	**1.5**	3.6	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1.4**	full NEWUOA [31]
G3-PCX	7.2	7.1	**2.4**	**3**	4.8	5.1	4.7	5.6	5.1	5.5	G3-PCX [26]
simple GA	60	81	66	150	380	3700	1.2e4	9700	*24e-3/1e5*	.	simple GA [22]
GLOBAL	12	10	**2.9**	**2.1**	**2**	**2.9**	**2.2**	**2.7**	3.6	35	GLOBAL [23]
iAMaLGaM IDEA	**3**	3.6	**2.1**	**2.3**	3.1	3.1	**2.7**	**2.6**	**2.2**	**2.3**	iAMaLGaM IDEA [4]
LSfminbnd	9.1	14	96	110	130	150	110	110	82	65	LSfminbnd [28]
LSstep	160	200	410	290	300	420	600	490	*21e-2/1e4*	.	LSstep [28]
MA-LS-Chain	12	11	4.8	6.8	7.9	7.4	5.8	5.1	4.1	3.7	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2.7**	47	41	61	71	63	46	54	MCS (Neum) [18]
NELDER (Han)	**1.7**	**2.4**	**1**	**1.9**	**2.8**	**2.6**	**2.3**	**2.3**	**2**	**2.6**	NELDER (Han) [16]
NELDER (Doe)	**2.3**	11	5.1	5.6	5.6	4.9	5.3	6.6	5.6	8.5	NELDER (Doe) [5]
NEWUOA	**1.4**	**2.8**	**1.7**	**2.4**	3.6	3.6	3.3	3.2	**2.7**	**2.9**	NEWUOA [31]
(1+1)-ES	**1.7**	3.4	**1.6**	**1.5**	**1.7**	**1.5**	**1.3**	**1.2**	**1**	**1**	(1+1)-ES [1]
POEMS	95	80	27	46	52	50	46	42	37	37	POEMS [20]
PSO	5.2	5.3	4.7	9	11	12	11	12	10	11	PSO [7]
PSO_Bounds	4.4	4.4	14	49	85	100	98	92	78	92	PSO_Bounds [8]
Monte Carlo	290	480	300	5.7e4	*14e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**3**	**2.6**	**2.2**	**2.8**	**2.4**	**2.2**	4.3	3.8	**2.8**	**2.4**	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.4**	7	**2.8**	**2.5**	**2.7**	**2.4**	**2.2**	**2**	**1.6**	**1.5**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	7.7	12	3.7	**2.7**	**2.9**	**2.5**	**2**	**1.8**	**1.5**	**1.4**	VNS (Garcia) [11]

Table 55: 05-D, running time excess ERT/ERT_{best} on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.2	1.24	4.72	64.7	234	290	314	314	314	319	ERT_{best}/D
ALPS	**1.1**	**2.3**	33	10	5.7	7.7	9	9	9	9.7	ALPS [17]
AMaLGaM IDEA	**1.3**	**2.8**	5.6	**1**	**1.2**	**1.8**	**2.3**	**2.3**	**2.3**	**2.4**	AMaLGaM IDEA [4]
avg NEWUOA	**1.1**	**2.5**	4.4	5.9	13	130	*17e-3/8e3*	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.5**	**2.4**	20	31	120	99	*73e-2/2e3*	.	.	.	BayEDAcG [10]
BFGS	3	14	*32e+0/100*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	10	31	33	4.9	**2.4**	**2.9**	**2.9**	**2.9**	**2.9**	3.4	Cauchy EDA [24]
BIPOP-CMA-ES	**1.7**	**2.2**	5	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.6**	3.5	5.3	**2**	**2.1**	3.1	3.1	3.1	3.1	(1+1)-CMA-ES [2]
DASA	24	43	230	280	1100	2e4	*16e-3/8e5*	.	.	.	DASA [19]
DEPSO	**1.2**	6.5	14	**3**	5	7.2	8.3	8.3	8.3	8.5	DEPSO [12]
DIRECT	**1**	**1**	**2.8**	**1.7**	120	*41e-3/2e4*	.	.	.	.	DIRECT [25]
EDA-PSO	**1.3**	**1.7**	22	24	13	17	18	18	18	19	EDA-PSO [6]
full NEWUOA	**1.7**	3.3	**1**	**1.2**	4	14	24	24	24	23	full NEWUOA [31]
G3-PCX	**1.3**	**2.5**	19	18	45	150	410	410	410	410	G3-PCX [26]
simple GA	**1.4**	3.5	50	35	57	240	520	520	520	520	simple GA [22]
GLOBAL	**1.6**	**2.9**	12	5.7	10	*82e-2/400*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**2.3**	3.8	**1.9**	**3**	**2.9**	3.7	3.7	3.7	3.7	iAMaLGaM IDEA [4]
LSfminbnd	3.8	17	49	64	100	510	*40e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	28	190	370	700	640	*19e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	3.5	8.4	3.2	13	13	24	24	24	24	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.3**	**2.8**	5.9	13	140	*25e-3/1e4*	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.1**	**1.6**	27	33	56	120	310	310	310	300	NELDER (Han) [16]
NELDER (Doe)	**1.4**	**1.3**	**1.4**	7.5	15	39	71	71	71	71	NELDER (Doe) [5]
NEWUOA	**1.5**	**2.2**	9.9	13	60	*32e-2/6e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.9**	**2.6**	5.6	6.8	100	370	810	810	810	790	(1+1)-ES [1]
POEMS	400	180	74	15	9.2	11	21	21	21	22	POEMS [20]
PSO	**1.1**	4	11	9.5	590	480	540	540	540	530	PSO [7]
PSO_Bounds	**1.3**	**2.3**	9.4	13	170	140	130	130	130	130	PSO_Bounds [8]
Monte Carlo	**1.3**	**2.9**	39	1200	*38e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	11	220	1200	670	*13e+0/3e3*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.1**	**2.5**	6	**1.8**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	3.5	11	**1.6**	6.8	6.6	7.8	7.8	7.8	7.8	VNS (Garcia) [11]

Table 56: 05-D, running time excess ERT/ERT_{best} on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	3.56	8.77	14.7	54.6	67.3	74.5	78.2	80.2	82	84.4	ERT_{best}/D
ALPS	11	32	51	49	100	150	180	210	250	340	ALPS [17]
AMaLGaM IDEA	3.1	4.3	5.2	6.1	7.7	8.1	8.5	8.9	9.1	9.7	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	**1.6**	**1.2**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	avg NEWUOA [31]
BayEDAcG	5.5	11	140	*45e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.1**	**2.4**	**2.1**	**1.8**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	BFGS [30]
Cauchy EDA	24	32	49	31	33	33	34	36	37	40	Cauchy EDA [24]
BIPOP-CMA-ES	**2.7**	3.6	3.2	3.7	4.5	4.7	4.8	5	5.1	5.4	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.1**	**2.1**	**2.1**	5.1	5	4.9	4.9	4.9	4.9	5	(1+1)-CMA-ES [2]
DASA	16	21	19	160	390	700	1e3	1500	2e3	3300	DASA [19]
DEPSO	4.7	7.2	12	18	*23e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**2.5**	**2.8**	4.1	5.7	22	56	100	150	190	290	DIRECT [25]
EDA-PSO	3.7	10	72	100	200	300	400	520	620	840	EDA-PSO [6]
full NEWUOA	**2.3**	**2.2**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	5.5	5.3	4.6	20	18	17	17	16	16	16	G3-PCX [26]
simple GA	8.4	110	190	840	*78e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	11	7.4	5	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.2**	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**2.8**	3.4	7.5	7.6	7.7	7.7	8	8.1	8.4	iAMaLGaM IDEA [4]
LSfminbnd	5.5	9.1	10	290	450	1900	*34e-1/1e4*	.	.	.	LSfminbnd [28]
LSstep	78	64	64	95	330	910	1800	1800	*53e-2/1e4*	.	LSstep [28]
MA-LS-Chain	5.8	7.3	8.7	7.2	9.6	10	11	11	11	12	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.4**	**1.5**	**1**	**1**	**1**	**1.1**	**1.1**	**1.1**	**1.1**	MCS (Neum) [18]
NELDER (Han)	**1.3**	**1.6**	**1.6**	3.7	3.3	3.2	3.1	3.1	3.1	3.2	NELDER (Han) [16]
NELDER (Doe)	**1.1**	**2.3**	**2.1**	**2.4**	**2.4**	**2.3**	**2.3**	**2.3**	**2.4**	**2.4**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	NEWUOA [31]
(1+1)-ES	**2.7**	22	15	240	230	240	260	290	320	380	(1+1)-ES [1]
POEMS	67	40	69	180	200	390	750	2100	5500	1.8e4	POEMS [20]
PSO	3.8	7.1	13	150	200	310	470	620	780	1100	PSO [7]
PSO_Bounds	5.1	12	30	470	920	1200	1400	3e3	*12e-5/1e5*	.	PSO_Bounds [8]
Monte Carlo	10	220	2e4	*64e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.3**	53	32	23	22	23	25	27	30	36	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.7**	**2.8**	3.5	5.8	6.8	6.7	6.8	6.8	6.9	7.1	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	8.9	5.9	5.1	6.6	7.7	21	46	48	47	46	VNS (Garcia) [11]

Table 57: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	6.92	25.4	42.8	52.7	60.1	64.8	67.1	73.8	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	140	1100	91	92	130	200	260	310	370	560	ALPS [17]
AMaLGaM IDEA	53	140	9.1	23	18	17	16	16	16	15	AMaLGaM IDEA [4]
avg NEWUOA	20	56	**2.4**	3.1	**2.1**	**1.8**	**1.7**	**1.6**	**1.6**	**1.5**	avg NEWUOA [31]
BayEDAcG	81	350	38	*39e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	31	84	3.6	**3**	**2**	**1.8**	**1.6**	**1.5**	**1.5**	**1.4**	BFGS [30]
Cauchy EDA	400	910	71	54	45	42	41	41	42	43	Cauchy EDA [24]
BIPOP-CMA-ES	28	98	5.8	8.7	7.2	6.7	6.4	6.2	6.3	6.2	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	30	86	4.2	7.7	5.9	5.3	5	4.9	4.9	4.7	(1+1)-CMA-ES [2]
DASA	330	7500	230	6700	4800	4600	4800	5300	6600	8900	DASA [19]
DEPSO	100	370	22	150	*10e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	3.2	4.2	48	56	130	140	150	310	DIRECT [25]
EDA-PSO	70	410	250	210	270	470	700	1100	1300	2800	EDA-PSO [6]
full NEWUOA	33	72	**2.6**	**2.7**	**1.9**	**1.7**	**1.5**	**1.5**	**1.4**	**1.3**	full NEWUOA [31]
G3-PCX	94	380	14	18	14	12	11	11	10	9.8	G3-PCX [26]
simple GA	100	3800	420	5.6e4	*17e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	210	340	11	4.6	3.2	**3**	**2.8**	**2.7**	**2.7**	**2.7**	GLOBAL [23]
iAMaLGaM IDEA	42	120	7	22	15	14	13	12	12	12	iAMaLGaM IDEA [4]
LSfminbnd	60	330	13	130	180	440	*25e-3/1e4*	.	.	.	LSfminbnd [28]
LSstep	2e3	1.3e4	520	5600	*19e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	84	260	18	20	17	17	17	16	16	16	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**13**	62	3.1	13	8.2	6.9	6.2	5.9	5.8	5.4	NELDER (Han) [16]
NELDER (Doe)	21	56	**2.4**	3.1	**2.5**	**2.3**	**2.1**	**2.1**	**2.1**	**2**	NELDER (Doe) [5]
NEWUOA	16	**28**	**1.8**	3.6	**2.5**	**2.1**	**1.9**	**1.9**	**1.9**	**1.7**	NEWUOA [31]
(1+1)-ES	29	64	**2.9**	100	80	99	130	160	200	270	(1+1)-ES [1]
POEMS	1200	1700	140	130	290	590	1100	1900	1.1e4	*39e-6/1e5*	POEMS [20]
PSO	66	290	25	940	680	790	1100	1400	2400	2800	PSO [7]
PSO_Bounds	69	360	220	1500	1600	1800	4e3	1.1e4	2.2e4	2e4	PSO_Bounds [8]
Monte Carlo	180	1.3e4	4.1e4	*58e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	32	150	5.3	9.8	10	14	14	14	14	14	Rosenbrock [27]
IPOP-SEP-CMA-ES	43	230	9.8	11	9.9	8.8	8.3	8	8	7.7	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	60	250	11	18	14	12	11	11	11	10	VNS (Garcia) [11]

Table 58: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	20.6	34.1	69.9	100	115	121	125	129	166	176	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	29	54	88	320	890	2e3	5300	2e4	*21e-5/1e6*	.	ALPS [17]
AMaLGaM IDEA	**2.7**	**2.6**	**1.9**	**1.9**	**2**	**2.3**	**2.5**	**2.7**	**2.3**	**2.6**	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**2.2**	3.1	4.6	6.6	8.1	10	12	11	14	avg NEWUOA [31]
BayEDAcG	400	840	*28e+2/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.7**	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	**1.1**	23	BFGS [30]
Cauchy EDA	16	16	11	9	9.4	11	12	13	11	13	Cauchy EDA [24]
BIPOP-CMA-ES	5.1	5.1	3.5	**2.9**	**2.7**	**2.7**	**2.8**	**2.8**	**2.3**	**2.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.2	3.8	**2.5**	**2.2**	**2**	**2.1**	**2.1**	**2.1**	**1.7**	**1.7**	(1+1)-CMA-ES [2]
DASA	99	1100	6900	1.8e4	3.9e4	5.9e4	1.2e5	1.1e5	9e4	*47e-1/1e6*	DASA [19]
DEPSO	18	78	210	*88e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	8.8	57	110	140	280	*15e-2/2e4*	.	.	.	.	DIRECT [25]
EDA-PSO	71	130	890	1400	3900	1.2e4	*21e-1/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**2**	3.6	6.2	8.7	10	13	15	13	17	full NEWUOA [31]
G3-PCX	3.3	7.2	22	27	36	41	49	57	51	64	G3-PCX [26]
simple GA	130	500	2400	*15e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	3.8	**3**	**1.9**	**1.6**	**1.8**	**1.9**	**2**	**2.2**	**1.7**	**1.7**	GLOBAL [23]
iAMaLGaM IDEA	**2.2**	**2.2**	**1.8**	**1.6**	**1.7**	**1.9**	**2**	**2.2**	**1.8**	**2**	iAMaLGaM IDEA [4]
LSfminbnd	160	780	*25e+1/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	1200	*25e+2/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.1	9.9	9	9.3	8.6	8.6	8.8	8.7	6.9	6.9	MA-LS-Chain [21]
MCS (Neum)	53	110	280	*17e+0/1e4*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.1**	**1.2**	**1.4**	**1.3**	**1.4**	**1.4**	**1.5**	**1.5**	**1.2**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.5**	**2.6**	3.1	5.5	8.1	11	14	17	16	21	NEWUOA [31]
(1+1)-ES	34	130	700	2500	4500	5900	1.4e4	5.8e4	*67e-5/1e6*	.	(1+1)-ES [1]
POEMS	41	170	790	2500	*45e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	15	120	1700	3300	*10e+0/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	290	1200	3800	1.5e4	*20e+0/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	990	4.7e4	*10e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	11	25	24	44	40	38	37	36	29	37	Rosenbrock [27]
IPOP-SEP-CMA-ES	10	12	7.4	5.6	5.1	5	5	5	4	3.9	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	6.6	6.2	4.5	3.5	3.4	3.4	3.5	3.5	**2.8**	**2.8**	VNS (Garcia) [11]

Table 59: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.48	4.88	28.5	40.4	153	195	235	270	293	335	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	15	23	54	340	300	540	810	1100	1800	2.2e4	ALPS [17]
AMaLGaM IDEA	4.5	5.4	**2.1**	**2.7**	**1**	**1**	**1**	**1**	**1**	**1.1**	AMaLGaM IDEA [4]
avg NEWUOA	**2.6**	11	5.4	7.2	**2.7**	**2.6**	**2.8**	**2.9**	3.1	3.4	avg NEWUOA [31]
BayEDAcG	9.1	15	160	*15e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.1**	**1.8**	**1**	**1**	**1.1**	**1.9**	8.2	21	200	*32e-6/8e3*	BFGS [30]
Cauchy EDA	25	51	18	17	6	5.5	5.3	5.4	5.6	5.9	Cauchy EDA [24]
BIPOP-CMA-ES	6.4	15	8.4	7.2	**2.2**	**1.8**	**1.6**	**1.5**	**1.4**	**1.3**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4	7	6.5	6.6	**2.1**	**1.8**	**1.5**	**1.4**	**1.3**	**1.2**	(1+1)-CMA-ES [2]
DASA	11	12	1900	5200	2300	2800	3200	4200	9700	4.5e4	DASA [19]
DEPSO	11	22	140	*10e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	5.8	15	87	2200	*19e-1/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	8.9	30	110	650	970	2400	6200	5500	*70e-3/1e5*	.	EDA-PSO [6]
full NEWUOA	**2.7**	20	11	14	5.4	4.9	5.3	5.5	5.9	6.5	full NEWUOA [31]
G3-PCX	7.6	7.9	55	110	45	44	49	52	56	61	G3-PCX [26]
simple GA	15	34	340	7100	9400	*21e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	13	10	4	5.5	3.5	5.1	5	4.8	5	8.5	GLOBAL [23]
iAMaLGaM IDEA	6.1	6.6	3.4	**3.8**	**1.2**	**1.1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	**2.7**	320	*61e+0/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3.6	750	4900	*73e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.9	8.7	15	19	6.7	5.6	4.9	4.4	4.2	3.8	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	82	460	*13e-1/1e4*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**2.9**	**2.7**	**3.2**	5	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.6**	NELDER (Han) [16]
NELDER (Doe)	4.4	3.4	4.5	4.7	**1.5**	**1.4**	**1.2**	**1.2**	**1.1**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1.7**	5.9	3.5	4.7	**1.8**	**1.7**	**1.8**	**1.8**	**2**	**2.2**	NEWUOA [31]
(1+1)-ES	**2.8**	6700	6400	9300	3700	3800	6700	2.8e4	*90e-5/1e6*	.	(1+1)-ES [1]
POEMS	88	61	230	510	270	350	630	800	940	2200	POEMS [20]
PSO	8.2	13	91	240	120	140	160	190	240	390	PSO [7]
PSO_Bounds	7.2	21	430	1400	1e3	1e3	1100	1600	1500	1400	PSO_Bounds [8]
Monte Carlo	7.4	30	730	1.1e5	*11e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	12	120	88	26	21	18	16	14	13	Rosenbrock [27]
IPOP-SEP-CMA-ES	18	33	16	14	4.2	3.4	**2.9**	**2.6**	**2.5**	**2.2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	11	34	11	8.7	**2.5**	**2.1**	**1.8**	**1.6**	**1.6**	**1.5**	VNS (Garcia) [11]

Table 60: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	13.3	15.9	21.6	53.6	74.1	82.6	92.3	233	261	299	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	100	120	130	170	540	1400	4200	1.4e4	2.7e4	*24e-5/1e6*	ALPS [17]
AMaLGaM IDEA	8.8	9.2	10	6.7	8.6	9.8	11	4.9	5.1	5.2	AMaLGaM IDEA [4]
avg NEWUOA	**1.1**	**1.8**	3.5	**2.8**	**2.8**	**2.9**	**3**	**1.3**	**1.3**	**1.4**	avg NEWUOA [31]
BayEDAcG	46	46	96	260	390	*71e-1/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1.1**	**1**	**1.1**	**1**	**1**	**1**	**1**	**1.3**	**2**	49	BFGS [30]
Cauchy EDA	66	75	79	41	35	37	38	17	17	17	Cauchy EDA [24]
BIPOP-CMA-ES	5.1	6.3	11	7.4	7.4	7.5	7.7	3.4	3.3	3.3	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.8**	3.4	4	**2.9**	3.5	3.9	4.1	**1.9**	**1.9**	**1.9**	(1+1)-CMA-ES [2]
DASA	17	17	1.2e4	5.4e4	5.9e4	1.8e5	*32e-1/1e6*	.	.	.	DASA [19]
DEPSO	23	33	55	47	120	*95e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	6.6	8	8.5	8.7	19	39	110	96	380	*21e-6/2e4*	DIRECT [25]
EDA-PSO	310	390	1100	3e3	8900	*21e-1/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.5**	3.7	**2.6**	**2.7**	3	3.3	**1.6**	**1.6**	**1.7**	full NEWUOA [31]
G3-PCX	4	4.2	14	11	13	13	12	5.3	5.2	5.1	G3-PCX [26]
simple GA	520	620	930	2400	1.9e4	*11e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	5.6	5	4.6	**2.7**	**2.4**	3	5	**3**	3.1	3.4	GLOBAL [23]
iAMaLGaM IDEA	5.5	6.1	6.9	4.3	4	4.3	4.7	**2.1**	**2.1**	**2.3**	iAMaLGaM IDEA [4]
LSfminbnd	3.4	3.6	310	1200	1900	*68e-1/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	23	26	460	1200	*57e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	11	11	13	16	15	16	6.9	6.7	6.5	MA-LS-Chain [21]
MCS (Neum)	**1.2**	**1.1**	**1**	18	17	15	22	22	26	56	MCS (Neum) [18]
NELDER (Han)	**1.4**	**1.7**	**2.3**	**2.2**	**2.2**	**2.2**	**2.3**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**2.4**	4.4	**2.9**	**2.7**	**2.7**	**2.7**	**1.2**	**1.1**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1.1**	**1.5**	3.5	**2.6**	**2.5**	**2.5**	**2.6**	**1.1**	**1.1**	**1.1**	NEWUOA [31]
(1+1)-ES	**2.6**	1200	2.1e4	6.1e4	1.9e5	*23e-1/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	180	210	1900	2900	8900	*17e-1/1e5*	.	.	.	.	POEMS [20]
PSO	28	35	750	3800	5400	7900	1.5e4	*41e-1/1e5*	.	.	PSO [7]
PSO_Bounds	120	180	1900	2500	5500	1.7e4	*46e-1/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	*19e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.4**	**1.4**	98	63	91	100	95	46	42	48	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.6	6.2	12	11	9.1	8.7	8.6	3.7	3.5	3.3	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	6.9	9	19	12	10	9.7	9.4	4	3.8	3.6	VNS (Garcia) [11]

Table 61: 05-D, running time excess ERT/ERT_{best} on f_{13}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.56	8.88	26.4	38.9	50	63.9	262	305	350	451	ERT_{best}/D
ALPS	**2.7**	43	50	83	280	440	570	2300	3900	*76e-7/1e6*	ALPS [17]
AMaLGaM IDEA	3.3	5.8	4.2	4.6	**4.9**	**4.9**	**1.5**	**1.5**	**1.4**	**1.4**	AMaLGaM IDEA [4]
avg NEWUOA	4	**1**	4.5	8.1	42	67	68	450	390	*15e-4/9e3*	avg NEWUOA [31]
BayEDAcG	**1.9**	38	170	350	*19e+0/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	4.6	**1.2**	**1**	**1**	**1**	**1**	4.8	24	140	*37e-6/1e4*	BFGS [30]
Cauchy EDA	54	31	21	24	25	25	7.4	7.5	7.3	7.3	Cauchy EDA [24]
BIPOP-CMA-ES	3.4	3.8	3.9	5.4	5.9	5.4	**1.6**	**1.6**	**1.5**	**1.7**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.6**	**2.1**	4.4	6.3	6.1	6.3	**1.9**	**2.9**	3.2	3.1	(1+1)-CMA-ES [2]
DASA	54	51	200	640	2500	7800	5e3	1.4e4	*23e-4/1e6*	.	DASA [19]
DEPSO	**2.1**	8.7	11	350	280	240	*21e-1/2e3*	.	.	.	DEPSO [12]
DIRECT	**1.6**	4.7	7	21	34	140	42	57	120	*12e-6/2e4*	DIRECT [25]
EDA-PSO	3.4	47	150	390	2e3	1e4	*64e-3/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	5.5	**1**	**1.8**	6.7	23	85	97	*19e-4/1e4*	.	.	full NEWUOA [31]
G3-PCX	3.3	3.9	14	60	150	340	120	260	590	*15e-5/5e4*	G3-PCX [26]
simple GA	**2.6**	120	240	730	4400	2.2e4	*20e-2/1e5*	.	.	.	simple GA [22]
GLOBAL	3.4	7.4	4.2	6.1	11	*19e-2/300*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.9**	3.1	**2.6**	**3**	**3.2**	**3.3**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	14	15	33	150	540	1100	*19e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	250	140	550	1100	2900	*22e+0/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.8**	9.9	8.3	21	24	19	5.1	4.8	5.3	4.9	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.6**	41	210	460	2300	550	*21e-2/1e4*	.	.	MCS (Neum) [18]
NELDER (Han)	**2.2**	**1.2**	**2**	3.8	5.3	4.9	**1.3**	**1.3**	**1.2**	**1.3**	NELDER (Han) [16]
NELDER (Doe)	**2.9**	**1.7**	**2.4**	**2.4**	5.3	6.1	**1.9**	**2.5**	3.9	5	NELDER (Doe) [5]
NEWUOA	**2.6**	**1.8**	3.1	9.3	35	55	54	120	330	*17e-4/8e3*	NEWUOA [31]
(1+1)-ES	4.3	11	20	30	110	250	160	350	1500	7200	(1+1)-ES [1]
POEMS	310	57	87	660	5600	1e4	*22e-2/1e5*	.	.	.	POEMS [20]
PSO	3	8.7	1600	1e4	2.8e4	*57e-1/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	**1.3**	20	350	2400	5700	1e4	5400	*81e-2/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	**1.9**	960	*30e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	8.6	3.1	7.6	13	26	49	39	56	63	290	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.1	**2.9**	9	11	12	11	**2.8**	**2.7**	**2.5**	**2.3**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.9**	6.2	4.8	5.6	6.6	6.2	**1.9**	**1.9**	**1.9**	**2.1**	VNS (Garcia) [11]

Table 62: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	1.96	8.17	11.6	18	27.7	42.2	50.3	95.1	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.3**	**2.5**	32	66	72	75	130	390	1e4	ALPS [17]
AMaLGaM IDEA	**1**	**1.5**	**2.1**	4.5	6.1	6.6	5.8	5	5.2	3.8	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.7**	**2.1**	**1**	**1**	**1**	**1.2**	**1.8**	5	1e3	avg NEWUOA [31]
BayEDAcG	**1**	**1.4**	**3**	100	220	250	1e3	*12e-2/2e3*	.	.	BayEDAcG [10]
BFGS	**1**	3.4	**2.2**	**1.7**	**1.8**	**1.5**	**1.3**	**1**	**1**	350	BFGS [30]
Cauchy EDA	**1**	18	23	29	40	40	33	28	28	19	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.3**	**1.1**	**2.8**	3.7	4	4.6	4.3	5.4	4.5	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**2.2**	**1.8**	**1.9**	**2.3**	**2.3**	**2.6**	3.3	4	3.2	(1+1)-CMA-ES [2]
DASA	**1**	18	19	18	20	21	49	460	3500	*12e-7/1e6*	DASA [19]
DEPSO	**1**	**1.5**	**2.6**	6.9	8.9	11	17	45	*47e-6/2e3*	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	3.7	4.8	7.4	23	370	1900	*62e-6/2e4*	DIRECT [25]
EDA-PSO	**1**	**1.5**	**1.4**	7.1	96	190	210	190	300	*22e-7/1e5*	EDA-PSO [6]
full NEWUOA	**1**	**2.8**	**2.7**	**1.1**	**1.1**	**1**	**1**	**1.4**	3.2	26	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**1.7**	3.5	3.5	3.6	5	9.7	26	390	G3-PCX [26]
simple GA	**1**	**1.8**	**2.1**	91	270	310	350	3300	*13e-5/1e5*	.	simple GA [22]
GLOBAL	**1.1**	**1.7**	**2.2**	7.7	5.9	4.4	3.3	**2.6**	3.6	*59e-7/300*	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.3**	**1.4**	**2.7**	4.3	4.5	4.1	3.5	3.6	**2.7**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	3.7	5.9	4.5	4.3	7.4	70	1700	*35e-5/1e4*	.	LSfminbnd [28]
LSstep	**1**	28	120	96	97	180	*35e-4/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.3**	**2**	7.2	11	11	11	13	16	12	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.4**	**2.8**	**2.7**	**2.5**	**2.8**	3.4	230	*10e-6/1e4*	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	**1.1**	**1.2**	**1.5**	**1.5**	**1.4**	**1.2**	**1.3**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.3**	**1.1**	**1.1**	**1.4**	**1.6**	**1.7**	**1.6**	**1.6**	**1.3**	NELDER (Doe) [5]
NEWUOA	**1**	**1.8**	**1.7**	**1**	**1**	**1**	**1.2**	**1.9**	5.5	2500	NEWUOA [31]
(1+1)-ES	**1**	3	**2.1**	**1.8**	**2.1**	**2.2**	5.6	66	1100	*12e-7/1e6*	(1+1)-ES [1]
POEMS	**1**	180	110	42	81	130	140	130	630	*31e-7/1e5*	POEMS [20]
PSO	**1**	**1.4**	**1.9**	5.6	15	21	30	50	220	*90e-8/1e5*	PSO [7]
PSO_Bounds	**1**	**1.7**	**1.9**	12	45	74	140	200	410	*14e-7/1e5*	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	**1.2**	100	7.6e4	*93e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	7.9	**2.4**	**1.2**	**1.3**	**1.5**	4.6	23	26	43	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.5**	**1.6**	3	3.6	3.6	5.3	9	9.5	6.4	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.2**	3.3	5.5	5.4	5.3	5.3	5.4	7	5.5	VNS (Garcia) [11]

Table 63: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	2.6	102	1860	3870	3950	4010	4080	4150	4270	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.1**	**1.9**	9.2	9	26	26	26	25	25	25	ALPS [17]
AMaLGaM IDEA	**1.3**	**2.7**	**1.7**	**2.6**	**5.3**	**5.2**	**5.2**	**5.1**	**5.1**	**5**	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	**2**	5.8	46	*30e-1/6e3*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.2**	**2.7**	4.8	*61e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.2**	46	87	*13e+0/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	8.7	36	12	190	*24e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.3**	**1.6**	**1.5**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.4**	**2**	10	80	*30e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	15	26	230	1700	*20e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	5.7	7.9	*41e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.2**	5.4	9.4	*99e-2/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	**2**	20	7.5	24	23	23	24	24	24	EDA-PSO [6]
full NEWUOA	**1.9**	**2.9**	6.3	55	*50e-1/7e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.3**	**2.2**	130	370	*50e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	**1.9**	35	91	370	360	360	350	350	*15e-1/1e5*	simple GA [22]
GLOBAL	**1**	**2**	6	*90e-1/500*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.8**	**1**	7	9.2	9.1	9	8.9	8.8	8.6	iAMaLGaM IDEA [4]
LSfminbnd	**1**	4	35	*60e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	80	1400	80	*24e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	**2.3**	**2.6**	5.3	6	5.9	5.8	5.7	5.6	5.5	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	4	25	38	38	37	36	36	*20e-1/1e4*	MCS (Neum) [18]
NELDER (Han)	**1.7**	**2.5**	20	43	83	81	80	79	77	75	NELDER (Han) [16]
NELDER (Doe)	**1.3**	5	4.5	20	73	72	71	70	69	67	NELDER (Doe) [5]
NEWUOA	**1.9**	7.8	5.8	41	*30e-1/5e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.3**	**1.7**	28	100	250	240	240	230	230	220	(1+1)-ES [1]
POEMS	**1**	80	15	130	370	370	360	360	350	340	POEMS [20]
PSO	**1.1**	**1.5**	16	220	370	360	350	350	340	330	PSO [7]
PSO_Bounds	**1.3**	**2.3**	170	120	*20e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1.2**	**1.7**	6900	*83e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	4.4	190	310	*16e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1.5**	**1.7**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	3.1	**2.4**	5.9	680	690	680	690	680	670	VNS (Garcia) [11]

Table 64: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.24	24.1	122	532	2030	2090	2280	2330	2420	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.7**	**2.5**	8.6	6.3	6.7	13	60	160	830	ALPS [17]
AMaLGaM IDEA	**1**	**1.4**	3	15	12	5	4.9	**5.6**	**5.5**	**5.4**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.2**	**2.6**	12	47	*35e-2/8e3*	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.2**	5.7	*35e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	4.2	150	960	*49e-1/8e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.4	5.6	1200	*15e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.1**	3	**3.6**	**2.6**	**1.1**	**1.3**	**1.3**	**1.4**	**1.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**2.5**	10	17	21	31	62	60	*70e-3/1e4*	(1+1)-CMA-ES [2]
DASA	**1**	6.6	4.8	310	980	1200	*24e-3/1e6*	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	11	*42e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2**	**1.2**	**1.6**	**3.4**	**2.1**	5.9	10	19	40	DIRECT [25]
EDA-PSO	**1**	**1.4**	4.6	210	82	38	53	49	61	61	EDA-PSO [6]
full NEWUOA	**1**	**2.3**	**2.7**	12	29	32	*12e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.2**	**1**	22	44	32	350	320	*60e-4/5e4*	.	G3-PCX [26]
simple GA	**1**	**1.3**	**2.1**	84	93	71	150	630	620	600	simple GA [22]
GLOBAL	**1**	**1.3**	**1.4**	**1**	**1**	**1.3**	**3.5**	7	6.8	6.6	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**1.9**	8.6	5.5	4.4	5.9	6.5	6.4	6.8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.3**	3.2	28	130	71	*37e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	**1**	**1.1**	14	280	*13e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	**2.7**	8.2	18	11	26	51	50	75	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.8**	**1.9**	18	130	*30e-2/1e4*	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1.5**	4.4	28	23	25	95	200	300	600	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.3**	**1.6**	4.8	9.8	6.3	13	27	59	120	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	**2.1**	29	*50e-2/7e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	37	88	340	590	2200	6200	*73e-4/1e6*	.	(1+1)-ES [1]
POEMS	**1**	130	12	74	76	58	57	53	52	54	POEMS [20]
PSO	**1**	**1.2**	**2.4**	6.2	59	55	89	310	300	580	PSO [7]
PSO_Bounds	**1**	**1.2**	**2.4**	36	140	140	320	620	*16e-3/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	3.5	510	*30e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.8**	40	1200	*36e-1/1e4*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.1**	**2.1**	5	3.5	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.2**	**2.8**	12	12	9.1	12	16	34	45	VNS (Garcia) [11]

Table 65: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	1.04	43	180	572	734	959	1270	1590	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	**2.4**	12	8	4.8	7.1	10	21	68	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	3.9	**1.5**	**2.7**	**2.6**	**2.7**	**3.5**	**3.4**	**3.5**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.2**	3.1	42	410	*24e-2/1e4*	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.3**	**2.2**	6.7	5.4	4.1	7.5	15	*47e-4/2e3*	.	BayEDAcG [10]
BFGS	**1**	3.4	120	650	*19e-1/4e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	44	13	7	3.8	4.3	4.3	5.3	13	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.3**	3.4	**1**	**1**	**1**	**1**	**1**	**1**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	4.5	27	110	*17e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	25	170	380	730	1800	1.9e4	*82e-4/1e6*	.	.	DASA [19]
DEPSO	**1**	**1**	7.6	3.5	**2.8**	3.1	4.5	5.6	12	*31e-4/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1.4**	**1.7**	**2.7**	4.4	6.7	9.5	10	DIRECT [25]
EDA-PSO	**1**	**1.1**	**2.4**	27	28	16	18	18	17	19	EDA-PSO [6]
full NEWUOA	**1**	**1.1**	4.9	25	76	250	*13e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**2.2**	130	290	*60e-3/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.3**	5.4	46	36	52	190	320	550	*13e-4/1e5*	simple GA [22]
GLOBAL	**1**	**1.3**	3.5	5	*47e-2/600*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.7**	**1.1**	3.8	**2.9**	4.6	5	6.3	6.8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.3**	240	64	180	260	*16e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	**1**	**1.1**	150	680	*26e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	3.8	**2.8**	3.1	4.1	9.3	7.5	7.3	11	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.9**	24	63	*87e-3/1e4*	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**2**	55	170	290	2500	*54e-3/1e5*	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.9**	10	48	*36e-3/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	**2.3**	40	620	*32e-2/7e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2**	1200	7900	3.8e4	*48e-2/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	140	170	15	14	21	19	17	29	41	POEMS [20]
PSO	**1**	**1.1**	3.3	170	140	160	550	420	510	420	PSO [7]
PSO_Bounds	**1**	**1.1**	3.4	7.9	52	35	51	49	61	120	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	4	840	*48e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	2700	*57e-1/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.1**	3.8	3.4	**1.3**	**1**	**1**	**1.1**	**1.1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	6.6	**1.6**	4.8	4.8	7.9	9.8	18	82	VNS (Garcia) [11]

Table 66: 05-D, running time excess ERT/$\mathrm{ERT_{best}}$ on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.2	0.24	20.7	75.5	794	1690	1860	2080	2180	2490	$\mathrm{ERT_{best}}$/D
ALPS	**1**	**1.5**	8.1	14	3.3	14	49	240	420	*53e-7/1e6*	ALPS [17]
AMaLGaM IDEA	**1.1**	**2.1**	**1.6**	**1.7**	**2**	**1.5**	**2.4**	3.1	3.4	**3.1**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	5.4	10	270	*57e-2/3e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**2.6**	4.4	9.6	11	8.7	*14e-2/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1.8**	100	57	*51e-1/4e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**2.5**	83	13	12	**2.4**	**2.1**	**2.7**	**2.8**	3.7	8.6	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.8**	**1**	3.4	**1**	**1**	**1**	**1.1**	**1.2**	**1.3**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**2.9**	4.9	57	84	*37e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1.9**	47	270	930	1600	*64e-3/1e6*	.	.	.	.	DASA [19]
DEPSO	**1.1**	**2.4**	**2.6**	5.5	**2.2**	4.1	*57e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.4**	**2.9**	**1.9**	6.2	6.5	8.1	*44e-6/2e4*	.	DIRECT [25]
EDA-PSO	**1**	**1.3**	3.6	41	8.8	6.4	17	34	41	58	EDA-PSO [6]
full NEWUOA	**1**	8.6	10	84	90	88	*78e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.7**	130	800	*12e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	**2.3**	22	59	34	130	*15e-3/1e5*	.	.	.	simple GA [22]
GLOBAL	**1.1**	**2.4**	3.9	15	14	*12e-1/500*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**2**	**1.1**	**1**	**1.4**	**1.6**	**1.9**	**2.3**	**3.1**	4.8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	3.2	64	71	*31e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	160	150	400	86	*60e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.8**	**2.5**	4.9	**1.3**	23	88	84	160	140	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.5**	19	150	*75e-2/1e4*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.1**	**2.9**	45	230	320	*17e-2/1e5*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.2**	4.3	28	43	*15e-2/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.2**	5.7	31	1400	*11e-1/2e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.9**	3100	3.1e4	*22e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	41	560	18	24	14	71	150	200	300	570	POEMS [20]
PSO	**1**	**2.6**	**2.2**	6.6	110	250	*53e-3/1e5*	.	.	.	PSO [7]
PSO_Bounds	**1.1**	**2.5**	3.8	21	69	72	120	330	*10e-3/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	18	9.4e4	*15e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.1**	2600	3400	*16e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	3	**1.3**	5	**1.6**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.5**	**2.2**	4.9	3.6	8.6	26	46	300	1200	VNS (Garcia) [11]

Table 67: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	0.2	0.2	48.4	21000	24100	24200	24200	24400	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	58	5100	500	15	39	40	40	40	ALPS [17]
AMaLGaM IDEA	**1**	**1.3**	38	1100	360	4.5	4.2	**4.2**	**4.2**	**4.2**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	24	1.6e4	1e3	*55e-3/1e5*	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.1**	37	2100	*45e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**2.2**	1700	2.2e4	1800	*62e-2/6e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	9.4	300	2.1e4	*48e-2/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	20	2800	160	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	20	4100	970	*19e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	4.8	290	6.7e4	4.7e4	*13e-2/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	93	3100	*71e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1.1**	**4.2**	**3.7**	*16e-3/2e4*	.	.	DIRECT [25]
EDA-PSO	**1**	**1.2**	37	6700	1600	71	*66e-3/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**2.7**	31	1.1e4	860	6.9	*19e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	39	9.5e4	1.4e4	*50e-2/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	35	1.2e4	700	68	60	*59e-3/1e5*	.	.	simple GA [22]
GLOBAL	**1**	**1.3**	46	7300	*10e-1/900*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	28	1100	370	10	12	12	12	12	iAMaLGaM IDEA [4]
LSfminbnd	**1**	5.9	54	3e3	*38e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	29	910	9500	1500	*23e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	32	1300	250	8.4	*47e-3/2e4*	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	*16e-3/1e4*	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	12	2900	590	*59e-3/1e5*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	**12**	**340**	**110**	14	*47e-3/2e4*	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.9**	14	2.7e4	1400	*79e-3/1e5*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.3**	100	4.1e5	2.9e5	*49e-2/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	200	1e3	7200	1.4e4	*18e-2/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1.1**	35	3400	2400	67	60	60	61	61	PSO [7]
PSO_Bounds	**1**	**1.4**	27	1.6e4	2500	70	*80e-3/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	38	1.4e5	*36e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.2	1.3e4	7.1e5	*38e-1/1e4*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.1**	22	1900	160	**2.2**	**3**	**3**	**3**	**3**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	55	7600	1300	20	75	81	130	260	VNS (Garcia) [11]

Table 68: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.71	2.96	3.2	170	7620	10300	10900	10900	11000	11100	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	5.3	15	18	7	**1.3**	**1**	**1**	**1.1**	**1.1**	**1.3**	ALPS [17]
AMaLGaM IDEA	3.2	3.8	3.9	29	24	18	17	17	17	17	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**1.1**	**1**	8.4	12	8.6	8.2	8.1	8.1	8	avg NEWUOA [31]
BayEDAcG	**2.5**	4	8	*20e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.1**	**1.5**	**1.8**	**2.5**	10	7.6	7.2	7.2	7.1	7.1	BFGS [30]
Cauchy EDA	44	49	48	460	*11e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**2.2**	**2.9**	3.3	8.2	**2.8**	**2.2**	**2.1**	**2.2**	**2.2**	**2.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.5**	**2.1**	**2.4**	6.4	5.9	4.4	4.1	4.1	4.1	4.1	(1+1)-CMA-ES [2]
DASA	24	29	32	13	47	35	33	33	33	33	DASA [19]
DEPSO	3.6	7.7	8.6	3.2	*24e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	4.5	4.1	3.8	**1.5**	*47e-2/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	3.3	4.9	5.7	13	**2.5**	**2**	**2**	**2.1**	**2.3**	**2.5**	EDA-PSO [6]
full NEWUOA	**1.6**	**1.5**	**1.4**	6.4	*47e-2/6e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	3.2	7.7	7.4	36	88	66	62	62	61	61	G3-PCX [26]
simple GA	5.5	22	47	21	**1**	**1**	**1.3**	**2.2**	**2.6**	5	simple GA [22]
GLOBAL	4.8	12	17	18	*13e-1/500*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.1**	3	3.2	30	25	19	18	18	18	18	iAMaLGaM IDEA [4]
LSfminbnd	5.8	7	8.2	18	*65e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	110	190	230	41	18	14	13	13	13	13	LSstep [28]
MA-LS-Chain	**2.9**	5.6	5.8	4.1	**1.4**	**1.1**	**1**	**1**	**1**	**1**	MA-LS-Chain [21]
MCS (Neum)	**2.5**	**2.8**	**2.7**	**1**	9.1	6.8	6.4	6.4	6.4	6.3	MCS (Neum) [18]
NELDER (Han)	**1.1**	**1.5**	**1.5**	25	*24e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**2.1**	**2.2**	8.5	37	28	26	26	26	26	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	3.3	*43e-2/6e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.4	3.9	4	16	43	32	30	30	30	30	(1+1)-ES [1]
POEMS	83	80	78	8.5	14	10	9.9	9.9	10	10	POEMS [20]
PSO	**2.5**	6	8.7	3.1	27	20	19	19	19	18	PSO [7]
PSO_Bounds	3.1	7	8.1	8.6	21	16	15	15	15	16	PSO_Bounds [8]
Monte Carlo	6.7	20	29	9200	*99e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.6**	**2.8**	**2.9**	4.6	*47e-2/1e4*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.1**	3	3.3	6.6	**2.3**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	3.7	11	10	7.8	4.3	3.9	4.3	4.5	4.6	5.7	VNS (Garcia) [11]

Table 69: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{21}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	8.2	231	335	338	341	344	346	351	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	3.4	**2.2**	**2.9**	3.9	4.7	5.6	6.4	8.1	ALPS [17]
AMaLGaM IDEA	**1**	**1**	3	37	34	35	36	38	38	38	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**1.7**	**2.5**	3.6	3.5	3.5	3.5	3.5	3.5	avg NEWUOA [31]
BayEDAcG	**1**	**1**	4.1	8.6	40	85	84	84	83	82	BayEDAcG [10]
BFGS	**1**	**1**	3.8	**1.4**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**2**	BFGS [30]
Cauchy EDA	**1**	**1**	20	27	190	430	420	420	420	410	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**2.3**	14	24	25	25	25	25	25	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	4.2	4.6	6.6	6.6	6.5	6.5	6.5	6.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	10	210	320	320	320	310	310	310	DASA [19]
DEPSO	**1**	**1**	4.2	5.5	4.2	4.7	5	5.3	6.2	6.7	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1.1**	**1.8**	**2.1**	**2.9**	19	19	DIRECT [25]
EDA-PSO	**1**	**1**	4	160	110	110	120	120	120	120	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.4**	**2.3**	**2.8**	**2.8**	**2.8**	**2.7**	**2.7**	**2.7**	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.1**	4.7	6.8	6.7	6.7	6.7	6.7	6.6	G3-PCX [26]
simple GA	**1**	**1**	4.6	5.5	61	68	70	77	140	290	simple GA [22]
GLOBAL	**1**	**1**	**2.3**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.2**	27	22	22	22	22	22	22	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	30	38	39	45	44	44	44	44	LSfminbnd [28]
LSstep	**1**	**1**	560	120	120	120	130	130	130	130	LSstep [28]
MA-LS-Chain	**1**	**1**	3.6	22	16	16	16	16	16	16	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	3.9	5.1	5.1	5	5	5	5	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	12	8.4	10	10	10	10	9.9	9.8	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.9**	**1.5**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.1**	**2.2**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.9**	NEWUOA [31]
(1+1)-ES	**1**	**1**	45	19	18	18	18	18	18	18	(1+1)-ES [1]
POEMS	**1**	**1**	34	330	290	290	290	290	290	290	POEMS [20]
PSO	**1**	**1**	**2**	380	260	260	260	260	260	250	PSO [7]
PSO_Bounds	**1**	**1**	3.5	380	340	340	340	340	340	340	PSO_Bounds [8]
Monte Carlo	**1**	**1**	3.2	8.5	270	1.4e4	*14e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	9.7	7.9	15	15	15	15	15	15	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	3.6	14	9.9	10	10	10	10	10	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.4**	7.5	6.5	6.6	6.9	7.8	8.3	9.1	VNS (Garcia) [11]

Table 70: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{22}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	14.2	77.3	188	196	202	205	208	214	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	6.6	9.3	8.8	13	17	21	24	34	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**3**	19	59	69	69	69	68	67	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	3.4	**2.6**	**2.3**	**2.3**	**2.3**	**2.3**	**2.4**	**2.4**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	13	75	*22e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	3.1	**2.9**	**2.1**	**2.1**	**2**	**2**	**2**	**2.6**	BFGS [30]
Cauchy EDA	**1**	**1**	11	280	780	1700	3500	3400	3400	3300	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	6.9	20	45	43	42	42	41	40	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**2.8**	7.1	4.7	4.6	4.5	4.5	4.4	4.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	96	270	130	130	130	140	140	150	DASA [19]
DEPSO	**1**	**1**	6.5	6.3	7.5	10	11	14	16	32	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	12	19	22	62	130	400	DIRECT [25]
EDA-PSO	**1**	**1**	6.7	12	89	90	92	95	98	100	EDA-PSO [6]
full NEWUOA	**1**	**1**	4.3	3.7	3	**2.9**	**2.9**	**3**	**3**	3.1	full NEWUOA [31]
G3-PCX	**1**	**1**	12	15	13	12	12	12	12	12	G3-PCX [26]
simple GA	**1**	**1**	6	18	390	650	1500	6900	6800	*24e-3/1e5*	simple GA [22]
GLOBAL	**1**	**1**	3.6	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.8**	22	40	41	41	41	41	40	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	13	47	29	60	62	120	120	220	LSfminbnd [28]
LSstep	**1**	**1**	190	180	380	*11e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	3.3	15	22	22	22	22	22	22	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1.1**	12	11	11	11	11	15	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	19	13	13	13	13	12	12	12	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.5**	**2.5**	**2.1**	**2**	**2**	**2**	**2**	**2.1**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.1**	**2.1**	**2**	**2**	**2.1**	**2.2**	**2.3**	**2.4**	NEWUOA [31]
(1+1)-ES	**1**	**1**	21	37	30	29	29	29	29	30	(1+1)-ES [1]
POEMS	**1**	**1**	470	1100	1300	1200	1200	1200	1200	1200	POEMS [20]
PSO	**1**	**1**	**2.6**	330	470	450	440	430	430	420	PSO [7]
PSO_Bounds	**1**	**1**	510	870	820	820	810	820	820	820	PSO_Bounds [8]
Monte Carlo	**1**	**1**	7.6	73	390	7500	7.1e4	7e4	*93e-4/1e6*	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	19	13	10	10	10	10	10	11	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	7.5	23	60	58	57	57	56	55	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	5.8	16	18	18	18	18	19	20	VNS (Garcia) [11]

Table 71: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	0.6	104	2850	5580	6330	6480	6610	6850	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**2.2**	21	29	100	3100	*54e-4/1e6*	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.7**	7	**1.8**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	6	**2.5**	14	*15e-2/9e3*	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.8**	62	*12e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	11	31	*69e-2/5e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	**2.2**	230	*68e-2/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**1.7**	13	3.7	**2.1**	**1.8**	**1.8**	**1.8**	**1.8**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	4.2	3.3	7.5	26	*11e-2/1e4*	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	9	20	360	*88e-3/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**2**	66	*15e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	3.5	5.7	3.7	6	*93e-4/2e4*	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	**2.4**	28	*59e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	5.4	**2**	3.8	*87e-3/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.6**	**2.4**	8.6	60	*44e-3/5e4*	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.5**	59	*49e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**1.6**	**1**	4.8	*23e-2/1e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.6**	7.8	**2.1**	**1.3**	**1.2**	**1.2**	**1.1**	**1.1**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**1.8**	11	*45e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	**1.4**	6.6	51	*31e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.6**	**2.5**	**1.7**	4	3.6	3.5	3.4	3.3	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	3.4	**2.4**	51	*16e-2/1e4*	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**2.9**	3.5	**2.7**	3.2	4	4.6	4.6	5.6	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.5**	**1**	**1**	3.6	15	46	*38e-4/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	6.2	**2.4**	7.1	*20e-2/7e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.1	4.8	52	590	*14e-3/1e6*	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	13	23	26	22	25	33	33	32	POEMS [20]
PSO	**1**	**1**	**2.2**	20	240	*15e-2/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	**2.1**	58	240	*30e-2/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.3**	49	*38e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.6**	**1.8**	4.6	13	*17e-2/5e3*	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	3.1	9.7	3.7	**1.9**	**1.7**	**1.7**	**1.7**	**1.6**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1**	9.6	15	26	23	26	25	24	VNS (Garcia) [11]

Table 72: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.2	0.2	324	43300	1.27e6	1.92e6	1.92e6	1.92e6	2.57e6	2.57e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	5	8.1	9.6	*75e-2/1e6*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	5.3	3.3	**2.4**	**2.1**	**3.8**	**3.7**	**3.7**	**5.6**	**5.6**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	14	**2**	**2.2**	*30e-1/7e3*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	5.4	15	*11e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	160	69	*17e+0/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	75	30	*81e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	7.8	**2.1**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	76	6.7	**1.7**	*39e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	79	250	*32e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	5	29	*14e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	7.5	**1.9**	*72e-1/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	3.6	9.7	*61e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	21	**2.5**	**1.1**	*31e-1/7e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	4.9	44	*61e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	7.3	21	*54e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	6.3	4.2	*91e-1/1e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	6.3	3.1	**2.2**	**2.2**	**7.5**	**7.5**	**7.5**	**5.6**	**5.6**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	30	9.1	*63e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3	360	200	*15e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	3.8	**2.1**	*52e-1/2e4*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	7	3.5	*37e-1/1e4*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	10	11	5.6	*12e-1/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	4.3	**1**	**1.4**	*15e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	12	**2.9**	**2.1**	*26e-1/6e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	14	31	68	*14e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	620	47	*70e-1/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1**	6.5	5.7	*63e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	5.2	10	33	*60e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	4.1	2900	*96e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	200	210	*19e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	7.5	**1.8**	**1**	*53e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**3.4**	3.3	49	13	16	46	200	*69e-4/3e7*	.	VNS (Garcia) [11]

Table 73: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_1, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.1	2.2	2.27	2.29	2.3	2.3	2.3	2.3	2.3	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	8.9	84	230	410	590	780	950	1100	1500	ALPS [17]
AMaLGaM IDEA	**1**	5	18	45	73	100	130	160	190	240	AMaLGaM IDEA [4]
avg NEWUOA	**1**	27	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	avg NEWUOA [31]
BayEDAcG	**1**	6.5	39	100	230	300	370	440	500	640	BayEDAcG [10]
BFGS	**1**	13	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BFGS [30]
Cauchy EDA	**1**	240	160	350	510	700	870	1100	1200	1600	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	7.8	5.7	12	18	25	31	38	44	58	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	5.3	3.8	7.5	11	15	18	22	25	33	(1+1)-CMA-ES [2]
DASA	**1**	110	29	45	59	77	95	110	130	180	DASA [19]
DEPSO	**1**	**3.2**	19	45	84	130	170	220	280	390	DEPSO [12]
DIRECT	**1**	**1**	8.8	31	64	97	140	190	240	400	DIRECT [25]
EDA-PSO	**1**	9.2	22	800	1500	2300	3100	3900	4700	6400	EDA-PSO [6]
full NEWUOA	**1**	40	3.1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	full NEWUOA [31]
G3-PCX	**1**	4.7	7.9	11	15	20	24	28	33	43	G3-PCX [26]
simple GA	**1**	4.4	310	1200	2100	3200	4400	7100	1.2e4	6.1e4	simple GA [22]
GLOBAL	**1**	5.3	15	14	14	14	14	14	14	14	GLOBAL [23]
iAMaLGaM IDEA	**1**	5.7	8.5	25	41	57	72	87	100	140	iAMaLGaM IDEA [4]
LSfminbnd	**1**	39	7.1	8.1	8.3	8.3	8.3	8.3	8.3	8.3	LSfminbnd [28]
LSstep	**1**	960	140	150	160	160	160	160	160	160	LSstep [28]
MA-LS-Chain	**1**	4.7	12	36	58	80	110	120	140	180	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.2**	**2**	**2.1**	**2.2**	**2.9**	**2.9**	**2.9**	**2.9**	MCS (Neum) [18]
NELDER (Han)	**1**	7.1	**2.5**	6.1	9.5	13	16	19	23	31	NELDER (Han) [16]
NELDER (Doe)	**1**	8.3	**2.4**	5.3	8.1	11	14	17	21	32	NELDER (Doe) [5]
NEWUOA	**1**	14	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	17	3.9	6.9	10	13	16	19	22	28	(1+1)-ES [1]
POEMS	**1**	1600	140	220	620	1e3	1500	2e3	2400	3300	POEMS [20]
PSO	**1**	5.8	10	55	100	150	210	280	330	450	PSO [7]
PSO_Bounds	**1**	5.7	18	180	700	1400	1700	2100	2500	5300	PSO_Bounds [8]
Monte Carlo	**1**	5.4	3e3	*35e-1 /1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	37	3.4	4.9	6.5	8.1	9.7	11	13	16	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	5.3	4.8	11	16	21	26	33	37	48	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	12	12	18	26	32	38	44	51	65	VNS (Garcia) [11]

Table 74: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	14.6	18.5	18.7	19	19.1	19.1	19.3	19.3	19.4	19.5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	47	58	80	100	130	150	170	200	220	280	ALPS [17]
AMaLGaM IDEA	8.7	11	15	20	25	29	32	35	39	46	AMaLGaM IDEA [4]
avg NEWUOA	**2.5**	6.1	16	39	67	90	120	160	180	250	avg NEWUOA [31]
BayEDAcG	32	34	42	57	66	74	81	89	97	110	BayEDAcG [10]
BFGS	4.7	7.5	10	12	14	14	14	14	15	15	BFGS [30]
Cauchy EDA	60	72	95	120	140	160	190	210	230	270	Cauchy EDA [24]
BIPOP-CMA-ES	11	14	20	24	26	27	28	28	29	30	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	7.9	10	16	20	21	22	23	23	24	25	(1+1)-CMA-ES [2]
DASA	6.4	6.7	8.6	11	13	15	18	21	25	34	DASA [19]
DEPSO	8.9	11	16	22	28	34	42	48	55	69	DEPSO [12]
DIRECT	11	12	15	150	150	160	170	380	410	1e3	DIRECT [25]
EDA-PSO	200	250	350	440	520	620	710	810	890	1100	EDA-PSO [6]
full NEWUOA	6.2	18	53	150	300	590	2500	7700	*53e-4/1e4*	.	full NEWUOA [31]
G3-PCX	13	31	89	190	290	370	460	540	640	860	G3-PCX [26]
simple GA	240	300	820	1400	2700	4400	7e3	1.2e4	7.4e4	*53e-4/1e5*	simple GA [22]
GLOBAL	6.5	8.6	12	13	14	14	15	15	15	16	GLOBAL [23]
iAMaLGaM IDEA	5.9	7.9	11	14	16	18	19	21	23	27	iAMaLGaM IDEA [4]
LSfminbnd	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	19	16	16	16	16	16	16	16	16	16	LSstep [28]
MA-LS-Chain	7	9.6	14	18	23	27	32	37	42	52	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.3**	**3.2**	**4.6**	**6.5**	**7.5**	10	11	**11**	110	MCS (Neum) [18]
NELDER (Han)	3.9	5.1	**6.1**	**7**	**8.1**	**8.6**	**9.2**	**9.7**	**10**	**11**	NELDER (Han) [16]
NELDER (Doe)	4.2	10	22	52	83	100	120	130	130	200	NELDER (Doe) [5]
NEWUOA	**1.2**	4.4	13	37	74	100	150	180	220	300	NEWUOA [31]
(1+1)-ES	280	1300	5600	1.4e4	2.3e4	3.1e4	4.9e4	1.4e5	2.4e5	7.5e5	(1+1)-ES [1]
POEMS	130	180	220	280	320	380	430	470	540	650	POEMS [20]
PSO	17	26	41	420	420	430	430	440	440	450	PSO [7]
PSO_Bounds	120	190	290	420	530	600	890	1200	1500	1800	PSO_Bounds [8]
Monte Carlo	*67e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.6**	**3.4**	39	100	160	210	220	280	370	650	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.9	5.6	6.9	7.7	8.5	9.3	**9.9**	**11**	11	**12**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	20	24	29	33	37	39	41	43	44	47	VNS (Garcia) [11]

Table 75: 10-D, running time excess ERT/ERT_{best} on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.1	6.9	174	360	361	364	364	364	365	365	ERT_{best}/D
ALPS	**2.6**	30	11	40	59	59	61	64	**67**	81	ALPS [17]
AMaLGaM IDEA	3.7	6.7	4.6	1300	3.9e4	3.9e4	3.8e4	3.8e4	3.8e4	3.8e4	AMaLGaM IDEA [4]
avg NEWUOA	11	16	*21e+0/7e3*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**2.1**	18	*22e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	30	370	*70e+0/5e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	160	69	4100	*15e+0/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	4.5	3.4	3.6	310	5900	5900	5900	5900	5900	5900	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.3	14	390	*17e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	17	7.2	**1**	**11**	**19**	**19**	**19**	**19**	**19**	**20**	DASA [19]
DEPSO	**1.5**	8	170	*19e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	5.6	87	*26e+0/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.6**	34	18	1800	*20e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	9.3	14	*17e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.7**	71	*20e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**2.6**	150	26	**23**	73	140	460	610	830	3900	simple GA [22]
GLOBAL	**2.3**	6.8	140	*34e+0/2e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.7**	3.6	4.4	270	2300	2300	2300	2300	2300	2300	iAMaLGaM IDEA [4]
LSfminbnd	57	**2.2**	47	*11e+0/5e3*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	1300	46	**2.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1.9**	5.6	3.9	43	79	79	79	79	79	**79**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	11	*40e-1/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	5.1	31	320	*90e-1/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	4.4	**1.1**	180	*11e+0/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	5.1	20	*23e+0/6e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	5.9	74	6400	*90e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	470	42	6.7	29	66	68	73	75	79	84	POEMS [20]
PSO	3.9	6.4	150	1800	1800	1800	1800	1800	1800	1800	PSO [7]
PSO_Bounds	**2**	11	50	44	**51**	**52**	**54**	**55**	70	95	PSO_Bounds [8]
Monte Carlo	**2.4**	2900	*63e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	18	330	*53e+0/8e3*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.5**	**2.7**	**3.1**	62	*20e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**2**	5.6	3.2	24	190	210	230	230	260	290	VNS (Garcia) [11]

Table 76: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_4, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	9.82	223	363	366	370	371	374	374	2880	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**2.4**	39	14	100	170	170	170	180	190	30	ALPS [17]
AMaLGaM IDEA	**2.6**	8.9	41	*50e-1/1e6*	.	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	13	42	*27e+0/1e4*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**2.1**	28	*18e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	89	850	*10e+1/5e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	190	100	*31e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	5.8	**2.8**	6.5	*50e-1/3e5*	.	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.3	20	*33e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	130	7.8	**1**	**16**	**52**	**51**	**51**	**51**	**51**	**6.8**	DASA [19]
DEPSO	3.1	9.4	66	*18e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	4.2	180	*19e+0/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.5**	83	20	*50e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	35	13	*27e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**2.9**	500	*35e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**2.7**	140	22	**26**	**79**	310	1800	*84e-4/1e5*	.	.	simple GA [22]
GLOBAL	**2.5**	33	*57e+0/2e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	3.5	5.5	29	*50e-1/1e6*	.	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	56	**1.6**	*21e+0/6e3*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	670	31	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**2.8**	6.1	**5.1**	290	2e3	2e3	2e3	2e3	2e3	260	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	27	*12e+0/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	5.1	46	3300	*17e+0/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	3.1	**2.8**	*20e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	11	110	*55e+0/7e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	9.5	120	6.3e4	*15e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	570	35	6.4	43	85	**89**	**91**	**94**	**97**	**13**	POEMS [20]
PSO	3.3	8.5	120	*80e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	3.5	28	37	190	200	200	200	200	210	30	PSO_Bounds [8]
Monte Carlo	**2.3**	2e4	*86e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	32	780	*70e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	6.5	**2.7**	6.6	*60e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	3.2	5	7.2	2900	2.5e4	2.5e4	2.7e4	2.7e4	2.7e4	4600	VNS (Garcia) [11]

Table 77: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	1.64	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	7.4	130	190	220	240	250	250	250	260	ALPS [17]
AMaLGaM IDEA	**1**	4.6	39	45	46	46	46	46	46	46	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.9**	**2**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	avg NEWUOA [31]
BayEDAcG	**1**	5.9	91	120	140	140	140	140	140	140	BayEDAcG [10]
BFGS	**1**	**1.3**	**2.2**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	BFGS [30]
Cauchy EDA	**1**	24	68	70	72	72	72	72	72	72	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.2**	4.8	6	6.1	6.1	6.1	6.1	6.1	6.1	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	3.2	3.9	3.9	3.9	3.9	3.9	3.9	3.9	(1+1)-CMA-ES [2]
DASA	**1**	13	23	31	36	40	43	47	50	58	DASA [19]
DEPSO	**1**	7	33	47	50	50	50	50	50	50	DEPSO [12]
DIRECT	**1**	6	36	52	53	53	53	53	53	53	DIRECT [25]
EDA-PSO	**1**	**2.9**	11	17	20	20	21	21	21	21	EDA-PSO [6]
full NEWUOA	**1**	**2.8**	3.6	4	4	4	4	4	4	4	full NEWUOA [31]
G3-PCX	**1**	6.8	17	26	27	28	28	28	28	28	G3-PCX [26]
simple GA	**1**	5.8	1400	3100	5400	8200	1.1e4	1.5e4	1.9e4	3e4	simple GA [22]
GLOBAL	**1**	5.2	17	18	18	18	18	18	18	18	GLOBAL [23]
iAMaLGaM IDEA	**1**	**2.4**	8.8	11	12	12	12	12	12	12	iAMaLGaM IDEA [4]
LSfminbnd	**1**	8.3	14	15	15	15	15	15	15	15	LSfminbnd [28]
LSstep	**1**	83	170	180	180	180	180	180	180	180	LSstep [28]
MA-LS-Chain	**1**	4.7	41	45	49	49	49	49	49	49	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	**1.6**	3.4	4.2	4.3	4.3	4.3	4.3	4.3	4.3	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	3.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	NELDER (Doe) [5]
NEWUOA	**1**	**1.3**	**1.2**	**1.3**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	**2.1**	**2.6**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	(1+1)-ES [1]
POEMS	**1**	130	190	230	260	270	270	270	270	270	POEMS [20]
PSO	**1**	**2.9**	13	17	19	19	20	20	20	20	PSO [7]
PSO_Bounds	**1**	3.1	10	14	15	15	16	16	16	16	PSO_Bounds [8]
Monte Carlo	**1**	11	*27e+0 /1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.7	4.1	4.3	4.4	4.4	4.4	4.4	4.4	4.4	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**2.2**	5.4	7.1	7.2	7.3	7.3	7.3	7.3	7.3	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	5.6	9.6	10	11	11	11	11	11	11	VNS (Garcia) [11]

Table 78: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_6, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.79	10.2	39.9	61.5	82.6	104	129	157	184	237	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	30	24	32	43	51	59	64	67	68	87	ALPS [17]
AMaLGaM IDEA	8	6.1	7.9	9.8	11	12	12	11	11	11	AMaLGaM IDEA [4]
avg NEWUOA	**1.5**	**1.6**	**1**	**1**	**1**	**1**	**1.1**	**1.1**	**1.1**	**1.1**	avg NEWUOA [31]
BayEDAcG	23	20	360	*25e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.9**	3.7	3.9	4.2	4.5	4.6	4.5	4.4	4.5	66	BFGS [30]
Cauchy EDA	690	550	190	150	140	130	120	110	100	99	Cauchy EDA [24]
BIPOP-CMA-ES	**2.2**	3.6	**2.1**	**2.1**	**2**	**1.9**	**1.9**	**1.8**	**1.7**	**1.7**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.7**	**1.4**	**1.1**	**2.6**	20	69	150	*21e-4/1e4*	.	.	(1+1)-CMA-ES [2]
DASA	15	9.9	75	150	350	490	570	620	670	700	DASA [19]
DEPSO	11	5.5	6.8	11	14	24	37	*50e-4/2e3*	.	.	DEPSO [12]
DIRECT	4.9	3.1	98	*34e-1/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	5.7	14	49	62	68	73	72	71	71	71	EDA-PSO [6]
full NEWUOA	**2.4**	**2.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	5	**2.2**	**1.7**	**2.4**	3.6	3.8	3.9	4.1	4.5	5.4	G3-PCX [26]
simple GA	160	80	140	4700	*28e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	9.3	4.6	3.2	3.3	3.5	3.4	3.4	3.3	4	83	GLOBAL [23]
iAMaLGaM IDEA	3.8	3.8	3.2	4.2	4.8	5.1	5.1	5.1	5	4.9	iAMaLGaM IDEA [4]
LSfminbnd	8.2	85	220	370	300	680	1100	920	790	*40e-1/1e4*	LSfminbnd [28]
LSstep	120	160	600	2400	*24e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	10	4.9	6.6	9.1	9.7	9.5	8.6	7.8	7.3	6.4	MA-LS-Chain [21]
MCS (Neum)	**1.8**	3.6	19	180	170	280	*16e-1/4e3*	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.8**	4.6	4.2	5.3	5.5	5.8	5.7	6.1	6.3	9	NELDER (Han) [16]
NELDER (Doe)	**1.3**	**1.1**	3.8	10	15	18	25	58	260	*14e-6/2e4*	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	**2.1**	3.3	4	4.9	5.5	5.9	5.9	6.2	NEWUOA [31]
(1+1)-ES	**2**	**2.8**	**1.8**	**1.9**	**2.1**	**2.5**	**2.4**	**2.4**	**2.4**	**2.6**	(1+1)-ES [1]
POEMS	92	36	30	40	44	46	46	45	44	45	POEMS [20]
PSO	4.9	4.7	400	420	320	260	210	180	160	130	PSO [7]
PSO_Bounds	4.8	5.6	45	120	140	150	140	130	130	160	PSO_Bounds [8]
Monte Carlo	1300	1500	*25e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.5**	**1**	10	38	41	37	34	33	31	29	Rosenbrock [27]
IPOP-SEP-CMA-ES	3	4.2	**2.2**	**2.3**	**2.4**	**2.4**	**2.4**	**2.3**	**2.2**	**2.1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	6	6.1	**2.6**	**2.4**	**2.3**	**2.2**	**2.1**	**2**	**1.9**	**1.8**	VNS (Garcia) [11]

Table 79: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	3.29	17.2	161	420	510	514	514	514	539	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.6**	15	25	9.8	25	57	59	59	59	56	ALPS [17]
AMaLGaM IDEA	**1.5**	4.9	3.9	**1**	**2.3**	**2.6**	**2.6**	**2.6**	**2.6**	**2.5**	AMaLGaM IDEA [4]
avg NEWUOA	3	**1.4**	16	38	*73e-2/1e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**2.4**	13	23	*47e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	14	150	*13e+1/100*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	93	50	31	7.2	4.4	4.7	4.9	4.9	4.9	4.9	Cauchy EDA [24]
BIPOP-CMA-ES	3.2	**2.8**	**2.3**	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.5**	**2.1**	7.4	5.9	5	20	20	20	20	19	(1+1)-CMA-ES [2]
DASA	37	33	280	8800	*13e-1/6e5*	.	.	.	.	.	DASA [19]
DEPSO	**2.1**	6.6	9.2	21	32	*14e-1/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.7**	16	68	*70e-2/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.7**	5.6	57	17	130	110	110	110	110	100	EDA-PSO [6]
full NEWUOA	3.7	**2.1**	**1**	7.6	110	*51e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**2.1**	3.7	21	520	*19e-1/2e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**2.7**	23	140	270	680	2900	2800	2800	2800	*48e-2/1e5*	simple GA [22]
GLOBAL	**1.8**	6.1	11	50	*45e-1/500*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.8**	4	3	**1**	**1**	**2.1**	**2.1**	**2.1**	**2.1**	**2**	iAMaLGaM IDEA [4]
LSfminbnd	16	12	95	270	*40e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	110	160	720	*93e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**2.7**	4.8	7.7	15	110	120	120	120	120	110	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.3**	53	*50e-1/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	3	**1.4**	69	940	*11e-1/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	4.5	**1.1**	59	400	*19e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	4.1	**1**	27	1e3	*24e-1/1e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	6.3	**2.7**	190	7e3	*85e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	1100	88	40	12	74	80	80	80	80	76	POEMS [20]
PSO	**2.2**	3.4	10	770	*11e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.9**	4.2	19	730	3300	*13e-1/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**2.2**	32	6e4	*94e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	150	400	*67e+0/3e3*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.4**	**2.2**	**2.5**	**1.5**	**1.1**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.4**	8.3	3.2	4.1	19	31	34	34	34	33	VNS (Garcia) [11]

Table 80: 10-D, running time excess ERT/ERT_{best} on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	4.23	13.2	32.2	80.6	93.4	101	104	106	108	110	ERT_{best}/D
ALPS	53	43	43	120	170	250	330	450	570	3300	ALPS [17]
AMaLGaM IDEA	10	7.4	7.4	13	14	14	15	15	15	16	AMaLGaM IDEA [4]
avg NEWUOA	**1.2**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	avg NEWUOA [31]
BayEDAcG	29	22	75	*93e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.9**	**2.3**	**1.7**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	BFGS [30]
Cauchy EDA	110	82	66	120	110	110	110	110	120	120	Cauchy EDA [24]
BIPOP-CMA-ES	4	**2.4**	**1.9**	4.7	5	5.1	5.2	5.3	5.4	5.6	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.1	**2.9**	**1.9**	6.8	6.7	6.5	6.5	6.6	6.6	6.7	(1+1)-CMA-ES [2]
DASA	18	21	22	200	420	630	900	1200	1400	1900	DASA [19]
DEPSO	11	9	12	*54e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	9.1	7.7	32	550	*64e-1/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	65	130	140	220	300	410	530	640	760	*46e-8/1e5*	EDA-PSO [6]
full NEWUOA	**2.8**	**2**	**1.3**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	full NEWUOA [31]
G3-PCX	4.6	3.5	**2.9**	6.9	6.8	6.7	6.7	6.7	6.8	7	G3-PCX [26]
simple GA	280	230	210	*53e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	7.7	3.2	**2.1**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	GLOBAL [23]
iAMaLGaM IDEA	6.5	4.7	4	8.4	8.8	8.9	9.1	9.3	9.6	10	iAMaLGaM IDEA [4]
LSfminbnd	7.2	7.3	19	190	180	440	1300	1400	*40e-1/1e4*	.	LSfminbnd [28]
LSstep	140	80	63	180	470	1500	*12e-1/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	7.9	6.7	7.3	13	14	14	15	15	15	15	MA-LS-Chain [21]
MCS (Neum)	**1.6**	**1**	**1**	**1.6**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	MCS (Neum) [18]
NELDER (Han)	**1.6**	**2.5**	**2**	5.4	5.1	5	5	5.1	5.1	5.2	NELDER (Han) [16]
NELDER (Doe)	**2.2**	**1.3**	**1.4**	**2.5**	3.3	3.5	3.7	3.8	4	4.4	NELDER (Doe) [5]
NEWUOA	**1**	**1.4**	**1**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	NEWUOA [31]
(1+1)-ES	3.7	13	22	160	150	170	200	240	270	340	(1+1)-ES [1]
POEMS	80	59	64	470	840	*45e-3/1e5*	.	.	.	.	POEMS [20]
PSO	9.1	10	13	270	350	470	620	790	1500	6700	PSO [7]
PSO_Bounds	17	44	66	690	750	820	1700	1.4e4	1.4e4	*93e-5/1e5*	PSO_Bounds [8]
Monte Carlo	5400	*36e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.1**	3.6	12	59	81	110	170	320	430	1300	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.2	**2.4**	**2.9**	7.5	7.5	7.4	7.5	7.5	7.5	7.7	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	10	5.6	3.5	8.4	8.7	8.6	8.8	8.8	8.9	9	VNS (Garcia) [11]

Table 81: 10-D, running time excess ERT/ERT_{best} on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.1	0.1	20	64.8	85.7	99.3	107	111	114	119	ERT_{best}/D
ALPS	1700	5e3	66	320	470	730	1900	3e3	4400	6.1e4	ALPS [17]
AMaLGaM IDEA	350	700	9.3	17	15	15	15	15	15	16	AMaLGaM IDEA [4]
avg NEWUOA	69	150	**1.3**	**1.8**	**1.5**	**1.4**	**1.3**	**1.3**	**1.2**	**1.2**	avg NEWUOA [31]
BayEDAcG	860	2500	56	*88e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	88	230	**2.1**	**1.9**	**1.6**	**1.4**	**1.4**	**1.3**	**1.3**	**1.3**	BFGS [30]
Cauchy EDA	4400	1e4	100	150	130	120	110	110	110	120	Cauchy EDA [24]
BIPOP-CMA-ES	130	350	3.4	6.3	5.9	5.5	5.4	5.4	5.5	5.5	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	100	350	3.3	7.7	6.6	6.1	5.9	5.8	5.8	5.8	(1+1)-CMA-ES [2]
DASA	750	1.6e4	160	2200	2e3	2400	2900	3700	4300	5800	DASA [19]
DEPSO	420	1100	15	*70e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	9.4	350	*17e-1/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	3200	1.7e4	220	340	540	1500	*85e-4/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	140	250	**1.6**	**2**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	full NEWUOA [31]
G3-PCX	190	470	4.7	15	12	11	10	10	10	9.9	G3-PCX [26]
simple GA	9e3	2.8e4	370	*79e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	330	450	**2.9**	**2.2**	**1.8**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	GLOBAL [23]
iAMaLGaM IDEA	250	560	6.3	10	9.6	9	8.9	8.9	9.1	9.3	iAMaLGaM IDEA [4]
LSfminbnd	230	1200	51	120	860	*14e-2/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	5800	3.3e4	420	*90e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	290	870	12	36	31	28	27	26	26	25	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	45	240	**2.4**	3.7	3.4	3.1	3.2	3.2	3.2	3.3	NELDER (Han) [16]
NELDER (Doe)	49	150	**2.7**	7.1	6.5	6.1	6	5.9	6	6	NELDER (Doe) [5]
NEWUOA	**39**	**140**	**1.7**	**1.7**	**1.4**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	NEWUOA [31]
(1+1)-ES	100	1600	9.5	230	190	190	220	240	280	330	(1+1)-ES [1]
POEMS	3100	6200	110	770	1.7e4	*18e-2/1e5*	.	.	.	.	POEMS [20]
PSO	320	1700	24	840	1900	*11e-2/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	770	4.3e4	450	1100	1600	*78e-3/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	3.7e5	*33e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	79	200	27	77	70	87	130	180	*12e-5/1e4*	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	130	780	6.9	10	8.9	8.1	7.8	7.7	7.7	7.7	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	340	580	4.6	9.8	12	13	13	12	12	12	VNS (Garcia) [11]

Table 82: 10-D, running time excess ERT/ERT_{best} on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	46.3	104	184	217	245	273	280	308	454	474	ERT_{best}/D
ALPS	59	180	850	7800	*30e-1/5e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**2.9**	**2.2**	**1.8**	**1.9**	**2**	**2**	**2.2**	**2.2**	**1.6**	**1.9**	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	**1.3**	**1.9**	3.5	5.4	6.6	9	9.9	8.1	10	avg NEWUOA [31]
BayEDAcG	*16e+3/2e3*	.	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.8**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1.3**	920	BFGS [30]
Cauchy EDA	22	14	10	11	11	12	13	13	10	11	Cauchy EDA [24]
BIPOP-CMA-ES	3.8	**2.7**	**2.3**	**2.1**	**1.9**	**1.8**	**1.8**	**1.7**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.8**	**2.1**	**1.7**	**1.8**	**1.7**	**1.6**	**1.5**	**1.4**	**1**	**1**	(1+1)-CMA-ES [2]
DASA	320	1500	7200	2.2e4	6.1e4	*76e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	310	*19e+2/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	89	*37e+1/1e4*	.	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	300	830	*56e+0/1e5*	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1.9**	5.3	10	20	33	54	260	240	*79e-4/1e4*	.	full NEWUOA [31]
G3-PCX	6.1	6.9	10	19	26	30	37	40	31	38	G3-PCX [26]
simple GA	3500	1.4e4	*12e+2/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**2.6**	**1.6**	**1.2**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.6**	*29e-7/1e3*	GLOBAL [23]
iAMaLGaM IDEA	**2.1**	**1.5**	**1.2**	**1.3**	**1.3**	**1.3**	**1.4**	**1.4**	**1**	**1.1**	iAMaLGaM IDEA [4]
LSfminbnd	440	*14e+2/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	1600	*88e+2/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	10	8	11	11	9.8	9	9	8.3	5.7	5.6	MA-LS-Chain [21]
MCS (Neum)	170	*11e+2/4e3*	.	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.8**	**2.2**	4.1	16	43	100	240	820	1600	*27e-5/1e5*	NELDER (Han) [16]
NELDER (Doe)	**2.7**	3.7	9.5	25	34	57	330	970	*31e-4/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.1**	3.8	6	7.4	10	11	9.2	12	NEWUOA [31]
(1+1)-ES	43	170	530	1100	1700	2400	3700	9100	1.1e4	*43e-5/1e6*	(1+1)-ES [1]
POEMS	300	1300	*10e+1/1e5*	.	.	.	.	.	.	.	POEMS [20]
PSO	110	1e3	3900	*74e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	640	2200	*12e+1/1e5*	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*72e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	57	80	120	230	*22e+0/1e4*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	9.3	5.6	4	3.7	3.4	3.2	3.2	**2.9**	**2**	**2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	6	3.7	**2.8**	**2.7**	**2.5**	**2.3**	**2.3**	**2.2**	**1.5**	**1.5**	VNS (Garcia) [11]

Table 83: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.98	2.3	26.6	104	260	295	334	375	409	484	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	6.3	83	370	460	490	990	4300	*14e-4/5e5*	.	.	ALPS [17]
AMaLGaM IDEA	5.5	14	**4.4**	**1.9**	**1.1**	**1.2**	**1.3**	**1.4**	**1.4**	**1.5**	AMaLGaM IDEA [4]
avg NEWUOA	10	220	36	18	9.5	12	14	14	15	15	avg NEWUOA [31]
BayEDAcG	4	58	*62e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.2**	**7.1**	**1**	**1**	**1.7**	6	56	*12e-4/8e3*	.	.	BFGS [30]
Cauchy EDA	37	200	36	13	7	7.5	7.8	8.1	8.3	8.8	Cauchy EDA [24]
BIPOP-CMA-ES	6	82	13	3.8	**1.7**	**1.6**	**1.5**	**1.4**	**1.3**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.2**	42	9.9	3.8	**1.9**	**2**	**1.9**	**1.8**	**1.7**	**1.5**	(1+1)-CMA-ES [2]
DASA	5.9	850	1300	1e3	750	1100	1400	1600	2e3	3500	DASA [19]
DEPSO	7.1	140	*47e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1.8**	**7.9**	*20e+0/1e4*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	6.7	200	550	990	5700	*57e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	15	820	290	*31e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	5.7	65	40	22	14	16	17	18	19	21	G3-PCX [26]
simple GA	5.3	100	1.6e4	*17e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5	17	**2.5**	**1.7**	**1.5**	8.1	*11e-3/2e3*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	5	25	5.7	**2**	**1**	**1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	**2.2**	9400	*13e+1/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	4.3	6.1e4	*14e+1/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7	31	39	14	6	5.6	5.1	4.6	4.3	3.8	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	*30e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	3.8	17	15	8.8	6.9	13	37	85	440	*24e-6/1e5*	NELDER (Han) [16]
NELDER (Doe)	5.2	17	13	7.8	5.4	9.7	17	34	93	*32e-6/2e4*	NELDER (Doe) [5]
NEWUOA	**1.4**	41	11	5.5	3.1	3.4	4	4.1	4.3	4.6	NEWUOA [31]
(1+1)-ES	840	2.1e4	5300	2400	1300	1500	1700	1800	1900	3e3	(1+1)-ES [1]
POEMS	86	200	220	200	140	160	210	270	350	1500	POEMS [20]
PSO	6.7	240	220	150	100	130	160	170	190	500	PSO [7]
PSO_Bounds	6.5	670	1400	920	670	1200	1400	3900	3600	*12e-2/1e5*	PSO_Bounds [8]
Monte Carlo	7.9	120	5.3e5	*12e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.3**	1e3	5500	1400	570	500	440	390	360	300	Rosenbrock [27]
IPOP-SEP-CMA-ES	5.3	260	29	8.4	3.5	3.2	**2.9**	**2.6**	**2.4**	**2.1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	5.9	160	17	4.7	**2**	**1.9**	**1.7**	**1.6**	**1.5**	**1.3**	VNS (Garcia) [11]

Table 84: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	21.2	27.5	51.5	89.6	124	139	157	197	366	515	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	86	84	57	120	210	1100	5400	1.1e4	1.9e4	*13e-4/5e5*	ALPS [17]
AMaLGaM IDEA	14	13	8.5	6.6	6.6	7.9	9.1	9.2	5.9	5.3	AMaLGaM IDEA [4]
avg NEWUOA	**1.1**	**1.7**	4.7	8	10	12	12	12	6.9	10	avg NEWUOA [31]
BayEDAcG	73	72	48	59	*71e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.5**	**1.3**	**1.3**	**1.4**	**1.4**	**1.3**	**1.3**	**2.2**	**2.6**	23	BFGS [30]
Cauchy EDA	100	110	84	69	68	71	74	68	42	34	Cauchy EDA [24]
BIPOP-CMA-ES	3.7	3.3	3.7	4.6	5.3	5.6	5.6	5.2	3.1	**2.5**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2**	**2.3**	4.2	5.5	6.1	7.4	7.2	6.4	3.8	3.5	(1+1)-CMA-ES [2]
DASA	12	10	7100	4.5e4	1.1e5	*39e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	19	19	19	42	110	*55e-1/2e3*	.	.	.	.	DEPSO [12]
DIRECT	35	31	29	130	170	340	*64e-2/1e4*	.	.	.	DIRECT [25]
EDA-PSO	300	290	490	300	810	4800	*66e-3/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	**1.2**	**1.4**	**2.9**	4.1	4.6	6.2	6.6	6.2	4.4	4.7	full NEWUOA [31]
G3-PCX	**2.5**	**2.3**	**2.8**	3.7	4	4.4	4.6	4.1	**2.5**	**2**	G3-PCX [26]
simple GA	460	490	1300	1900	1.1e4	*18e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1.8**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2.9**	GLOBAL [23]
iAMaLGaM IDEA	7.7	7.2	5	4.8	4.9	5.4	5.7	5.5	3.4	**3**	iAMaLGaM IDEA [4]
LSfminbnd	**2.6**	**2.4**	98	170	1100	1e3	890	*51e-1/1e4*	.	.	LSfminbnd [28]
LSstep	74	67	170	730	*63e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	12	11	8	7.2	9.7	16	25	29	16	12	MA-LS-Chain [21]
MCS (Neum)	**1.2**	**1**	3.2	3.9	7	11	13	27	76	110	MCS (Neum) [18]
NELDER (Han)	**1.6**	**1.8**	**3**	4.7	5.3	5.3	5.4	4.8	**2.8**	**2.3**	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**1.6**	3	6	7.2	7.6	7.7	6.9	4.3	6.5	NELDER (Doe) [5]
NEWUOA	**1.1**	**1**	**1.9**	**2**	**2.1**	**2.3**	**2.3**	**2.1**	**1.2**	**1**	NEWUOA [31]
(1+1)-ES	**1.9**	1600	1.5e4	4.8e4	*56e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	160	160	1100	2300	3300	*25e-1/1e5*	.	.	.	.	POEMS [20]
PSO	19	20	310	1700	5200	*41e-1/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	160	160	580	1800	3300	*27e-1/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*20e+5/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	27	38	340	1200	*14e-1/1e4*	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	3	**2.9**	**3**	4.5	5.6	6.3	6.3	5.7	3.4	**2.7**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	4.4	5.1	4.9	5.6	17	16	15	12	6.9	5.2	VNS (Garcia) [11]

Table 85: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{13}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.18	7.75	38.7	59.6	79.7	101	459	534	621	778	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	22	93	53	110	480	830	1100	3e3	*54e-5/5e5*	.	ALPS [17]
AMaLGaM IDEA	12	15	6.8	6.9	7	6.8	**1.8**	**1.8**	**1.8**	**1.8**	AMaLGaM IDEA [4]
avg NEWUOA	3.6	**1.4**	**3**	13	30	76	32	70	280	*39e-5/1e4*	avg NEWUOA [31]
BayEDAcG	17	99	230	*26e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.8**	**1.5**	**1**	**1**	**1**	**1**	86	*14e-4/1e4*	.	.	BFGS [30]
Cauchy EDA	160	130	46	43	42	41	11	11	11	11	Cauchy EDA [24]
BIPOP-CMA-ES	4.5	5.3	3.6	4.2	5.6	4.8	**1.3**	**1.3**	**1.5**	**1.8**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.9	3.3	4.7	5.7	6.9	9.7	3.5	3.7	4.4	6.9	(1+1)-CMA-ES [2]
DASA	24	20	220	380	1200	3600	1800	2900	1.1e4	*14e-5/1e6*	DASA [19]
DEPSO	8.8	19	58	*73e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**2.9**	22	62	160	580	*28e-2/1e4*	.	.	.	.	DIRECT [25]
EDA-PSO	5.9	300	140	150	990	2900	3100	*22e-3/1e5*	.	.	EDA-PSO [6]
full NEWUOA	6.2	**2.1**	**1.8**	12	25	66	40	130	*14e-4/1e4*	.	full NEWUOA [31]
G3-PCX	9.8	4.9	13	50	96	160	72	290	820	*26e-5/3e4*	G3-PCX [26]
simple GA	22	490	480	1.1e4	*33e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	11	4.9	**1.7**	**1.4**	**1.3**	**1.2**	5.3	*23e-4/600*	.	.	GLOBAL [23]
iAMaLGaM IDEA	4.7	9.6	3.9	**3.8**	**3.9**	**3.8**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	9	16	28	70	180	460	*53e-3/1e4*	.	.	.	LSfminbnd [28]
LSstep	250	300	470	750	1800	1500	*12e+0/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	6.6	19	16	33	140	160	50	43	43	43	MA-LS-Chain [21]
MCS (Neum)	**1**	4.2	37	44	59	280	*86e-3/4e3*	.	.	.	MCS (Neum) [18]
NELDER (Han)	**2**	3.8	4.4	9.1	15	21	5.9	6.2	9	13	NELDER (Han) [16]
NELDER (Doe)	**2**	**2.4**	7.2	16	40	76	64	160	480	*11e-4/2e4*	NELDER (Doe) [5]
NEWUOA	**2.3**	**1**	**2**	9	20	42	29	69	*20e-4/8e3*	.	NEWUOA [31]
(1+1)-ES	4.4	8.1	11	21	44	99	130	390	940	1.9e4	(1+1)-ES [1]
POEMS	190	130	270	2e3	5100	*31e-1/1e5*	.	.	.	.	POEMS [20]
PSO	6	25	950	1.1e4	1.8e4	1.4e4	*44e-1/1e5*	.	.	.	PSO [7]
PSO_Bounds	5.2	98	2300	6800	1.8e4	1.4e4	*86e-1/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	25	*28e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.2	**2**	3.4	11	15	33	15	42	110	*31e-5/1e4*	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.2	5.2	8.7	10	9.2	8.4	**2.1**	**1.9**	**1.8**	**2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	13	7.7	4.9	16	20	17	9.4	14	14	20	VNS (Garcia) [11]

Table 86: 10-D, running time excess ERT/$\mathrm{ERT_{best}}$ on f_{14}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.1	0.1	3.69	9.83	13.3	20.5	39.2	50.5	68.7	430	$\mathrm{ERT_{best}}$/D
ALPS	**1**	**2.7**	19	50	74	76	85	320	1400	*28e-7/5e5*	ALPS [17]
AMaLGaM IDEA	**1**	3.1	4.7	9	13	12	8.5	8.4	7.5	**1.6**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	9.2	**1.7**	**1.3**	**1.3**	**1.2**	**1.1**	**2.2**	7.1	64	avg NEWUOA [31]
BayEDAcG	**1**	**2.5**	7.8	75	110	210	*11e-3/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1**	11	**1.6**	**1.6**	**1.6**	**1.4**	**1**	**1**	**1**	*11e-7/9e3*	BFGS [30]
Cauchy EDA	**1**	230	71	85	94	88	60	57	51	11	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	9.2	**2.6**	3.3	3.8	4.1	4.3	4.9	5.2	**1.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	4.9	**2**	**1.9**	**2.3**	**2.4**	**2.5**	3.7	4.4	**1.1**	(1+1)-CMA-ES [2]
DASA	**1**	27	14	13	14	15	80	600	3600	*18e-7/1e6*	DASA [19]
DEPSO	**1.1**	**2.5**	6.6	9.5	15	21	33	*35e-5/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	11	50	110	500	*23e-4/1e4*	.	.	DIRECT [25]
EDA-PSO	**1**	4	4.2	130	240	250	170	190	1100	*68e-7/1e5*	EDA-PSO [6]
full NEWUOA	**1**	7	3.1	**1.8**	**2**	**1.7**	**1.4**	**2.8**	12	*37e-8/1e4*	full NEWUOA [31]
G3-PCX	**1**	**2.5**	3.9	**2.8**	**3**	3.1	**2.9**	5.5	16	120	G3-PCX [26]
simple GA	**1**	3.2	18	250	370	400	4200	*13e-4/1e5*	.	.	simple GA [22]
GLOBAL	**1.1**	3.1	8	3.7	3.1	**2.3**	**1.4**	**1.3**	**1.1**	*23e-7/300*	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	3.4	**2.2**	5	7.2	7	5	5.1	4.5	**1**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	45	7.5	5.5	5.6	8.1	52	*30e-5/1e4*	.	.	LSfminbnd [28]
LSstep	**1**	560	150	120	110	170	*29e-4/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**2.7**	4.4	8.3	12	13	13	15	16	3.6	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.1**	**2.4**	**2.9**	**2.8**	**2.8**	6.9	*32e-6/4e3*	.	MCS (Neum) [18]
NELDER (Han)	**1**	3.7	**1.2**	**2.1**	**2.9**	**2.9**	**2.6**	3.2	**4.2**	8.8	NELDER (Han) [16]
NELDER (Doe)	**1**	4.9	**1.1**	**2.4**	**2.8**	3.5	3.7	4.5	6.3	43	NELDER (Doe) [5]
NEWUOA	**1**	7.2	**1**	**1**	**1**	**1**	**1**	**2.3**	7.3	570	NEWUOA [31]
(1+1)-ES	**1**	6.8	**2.2**	**2**	**2.2**	**2.3**	4.6	44	580	*82e-8/1e6*	(1+1)-ES [1]
POEMS	110	970	68	50	110	140	120	170	3e3	*12e-6/1e5*	POEMS [20]
PSO	**1.1**	**2.9**	3.2	8.6	17	22	28	140	2100	*83e-7/1e5*	PSO [7]
PSO_Bounds	**1**	3.2	3.7	29	93	180	230	560	*13e-6/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	**2.5**	17	*15e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	25	**2.1**	**1.3**	**1.4**	**1.7**	6.3	46	190	*96e-7/1e4*	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	4.4	3	3.2	3.7	3.9	5.2	9	8.9	**2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	3	7.6	5.3	5.6	5.5	6.1	7.6	7.4	**1.8**	VNS (Garcia) [11]

Table 87: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	18.6	477	3920	7360	7470	7580	7670	7780	7980	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1.9**	12	15	*30e-1/5e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1.9**	**2.5**	**1**	**3.5**	**3.7**	**3.7**	**3.7**	**3.7**	**3.7**	**3.6**	AMaLGaM IDEA [4]
avg NEWUOA	5.5	4.3	230	*25e+0/7e3*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1.8**	7.6	*28e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	59	110	*70e+0/4e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	80	22	*16e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1.9**	**1**	**1**	**1.7**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.2**	**2.9**	150	*18e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	29	270	2.9e4	*19e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1.6**	3.4	*37e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.2**	84	*17e+0/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.5**	23	7	170	190	190	190	180	180	180	EDA-PSO [6]
full NEWUOA	5.4	**2.6**	300	*21e+0/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.7**	100	1500	*24e+0/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1.7**	56	27	*41e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1.4**	13	*67e+0/900*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.7**	**1.6**	**2.6**	9.4	10	10	10	10	10	9.9	iAMaLGaM IDEA [4]
LSfminbnd	14	14	*29e+0/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	450	310	*74e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.8**	**2.3**	3.6	23	98	96	95	94	92	90	MA-LS-Chain [21]
MCS (Neum)	**1**	**1.7**	*24e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	3.3	8.1	240	*99e-1/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**2.9**	3.7	47	*90e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	5.1	4.5	170	*22e+0/6e3*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	5.4	17	2100	*99e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	240	19	320	*11e+0/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1.6**	**2.1**	840	*23e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.7**	5.7	360	*11e+0/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1.3**	1e3	*68e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	13	710	*89e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.3**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.6**	**1.8**	6.5	4300	6200	6100	6e3	5900	5900	7700	VNS (Garcia) [11]

Table 88: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.1	42.5	703	1580	4570	5120	6510	6580	7160	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.5**	8.2	3	56	470	*23e-3/5e5*	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.4**	8.5	4.9	5.8	**4.5**	**5.1**	**4.2**	**4.2**	**3.9**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.5**	3.3	41	*13e-1/1e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.3**	41	*95e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	190	*18e+0/1e4*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	4.3	400	*76e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.1**	3	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.3**	5.4	49	*12e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1.7**	190	3e3	*11e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	170	*11e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.2**	**2.5**	**1.6**	**2.4**	9.9	*21e-3/1e4*	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.5**	55	130	190	95	130	100	100	95	EDA-PSO [6]
full NEWUOA	**1**	**1.1**	3.6	16	90	*99e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.3**	4.7	69	*75e-2/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.5**	28	130	910	*91e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.3**	**1**	**1.7**	*11e-1/800*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	3.3	**1.8**	6.5	8.2	9.8	8.6	8.6	8	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.4**	7.9	*28e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**2.1**	51	*47e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**2**	16	460	*30e-2/5e4*	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**2.4**	17	86	*33e-1/4e3*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1.5**	17	100	*75e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.3**	**1.4**	23	*69e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**2.3**	4.7	*25e-1/9e3*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	65	3700	*12e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	12	4.4	58	61	79	62	62	92	POEMS [20]
PSO	**1**	**1.4**	5.2	130	*92e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.5**	42	140	260	*89e-2/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.6**	43	*31e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.9**	770	*12e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.5**	**2.9**	**1.2**	**1.6**	**1.2**	**1.3**	**1.3**	**1.3**	**1.2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.4**	4.1	3.7	28	37	180	370	670	1600	VNS (Garcia) [11]

Table 89: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.1	2.64	42.9	220	633	985	1530	2020	2650	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.2**	3.5	18	19	130	1100	*14e-4/5e5*	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**2.8**	3.8	**1.5**	**1.7**	**2.3**	**3.2**	**4.1**	**4**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.1**	**2.2**	990	*10e-1/3e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.3**	4	11	6.4	7.3	*18e-3/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1**	79	53	*36e-1/8e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	56	67	35	27	12	9.4	6.9	6.2	6.6	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.4**	**1.6**	**1.1**	**1.7**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	3.9	14	620	*15e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	110	2e4	*83e-2/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.5**	5.5	6.7	4.9	15	*28e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.3**	3.7	7.2	23	*44e-4/1e4*	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.1**	**2.4**	44	22	13	11	9.4	8.8	9.4	EDA-PSO [6]
full NEWUOA	**1**	**2.1**	3.1	290	*95e-2/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.2**	**3**	5400	*15e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.5**	4.8	77	45	210	1500	*11e-3/1e5*	.	.	simple GA [22]
GLOBAL	**1**	**1.2**	3.9	*27e-1/2e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	**1.8**	3.3	**2.2**	3.6	5	8.6	12	iAMaLGaM IDEA [4]
LSfminbnd	**1**	4.1	35	*26e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	110	960	*73e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**2.8**	5	8.9	15	21	21	26	53	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	1400	*18e-1/4e3*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**2.4**	19	4200	6600	*11e-1/1e5*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	**1.2**	450	*77e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	**1.4**	2100	*14e-1/2e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.9**	3500	*32e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	290	91	23	15	33	58	63	140	250	POEMS [20]
PSO	**1**	**1.3**	**1.6**	5	230	1e3	*52e-3/1e5*	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.2**	**1.5**	29	320	1e3	1400	*71e-3/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	3.2	*21e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	1.5e4	8300	*12e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1.6**	**1**	**1.1**	**1.3**	**1.3**	**1**	**1**	**1.1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	5.7	**1.4**	**1**	**2.2**	7.7	28	330	*39e-8/7e6*	VNS (Garcia) [11]

Table 90: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.193	23.8	83.6	701	1590	2750	3160	3720	4270	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	3.2	13	20	60	4700	*19e-3/5e5*	.	.	.	ALPS [17]
AMaLGaM IDEA	**1.2**	**1.8**	**2.9**	**2.8**	**1.4**	**1.5**	**2.2**	**2.3**	**2.7**	**2.4**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	10	73	*32e-1/9e4*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**2.3**	8.8	13	6.4	19	*17e-2/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1.7**	160	5e3	*16e+0/8e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	110	31	24	5.2	3.6	**2.8**	**3**	3.1	4.1	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	3.1	**1**	**1**	**1**	**1**	**1.2**	**1.1**	**1.1**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	4	110	*40e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1.4**	17	1400	8.1e4	*19e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	4.4	4.3	10	13	*19e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.3**	8.1	4.2	28	*38e-3/1e4*	.	.	.	DIRECT [25]
EDA-PSO	**1**	**2.1**	28	42	9.2	6	7.5	21	79	*43e-6/1e5*	EDA-PSO [6]
full NEWUOA	**1.1**	13	120	1700	*39e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	**1.6**	800	*51e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	57	85	120	*88e-3/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.9**	84	*90e-1/2e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**2.1**	**1.6**	3.3	**1.4**	**2.9**	3.1	4.8	6.5	9.1	iAMaLGaM IDEA [4]
LSfminbnd	**1**	15	210	*66e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	230	*19e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	3.4	**2.5**	6.1	12	49	260	*13e-3/5e4*	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	57	*51e-1/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	3.5	510	8400	*32e-1/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.1**	**2.8**	72	3500	*34e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.1**	99	560	*51e-1/4e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**2**	10	2.8e5	*14e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**2.1**	530	19	28	42	130	240	450	*24e-3/1e5*	.	POEMS [20]
PSO	**1**	**1.7**	3.5	2400	2e3	*11e-1/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	**1.1**	**2.5**	10	140	580	880	*38e-2/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.4**	3300	*72e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	8700	*40e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	3.3	4.4	**2.8**	**1.2**	**1.1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**2.7**	**1.7**	**1.1**	**1.8**	22	93	1500	*85e-6/6e6*	.	VNS (Garcia) [11]

Table 91: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.1	0.1	0.1	1060	98400	1.37e5	1.37e5	1.38e5	1.39e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	410	7.7e4	550	*74e-3/5e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	160	**7300**	83	**7.7**	**8.8**	**8.7**	**8.7**	**8.6**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	48	7.1e5	*83e-2/1e5*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.3**	210	*20e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1.7**	1.9e4	*51e-1/8e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	6.8	1400	3.4e6	*14e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	52	9400	**9.8**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	63	8.7e4	*55e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1.1**	7100	1.5e7	*13e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	210	*29e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**16**	*11e-2/1e4*	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.1**	130	3.7e5	1300	*73e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.4**	150	1.4e5	*11e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	3.6e4	1.5e6	*16e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	1e3	1.7e5	290	*14e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.2**	370	1.2e5	*15e-1/2e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	78	2.5e5	370	**73**	**110**	**110**	**110**	**110**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	3.1	200	1.4e6	*18e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	55	2700	*17e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	120	8600	87	*13e-2/5e4*	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	*16e-3/4e3*	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	28	2.8e4	*24e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**24**	1.2e4	*26e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**2.1**	27	3.2e5	*63e-2/1e5*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.5**	6500	2.8e7	*18e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	380	2500	2.1e5	1400	*57e-2/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1.3**	110	3.7e5	*51e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.1**	120	9.2e5	*57e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	500	*31e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.5**	6.5e5	*24e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	54	1.6e4	17	*10e-2/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.4**	220	3.1e4	1900	*60e-3/5e6*	.	.	.	.	VNS (Garcia) [11]

Table 92: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.58	3	3.19	1540	55000	56700	57300	57600	58100	58900	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	31	52	61	**1.5**	10	9.7	9.6	9.6	9.6	9.7	ALPS [17]
AMaLGaM IDEA	8.1	9.6	11	18	270	260	260	260	260	250	AMaLGaM IDEA [4]
avg NEWUOA	**1.5**	**1.3**	**1.2**	37	*12e-1/8e3*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	16	22	30	*27e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.6**	**1.9**	**2.4**	**1.1**	*65e-2/1e4*	.	.	.	.	.	BFGS [30]
Cauchy EDA	110	140	140	*21e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	4.4	5.1	5.5	3.6	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.9**	3.2	3.3	3.3	*83e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	27	29	30	**1.9**	270	260	260	260	250	250	DASA [19]
DEPSO	11	14	15	**1.1**	*68e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	7.2	17	16	*14e-1/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	15	44	92	7.8	3.8	3.7	3.7	**3.7**	**3.7**	**3.7**	EDA-PSO [6]
full NEWUOA	**2.6**	**2.2**	**2.1**	10	*10e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	5.8	6	6.1	12	*85e-2/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	130	310	360	3.2	**1.8**	**2**	**2.6**	25	*18e-4/1e5*	.	simple GA [22]
GLOBAL	12	11	11	**2.6**	*11e-1/1e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	4.8	5.8	6.2	38	*24e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	9.6	11	13	3.5	*81e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	200	250	300	8.3	*98e-2/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.4	8.5	9.3	**2.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	MA-LS-Chain [21]
MCS (Neum)	4.8	4.6	4.4	**1**	*77e-2/4e3*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1.5**	**1.9**	**2.3**	16	*75e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.7**	**2.1**	**2.3**	5.7	*81e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1.9**	*69e-2/1e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**2.7**	3	3.1	7.2	*47e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	95	95	97	**1.1**	12	12	12	12	12	12	POEMS [20]
PSO	6.8	8.9	10	**1.5**	*57e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	9.4	29	38	**2**	5.1	7.1	7.1	7.1	7	7.4	PSO_Bounds [8]
Monte Carlo	210	2400	8200	*29e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	3	3.1	3.1	**1.7**	*67e-2/1e4*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.4	4.6	4.8	3.1	*55e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	11	11	11	**1.2**	52	50	50	49	49	51	VNS (Garcia) [11]

Table 93: 10-D, running time excess ERT/$\mathrm{ERT_{best}}$ on f_{21}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.1	0.1	13	224	439	449	462	486	507	1130	$\mathrm{ERT_{best}}$/D
ALPS	**1**	**1**	21	**4.5**	5	5.8	6.6	7.3	8	4.6	ALPS [17]
AMaLGaM IDEA	**1**	**1**	27	140	120	120	110	110	100	48	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	3.2	8.2	4.7	4.7	4.5	4.3	4.1	**1.9**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	48	27	32	*19e-1/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	4.6	**2.9**	**2.8**	**2.7**	**2.7**	**2.6**	**2.5**	**2**	BFGS [30]
Cauchy EDA	**1**	**1**	79	340	320	310	300	290	280	120	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	5.9	28	16	15	15	14	14	6.3	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	9.7	6.1	5.1	5	4.9	4.6	4.5	**2**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	170	500	430	420	410	390	370	170	DASA [19]
DEPSO	**1**	**1**	11	26	19	19	18	18	17	7.8	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	7.5	17	36	35	33	34	17	DIRECT [25]
EDA-PSO	**1**	**1**	53	1200	920	900	870	830	800	360	EDA-PSO [6]
full NEWUOA	**1**	**1**	4.4	7.3	4.4	4.3	4.2	4	3.8	**1.7**	full NEWUOA [31]
G3-PCX	**1**	**1**	5	13	9	8.8	8.6	8.2	7.8	3.5	G3-PCX [26]
simple GA	**1**	**1**	91	85	95	97	130	120	120	260	simple GA [22]
GLOBAL	**1**	**1**	3.6	**1**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	3.2	49	44	44	43	41	40	18	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	99	100	170	160	160	150	140	65	LSfminbnd [28]
LSstep	**1**	**1**	690	630	330	320	320	300	290	*91e-1/1e4*	LSstep [28]
MA-LS-Chain	**1**	**1**	7.5	66	43	42	41	39	38	17	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	20	10	10	10	9.5	9.1	4.9	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	20	16	16	16	15	14	14	6.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	8.4	6	**3.7**	**3.6**	**3.5**	**3.4**	**3.3**	**1.6**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.1**	7.4	4.8	4.7	4.6	4.4	4.2	**1.9**	NEWUOA [31]
(1+1)-ES	**1**	**1**	9.8	20	18	18	17	17	16	7.1	(1+1)-ES [1]
POEMS	**1**	**1**	290	1800	1500	1500	1400	1300	1300	580	POEMS [20]
PSO	**1**	**1**	1200	510	340	330	330	310	300	130	PSO [7]
PSO_Bounds	**1**	**1**	560	1200	1500	1500	1400	1300	1300	580	PSO_Bounds [8]
Monte Carlo	**1**	**1**	570	6.3e4	*20e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	16	18	12	12	12	11	11	4.8	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	5.9	14	10	10	9.9	9.5	9.1	4.1	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	10	22	30	46	66	68	68	32	VNS (Garcia) [11]

Table 94: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{22}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.1	9.79	284	635	662	680	692	830	1040	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	33	7	12	15	18	24	24	27	ALPS [17]
AMaLGaM IDEA	**1**	**1**	8.8	490	4900	4700	4600	4500	3800	3e3	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	3.6	**2.6**	**2.1**	**2.1**	**2**	**2**	**1.7**	**1.4**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	62	31	*20e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	6.6	3.1	4.4	4.2	4.2	4.1	3.5	5.7	BFGS [30]
Cauchy EDA	**1**	**1**	450	360	*20e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	29	58	200	190	190	180	150	120	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	9.3	3.7	3.4	3.3	3.2	3.2	**2.7**	**2.2**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	320	220	190	190	190	190	160	140	DASA [19]
DEPSO	**1**	**1**	66	47	*51e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**3.5**	5.1	*69e-2/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	1600	980	*20e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	3.6	**1.1**	**1.9**	**1.8**	**1.8**	**1.8**	**1.5**	**1.3**	full NEWUOA [31]
G3-PCX	**1**	**1**	9.3	5.6	5.6	5.5	5.4	5.3	4.5	3.7	G3-PCX [26]
simple GA	**1**	**1**	130	720	*20e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	4.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	24	170	1200	1200	1100	1100	930	750	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	170	26	48	47	48	49	42	72	LSfminbnd [28]
LSstep	**1**	**1**	330	89	230	*20e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	55	510	540	520	500	490	410	330	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.1**	3.2	6.4	6.1	6	5.9	4.9	12	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1**	7.4	10	9.6	9.4	9.3	7.8	6.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	18	**2.5**	5	4.9	4.9	4.8	4	3.3	NELDER (Doe) [5]
NEWUOA	**1**	**1**	6.7	**1.8**	**2.5**	**2.4**	**2.4**	**2.4**	**2**	**1.7**	NEWUOA [31]
(1+1)-ES	**1**	**1**	47	17	13	13	13	13	11	8.9	(1+1)-ES [1]
POEMS	**1**	**1**	4400	1400	1e3	990	960	940	790	640	POEMS [20]
PSO	**1**	**1**	3700	1400	2200	2100	2100	2e3	1700	1400	PSO [7]
PSO_Bounds	**1**	**1**	740	1400	2200	2100	2100	2100	1700	1400	PSO_Bounds [8]
Monte Carlo	**1**	**1**	2500	*20e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	35	5	5.4	5.3	5.3	5.4	4.7	4.1	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	22	61	220	210	210	200	170	140	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	39	160	1100	1400	1500	1500	1200	980	VNS (Garcia) [11]

Table 95: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	0.1	0.28	91.5	1640	18400	20400	20600	20900	21400	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.7**	42	1e3	*14e-2/5e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.6**	10	**1**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	11	**2.6**	*21e-2/1e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.3**	*16e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	17	130	*11e-1/5e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	**2.3**	1700	*11e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	**2**	21	**2.7**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	3.4	**2.9**	*22e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	5	28	4300	*15e-2/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**1.7**	*18e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.1**	**2.1**	*65e-2/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	**1.7**	590	*87e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	13	**2.9**	44	*19e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.8**	4.9	98	*19e-2/4e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.4**	390	*85e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**2.1**	**1**	*32e-2/700*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.8**	5.7	**3.6**	**1.1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**2.1**	26	*66e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	**1.2**	31	*51e-2/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**2**	**2.3**	17	38	35	*44e-3/5e4*	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	3.4	15	*56e-2/4e3*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**1**	5.7	40	80	*59e-3/1e5*	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.7**	**1.4**	11	*97e-3/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	7.5	3.6	*34e-2/7e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	4.4	7.6	2900	*14e-2/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	15	31	19	36	69	*63e-3/1e5*	.	.	POEMS [20]
PSO	**1**	**1**	**1.7**	91	*42e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	**1.5**	130	*67e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.6**	530	*61e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**2.1**	**2.2**	*32e-2/5e3*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**2.4**	17	12	*11e-2/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**2.6**	18	34	140	420	680	670	650	VNS (Garcia) [11]

Table 96: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.1	6.64	9880	1.04e5	7.47e6	7.48e6	7.48e6	7.48e6	7.48e6	7.48e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	24	10	*44e-1/5e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	5.5	18	**8.3**	***78e-2/1e6***	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.4**	*21e+0/8e3*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	19	*37e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	350	*81e+0/4e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	51	*27e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.2**	**2.7**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	8.6	14	*20e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	1300	*31e+0/1e6*	.	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	6.8	*38e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	5.9	*19e+0/1e4*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	56	*23e+0/1e5*	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**2.6**	*16e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	16	*31e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	120	*14e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	7.2	*62e+0/1e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	4.2	4.2	**4.2**	***66e-2/1e6***	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	**1**	20	*33e+0/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3	170	*49e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	5.7	*11e+0/5e4*	.	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	15	*30e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	8.2	22	*11e+0/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	4.7	**2.6**	*96e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	*26e+0/7e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	140	740	*17e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	48	140	*19e+0/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1**	8.1	140	*20e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	22	140	*22e+0/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	820	*60e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	1e4	*12e+1/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**2.2**	**1**	*91e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	4.8	3.7	*21e-1/8e6*	.	.	.	.	.	.	VNS (Garcia) [11]

Table 97: 20-D, running time excess ERT/ERT_{best} on f_1, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.05	0.28	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	ERT_{best}/D
ALPS	**1**	64	150	320	520	710	920	1100	1400	1800	ALPS [17]
AMaLGaM IDEA	**1**	58	55	130	200	260	320	390	440	550	AMaLGaM IDEA [4]
avg NEWUOA	**1**	18	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	avg NEWUOA [31]
BayEDAcG	**1**	49	110	200	310	410	500	610	710	1e3	BayEDAcG [10]
BFGS	**1**	**7.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BFGS [30]
Cauchy EDA	**1**	840	730	1600	2500	3500	4300	5200	6100	7800	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	9.2	7.9	14	20	26	33	39	45	57	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	12	5.4	9.2	13	17	21	25	29	37	(1+1)-CMA-ES [2]
DASA	**1**	60	26	45	66	86	120	150	200	300	DASA [19]
DEPSO	**1**	31	30	81	190	330	560	810	1400	*44e-7/2e3*	DEPSO [12]
DIRECT	**1**	8.6	48	110	220	360	490	680	870	1400	DIRECT [25]
EDA-PSO	**1**	19	450	1100	1700	2300	2900	3600	4200	5400	EDA-PSO [6]
full NEWUOA	**1**	41	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	full NEWUOA [31]
G3-PCX	**1**	31	8	13	18	23	27	32	37	48	G3-PCX [26]
simple GA	**1**	130	880	1900	3200	1.2e4	3.1e4	2e5	6.7e5	*74e-5/1e5*	simple GA [22]
GLOBAL	**1**	37	8	8	8	8	8	8	8	8	GLOBAL [23]
iAMaLGaM IDEA	**1**	13	27	57	88	120	150	180	210	270	iAMaLGaM IDEA [4]
LSfminbnd	**1**	43	9.3	10	10	10	10	10	10	10	LSfminbnd [28]
LSstep	**1**	850	160	170	180	180	180	180	180	180	LSstep [28]
MA-LS-Chain	**1**	19	21	51	78	100	120	140	160	200	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**2.4**	6.4	6.8	7	7	7	7	7	MCS (Neum) [18]
NELDER (Han)	**1**	9.1	5.2	12	19	27	32	36	40	49	NELDER (Han) [16]
NELDER (Doe)	**1**	**6.8**	3.3	6.7	11	16	21	27	32	40	NELDER (Doe) [5]
NEWUOA	**1**	7.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	11	4.9	8.1	11	15	18	22	25	31	(1+1)-ES [1]
POEMS	**1**	830	180	400	870	1400	1800	2300	2800	3800	POEMS [20]
PSO	**1**	16	22	3400	3400	3500	3600	3600	3700	3800	PSO [7]
PSO_Bounds	**1**	19	120	1500	2100	2800	3300	3800	4500	1.6e4	PSO_Bounds [8]
Monte Carlo	**1**	170	*29e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	19	3.8	5.8	7.2	9.1	11	12	14	17	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	13	7.1	12	18	23	29	34	39	50	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	28	10	17	23	29	36	41	48	60	VNS (Garcia) [11]

Table 98: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	18.6	19	19.2	19.3	19.3	19.4	19.5	19.5	19.6	19.7	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	45	66	88	110	140	160	190	220	260	370	ALPS [17]
AMaLGaM IDEA	22	29	35	43	50	56	62	68	76	88	AMaLGaM IDEA [4]
avg NEWUOA	3.5	10	21	43	63	89	120	140	160	200	avg NEWUOA [31]
BayEDAcG	31	42	54	64	76	94	100	*34e-5/2e3*	.	.	BayEDAcG [10]
BFGS	9.1	15	20	24	26	27	27	27	28	28	BFGS [30]
Cauchy EDA	190	310	410	510	610	710	800	900	990	1200	Cauchy EDA [24]
BIPOP-CMA-ES	15	26	35	40	44	45	47	47	48	50	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	14	22	30	37	39	41	41	42	43	44	(1+1)-CMA-ES [2]
DASA	5.6	7.8	10	14	18	23	28	34	39	49	DASA [19]
DEPSO	12	23	42	66	110	500	*39e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	38	53	130	470	490	510	540	1200	*14e-1/5e3*	.	DIRECT [25]
EDA-PSO	200	270	330	400	470	540	600	670	740	880	EDA-PSO [6]
full NEWUOA	23	94	450	3800	*47e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	15	47	130	210	320	420	550	650	760	990	G3-PCX [26]
simple GA	300	460	3200	6800	7.3e4	*29e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	8.4	13	18	23	26	30	33	49	51	63	GLOBAL [23]
iAMaLGaM IDEA	11	17	22	27	30	33	36	40	43	49	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	17	17	17	17	17	17	17	17	17	17	LSstep [28]
MA-LS-Chain	7.6	11	15	19	23	27	32	36	43	76	MA-LS-Chain [21]
MCS (Neum)	**1**	**2.2**	**5.4**	14	21	41	43	45	45	*30e-8/4e3*	MCS (Neum) [18]
NELDER (Han)	4.3	6	7	**7.8**	**8.6**	**9.2**	**9.7**	**10**	**11**	**12**	NELDER (Han) [16]
NELDER (Doe)	5.3	8.5	13	17	19	23	28	32	36	48	NELDER (Doe) [5]
NEWUOA	**1.9**	6.8	18	42	71	92	130	150	170	220	NEWUOA [31]
(1+1)-ES	270	1800	6900	1.6e4	2.6e4	3.8e4	7.4e4	1.8e5	3.7e5	*59e-5/1e6*	(1+1)-ES [1]
POEMS	150	190	250	300	340	410	450	500	560	660	POEMS [20]
PSO	16	1900	4600	4600	4600	4600	4500	4500	4500	4500	PSO [7]
PSO_Bounds	120	230	360	530	840	1400	1800	2100	2300	2600	PSO_Bounds [8]
Monte Carlo	*12e+4/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.2**	**1.4**	**1.6**	**5.8**	18	29	66	73	73	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.8	6.2	7.5	8.3	9.1	**9.7**	**10**	**11**	**11**	**13**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	35	57	72	82	88	95	97	98	98	99	VNS (Garcia) [11]

Table 99: 20-D, running time excess ERT/ERT_{best} on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.05	12.7	253	381	382	382	382	382	382	383	ERT_{best}/D
ALPS	19	54	50	190	230	240	270	310	400	3200	ALPS [17]
AMaLGaM IDEA	17	43	27	*40e-1/1e6*	.	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	88	1e3	*97e+0/1e4*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**15**	85	*73e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	570	*28e+1/6e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	2900	450	*69e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	25	6.7	12	*40e-1/3e5*	.	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	37	840	*92e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	210	5.9	**1**	**8.3**	**35**	**35**	**35**	**35**	**36**	**36**	DASA [19]
DEPSO	42	130	*84e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	28	*43e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	22	150	44	*70e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	180	650	*88e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	24	1.2e4	*13e+1/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	26	190	29	3700	*21e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	19	1400	*15e+1/2e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	24	19	38	1.8e4	*20e-1/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	190	**1.3**	*19e+0/6e3*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	4e3	27	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	20	12	**7**	95	160	160	160	160	160	**160**	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	28	*13e+0/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	42	260	*81e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	24	71	*47e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	41	7500	*13e+1/6e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	360	2.3e4	*81e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	4e3	43	9.6	**69**	**140**	**140**	**150**	**150**	**150**	160	POEMS [20]
PSO	19	21	*21e+0/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	28	330	120	190	360	360	360	380	400	430	PSO_Bounds [8]
Monte Carlo	32	*26e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	560	*23e+1/7e3*	.	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	28	**5.2**	10	*60e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	20	8.1	8.3	340	490	520	560	620	630	630	VNS (Garcia) [11]

Table 100: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_4, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	37.3	236	381	383	384	385	386	388	7050	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	92	29	150	9800	*30e-1/2e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	79	20	*14e+0/1e6*	.	.	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	110	1400	*12e+1/2e4*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	83	40	*69e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	1700	*40e+1/8e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	5100	4300	*11e+1/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	37	**2.4**	*12e+0/3e5*	.	.	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	46	*14e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	290	**2.1**	**1**	**130**	1700	1700	1700	1700	1700	91	DASA [19]
DEPSO	120	120	*10e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	11	*88e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**20**	56	6e3	*15e+0/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	270	4e3	*13e+1/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	79	*19e+1/5e4*	.	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	100	80	65	3800	*34e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	160	*20e+1/4e3*	.	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	61	7.1	*13e+0/1e6*	.	.	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	280	**1.2**	*49e+0/7e3*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	4400	9.5	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	60	6.2	53	*30e-1/1e5*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	*21e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	40	*13e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	35	1600	*11e+1/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	55	4300	*17e+1/1e4*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	82	3.8e5	*13e+1/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	4e3	18	**13**	**140**	**220**	**240**	**250**	**250**	**250**	**14**	POEMS [20]
PSO	44	8.6	5900	*23e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	66	130	190	290	**300**	**360**	**360**	**370**	**380**	**21**	PSO_Bounds [8]
Monte Carlo	130	*33e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	650	*20e+1/8e3*	.	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	55	**2.5**	*14e+0/1e4*	.	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	110	3.2	27	2.8e4	1.3e5	1.3e5	*20e-1/4e6*	.	.	.	VNS (Garcia) [11]

Table 101: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	1.83	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	51	160	210	250	280	300	310	320	330	ALPS [17]
AMaLGaM IDEA	**1**	34	75	80	80	80	80	80	80	80	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**2.7**	**2.7**	3.2	3.3	3.3	3.3	3.3	3.3	3.3	avg NEWUOA [31]
BayEDAcG	**1**	67	150	200	200	200	210	210	210	210	BayEDAcG [10]
BFGS	**1**	**1.4**	**2.4**	**2.7**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	BFGS [30]
Cauchy EDA	**1**	110	160	170	170	170	170	170	170	170	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**2.7**	5.1	6.2	6.3	6.3	6.3	6.3	6.3	6.3	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.6**	3.1	3.6	3.7	3.7	3.7	3.7	3.7	3.7	(1+1)-CMA-ES [2]
DASA	**1**	14	24	29	34	38	43	47	52	64	DASA [19]
DEPSO	**1**	16	39	46	48	48	48	48	48	48	DEPSO [12]
DIRECT	**1**	62	180	220	230	230	230	230	230	230	DIRECT [25]
EDA-PSO	**1**	5.2	27	34	37	39	39	39	39	39	EDA-PSO [6]
full NEWUOA	**1**	6.4	6.2	6.5	6.6	6.6	6.6	6.6	6.6	6.6	full NEWUOA [31]
G3-PCX	**1**	7.5	19	25	26	27	27	27	27	27	G3-PCX [26]
simple GA	**1**	570	2200	4600	7500	1.1e4	1.4e4	1.8e4	2.2e4	2.3e5	simple GA [22]
GLOBAL	**1**	9.5	9.9	11	11	11	11	11	11	11	GLOBAL [23]
iAMaLGaM IDEA	**1**	4.4	9.8	11	11	11	11	11	11	11	iAMaLGaM IDEA [4]
LSfminbnd	**1**	14	16	16	16	16	16	16	16	16	LSfminbnd [28]
LSstep	**1**	150	180	190	190	190	190	190	190	190	LSstep [28]
MA-LS-Chain	**1**	22	41	44	46	46	46	46	46	46	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS (Neum) [18]
NELDER (Han)	**1**	3.8	7.4	8.8	9.2	9.2	9.2	9.2	9.2	9.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.6**	5.2	6.2	6.3	6.4	6.4	6.4	6.4	6.4	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	**1.2**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	3.1	3.5	3.6	3.6	3.6	3.6	3.6	3.6	(1+1)-ES [1]
POEMS	**1**	180	260	310	330	350	350	350	350	350	POEMS [20]
PSO	**1**	4.7	4.3e4	4.3e4	4.3e4	4.3e4	4.3e4	4.3e4	4.3e4	4.3e4	PSO [7]
PSO_Bounds	**1**	4.5	160	160	160	160	160	160	160	160	PSO_Bounds [8]
Monte Carlo	**1**	2.5e6	*11e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.8	4.2	4.3	4.3	4.3	4.3	4.3	4.3	4.3	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**2.9**	6.2	7.3	7.7	7.7	7.7	7.7	7.7	7.7	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	4.9	6.8	7.6	7.8	7.8	7.8	7.8	7.8	7.8	VNS (Garcia) [11]

Table 102: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_6, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.03	26	64.7	87.2	123	152	184	219	248	309	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	59	25	34	54	64	78	100	150	370	*14e-7/2e5*	ALPS [17]
AMaLGaM IDEA	26	22	19	22	21	22	22	21	22	22	AMaLGaM IDEA [4]
avg NEWUOA	**2.3**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	avg NEWUOA [31]
BayEDAcG	46	41	*60e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.2**	**2.7**	3.6	4.7	4.7	4.9	5	4.8	4.9	61	BFGS [30]
Cauchy EDA	6200	1500	1e3	1700	*17e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**2.9**	**2.2**	**1.5**	**1.7**	**1.6**	**1.6**	**1.6**	**1.5**	**1.6**	**1.6**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.9**	4.5	13	180	1200	*13e-1/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	12	6.8	9.9	19	25	33	49	58	63	74	DASA [19]
DEPSO	11	7.5	12	64	*13e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	18	31	*40e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	27	46	40	45	44	44	44	44	44	44	EDA-PSO [6]
full NEWUOA	5	**1.9**	**1.5**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	full NEWUOA [31]
G3-PCX	4.1	**1.4**	**1.4**	**2**	**2.1**	**2.1**	**2.2**	**2.2**	**2.3**	**2.4**	G3-PCX [26]
simple GA	320	130	2e3	*11e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5	**2.9**	3.6	4.9	8.5	*42e-3/2e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	5.1	5.6	5.4	6.8	7.1	7.7	7.8	7.7	8	8.3	iAMaLGaM IDEA [4]
LSfminbnd	9	31	160	760	1100	960	*72e-1/1e4*	.	.	.	LSfminbnd [28]
LSstep	140	260	2300	*59e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	4.9	7.5	8.9	8	7.7	7.2	6.7	6.5	6	MA-LS-Chain [21]
MCS (Neum)	**1.8**	33	*42e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**2.2**	**2.4**	**2.7**	3.3	3.2	3.5	3.5	3.5	4	7.4	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**2.3**	9.1	20	28	65	110	430	*46e-5/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1.3**	**1.4**	**1.5**	**1.6**	**1.6**	**1.7**	**1.7**	NEWUOA [31]
(1+1)-ES	**2**	**2.2**	**2.1**	**2.8**	3.9	5.2	6.1	6.5	6.4	6.7	(1+1)-ES [1]
POEMS	89	26	31	37	36	36	36	35	36	37	POEMS [20]
PSO	6.4	280	1100	1400	980	820	710	620	570	790	PSO [7]
PSO_Bounds	9.5	45	120	150	140	140	140	130	160	220	PSO_Bounds [8]
Monte Carlo	2.4e5	*48e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.1**	3.9	31	76	210	230	810	*21e-2/1e4*	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.2	**2.1**	**1.7**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**2**	**2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	5	**2.8**	**1.9**	**1.9**	**1.7**	**1.7**	**1.7**	**1.6**	**1.6**	**1.6**	VNS (Garcia) [11]

Table 103: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.53	7.59	67.5	214	475	826	826	826	826	848	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	5	26	30	850	930	*48e-2/2e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**3**	10	3.6	**2.1**	**1.3**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
avg NEWUOA	7.1	**1.4**	100	*51e-1/2e4*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	4.3	31	57	*11e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	69	*67e+1/100*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	130	130	44	29	18	14	14	14	14	14	Cauchy EDA [24]
BIPOP-CMA-ES	**2.5**	**2.8**	**1**	4.9	3.5	**2.2**	**2.2**	**2.2**	**2.2**	**2.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.6**	16	30	54	300	*92e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	16	49	1.8e4	*13e+0/4e5*	.	.	.	.	.	.	DASA [19]
DEPSO	**2.7**	7.9	18	*77e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	3.5	7	*15e+0/6e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.5**	65	26	950	*15e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	14	**1.9**	4.6	700	*27e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	4.7	**2.8**	760	*12e+0/1e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	5.8	180	77	*32e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	4.6	**2.9**	*22e+0/700*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2**	5.8	**1.7**	**1**	**1**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	iAMaLGaM IDEA [4]
LSfminbnd	23	21	1e3	*15e+0/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	230	180	2200	*29e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	3.4	5.4	4.3	120	360	390	390	390	390	380	MA-LS-Chain [21]
MCS (Neum)	**1**	57	*38e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	4.5	4.6	2200	*16e+0/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**2.5**	**1**	370	*97e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	3.6	43	*18e+0/2e4*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.1	1100	*27e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	440	55	21	2e3	3100	*12e-1/1e5*	.	.	.	.	POEMS [20]
PSO	**2.5**	4.8	430	*62e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	3.3	26	9700	*22e+0/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	3.2	2.1e5	*10e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	500	*38e+1/3e3*	.	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.4	**2.8**	**2.3**	**4**	**2.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1.1**	3.7	5.4	78	72	2400	2400	2400	2400	2300	VNS (Garcia) [11]

Table 104: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	5.52	21	97.9	187	202	207	211	215	219	222	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	70	51	100	460	600	740	1e3	1200	3100	*26e-6 /2e5*	ALPS [17]
AMaLGaM IDEA	25	16	20	18	19	20	20	21	21	22	AMaLGaM IDEA [4]
avg NEWUOA	**2**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	avg NEWUOA [31]
BayEDAcG	55	35	*48e+0 /2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.9**	**2**	**1.9**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	BFGS [30]
Cauchy EDA	360	200	200	180	210	250	260	290	360	550	Cauchy EDA [24]
BIPOP-CMA-ES	4	**2.4**	4.2	4.2	4.3	4.5	4.5	4.6	4.6	4.7	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.7**	**1.8**	3.9	6.5	6.6	6.6	6.6	6.7	6.6	6.7	(1+1)-CMA-ES [2]
DASA	15	26	34	57	120	200	280	350	420	550	DASA [19]
DEPSO	16	16	*17e+0 /2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	25	82	*64e+0 /5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	220	110	190	220	260	330	410	*17e-5 /1e5*	.	.	EDA-PSO [6]
full NEWUOA	3.4	**2.6**	**1.4**	**1.6**	**1.6**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	full NEWUOA [31]
G3-PCX	3.9	**2**	**2.7**	5.6	5.5	5.5	5.5	5.5	5.5	5.7	G3-PCX [26]
simple GA	480	250	*17e+0 /1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	4.1	**2.4**	**1.7**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	GLOBAL [23]
iAMaLGaM IDEA	13	6.4	8.6	9.2	9.5	9.8	10	10	10	11	iAMaLGaM IDEA [4]
LSfminbnd	7.1	17	9.6	120	710	720	*40e-1 /1e4*	.	.	.	LSfminbnd [28]
LSstep	150	71	25	130	220	350	*12e-1 /1e4*	.	.	.	LSstep [28]
MA-LS-Chain	12	10	14	13	13	13	14	13	13	14	MA-LS-Chain [21]
MCS (Neum)	**1.4**	**1.2**	**1.6**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	MCS (Neum) [18]
NELDER (Han)	3.2	**2.9**	3.4	3.9	4.1	4.5	4.9	5.1	5.3	5.6	NELDER (Han) [16]
NELDER (Doe)	3.2	**3**	**2.9**	4.9	5.5	6	6.5	7.2	7.7	9.2	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**2.5**	11	13	120	120	140	160	180	200	240	(1+1)-ES [1]
POEMS	100	84	590	7600	*74e-1 /1e5*	.	.	.	.	.	POEMS [20]
PSO	15	19	93	320	350	410	470	580	890	3300	PSO [7]
PSO_Bounds	88	160	540	450	1800	7200	*15e-2 /1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	*80e+2 /1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2**	**1.1**	4	25	28	35	42	55	62	670	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.5	**1.7**	5.6	5.6	5.7	5.7	5.8	5.8	5.8	5.8	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	6	3.1	6	6.3	6.3	6.4	6.4	6.4	6.4	6.4	VNS (Garcia) [11]

Table 105: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.05	17.8	85.8	155	164	169	173	176	180	186	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	4800	37	350	*48e-1/2e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	2e3	11	22	22	23	24	24	25	25	25	AMaLGaM IDEA [4]
avg NEWUOA	230	**1.5**	**1**	**1.2**	**1.2**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	avg NEWUOA [31]
BayEDAcG	4800	27	*18e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	210	**1.9**	**2.2**	**2.2**	**2.1**	**2.1**	**2**	**2**	**2**	**1.9**	BFGS [30]
Cauchy EDA	3.3e4	220	190	270	290	300	310	340	470	630	Cauchy EDA [24]
BIPOP-CMA-ES	390	**2.6**	4.7	5.7	6	6.1	6.1	6.1	6.1	6.1	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	260	**2.4**	4.5	6.7	7	7	7	7	7	6.9	(1+1)-CMA-ES [2]
DASA	2e3	77	210	1300	1500	1800	2100	2400	2700	3700	DASA [19]
DEPSO	1400	25	*18e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	4.7	*22e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	2.2e4	130	280	450	*14e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	460	**3**	**1.8**	**2.2**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	full NEWUOA [31]
G3-PCX	410	3.6	**2.9**	3.8	4	4.1	4.1	4.1	4.1	4.2	G3-PCX [26]
simple GA	4.4e4	270	*19e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	420	**2**	**1.7**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.5**	GLOBAL [23]
iAMaLGaM IDEA	1400	7.5	9.6	11	12	12	12	12	12	13	iAMaLGaM IDEA [4]
LSfminbnd	740	6.5	52	470	*32e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	1.5e4	130	*18e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	820	7.3	17	25	27	29	31	31	30	30	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1.3**	**1.5**	**1.6**	**1.6**	**1.7**	**1.7**	**1.6**	MCS (Neum) [18]
NELDER (Han)	200	**2.3**	3.6	6.6	7.2	7.8	8.4	8.6	8.8	8.9	NELDER (Han) [16]
NELDER (Doe)	150	**1.4**	3.3	6.1	6.6	7	7.5	7.9	8.4	9.4	NELDER (Doe) [5]
NEWUOA	**130**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	260	**2.2**	12	52	65	86	110	130	160	200	(1+1)-ES [1]
POEMS	1e4	74	2e3	*99e-1/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	1600	40	670	*75e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	8.2e4	650	700	9700	*20e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*68e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	190	**1.2**	8.4	31	37	49	63	850	*35e-5/1e4*	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	320	**2.2**	6.9	7	7.2	7.3	7.3	7.3	7.2	7.2	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	510	3.2	6.9	8.2	8.7	8.7	8.7	8.6	8.6	8.5	VNS (Garcia) [11]

Table 106: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	94	263	371	433	537	682	746	810	854	874	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	330	2500	*16e+1/2e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	3.9	**1.9**	**1.8**	**2**	**1.9**	**1.7**	**1.7**	**1.8**	**1.8**	**2.1**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**1.5**	**2.6**	3.1	3.1	3.6	3.9	4.2	5	avg NEWUOA [31]
BayEDAcG	*42e+3/2e3*	.	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.6**	**1**	**1**	**1**	**1**	**1.1**	**1.1**	**1.3**	3.1	*77e-8/5e4*	BFGS [30]
Cauchy EDA	36	21	20	22	20	19	20	21	21	25	Cauchy EDA [24]
BIPOP-CMA-ES	3.1	**1.9**	**1.9**	**1.8**	**1.6**	**1.3**	**1.2**	**1.1**	**1.1**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.5**	**1.7**	**1.7**	**1.7**	**1.4**	**1.2**	**1.1**	**1**	**1**	**1**	(1+1)-CMA-ES [2]
DASA	390	1200	3400	*72e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	*17e+3/2e3*	.	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	*94e+2/5e3*	.	.	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	480	*36e+1/1e5*	.	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	9.9	15	34	*67e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	3.1	3.4	6.5	10	12	13	15	16	18	23	G3-PCX [26]
simple GA	*15e+3/1e5*	.	.	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1.7**	**1**	**1**	**1.1**	**1.1**	**1.2**	**2**	**2.6**	5.9	*19e-6/2e3*	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**1.3**	**1.3**	**1.3**	**1.2**	**1**	**1**	**1**	**1**	**1.1**	iAMaLGaM IDEA [4]
LSfminbnd	290	*22e+2/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	*18e+3/1e4*	.	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	12	11	13	11	8.5	7.8	7.2	6.9	6.8	MA-LS-Chain [21]
MCS (Neum)	*72e+2/4e3*	.	.	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**2.9**	5.3	390	*30e+0/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**2.2**	4.2	30	*57e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.2**	**1.1**	**1.7**	**2.6**	3.3	3.3	4	4.3	4.7	5.8	NEWUOA [31]
(1+1)-ES	50	110	300	700	1e3	1e3	2200	3500	8700	*94e-5/1e6*	(1+1)-ES [1]
POEMS	5100	*12e+2/1e5*	.	.	.	.	.	.	.	.	POEMS [20]
PSO	1200	5600	*84e+1/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	650	*41e+1/1e5*	.	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*11e+4/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	27	140	*27e+1/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	7.2	3.8	3.1	**2.9**	**2.4**	**2**	**1.8**	**1.7**	**1.6**	**1.6**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	8.2	5.7	4.8	4.7	4.2	3.4	3.1	**2.9**	**2.8**	**2.7**	VNS (Garcia) [11]

Table 107: 20-D, running time excess ERT/ERT_{best} on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	1.35	24.1	50.1	111	314	429	488	554	614	742	ERT_{best}/D
ALPS	5	59	490	980	2200	*12e-2/2e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	7	**3.3**	5	3.7	**1.9**	**1.6**	**1.7**	**1.8**	**1.8**	**1.9**	AMaLGaM IDEA [4]
avg NEWUOA	6	11	15	11	5.7	5.1	5.6	5.5	5.8	6.1	avg NEWUOA [31]
BayEDAcG	4.9	250	*14e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.9**	**1**	**1**	**1**	**1.3**	**2.6**	150	*31e-4/1e4*	.	.	BFGS [30]
Cauchy EDA	100	71	64	44	22	20	22	24	25	26	Cauchy EDA [24]
BIPOP-CMA-ES	4.1	18	10	5.1	**1.9**	**1.5**	**1.4**	**1.3**	**1.2**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.4**	5.6	7	5.1	**2.4**	**2.3**	**2.4**	**2.4**	**2.3**	**2**	(1+1)-CMA-ES [2]
DASA	4.4	120	570	690	420	550	730	810	980	1500	DASA [19]
DEPSO	8.2	110	*95e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**2.1**	23	*76e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	4.3	74	1900	1.3e4	*79e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	5	40	57	45	21	18	36	88	*75e-5/1e4*	.	full NEWUOA [31]
G3-PCX	4	9.7	18	14	7	6.5	7.1	7.3	7.6	8	G3-PCX [26]
simple GA	4.2	120	2.9e4	*20e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5	**1.5**	**1.2**	**1**	**1**	**2.2**	*74e-4/1e3*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	4.4	5.2	**4.4**	**2.7**	**1.2**	**1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	**2**	*22e+1/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**2.4**	*29e+1/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**2.6**	30	63	35	14	12	11	10	9.3	7.8	MA-LS-Chain [21]
MCS (Neum)	**1**	53	*62e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	3.3	5.2	41	290	*16e-1/1e4*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	4.4	4.4	17	24	74	*75e-3/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.5**	15	15	13	5.8	5.6	6.1	6.2	6.6	6.5	NEWUOA [31]
(1+1)-ES	2100	1400	1600	1200	580	560	610	620	670	680	(1+1)-ES [1]
POEMS	130	52	440	410	190	190	980	*34e-4/1e5*	.	.	POEMS [20]
PSO	4.1	46	140	190	110	110	130	140	150	2e3	PSO [7]
PSO_Bounds	4.4	210	570	440	220	240	480	660	1200	*12e-4/1e5*	PSO_Bounds [8]
Monte Carlo	5.5	930	*67e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.9**	880	*11e+1/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.1	34	20	10	3.7	**2.8**	**2.5**	**2.3**	**2.1**	**1.8**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	44	23	12	6.2	**2.4**	**1.9**	**1.8**	**1.6**	**1.6**	**1.4**	VNS (Garcia) [11]

Table 108: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	25.4	29.6	52.1	96.9	137	158	207	321	620	691	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	80	90	87	240	840	3500	*33e-3/2e5*	.	.	.	ALPS [17]
AMaLGaM IDEA	28	29	19	12	13	16	15	12	7.6	8.4	AMaLGaM IDEA [4]
avg NEWUOA	**1.4**	**1.3**	11	15	18	24	24	20	12	21	avg NEWUOA [31]
BayEDAcG	55	60	42	77	*21e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.7**	**1.6**	**2.2**	**1.8**	45	BFGS [30]
Cauchy EDA	450	520	510	440	420	400	380	360	390	1100	Cauchy EDA [24]
BIPOP-CMA-ES	**3**	3	3	4	4.5	4.9	4.5	3.3	**1.9**	**2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.8**	3.1	7.7	9.6	9.9	9.6	8.3	6	3.4	3.6	(1+1)-CMA-ES [2]
DASA	13	16	2.2e4	2.8e4	4.7e4	8.9e4	6.8e4	4.4e4	2.3e4	*13e+0/1e6*	DASA [19]
DEPSO	39	48	68	*77e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	340	330	420	240	*25e+3/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	230	250	300	260	720	2600	6800	4400	2300	*57e-3/1e5*	EDA-PSO [6]
full NEWUOA	**2.3**	6.7	11	15	26	27	38	37	35	100	full NEWUOA [31]
G3-PCX	**2.4**	**2.5**	**2.7**	**2.8**	**3**	3.3	**2.9**	**2.1**	**1.2**	**1.3**	G3-PCX [26]
simple GA	7100	1.5e4	*14e+2/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1.1**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.1**	3.4	GLOBAL [23]
iAMaLGaM IDEA	12	13	8.7	6.6	7.2	8.1	7.8	6	3.6	3.9	iAMaLGaM IDEA [4]
LSfminbnd	**2.9**	3	97	410	*76e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	29	35	230	680	*16e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	12	7.4	9.8	130	140	150	97	51	47	MA-LS-Chain [21]
MCS (Neum)	**1.3**	**1.3**	**1.1**	8.4	12	24	43	87	94	*16e-4/4e3*	MCS (Neum) [18]
NELDER (Han)	**2.7**	5.5	19	26	57	78	340	460	*54e-4/1e4*	.	NELDER (Han) [16]
NELDER (Doe)	**2.3**	4.1	13	45	61	400	1400	*21e-3/2e4*	.	.	NELDER (Doe) [5]
NEWUOA	**1.3**	**1.3**	**3**	3	3	**3**	**2.5**	**1.8**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.7**	**1.7**	1.2e4	6.7e4	*52e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	160	170	420	2100	*37e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	640	550	1700	*64e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	240	270	700	3e3	5100	*64e-1/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*28e+6/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	14	56	210	910	*70e-2/1e4*	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**2.7**	**2.8**	5.8	6.7	6.4	6.8	5.9	4.3	**2.4**	**2.5**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	3.3	3.4	5.9	5.9	6.6	9.1	8.3	7.4	4.1	4.4	VNS (Garcia) [11]

Table 109: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{13}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	3.21	8.51	32.6	101	138	175	937	1090	1220	1510	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	49	130	97	130	420	2700	*14e-3/2e5*	.	.	.	ALPS [17]
AMaLGaM IDEA	18	41	18	8	8	7.7	**1.7**	**1.7**	**1.7**	**1.7**	AMaLGaM IDEA [4]
avg NEWUOA	**2.1**	**1.8**	**1.5**	5.3	14	30	14	57	170	*67e-5/2e4*	avg NEWUOA [31]
BayEDAcG	45	150	910	*49e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.2**	**1.6**	**1.7**	**1**	**1**	**1**	23	87	*96e-5/2e4*	.	BFGS [30]
Cauchy EDA	260	410	210	100	100	100	23	23	23	23	Cauchy EDA [24]
BIPOP-CMA-ES	3.6	5.1	4.3	**2.7**	5.1	6.2	**1.5**	**1.6**	**2.3**	3	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.9**	3.4	4.9	7.1	10	11	4.2	5.7	6.3	14	(1+1)-CMA-ES [2]
DASA	15	22	380	230	570	1600	670	1200	3700	*51e-6/1e6*	DASA [19]
DEPSO	11	40	64	*53e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	15	2400	*13e+1/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	110	330	160	330	1200	*12e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	4.1	3.6	**1.8**	6	18	49	26	40	120	*30e-4/1e4*	full NEWUOA [31]
G3-PCX	4.3	4.8	9.3	17	43	75	47	110	130	330	G3-PCX [26]
simple GA	290	700	5100	*10e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5.7	3.1	**2**	**1.1**	**1.1**	**1.1**	4.5	4.2	*16e-4/1e3*	.	GLOBAL [23]
iAMaLGaM IDEA	9.2	18	8.7	4.1	**4.3**	**4.4**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
LSfminbnd	6.2	8.7	19	19	68	150	160	130	*53e-3/1e4*	.	LSfminbnd [28]
LSstep	180	310	460	1400	*12e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.3	22	11	390	700	1800	1500	1300	*27e-3/1e5*	.	MA-LS-Chain [21]
MCS (Neum)	**1.3**	8.4	34	37	61	330	*60e-2/4e3*	.	.	.	MCS (Neum) [18]
NELDER (Han)	**2.3**	6.4	11	29	60	180	77	130	*35e-3/1e4*	.	NELDER (Han) [16]
NELDER (Doe)	**1.5**	3.4	12	18	31	87	98	270	*36e-4/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	3	9.3	37	19	130	*43e-4/9e3*	.	NEWUOA [31]
(1+1)-ES	**2.5**	3.3	7.4	13	26	95	50	110	410	2e3	(1+1)-ES [1]
POEMS	100	200	1700	1.4e4	*59e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	6.1	1800	6200	6400	1e4	8e3	1500	1300	*22e+0/1e5*	.	PSO [7]
PSO_Bounds	12	310	2300	4100	*50e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	1.5e5	*92e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	**2**	**2.5**	4.2	8.3	31	17	43	120	*18e-4/1e4*	Rosenbrock [27]
IPOP-SEP-CMA-ES	3.6	5	5.8	5.4	7.7	8	**1.7**	**1.9**	**1.9**	**2**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	5.8	6.2	4.3	55	120	180	130	320	540	1500	VNS (Garcia) [11]

Table 110: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.05	0.05	3.75	12	15.2	22.5	46.6	66.6	82.4	783	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	**1**	3.7	41	56	78	93	190	1200	*34e-6/2e5*	.	ALPS [17]
AMaLGaM IDEA	**1**	4.7	19	22	30	28	17	15	14	**1.9**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	38	**2.7**	**1.5**	**1.6**	**1.6**	**1.3**	**2.7**	9.3	26	avg NEWUOA [31]
BayEDAcG	**1**	7.2	55	67	150	250	*15e-3/2e3*	.	.	.	BayEDAcG [10]
BFGS	**1**	23	**2.7**	**1.8**	**2**	**1.8**	**1.2**	**1.1**	**1.1**	*18e-7/1e4*	BFGS [30]
Cauchy EDA	**1**	930	280	270	350	340	210	180	180	25	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	7.6	3.9	**2.9**	3.7	4.3	4.1	5	6.2	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	18	3.1	**1.9**	**2.3**	**2.5**	**2.3**	3.4	**5.6**	**1.2**	(1+1)-CMA-ES [2]
DASA	**1**	93	16	10	12	22	75	560	5200	*43e-7/1e6*	DASA [19]
DEPSO	**1**	13	14	14	25	49	*44e-4/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	8.4	150	290	*90e-3/5e3*	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	3.8	85	140	200	190	130	350	*21e-6/1e5*	.	EDA-PSO [6]
full NEWUOA	**1**	47	5.9	3	3.6	3.3	**2.6**	5	20	*12e-7/1e4*	full NEWUOA [31]
G3-PCX	**1**	5.7	4.1	**2.4**	**2.8**	3	**2.7**	4.5	13	59	G3-PCX [26]
simple GA	**1**	4.1	280	320	480	2900	*72e-4/1e5*	.	.	.	simple GA [22]
GLOBAL	**1**	7.5	5	**2.2**	**2.1**	**1.8**	**1.1**	**1**	**1**	*28e-7/400*	GLOBAL [23]
iAMaLGaM IDEA	**1**	4.3	11	9.3	13	12	7.8	6.9	6.9	**1**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	83	8.4	5.2	5.6	9.3	57	*31e-5/1e4*	.	.	LSfminbnd [28]
LSstep	**1**	910	190	110	120	210	*46e-4/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	4.1	7.6	11	13	16	14	23	23	6	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**2.1**	3.4	3.7	3.2	*15e-5/4e3*	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	23	**2.3**	**3**	3.9	3.6	**2.9**	4.9	36	*44e-7/1e4*	NELDER (Han) [16]
NELDER (Doe)	**1**	11	**2**	**2.1**	3.5	3.7	3	5.4	21	*26e-7/2e4*	NELDER (Doe) [5]
NEWUOA	**1**	20	**1.5**	**1**	**1**	**1**	**1**	**2.3**	9.1	43	NEWUOA [31]
(1+1)-ES	**1**	17	**2.5**	**1.8**	**2**	**2.2**	4.8	38	470	*71e-8/1e6*	(1+1)-ES [1]
POEMS	**1**	3100	110	66	120	160	130	2e3	*94e-6/1e5*	.	POEMS [20]
PSO	**1**	7.2	6.7	12	20	27	54	580	*44e-6/1e5*	.	PSO [7]
PSO_Bounds	**1**	4.6	23	100	170	240	380	1300	*78e-6/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	5.3	4.5e4	*80e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	80	**2.4**	**1.2**	**1.3**	**1.8**	7.4	97	*71e-6/1e4*	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	14	3.3	**2.6**	3.2	3.7	6.8	8.8	10	**1.6**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**3.6**	6.4	3.9	4.4	5.1	5	6.4	7.8	**1.4**	VNS (Garcia) [11]

Table 111: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.06	83.5	1520	7330	15600	15800	16000	16100	22500	23000	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	18	10	*20e+0/2e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	12	7.1	**1.5**	**2**	**1.7**	**1.7**	**1.7**	**1.7**	**1.2**	**1.2**	AMaLGaM IDEA [4]
avg NEWUOA	56	120	*95e+0/1e4*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	13	23	*93e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	670	*25e+1/6e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	1700	68	*67e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	17	**1.2**	**1**	**2**	**1.4**	**1.4**	**1.4**	**1.4**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	33	73	*85e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	160	3e4	*11e+1/1e6*	.	.	.	.	.	.	.	DASA [19]
DEPSO	12	*12e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	110	*10e+1/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	20	22	36	*80e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	120	81	*77e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	21	550	*92e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	21	59	*25e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	13	*25e+1/1e3*	.	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	12	3.1	**2.8**	14	7.5	7.5	7.4	7.4	5.3	**5.2**	iAMaLGaM IDEA [4]
LSfminbnd	130	*14e+1/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	2400	*22e+1/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**10**	3.7	6.9	*60e-1/1e5*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	70	*10e+1/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	28	54	*80e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	25	17	*54e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	29	1100	*12e+1/6e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	340	5400	*82e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	2700	23	*34e+0/1e5*	.	.	.	.	.	.	.	POEMS [20]
PSO	16	92	*49e+0/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	14	220	*51e+0/1e5*	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	16	*26e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	7700	*35e+1/1e4*	.	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	14	**1**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1.1**	6.4	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	22	**1.5**	310	*60e-1/6e6*	.	.	.	.	.	.	VNS (Garcia) [11]

Table 112: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	69.2	1360	3850	6960	9400	9760	9890	11000	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.2**	9.3	110	*78e-2/2e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	14	3.3	**5.2**	**5.4**	**6.2**	**6.1**	**6.1**	**5.7**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1.5**	3.6	*31e-1/2e4*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.2**	*21e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	140	*26e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.5	*16e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1.3**	**1.7**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	34	*53e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**2.3**	980	*44e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	*23e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	8.3	7	*12e-1/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.3**	530	55	380	*75e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.9**	4.6	110	*25e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.3**	17	*32e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.3**	140	1e3	*24e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.2**	**1**	*42e-1/600*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	3.6	**1.7**	13	18	29	29	28	26	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1.1**	160	*95e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	240	*10e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	19	*18e-1/1e5*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	11	*75e-1/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	17	*47e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.4**	7.2	*30e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	16	*53e-1/1e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.2**	1400	*72e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	250	15	21	100	*58e-2/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1.3**	110	*47e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.2**	130	1e3	*25e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	6.5e4	*11e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.4	*29e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.2**	**3.1**	**1**	**1**	**1.1**	**1.4**	**1.9**	**1.9**	**1.7**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	3.6	9.1	500	*72e-3/3e6*	.	.	.	.	VNS (Garcia) [11]

Table 113: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	3.15	51.5	200	612	1530	2230	2810	4020	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.5**	19	28	5100	*16e-2/2e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	14	7.7	4.3	5.1	**4.7**	**3.5**	**5.1**	**5.4**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**2.1**	**2.4**	*29e-1/4e4*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**2**	19	19	48	*15e-2/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	350	360	*56e-1/2e4*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	200	260	120	62	30	16	16	23	*37e-7/5e4*	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	4	**2.2**	**1**	**1**	**1**	**1.2**	**1.4**	**1.3**	**1.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.9**	29	*49e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	8.5	6.6e4	*57e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.5**	8.3	18	150	*43e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.8**	55	*55e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.3**	13	36	20	22	10	8.1	18	21	EDA-PSO [6]
full NEWUOA	**1**	9.4	13	*37e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.2**	4	*35e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.2**	57	92	7100	*21e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.6**	6.2	*44e-1/3e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.5**	6.4	**2.9**	**1.5**	**1.4**	6.1	22	29	23	iAMaLGaM IDEA [4]
LSfminbnd	**1**	6.8	990	*82e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	55	1700	*78e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.3**	3.5	5.1	7.7	10	12	33	59	86	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	*42e-1/4e3*	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1.3**	240	*62e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	4	**2.1**	*46e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	5.1	16	*38e-1/8e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	5.7	5.2e4	*73e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	540	94	25	19	200	270	*11e-3/1e5*	.	.	POEMS [20]
PSO	**1**	**1.1**	3.2	2500	*10e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.3**	**3**	830	*85e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	120	*50e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	1.6e4	2.1e4	*19e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1.4**	**2.8**	4	3.1	**1.6**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.2**	5.3	**1.2**	**1.5**	5.8	34	2500	*10e-5/4e6*	.	VNS (Garcia) [11]

Table 114: 20-D, running time excess ERT/ERT_{best} on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.05	0.14	31	199	978	1430	3380	4980	6530	7330	ERT_{best}/D
ALPS	**1.1**	3.8	15	430	*69e-2/2e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1.2**	3.8	7.3	3	**1**	**1**	**1.7**	**2.7**	**2.8**	**3.7**	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	19	3200	*10e+0/6e4*	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	6.4	15	17	*95e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	920	*21e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**2.5**	270	96	42	15	16	12	13	38	*25e-6/5e4*	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	5.3	**1**	**2.4**	**1.2**	**1.6**	**1.1**	**1.8**	**1.7**	**1.6**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	12	4800	*16e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	60	4.6e5	*25e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	7.9	7.1	49	*16e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	6.5	9.1	110	*12e-1/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	4.2	30	15	5.2	5.4	18	83	220	*47e-5/1e5*	EDA-PSO [6]
full NEWUOA	**1.1**	23	950	*12e+0/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	**2.2**	7100	*14e+0/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	7.8	76	310	*73e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1.1**	5.9	*17e+0/4e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	3.4	**2.7**	**1.2**	**2.3**	3.7	19	18	16	18	iAMaLGaM IDEA [4]
LSfminbnd	**2.2**	31	4500	*26e+0/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	610	*31e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	5.8	3.6	3.6	26	78	210	*43e-4/1e5*	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	*17e+0/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	830	*20e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	6.5	4300	*14e+0/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	3.9	320	1.2e4	*11e+0/8e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	2.9e5	*24e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	5.1	1100	21	140	210	990	*38e-2/1e5*	.	.	.	POEMS [20]
PSO	**1.1**	5.2	240	*29e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.1**	**2.4**	69	7100	*22e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1.1**	7.7	*18e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	1.4e4	4.8e4	*97e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	8.5	**1**	**1**	**1.1**	**1.2**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**2.5**	**1.3**	**1**	14	250	*40e-4/4e6*	.	.	.	VNS (Garcia) [11]

Table 115: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.05	1e+02 0.05	1e+01 0.05	1e+00 0.05	1e-01 17200	1e-02 2.34e5	1e-03 3.11e5	1e-04 3.33e5	1e-05 3.34e5	1e-07 3.37e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	1200	6.2e5	*31e-2/2e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.2**	740	3.4e4	**7.6**	**4.5**	**8.8**	**8.2**	**8.2**	**8.1**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**2.9**	210	8e6	*20e-1/1e5*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1.1**	1500	*41e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	170	1.2e6	*12e+0/1e4*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.4	8400	*34e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	170	**2.4e4**	**1.2**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	1400	2.8e6	*18e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**2.1**	1.8e6	*58e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.1**	430	*50e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	*21e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.1**	4600	2.8e7	*26e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	480	*21e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	800	*26e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	1.4e4	6.5e5	*44e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	5600	*57e-1/3e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	460	1.8e6	44	***72e-3/1e6***	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**2.6**	1200	*38e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	130	7800	*41e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	280	2.9e4	13	***11e-2/1e5***	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1**	**1**	**1**	***25e-2/4e3***	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	160	1.4e6	*19e-1/1e4*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**73**	4.3e5	*96e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	76	4.3e6	*12e-1/1e5*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	6.3e6	*56e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	170	6200	1.4e6	*94e-2/1e5*	.	.	.	.	.	POEMS [20]
PSO	**1**	**1.1**	380	*32e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.1**	820	*31e-1/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	5.9e5	*78e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.1e4	*33e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	150	2.7e4	8.7	***29e-2/1e4***	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	330	8.2e4	*21e-2/6e6*	.	.	.	.	.	VNS (Garcia) [11]

Table 116: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.78	3.53	4.09	2310	1.55e5	2.76e5	2.77e5	2.78e5	2.8e5	2.82e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	48	54	53	9.2	*47e-2/2e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	20	22	20	88	*68e-2/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	**1.8**	**1.4**	**1.3**	110	*12e-1/2e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	47	51	49	*31e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.7**	**1.9**	**2.1**	5.8	*90e-2/2e4*	.	.	.	.	.	BFGS [30]
Cauchy EDA	310	330	340	*27e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	4.7	4.4	4.3	9.2	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.5	3.6	3.4	21	*11e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	22	21	20	**2.1**	*40e-2/1e6*	.	.	.	.	.	DASA [19]
DEPSO	15	16	15	*21e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	17	36	31	*18e-1/5e3*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	210	230	230	15	*63e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	4.2	3.4	3.1	64	*12e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	5.6	5.4	5	*12e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	470	520	500	**2.8**	*32e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	6.6	5.6	5.2	**1.6**	*99e-2/4e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	14	14	14	240	*88e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	11	11	11	5.9	*97e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	230	260	280	11	*10e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	8	9.7	9.4	3.3	**4.8**	*24e-2/1e5*	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	5.9	5.4	4.7	12	*12e-1/4e3*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	3.1	3.4	3.5	*13e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.9**	**2.1**	**2.2**	28	*11e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	15	*10e-1/2e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.4	3.2	3.1	110	*88e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	130	120	120	**1**	*30e-2/1e5*	.	.	.	.	.	POEMS [20]
PSO	12	15	17	50	*11e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	66	79	86	11	*53e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	1.7e6	*15e+2/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	3	**2.7**	**2.6**	**2.9**	*97e-2/1e4*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	4.4	4.7	4.5	13	*11e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	8.1	7.7	7.1	**1.1**	*30e-2/1e7*	.	.	.	.	.	VNS (Garcia) [11]

Table 117: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{21}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	28.1	327	705	716	732	754	778	879	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	14	13	7	7.7	8.3	9.2	9.8	11	ALPS [17]
AMaLGaM IDEA	**1**	**1**	51	2400	1500	1500	1500	1500	1400	1300	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	3.2	5.7	3.5	3.5	3.4	3.3	3.3	**2.9**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	55	*60e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	**1.9**	5.5	4.6	4.6	4.5	4.4	4.3	7.3	BFGS [30]
Cauchy EDA	**1**	**1**	1e3	*32e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	3.2	55	48	47	46	45	43	39	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	3.6	7.6	5.8	5.7	5.6	5.4	5.3	4.7	(1+1)-CMA-ES [2]
DASA	**1**	**1**	240	100	100	100	99	96	93	83	DASA [19]
DEPSO	**1**	**1**	22	13	8.3	8.6	8.9	9.3	19	*20e-1/2e3*	DEPSO [12]
DIRECT	**1**	**1**	3.3	27	*19e-1/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	35	850	570	560	550	530	520	460	EDA-PSO [6]
full NEWUOA	**1**	**1**	7.4	**3.4**	4.5	4.5	4.4	4.2	4.1	3.7	full NEWUOA [31]
G3-PCX	**1**	**1**	12	7.2	5.1	5	4.9	4.8	4.6	4.1	G3-PCX [26]
simple GA	**1**	**1**	90	620	400	400	900	890	*20e-1/1e5*	.	simple GA [22]
GLOBAL	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2.1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	10	670	540	540	530	520	540	490	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	30	27	20	20	19	19	18	16	LSfminbnd [28]
LSstep	**1**	**1**	120	200	200	200	200	190	190	170	LSstep [28]
MA-LS-Chain	**1**	**1**	140	310	230	230	220	210	210	180	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	26	32	26	25	25	24	23	32	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	7.7	20	24	24	23	23	22	20	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	7.6	4	**2**	**2.1**	**2.1**	**2**	**2**	**1.8**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.7**	**2.2**	**1.2**	**1.2**	**1.2**	**1.1**	**1.1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	8.3	13	9.4	9.3	9.1	8.8	8.6	7.6	(1+1)-ES [1]
POEMS	**1**	**1**	2500	*67e-1/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1**	**1**	1800	4300	2e3	2e3	1900	1900	1800	1600	PSO [7]
PSO_Bounds	**1**	**1**	560	1200	2e3	2e3	1900	1900	1800	1600	PSO_Bounds [8]
Monte Carlo	**1**	**1**	*26e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	7.8	7.6	4.7	4.6	4.5	4.4	4.3	3.8	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	15	50	58	57	56	54	53	47	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	11	55	29	29	29	28	27	25	VNS (Garcia) [11]

Table 118: 20-D, running time excess ERT/ERT_{best} on f_{22}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget ERT_{best}/D	1e+03 0.05	1e+02 0.05	1e+01 23.3	1e+00 279	1e-01 1170	1e-02 1210	1e-03 1250	1e-04 1310	1e-05 1340	1e-07 6740	Δftarget ERT_{best}/D
ALPS	**1**	**1**	19	9.7	79	81	86	110	180	130	ALPS [17]
AMaLGaM IDEA	**1**	**1**	8.2	1900	*69e-2/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	**2**	5.6	14	13	13	12	12	**2.4**	avg NEWUOA [31]
BayEDAcG	**1**	**1**	34	31	*20e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	**2.5**	**1.8**	8.1	7.9	7.7	7.4	9.5	14	BFGS [30]
Cauchy EDA	**1.1**	**1.1**	470	1200	*51e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	6.8	13	210	210	200	190	190	37	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	3.5	**4.2**	**5.6**	**5.5**	**5.3**	**5.1**	**5**	**1**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	34	75	220	210	210	200	200	40	DASA [19]
DEPSO	**1**	**1**	20	16	*26e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	9.8	16	*71e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	1600	1e3	*26e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.2**	12	60	59	57	54	53	11	full NEWUOA [31]
G3-PCX	**1**	**1**	11	6.6	23	22	22	21	20	4	G3-PCX [26]
simple GA	**1**	**1**	110	1500	*20e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.3**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	8.1	440	*69e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	59	16	37	36	36	35	34	7.2	LSfminbnd [28]
LSstep	**1**	**1**	280	*51e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	3.8	810	*20e-1/1e5*	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	17	20	50	48	47	*20e-1/4e3*	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	17	18	61	59	58	55	54	11	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	5.2	6.5	8.3	8.2	8	7.7	7.5	**1.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	4.9	**6.8**	**6.6**	**6.4**	**6.2**	**6**	**1.2**	NEWUOA [31]
(1+1)-ES	**1**	**1**	11	5	11	11	11	10	10	**2.1**	(1+1)-ES [1]
POEMS	**1**	**1**	2300	5e3	*51e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	**1**	**1**	5	410	*20e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	680	730	1200	1200	1100	1100	1100	210	PSO_Bounds [8]
Monte Carlo	**1**	**1**	6.4e5	*30e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	3.4	4.3	12	12	12	11	11	**2.2**	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	6.2	23	*69e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	14	67	1300	1200	1200	1200	1100	440	VNS (Garcia) [11]

Table 119: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.05	1e+02 0.05	1e+01 0.16	1e+00 80.7	1e-01 3370	1e-02 18300	1e-03 24400	1e-04 25500	1e-05 40600	1e-07 41900	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	**1.9**	82	*29e-2/2e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.7**	23	**1.1**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
avg NEWUOA	**1**	**1**	15	4.7	*20e-2/2e4*	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	**1**	**1.6**	*23e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	47	300	*13e-1/5e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	**1.9**	*19e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	**1**	4.3	32	**1**	**1.7**	**2**	**1.9**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	5.8	9.1	*37e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	3.4	64	*31e-2/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**1.6**	*26e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	4.1	52	*38e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	**2.1**	*16e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	14	7	44	*25e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.8**	7.8	*30e-2/3e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.7**	4600	*12e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**2.8**	**1**	*43e-2/500*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.9**	5.4	**1.6**	**2.3**	**5.1**	**5.2**	**3.3**	**3.2**	iAMaLGaM IDEA [4]
LSfminbnd	**1**	**1**	4.4	210	*10e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	**2.2**	81	*91e-2/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.8**	7.1	8.9	*61e-3/1e5*	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	**1**	**1.3**	120	*11e-1/4e3*	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	**1**	**2.1**	**3.3**	43	*20e-2/1e4*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.9**	**1.4**	86	*17e-2/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	12	3.5	32	*39e-2/8e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	27	32	*31e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	23	42	13	*59e-3/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1**	**2.2**	1600	*95e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	**3**	8400	*12e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.6**	5.5e4	*11e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.7**	4.6	*50e-2/4e3*	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	4.9	18	3.8	*81e-3/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1**	**1**	25	10	1700	*23e-3/2e6*	.	.	.	VNS (Garcia) [11]

Table 120: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	331	66900	3.74e5	2.6e6	2.6e6	2.6e6	2.6e6	2.6e6	2.6e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	5.7	*22e+0/2e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1.1**	4.2	5.1	**19**	***23e-1/1e6***	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	14	3.3	*74e+0/1e4*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	**1**	44	*11e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	8	*31e+1/6e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.7**	76	*91e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
BIPOP-CMA-ES	**1**	5.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	24	*90e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1.1**	*16e+1/1e6*	.	.	.	.	.	.	.	.	DASA [19]
DEPSO	**1.1**	*14e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	*15e+1/5e3*	.	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	28	*86e+0/1e5*	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	3.7	4.5	*71e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	190	*11e+1/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	35	*42e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	*21e+1/1e3*	.	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.3**	**2.8**	***21e-1/1e6***	.	.	.	.	.	.	iAMaLGaM IDEA [4]
LSfminbnd	7.1	*15e+1/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3.1	210	*19e+1/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	**2.1**	42	***25e+0/1e5***	.	.	.	.	.	.	MA-LS-Chain [21]
MCS (Neum)	**1**	12	*10e+1/4e3*	.	.	.	.	.	.	.	MCS (Neum) [18]
NELDER (Han)	**1**	49	*10e+1/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	3.7	*50e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	6.5	4.3	*83e+0/8e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	4.1	3100	*93e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**2.7**	10	*46e+0/1e5*	.	.	.	.	.	.	.	POEMS [20]
PSO	**1**	63	*60e+0/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.1**	81	*66e+0/1e5*	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	*26e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.4**	*37e+1/1e4*	.	.	.	.	.	.	.	.	Rosenbrock [27]
IPOP-SEP-CMA-ES	**1**	**1**	**1**	***23e+0/1e4***	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
VNS (Garcia)	**1**	**1.8**	68	***88e-1/1e7***	.	.	.	.	.	.	VNS (Garcia) [11]

Table 121: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_1, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	2.07	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	46	220	420	640	870	1100	1400	1700	2800	ALPS [17]
AMaLGaM IDEA	**1**	46	150	290	430	560	690	810	970	1200	AMaLGaM IDEA [4]
avg NEWUOA	**1**	3.2	**3.2**	**3.2**	**3.2**	**3.2**	**3.2**	**3.2**	**3.2**	**3.2**	avg NEWUOA [31]
BayEDAcG	**1**	60	210	350	500	650	790	940	*64e-6/2e3*	.	BayEDAcG [10]
BFGS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BFGS [30]
BIPOP-CMA-ES	**1**	3.1	9.6	15	21	28	34	40	45	58	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**3**	7	11	15	19	23	27	31	39	(1+1)-CMA-ES [2]
DASA	**1**	13	33	57	94	130	180	220	260	340	DASA [19]
DEPSO	**1**	12	65	360	1.4e4	*15e-2/2e3*	.	.	.	.	DEPSO [12]
simple GA	**1**	400	1500	3e3	2.3e4	6.8e5	*45e-3/1e5*	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	17	73	130	180	240	290	350	410	520	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	3.9	13	21	28	35	42	49	55	67	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	5.8	9.2	13	16	19	23	26	33	(1+1)-ES [1]
Monte Carlo	**1**	*13e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	3	8.7	14	19	25	30	35	41	51	IPOP-SEP-CMA-ES [29]

Table 122: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_2, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	74.3	96.6	118	137	155	172	190	208	221	256	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	14	15	17	19	20	23	26	32	46	140	ALPS [17]
AMaLGaM IDEA	14	14	14	14	14	14	14	14	14	14	AMaLGaM IDEA [4]
avg NEWUOA	**2**	4.7	6	9	10	12	12	13	13	14	avg NEWUOA [31]
BayEDAcG	13	13	13	14	*33e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	4.3	5.5	6	6.1	5.9	5.6	5.4	5	4.8	4.4	BFGS [30]
BIPOP-CMA-ES	7.7	9.8	11	10	10	9.5	9	8.4	8	7.1	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	6	8.1	9.3	9.5	9.5	9.3	8.7	8.2	7.8	6.8	(1+1)-CMA-ES [2]
DASA	**1.7**	**2.1**	**2.5**	**2.8**	**3**	**3.3**	**3.4**	**3.5**	**3.7**	**3.8**	DASA [19]
DEPSO	28	310	*65e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	610	2200	*24e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	6.2	7.4	7.7	7.7	7.7	7.6	7.4	7.3	7.4	7.3	iAMaLGaM IDEA [4]
NELDER (Han)	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NEWUOA	**1**	**2.6**	4.4	6.4	8.8	9.9	11	12	13	13	NEWUOA [31]
(1+1)-ES	140	630	1500	2500	3400	4400	8900	1.4e4	6.8e4	*93e-5/1e6*	(1+1)-ES [1]
Monte Carlo	*12e+5/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1.4**	**1.5**	**1.5**	**1.4**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	**1.1**	IPOP-SEP-CMA-ES [29]

Table 123: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_3, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	5.56	116	440	24600	1.59e5	1.59e5	1.59e5	1.59e5	1.59e5	1.59e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	11	32	*16e+0/1e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	13	16	2800	***11e+0/1e6***	.	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	21	*38e+1/1e4*	.	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	19	*24e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	110	*64e+1/8e3*	.	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1**	**1.1**	*12e+0/3e5*	.	.	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	4.1	*33e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	3.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	DASA [19]
DEPSO	3.1	*28e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	92	39	**420**	***11e+0/1e5***	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	4	4.6	**770**	***90e-1/1e6***	.	.	.	.	.	.	iAMaLGaM IDEA [4]
NELDER (Han)	**1.9**	*38e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	7.7	*46e+1/7e3*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	300	*42e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	1.5e4	*87e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1.2**	*16e+0/1e4*	.	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]

Table 124: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_4, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	11	134	574	1.7e6	nan	nan	nan	nan	nan	nan	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	12	66	***26e+0/1e5***	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	24	18	***32e+0/1e6***	.	.	.	.	.	.	.	AMaLGaM IDEA [4]
avg NEWUOA	7.5	*36e+1/3e4*	.	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	27	*25e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	1200	*97e+1/1e4*	.	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1.1**	**3.9**	***27e+0/3e5***	.	.	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	16	*54e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**2.5**	**1**	**1**	**1**	***20e-1/1e6***	.	.	.	.	.	DASA [19]
DEPSO	3.4	*33e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	85	39	**2500**	***17e+0/1e5***	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	6.4	**4.3**	***34e+0/1e6***	.	.	.	.	.	.	.	iAMaLGaM IDEA [4]
NELDER (Han)	110	*63e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	14	*54e+1/2e4*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	2900	*67e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	6.3e5	*11e+2/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	5.3	***30e+0/1e4***	.	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]

Table 125: 40-D, running time excess ERT/ERT_{best} on f_5, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.025	2.13	2.45	2.89	3	3.01	3.01	3.01	3.01	3.01	ERT_{best}/D
ALPS	**1**	81	140	160	180	200	210	220	230	230	ALPS [17]
AMaLGaM IDEA	**1**	97	120	100	100	100	100	100	100	100	AMaLGaM IDEA [4]
avg NEWUOA	**1**	3.1	3.1	3.2	3.4	3.4	3.4	3.4	3.4	3.4	avg NEWUOA [31]
BayEDAcG	**1**	140	210	220	220	220	220	220	220	220	BayEDAcG [10]
BFGS	**1**	**1.4**	**2.1**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	BFGS [30]
BIPOP-CMA-ES	**1**	3.2	4.5	4.5	4.4	4.4	4.4	4.4	4.4	4.4	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.9**	3	**3**	**2.9**	**3**	**3**	**3**	**3**	**3**	(1+1)-CMA-ES [2]
DASA	**1**	12	17	19	23	27	34	41	50	69	DASA [19]
DEPSO	**1**	18	29	30	30	31	31	31	31	31	DEPSO [12]
simple GA	**1**	1100	3e3	4800	7e3	9500	1.2e4	1.5e4	1.9e4	*19e-8/1e5*	simple GA [22]
iAMaLGaM IDEA	**1**	5.6	8.1	7.4	7.2	7.1	7.1	7.1	7.1	7.1	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	9.1	14	13	13	13	13	13	13	13	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1.8**	**2.9**	**3**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	(1+1)-ES [1]
Monte Carlo	**1**	*36e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	3.3	5.2	5.4	5.3	5.2	5.3	5.3	5.3	5.3	IPOP-SEP-CMA-ES [29]

Table 126: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_6, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.87	46	87.7	138	179	237	288	332	375	481	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	56	28	53	93	330	*24e-3/1e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	280	67	56	48	47	43	42	41	41	40	AMaLGaM IDEA [4]
avg NEWUOA	4.7	**1.5**	**1.3**	**1.3**	**1.2**	**1.2**	**1.1**	**1.2**	**1.1**	**1.1**	avg NEWUOA [31]
BayEDAcG	70	160	*13e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.9**	3.3	4.2	4.4	4.6	4.5	4.5	4.6	4.9	18	BFGS [30]
BIPOP-CMA-ES	6.1	**1.9**	**1.6**	**1.5**	**1.5**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.6	6.6	360	*12e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	9	8.8	18	25	36	41	46	52	56	59	DASA [19]
DEPSO	12	19	*38e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	350	730	*65e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	26	9.4	10	9.9	11	10	10	11	11	11	iAMaLGaM IDEA [4]
NELDER (Han)	3.3	**2.7**	**2.7**	**2.5**	**2.6**	**2.8**	3.5	5.5	16	68	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**3.1**	**1.9**	3.2	4.6	6.1	6.8	7.4	8.1	8.6	9	(1+1)-ES [1]
Monte Carlo	*12e+4/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	6.5	**1.9**	**1.9**	**1.8**	**1.9**	**1.8**	**1.8**	**2**	**2**	**2**	IPOP-SEP-CMA-ES [29]

Table 127: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_7, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.64	30.6	267	446	1030	1660	1660	1660	1660	1700	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	14	14	2e3	*13e+0/1e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	14	12	**2.5**	**2.2**	**1.3**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
avg NEWUOA	**2.6**	5.4	*24e+0/4e4*	.	.	.	.	.	.	.	avg NEWUOA [31]
BayEDAcG	24	23	*26e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	*20e+2/100*	.	.	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1.5**	**1**	**1.2**	8.3	4	**2.6**	**2.6**	**2.6**	**2.6**	**2.5**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.8**	73	100	*12e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	6	2200	*76e+0/2e5*	.	.	.	.	.	.	.	DASA [19]
DEPSO	4.9	7.5	*27e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	96	110	*36e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	3.9	**4**	**1**	**1**	**1**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	iAMaLGaM IDEA [4]
NELDER (Han)	**1.8**	100	*70e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	880	*77e+0/6e4*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	770	*24e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	260	*54e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1.4**	**1**	**2.3**	**5.2**	**2.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	IPOP-SEP-CMA-ES [29]

Table 128: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_8, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	15.2	40.4	177	266	275	282	286	289	293	299	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	40	84	530	1100	1900	2e3	3200	*14e-1/1e5*	.	.	ALPS [17]
AMaLGaM IDEA	27	20	47	40	41	42	43	43	43	44	AMaLGaM IDEA [4]
avg NEWUOA	**1.6**	**1.7**	**1.2**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	avg NEWUOA [31]
BayEDAcG	38	50	*87e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.1**	**1.7**	**2.4**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	BFGS [30]
BIPOP-CMA-ES	**1.8**	**1.7**	7.3	7.7	7.9	7.9	7.9	7.9	7.9	7.8	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.2**	**1**	8.3	8.3	8.6	8.7	8.8	8.8	8.8	8.9	(1+1)-CMA-ES [2]
DASA	6.6	27	55	61	85	120	150	190	220	290	DASA [19]
DEPSO	16	130	*13e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	270	1200	*91e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	11	7.5	17	15	15	15	16	16	16	16	iAMaLGaM IDEA [4]
NELDER (Han)	**2.4**	4	150	280	550	540	530	530	520	510	NELDER (Han) [16]
NEWUOA	**1**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	5.5	27	67	73	85	100	120	130	170	(1+1)-ES [1]
Monte Carlo	*87e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1.6**	**2**	9.7	9.1	9.2	9.1	9.1	9.1	9.1	9	IPOP-SEP-CMA-ES [29]

Table 129: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_9, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	12.7	34.9	153	325	333	337	341	345	348	354	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	21	36	*28e+0/1e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	28	18	54	32	34	35	35	36	36	37	AMaLGaM IDEA [4]
avg NEWUOA	**1.7**	**1.3**	**1.4**	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	avg NEWUOA [31]
BayEDAcG	38	26	*38e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.1**	**1.4**	**2.7**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	BFGS [30]
BIPOP-CMA-ES	**1.8**	**1.5**	8.2	6.2	6.4	6.5	6.5	6.5	6.5	6.5	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.2**	**1.2**	9.7	9.7	10	10	10	10	10	10	(1+1)-CMA-ES [2]
DASA	7.7	12	410	420	520	650	820	980	1100	1600	DASA [19]
DEPSO	14	110	*11e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	270	3500	*11e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	13	8.5	20	12	13	13	13	13	13	14	iAMaLGaM IDEA [4]
NELDER (Han)	**1.6**	**2.3**	160	230	460	450	440	440	*14e+0/1e4*	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.2**	**1.4**	33	91	95	110	120	130	150	170	(1+1)-ES [1]
Monte Carlo	*83e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1.6**	**1.2**	10	6.9	7.1	7.1	7.1	7.1	7.1	7.1	IPOP-SEP-CMA-ES [29]

Table 130: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{10}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	165	402	647	759	920	1290	1400	1520	1630	1770	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	*28e+2/1e5*	.	.	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	6.3	3.2	**2.4**	**2.4**	**2.2**	**1.8**	**1.9**	**1.9**	**1.9**	**2.1**	AMaLGaM IDEA [4]
avg NEWUOA	**1.3**	**1.6**	**1.4**	**1.9**	**1.8**	**1.7**	**1.8**	**1.9**	**1.9**	**2.1**	avg NEWUOA [31]
BayEDAcG	*16e+4/2e3*	.	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.7**	**1.2**	**1**	**1**	**1**	**2.1**	7.8	34	220	*40e-6/1e5*	BFGS [30]
BIPOP-CMA-ES	3.6	**2.3**	**1.9**	**1.9**	**1.7**	**1.3**	**1.2**	**1.2**	**1.1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.8**	**2**	**1.7**	**1.7**	**1.6**	**1.3**	**1.2**	**1.1**	**1.1**	**1**	(1+1)-CMA-ES [2]
DASA	290	1e3	2.3e4	*23e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	*14e+4/2e3*	.	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	*83e+3/1e5*	.	.	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**2.9**	**1.9**	**1.4**	**1.4**	**1.3**	**1**	**1**	**1**	**1**	**1.1**	iAMaLGaM IDEA [4]
NELDER (Han)	5.9	*35e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1.2**	**1.6**	**1.8**	**1.5**	**1.7**	**1.8**	**1.9**	**2.1**	NEWUOA [31]
(1+1)-ES	46	130	260	430	580	620	1e3	1600	*33e-5/1e6*	.	(1+1)-ES [1]
Monte Carlo	*13e+5/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	6.2	3.8	**2.9**	**2.7**	**2.4**	**1.8**	**1.7**	**1.5**	**1.5**	**1.4**	IPOP-SEP-CMA-ES [29]

Table 131: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{11}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.78	22.6	59.2	121	292	562	674	769	888	1090	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**2.7**	240	970	*33e-1/1e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**2.6**	11	9.5	6.8	3.8	**2.5**	**2.4**	**2.5**	**2.5**	**2.5**	AMaLGaM IDEA [4]
avg NEWUOA	3.4	**5.5**	**3.9**	**2.8**	**1.5**	**1**	**1**	**1**	**1**	**1**	avg NEWUOA [31]
BayEDAcG	**2.3**	*26e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**2.8**	**1**	**1**	**1**	**1**	**2.5**	72	*29e-4/1e4*	.	.	BFGS [30]
BIPOP-CMA-ES	99	35	15	8	3.5	**1.9**	**1.6**	**1.5**	**1.3**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	21	9.8	7.1	5.5	3.1	**2.1**	**2.2**	**2.3**	**2.4**	**2.6**	(1+1)-CMA-ES [2]
DASA	**1**	230	590	790	500	440	490	540	630	1e3	DASA [19]
DEPSO	6	*24e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	3.5	820	*43e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1.8**	**8.5**	**5**	**3.3**	**1.8**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	iAMaLGaM IDEA [4]
NELDER (Han)	**1.6**	88	*53e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	18	13	9.9	4.9	3.2	3	**3**	**3**	**3**	NEWUOA [31]
(1+1)-ES	2300	1100	870	650	350	240	240	240	240	250	(1+1)-ES [1]
Monte Carlo	**2.4**	*20e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	130	57	25	13	5.7	3	**2.6**	**2.3**	**2.1**	**1.7**	IPOP-SEP-CMA-ES [29]

Table 132: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{12}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	36	39.9	104	186	229	269	329	526	569	630	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	67	81	180	690	8100	*83e-2/1e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	46	48	21	13	14	16	17	13	14	15	AMaLGaM IDEA [4]
avg NEWUOA	**1.5**	6.5	21	24	31	38	42	32	39	86	avg NEWUOA [31]
BayEDAcG	66	*44e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1.1**	**1**	**1**	**1**	**1**	**1**	4.6	15	660	BFGS [30]
BIPOP-CMA-ES	**2.1**	**2.8**	**2.2**	**2.3**	**2.5**	**2.5**	**2.5**	**1.8**	**1.9**	**1.9**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1.4**	**1.7**	**2.1**	3.1	4.1	4.4	4.6	3.4	3.6	4.1	(1+1)-CMA-ES [2]
DASA	20	27	3.8e4	3.5e4	*22e+0/1e6*	.	.	.	.	.	DASA [19]
DEPSO	*12e+4/2e3*	.	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	*40e+3/1e5*	.	.	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	17	18	8.6	6.4	7	7.3	7.2	5.2	5.4	5.7	iAMaLGaM IDEA [4]
NELDER (Han)	**2.4**	**2.5**	15	24	52	190	*42e-3/1e4*	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1.4**	**1.4**	**1.4**	**1.5**	**1.4**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.2**	1300	4800	7700	*14e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	*16e+7/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1.8**	**2.8**	**2.8**	3.6	4.2	4.2	3.9	**2.7**	**2.7**	**2.7**	IPOP-SEP-CMA-ES [29]

Table 133: 40-D, running time excess ERT/ERT_{best} on f_{13}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	3.73	9.74	50.7	173	218	297	1800	2100	2460	2990	ERT_{best}/D
ALPS	80	180	130	190	860	*85e-3/1e5*	.	.	.	.	ALPS [17]
AMaLGaM IDEA	88	93	28	12	12	10	**2**	**2**	**1.9**	**1.9**	AMaLGaM IDEA [4]
BayEDAcG	100	160	*52e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.2**	**1.8**	**1.4**	**1**	**1**	**1**	46	73	*16e-4/4e4*	.	BFGS [30]
BIPOP-CMA-ES	4.6	5.1	**2.6**	**2.6**	5	17	4.4	5.2	5.3	5.9	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.3	3.3	**1.7**	4.2	9.5	20	5.6	9.7	18	48	(1+1)-CMA-ES [2]
DASA	15	24	40	73	150	540	220	940	2900	*21e-5/1e6*	DASA [19]
DEPSO	21	1500	*12e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	540	6800	*91e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	25	33	11	4.5	**4.7**	**4.8**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
NELDER (Han)	4.8	5.9	9.8	20	71	160	41	*13e-2/1e4*	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**2**	**3**	13	7.3	15	28	*88e-5/1e4*	NEWUOA [31]
(1+1)-ES	**2.9**	**3.3**	4.7	4.5	18	36	11	37	100	1400	(1+1)-ES [1]
Monte Carlo	*21e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	4.4	4.6	**2.1**	**2.8**	6.3	**8.2**	**2.6**	**2.8**	**2.8**	**2.9**	IPOP-SEP-CMA-ES [29]

Table 134: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	1.01	7.61	15.7	19.4	27.6	55.2	90.6	121	1440	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**2.4**	38	59	80	140	510	*27e-5/1e5*	.	.	ALPS [17]
AMaLGaM IDEA	**1.1**	**2.2**	44	46	53	50	30	22	20	**2.1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	3.3	74	89	180	*63e-3/2e3*	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**2.4**	**1.7**	**1.6**	**1.8**	**1.7**	**1.2**	**1**	**1**	*29e-7/2e4*	BFGS [30]
BIPOP-CMA-ES	**1**	**1.1**	**2.7**	**2.5**	3.1	3.9	4.4	5.4	**6.6**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**2.3**	**2.1**	**1.7**	**2**	**2.2**	**2.2**	**3.2**	**5.3**	**1**	(1+1)-CMA-ES [2]
DASA	**1**	4.8	8.7	8.6	13	22	71	500	4600	*58e-7/1e6*	DASA [19]
DEPSO	**1.1**	**1.7**	11	28	300	*11e-2/2e3*	.	.	.	.	DEPSO [12]
simple GA	**1**	3.3	280	390	1.1e4	*17e-2/1e5*	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	13	15	19	19	12	9.2	8.6	**1**	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**2.9**	**2.5**	**2.8**	3	3.4	3.4	11	*40e-6/1e4*	.	NELDER (Han) [16]
NEWUOA	**1.2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	8.6	24	NEWUOA [31]
(1+1)-ES	**1.2**	**2**	**1.9**	**1.6**	**1.8**	**2.2**	5.2	37	400	*81e-8/1e6*	(1+1)-ES [1]
Monte Carlo	**1.1**	**1.9**	*29e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1.1**	**2.4**	**2.3**	**2.9**	3.7	6.8	8.8	10	**1.5**	IPOP-SEP-CMA-ES [29]

Table 135: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.79	190	4700	19700	26200	26600	27000	27300	27700	28400	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	12	1100	*10e+1/1e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	13	9.6	**1.9**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.7**	AMaLGaM IDEA [4]
BayEDAcG	23	*24e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	28	*53e+1/9e3*	.	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1.2**	**1**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	5.1	*34e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	640	*39e+1/1e6*	.	.	.	.	.	.	.	.	DASA [19]
DEPSO	3.7	*35e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	100	2200	*11e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	3.9	**2.9**	9.8	14	**11**	**11**	**11**	**11**	**10**	**10**	iAMaLGaM IDEA [4]
NELDER (Han)	**1.6**	*33e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	7.4	*37e+1/7e3*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	450	*42e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	3.6e4	*91e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1.3**	**1**	**3.6**	*40e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]

Table 136: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	0.025	131	1800	8040	17800	35200	49300	49700	50500	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	11	*38e-1/1e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	17	**3.4**	**3.6**	**4.8**	**3.4**	**3.1**	**3.1**	**3.8**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	*31e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	3.7	*41e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1**	**1.1**	**1**	**1**	**1**	**1.3**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1.1**	550	*12e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1.2**	1.1e5	*13e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	*35e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1.1**	260	*79e-1/1e5*	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1.1**	**3.1**	4.3	24	27	17	23	**27**	**27**	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**1.1**	95	*10e+0/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1.2**	17	*78e-1/1e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	*15e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1.1**	*22e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1.1**	**1.8**	**1.5**	**1**	**1**	**1.4**	**3**	*30e-3/1e4*	.	IPOP-SEP-CMA-ES [29]

Table 137: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{17}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	0.025	9.98	106	354	874	1300	2220	3330	6640	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.1**	7	3800	*12e-1/1e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.3**	13	9.3	4.9	**3**	**2.6**	**1.9**	**1.6**	**4.5**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	22	14	*47e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	5.6	410	*68e-1/3e4*	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	67	*68e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	4.2	9.4e4	*98e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	**4**	31	*97e-2/2e3*	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1.3**	63	230	*89e-2/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1.4**	5.2	**2.6**	**1.5**	**1**	54	110	100	62	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**1.7**	310	*77e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1.9**	38	*54e-1/1e5*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	7.4	5.6e4	*80e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1.1**	2.2e4	*91e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1.2**	**1**	**2.1**	**2.4**	**1.6**	**1.6**	**1.3**	**1.3**	**1**	IPOP-SEP-CMA-ES [29]

Table 138: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	0.403	36.1	425	1180	3180	4690	6420	16800	23700	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	38	*39e-1/1e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1.1**	18	3.3	**1.9**	**1**	**2.2**	**3**	**2.6**	**5**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	23	35	*16e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	3.7	620	*28e+0/3e4*	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1.1**	**2.9**	**1.1**	**1.1**	**1.4**	**1.1**	**1.1**	**1.2**	**1.2**	**1.1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	3.1	*25e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	13	*41e+0/1e6*	.	.	.	.	.	.	.	DASA [19]
DEPSO	**1.1**	**1.5**	25	*57e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	**1.1**	**1.3**	100	*46e-1/1e5*	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1.1**	**1.1**	**4.6**	**1**	**1**	9	52	54	44	43	iAMaLGaM IDEA [4]
NELDER (Han)	**1.1**	12	*29e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1.1**	4.2	*20e+0/1e5*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	100	*35e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1**	*32e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**2.2**	**1**	**1.3**	**1.7**	**1.1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]

Table 139: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{19}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	0.025	8.79	1410	34800	4.21e5	6.38e5	1.13e6	1.13e6	1.14e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1.2**	6.5	620	*16e-1/1e5*	**.**	**.**	**.**	**.**	**.**	ALPS [17]
AMaLGaM IDEA	**1**	**1**	11	**2.4**	**1**	**2.6**	**7.4**	**4.2**	**4.2**	**4.2**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	18	*57e-1/2e3*	.	**.**	**.**	**.**	**.**	**.**	BayEDAcG [10]
BFGS	**1**	**1**	*19e+0/2e4*	.	.	**.**	**.**	**.**	**.**	**.**	BFGS [30]
BIPOP-CMA-ES	**1**	**1**	**1.1**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	16	*38e-1/1e4*	.	**.**	**.**	**.**	**.**	**.**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	1.6e6	*16e+0/1e6*	.	**.**	**.**	**.**	**.**	**.**	DASA [19]
DEPSO	**1**	**1.1**	3.9	*67e-1/2e3*	.	**.**	**.**	**.**	**.**	**.**	DEPSO [12]
simple GA	**1**	**1.1**	130	1e3	*24e-1/1e5*	**.**	**.**	**.**	**.**	**.**	simple GA [22]
iAMaLGaM IDEA	**1**	**1.1**	7	11	**46**	***10e-2/1e6***	**.**	**.**	**.**	**.**	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**1**	12	*40e-1/1e4*	.	**.**	**.**	**.**	**.**	**.**	NELDER (Han) [16]
NEWUOA	**1**	**1.2**	**1**	*28e-1/1e5*	.	**.**	**.**	**.**	**.**	**.**	NEWUOA [31]
(1+1)-ES	**1**	**1.4**	7.7e5	*16e+0/1e6*	.	**.**	**.**	**.**	**.**	**.**	(1+1)-ES [1]
Monte Carlo	**1**	**1.1**	*14e+0/1e6*	.	.	**.**	**.**	**.**	**.**	**.**	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1**	**1.1**	**4.6**	*84e-2/1e4*	**.**	**.**	**.**	**.**	**.**	IPOP-SEP-CMA-ES [29]

Table 140: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{20}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	3.12	4.33	5.54	3280	4.03e6	nan	nan	nan	nan	nan	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	45	44	40	*13e-1/1e5*	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	74	62	52	1400	***11e-1/1e6***	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	85	75	64	*34e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1.6**	**1.5**	**1.5**	33	***11e-1/3e4***	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	5.4	4.6	4.1	**22**	**1**	***17e-2/6e5***	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	3.6	3.1	**2.7**	*14e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	18	16	14	**1**	***57e-2/1e6***	.	.	.	.	.	DASA [19]
DEPSO	20	21	22	*30e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	630	570	510	**2.9**	***65e-2/1e5***	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	31	28	23	*15e-1/1e6*	.	.	.	.	.	.	iAMaLGaM IDEA [4]
NELDER (Han)	4.8	4.6	4.1	*14e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	310	***11e-1/3e4***	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**3.4**	**3**	**2.6**	1400	***12e-1/1e6***	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	*28e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	4.6	4	3.5	*16e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]

Table 141: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{21}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.025	0.025	26.1	529	2520	2530	2530	2540	2550	2560	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	**1**	**1**	20	6.5	**2.7**	**3**	3.3	3.7	4.2	5.9	ALPS [17]
AMaLGaM IDEA	**1**	**1**	21	1800	1700	1700	1700	1700	1700	1700	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	37	8	*13e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	**2.9**	**2.3**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	9.3	BFGS [30]
BIPOP-CMA-ES	**1**	**1**	**2.7**	49	110	110	110	110	110	110	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	4.1	**1.8**	**1.7**	**1.7**	**1.7**	**1.7**	**1.6**	**1.6**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	46	44	27	27	27	27	27	27	DASA [19]
DEPSO	**1**	**1**	18	16	12	*33e-1/2e3*	.	.	.	.	DEPSO [12]
simple GA	**1**	**1**	120	770	560	*25e-1/1e5*	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	38	660	850	850	850	840	840	840	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**1**	13	14	5.6	5.5	5.5	5.5	5.5	5.5	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.6	5.2	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	(1+1)-ES [1]
Monte Carlo	**1**	**1**	*69e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1**	3.4	19	16	16	16	16	16	16	IPOP-SEP-CMA-ES [29]

Table 142: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{22}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.025	0.025	116	886	16200	16200	16300	16300	16300	16400	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	**1**	**1**	8.5	12	35	110	*69e-2/1e5*	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1**	2200	760	*69e-2/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	18	10	*73e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	**1**	**1.5**	*69e-2/8e3*	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1**	**1**	6.4	60	*69e-2/1e5*	.	.	.	.	.	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	**2.7**	**1.8**	**2**	**2**	**2**	**2**	**2**	**2**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	32	31	45	45	45	45	45	45	DASA [19]
DEPSO	**1**	**1**	7.3	10	*26e-1/2e3*	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1**	87	180	*20e-1/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	370	760	*69e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**1**	4.7	3.8	9	9	9	8.9	8.9	8.9	NELDER (Han) [16]
NEWUOA	**1**	**1**	**2.7**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.3	**2.7**	**6.6**	**6.6**	**6.6**	**6.6**	**6.6**	**6.6**	(1+1)-ES [1]
Monte Carlo	**1**	**1**	*71e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1**	13	6	*69e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]

Table 143: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.025	0.025	0.237	298	1890	16500	32000	79000	81100	84000	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS	**1**	**1**	**1**	150	*80e-2/1e5*	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	**1**	**1**	**1.1**	12	**2.5**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.1**	*37e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BFGS	**1**	**1**	58	260	*30e-1/5e3*	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**1**	**1**	5.6	4.8	**1**	**1.6**	**2**	**1.4**	**1.4**	**1.4**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**1**	**1**	12	12	*82e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	**1.5**	76	*68e-2/6e5*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**1.2**	*44e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1**	**1.1**	440	*79e-2/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	**1.1**	**2.3**	**1.1**	**3.1**	**12**	**8.1**	**8**	**7.7**	iAMaLGaM IDEA [4]
NELDER (Han)	**1**	**1**	**1.3**	**1**	*29e-2/1e4*	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	7.1	**1.8**	*46e-2/8e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	24	280	*73e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1**	**1.4**	*22e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**1**	**1**	6.2	4.9	6.3	*89e-3/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]

Table 144: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{24}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.06	967	1.46e5	2.45e6	7.5e6	7.51e6	7.51e6	7.51e6	7.51e6	7.51e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS	5.8	82	*91e+0/1e5*	.	.	.	.	.	.	.	ALPS [17]
AMaLGaM IDEA	13	**4.2**	17	***42e+0/1e6***	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	15	*28e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BFGS	560	*89e+1/8e3*	.	.	.	.	.	.	.	.	BFGS [30]
BIPOP-CMA-ES	**2.3**	12	**4.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
(1+1)-CMA-ES	**2.3**	*34e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	3200	*55e+1/1e6*	.	.	.	.	.	.	.	.	DASA [19]
DEPSO	6.6	*37e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	110	1500	*14e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	6.6	**1**	**8.5**	***10e+0/1e6***	.	.	.	.	.	.	iAMaLGaM IDEA [4]
NELDER (Han)	28	*64e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	*25e+1/9e3*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	1700	*49e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	650	*82e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
IPOP-SEP-CMA-ES	**2.3**	**1.5**	**1**	***46e+0/1e4***	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]

References

[1] Anne Auger. Benchmarking the (1+1) evolution strategy with one-fifth success rule on the BBOB-2009 function testbed. In Rothlauf [32], pages 2447–2452.

[2] Anne Auger and Nikolaus Hansen. Benchmarking the (1+1)-CMA-ES on the BBOB-2009 function testbed. In Rothlauf [32], pages 2459–2466.

[3] Anne Auger and Raymond Ros. Benchmarking the pure random search on the BBOB-2009 testbed. In Rothlauf [32], pages 2479–2484.

[4] Peter A. N. Bosman, Jörn Grahl, and Dirk Thierens. AMaLGaM IDEAs in noiseless black-box optimization benchmarking. In Rothlauf [32], pages 2247–2254.

[5] Benjamin Doerr, Mahmoud Fouz, Martin Schmidt, and Magnus Wahlström. BBOB: Nelder-mead with resize and halfruns. In Rothlauf [32], pages 2239–2246.

[6] Mohammed El-Abd and Mohamed S. Kamel. Black-box optimization benchmarking for noiseless function testbed using an EDA and PSO hybrid. In Rothlauf [32], pages 2263–2268.

[7] Mohammed El-Abd and Mohamed S. Kamel. Black-box optimization benchmarking for noiseless function testbed using particle swarm optimization. In Rothlauf [32], pages 2269–2274.

[8] Mohammed El-Abd and Mohamed S. Kamel. Black-box optimization benchmarking for noiseless function testbed using PSO_Bounds. In Rothlauf [32], pages 2275–2280.

[9] S. Finck, N. Hansen, R. Ros, and A. Auger. Real-parameter black-box optimization benchmarking 2009: Presentation of the noiseless functions. Technical Report 2009/20, Research Center PPE, 2009.

[10] Marcus Gallagher. Black-box optimization benchmarking: results for the BayEDAcG algorithm on the noiseless function testbed. In Rothlauf [32], pages 2281–2286.

[11] Carlos García-Martínez and Manuel Lozano. A continuous variable neighbourhood search based on specialised EAs: application to the noiseless BBO-benchmark 2009. In Rothlauf [32], pages 2287–2294.

[12] José García-Nieto, Enrique Alba, and Javier Apolloni. Noiseless functions black-box optimization: evaluation of a hybrid particle swarm with differential operators. In Rothlauf [32], pages 2231–2238.

[13] N. Hansen, A. Auger, S. Finck, and R. Ros. Real-parameter black-box optimization benchmarking 2009: Experimental setup. Technical Report RR-6828, INRIA, 2009.

[14] N. Hansen, S. Finck, R. Ros, and A. Auger. Real-parameter black-box optimization benchmarking 2009: Noiseless functions definitions. Technical Report RR-6829, INRIA, 2009.

[15] Nikolaus Hansen. Benchmarking a bi-population CMA-ES on the BBOB-2009 function testbed. In Rothlauf [32], pages 2389–2396.

[16] Nikolaus Hansen. Benchmarking the nelder-mead downhill simplex algorithm with many local restarts. In Rothlauf [32], pages 2403–2408.

[17] Gregory S. Hornby. The Age-Layered Population Structure (ALPS) evolutionary algorithm, July 2009. Noiseless testbed.

[18] Waltraud Huyer and Arnold Neumaier. Benchmarking of MCS on the noiseless function testbed. `http://www.mat.univie.ac.at/~neum/papers.html`, 2009. P. 989.

[19] Peter Korosec and Jurij Silc. A stigmergy-based algorithm for black-box optimization: noiseless function testbed. In Rothlauf [32], pages 2295–2302.

[20] Jirí Kubalik. Black-box optimization benchmarking of prototype optimization with evolved improvement steps for noiseless function testbed. In Rothlauf [32], pages 2303–2308.

[21] Daniel Molina, Manuel Lozano, and Francisco Herrera. A memetic algorithm using local search chaining for black-box optimization benchmarking 2009 for noise free functions. In Rothlauf [32], pages 2255–2262.

[22] Miguel Nicolau. Application of a simple binary genetic algorithm to a noiseless testbed benchmark. In Rothlauf [32], pages 2473–2478.

[23] László Pál, Tibor Csendes, Mihály Csaba Markót, and Arnold Neumaier. BBO-benchmarking of the GLOBAL method for the noiseless function testbed. `http://www.mat.univie.ac.at/~neum/papers.html`, 2009. P. 986.

[24] Petr Posik. BBOB-benchmarking a simple estimation of distribution algorithm with Cauchy distribution. In Rothlauf [32], pages 2309–2314.

[25] Petr Posik. BBOB-benchmarking the DIRECT global optimization algorithm. In Rothlauf [32], pages 2315–2320.

[26] Petr Posik. BBOB-benchmarking the generalized generation gap model with parent centric crossover. In Rothlauf [32], pages 2321–2328.

[27] Petr Posik. BBOB-benchmarking the Rosenbrock's local search algorithm. In Rothlauf [32], pages 2337–2342.

[28] Petr Posik. BBOB-benchmarking two variants of the line-search algorithm. In Rothlauf [32], pages 2329–2336.

[29] Raymond Ros. Benchmarking sep-CMA-ES on the BBOB-2009 function testbed. In Rothlauf [32], pages 2435–2440.

[30] Raymond Ros. Benchmarking the BFGS algorithm on the BBOB-2009 function testbed. In Rothlauf [32], pages 2409–2414.

[31] Raymond Ros. Benchmarking the NEWUOA on the BBOB-2009 function testbed. In Rothlauf [32], pages 2421–2428.

[32] Franz Rothlauf, editor. *Genetic and Evolutionary Computation Conference, GECCO 2009, Proceedings, Montreal, Québec, Canada, July 8-12, 2009, Companion Material*. ACM, 2009.