Comparison tables: BBOB 2010 noisy testbed with BBOB 2009 as reference

The BBOBies

August 31, 2010

Abstract

This document provides tabular results of the workshop for Black-Box Optimization Benchmarking at GECCO 2010, see `http://coco.gforge.inria.fr/doku.php?id=bbob-2010`. 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 [11, 7]. The experimental set-up is described in [10].

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 in BBOB-2009 (see [6]) if an algorithm from BBOB-2009 reached the given target function value. The ERT value is given otherwise ($\mathrm{ERT}_{\mathrm{best}}$ is noted as infinite). See [10] for details on how ERT is obtained. Bold entries in the table correspond to values below 3 or the top-three best values.

Table 1: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{101}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss

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	0.50	0.50	0.90	4.0	5.0	5.6	7.2	8.4	10	11	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	3.8	**2.5**	4.2	6.6	8.1	9.5	10	12	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.8	**2.4**	4.8	7.4	8.3	8.7	11	12	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**2.4**	**1.4**	4.3	7.0	7.3	7.9	8.9	11	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	4.6	3.2	6.5	8.5	14	13	14	15	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	5.0	**2.5**	5.0	7.0	7.0	7.7	7.9	9.1	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	3.2	**1.7**	3.3	5.4	6.3	6.6	7.2	8.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	3.2	**1.6**	**2.9**	**4.1**	**4.8**	**5.2**	**5.3**	**6.2**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	4.6	**2.5**	3.3	5.2	5.5	6.4	6.0	7.3	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	3.2	**1.7**	**2.1**	**2.3**	**2.0**	**1.9**	**1.7**	**1.6**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	10	13	14	9.3	13	19	40	49	92	2502	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	5.2	**2.5**	3.8	7.7	8.1	8.9	10	12	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	3.6	3.2	5.8	7.5	8.5	9.2	11	12	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.3**	3.1	10	22	30	35	38	46	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.4**	**1.8**	**2.1**	**2.3**	**2.5**	**2.3**	**2.0**	**1.9**	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.3**	3.2	32	62	67	86	111	192	Basic RCGA [17]
SPSA	24	41	173	159	282	907	764	687	631	641	SPSA [9]

Table 2: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{102}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.90	3.5	5.4	8.3	10	11	12	16	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	5.6	3.2	5.2	5.7	6.6	8.6	9.3	10	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.3	**2.7**	**3.1**	4.7	6.7	7.1	7.6	8.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	3.2	**2.2**	4.1	5.1	6.2	6.9	8.0	8.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	3.1	**2.8**	4.0	5.0	7.5	7.6	10	12	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	4.0	**2.7**	3.9	**4.1**	5.1	5.4	5.5	6.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	4.0	**2.3**	3.2	4.2	4.8	5.6	6.0	6.6	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	3.1	**2.5**	**2.6**	**3.0**	**3.7**	**3.8**	**4.3**	**4.7**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	3.3	**2.3**	3.2	**3.0**	**3.9**	**4.1**	**4.5**	5.0	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.2**	4.0	**2.1**	**2.6**	4.4	**4.1**	**3.7**	**3.4**	**2.8**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	13	16	16	7.1	39	36	47	45	705	3827	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	4.1	3.5	5.9	5.8	7.0	7.9	8.2	9.1	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**2.8**	3.4	5.6	5.2	5.9	7.4	8.0	8.4	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.3**	4.3	11	17	25	26	32	34	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	7.1	11	9.3	7.0	6.6	5.8	5.2	**4.4**	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.0**	3.3	24	47	56	75	103	146	Basic RCGA [17]
SPSA	9.1	16	27	239	265	255	254	873	870	4083	SPSA [9]

Table 3: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{103}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy

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	0.50	0.50	0.90	3.9	4.7	4.7	4.7	4.9	4.9	6.8	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	3.4	3.3	5.3	9.3	13	17	22	23	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.0	**1.9**	4.0	8.0	13	16	19	21	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**2.5**	**2.0**	4.2	8.0	12	15	19	20	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	3.0	3.2	7.3	10	13	16	21	23	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	4.0	**2.1**	4.4	6.4	9.3	12	15	16	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.8**	**1.5**	3.6	6.2	9.1	11	14	14	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.4**	**1.6**	**2.6**	**4.8**	**7.0**	**8.4**	**11**	**11**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	4.3	**2.3**	3.5	5.4	8.1	10	13	13	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	3.1	**1.8**	**2.1**	**3.0**	**4.1**	**4.4**	**7.1**	**6.9**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	12	19	19	6.9	12	19	35	75	82	189	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	3.2	**2.4**	4.4	8.2	12	16	21	21	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	4.0	3.3	5.7	8.5	14	17	22	23	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.4**	**2.6**	13	30	51	63	83	94	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	3.2	**1.6**	**2.1**	**3.1**	**4.2**	**4.9**	**6.4**	**7.8**	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.6**	3.9	22	52	110	167	268	423	Basic RCGA [17]
SPSA	22	38	369	195	256	375	1471	4060	11338	12346	SPSA [9]

Table 4: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{104}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.60	2.0	2.7	7.3	97	120	124	126	128	132	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
(1,2)-CMA-ES	4.3	4.2	7.5	28	9.3	16	19	20	20	29	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.5**	4.0	5.8	22	4.9	8.6	10	10	10	11	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.2	**1.9**	4.8	14	4.4	8.5	11	12	12	13	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	11	4.8	9.2	37	11	22	29	57	58	74	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.2	3.6	6.6	13	**2.8**	**2.8**	3.0	3.2	3.3	3.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	4.6	3.2	5.6	18	**2.3**	**2.5**	**2.6**	**2.7**	**2.9**	**3.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.6**	**1.3**	**2.9**	**7.5**	**1.7**	**1.8**	**2.0**	**2.1**	**2.1**	**2.3**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.8**	**1.7**	**3.6**	12	**2.9**	3.8	3.9	4.0	4.0	4.1	(1,4s)-CMA-ES [3]
avg NEWUOA	5.2	**2.8**	4.3	**7.8**	**1.2**	3.5	5.3	6.4	6.8	8.7	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	45	18	20	19	26	72	199	197	305	392	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.8**	**2.2**	**3.5**	**5.8**	**1.2**	**1.8**	**2.1**	**2.3**	**2.4**	**2.7**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	5.3	3.2	5.1	15	**2.7**	3.2	3.9	4.1	4.4	4.6	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.8**	**2.3**	6.6	11	3.1	4.3	5.1	5.8	6.5	7.5	CMA+DE-MOS [13]
NEWUOA	7.3	**2.9**	6.4	13	3.4	6.5	10	13	12	13	NEWUOA [16]
Basic RCGA	3.2	**2.0**	7.7	19	34	89	245	514	1709	*10e-5/5e4*	Basic RCGA [17]
SPSA	611	294	840	1711	4319	*39e-2/1e5*	.	.	.	.	SPSA [9]

Table 5: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{105}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

105 Rosenbrock moderate unif

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	0.60	2.0	2.7	7.4	178	186	190	195	198	205	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	5.8	4.7	7.3	35	9.3	18	32	54	68	66	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	4.8	3.4	12	17	**2.3**	8.4	17	35	36	38	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.4**	**1.8**	**4.3**	**8.3**	3.3	13	22	32	41	40	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.7	3.3	12	36	4.4	16	42	119	121	156	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.4	4.0	5.6	35	**2.9**	4.9	6.4	6.4	6.3	6.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.7**	**2.4**	**4.1**	23	**1.8**	**3.6**	**4.0**	**4.3**	**4.3**	**4.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	5.4	**2.8**	5.6	17	**2.6**	4.5	5.4	5.9	6.8	6.7	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.3	5.8	**5.2**	24	3.1	6.2	7.3	7.8	7.8	7.7	(1,4s)-CMA-ES [3]
avg NEWUOA	6.4	3.7	7.0	13	**2.3**	8.6	29	55	196	388	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	50	21	18	17	41	238	959	2211	3364	6907	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	8.3	3.1	6.6	**8.3**	**1.0**	**1.5**	**1.9**	**2.0**	**2.0**	**2.2**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	6.5	3.7	5.5	16	**2.3**	5.4	5.7	5.8	5.9	6.1	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	**2.3**	6.2	**7.4**	**1.6**	**2.9**	**3.4**	**3.7**	**4.0**	**4.7**	CMA+DE-MOS [13]
NEWUOA	6.3	**2.7**	7.9	16	3.1	6.3	22	42	41	115	NEWUOA [16]
Basic RCGA	3.3	3.9	8.1	11	13	50	165	465	1153	*18e-5/5e4*	Basic RCGA [17]
SPSA	519	302	320	1513	1483	8005	*34e-2/1e5*	.	.	.	SPSA [9]

Table 6: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{106}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

106 Rosenbrock moderate Cauchy

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	0.60	2.0	2.7	7.6	70	140	176	206	245	325	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	8.0	7.2	28	53	13	9.3	8.4	7.5	6.5	5.1	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	5.1	4.8	6.8	12	4.8	3.8	3.8	3.6	3.3	**2.7**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.8	3.2	5.4	**3.9**	4.8	3.1	3.2	**3.0**	**2.6**	**2.1**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.8	3.3	3.9	84	30	21	18	20	18	16	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	5.4	3.2	6.1	11	**2.7**	**1.7**	**1.6**	**1.4**	**1.3**	**1.1**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.8**	**1.7**	4.2	6.3	**2.0**	**1.4**	**1.3**	**1.3**	**1.1**	**0.97**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	4.7	3.0	**3.0**	**2.8**	**1.3**	**1.1**	**1.0**	**1.0**	**0.91**	**0.76**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.8**	**1.7**	**2.6**	10	**2.9**	**1.8**	**1.7**	**1.5**	**1.3**	**1.1**	(1,4s)-CMA-ES [3]
avg NEWUOA	4.6	**2.2**	3.7	**4.5**	**2.1**	**2.1**	3.2	3.3	4.3	5.9	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	54	36	96	91	15	10	8.7	7.7	35	30	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.4	3.5	8.3	7.7	**2.1**	**1.7**	**1.5**	**1.5**	**1.4**	**1.2**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	3.1	**2.2**	3.9	9.2	3.4	**2.6**	**2.6**	**2.5**	**2.3**	**2.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	**2.2**	6.1	13	3.9	3.6	3.7	3.5	3.6	3.3	CMA+DE-MOS [13]
NEWUOA	3.1	**2.1**	**2.6**	6.1	**2.0**	**2.3**	3.2	3.2	4.8	5.7	NEWUOA [16]
Basic RCGA	**2.4**	3.2	6.8	12	18	103	308	384	658	2206	Basic RCGA [17]
SPSA	1018	895	2614	6207	3396	10059	*40e-2/1e5*	.	.	.	SPSA [9]

Table 7: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{107}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.90	6.6	14	57	79	101	128	211	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	30	14	10	3.9	5.1	7.8	11	13	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	4.4	5.2	4.0	**1.8**	**1.6**	**1.5**	**1.5**	**1.6**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**2.3**	**2.2**	**1.9**	**1.4**	**1.6**	**1.9**	**1.6**	**2.0**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	5.4	**2.4**	5.2	6.0	7.2	8.7	7.6	9.1	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	11	3.6	7.7	**2.6**	**2.2**	**2.1**	**2.1**	**1.8**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	7.3	**2.2**	4.4	**1.5**	**1.3**	**1.3**	**1.7**	**1.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.1**	**1.8**	**1.6**	**0.66**	**0.75**	**0.75**	**1.4**	**1.2**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	6.1	11	7.7	**2.4**	**2.5**	**2.1**	**2.0**	**2.0**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	14	32	24	13	15	31	45	80	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	9.2	14	20	6.9	11	3.6	25	84	153	303	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	5.2	**2.7**	**2.7**	**1.3**	**1.2**	**1.2**	**1.1**	**0.98**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	5.6	**1.9**	**2.7**	**1.2**	**1.1**	**1.2**	**1.1**	**1.00**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.5**	**2.0**	6.1	4.5	6.0	5.9	5.7	4.5	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	26	20	31	17	20	37	82	83	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.8**	**2.0**	9.1	8.6	10	8.8	13	20	Basic RCGA [17]
SPSA	16	21	483	1439	3795	4061	3907	14051	*27e-3/1e5*	.	SPSA [9]

Table 8: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{108}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.90	15	101	713	1711	2608	3684	7989	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.2**	17	13	5.6	3.7	14	*26e-4/1e4*	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	30	17	8.8	6.5	41	*29e-4/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	30	7.8	5.5	10	38	*60e-4/1e4*	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	17	12	10	8.9	*56e-4/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	49	12	4.1	**2.1**	7.5	54	38	*61e-5/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	86	14	5.8	**2.4**	4.7	17	*50e-5/1e4*	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	14	14	6.1	5.7	5.7	17	*48e-5/1e4*	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	145	26	8.7	3.8	4.8	18	40	*51e-5/1e4*	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	87	42	20	18	16	*14e-3/6e3*	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1612	6028	4047	310	143	67	53	61	188	184	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.2**	5.7	6.0	**3.5**	**0.82**	**0.68**	**0.99**	**1.0**	**0.79**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**3.7**	**3.8**	**1.6**	**0.97**	**0.93**	**1.0**	**1.1**	**0.76**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.4**	**1.0**	**2.3**	**1.8**	**1.6**	**4.1**	**4.5**	**3.7**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	121	56	24	22	25	*13e-3/6e3*	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.3**	**1.3**	12	20	21	28	46	*21e-5/5e4*	Basic RCGA [17]
SPSA	27	126	204	101	101	88	*28e-4/1e5*	.	.	.	SPSA [9]

Table 9: 02-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{109}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy

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	0.50	0.50	0.90	4.8	6.3	34	34	48	48	48	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1.5**	**2.5**	3.4	4.5	**1.5**	4.3	3.8	5.1	9.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**2.6**	**2.0**	**2.8**	**1.4**	**2.3**	**2.3**	3.3	5.3	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1.7**	**1.4**	**2.8**	**1.1**	**1.9**	**1.7**	**2.3**	3.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	6.6	3.7	5.0	6.4	9.4	7.4	8.2	15	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	4.3	**2.1**	3.0	**0.97**	**1.8**	**1.7**	**2.5**	3.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	5.1	**2.6**	4.0	**1.1**	**1.9**	**1.8**	**2.3**	**3.5**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.5**	**1.9**	**3.0**	**0.96**	**1.4**	**1.3**	**1.8**	**2.4**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**2.2**	**1.4**	**2.9**	**0.96**	**1.7**	**1.5**	**1.9**	**2.6**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	3.3	**2.6**	15	7.0	9.0	11	15	31	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	21	21	6.9	11	7.0	116	95	889	29122	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	3.2	**2.0**	3.4	**1.2**	**2.0**	**2.4**	3.1	4.8	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**2.0**	**1.4**	3.8	**1.2**	**2.1**	**2.2**	3.4	5.4	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.3**	**2.3**	8.6	5.9	8.8	11	14	24	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	3.3	3.6	12	5.6	10	13	22	36	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.8**	**2.5**	15	10	19	24	36	67	Basic RCGA [17]
SPSA	19	32	282	131	273	349	1660	2432	9217	*72e-6/1e5*	SPSA [9]

Table 10: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{110}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss

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	0.60	2.2	3.6	17	312	651	1159	2181	4204	4577	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	3.4	**1.7**	23	11	3.4	6.1	6.9	15	34	*22e-5/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	15	7.2	7.7	5.7	**2.1**	3.3	4.4	5.5	4.6	15	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**3.1**	3.3	5.2	5.6	**1.5**	**3.2**	8.2	8.0	17	32	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	5.3	15	17	18	4.2	4.7	6.3	8.9	7.6	31	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	3.2	**2.2**	**3.7**	6.0	4.1	5.9	5.4	4.6	3.5	5.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	4.8	**3.0**	**3.2**	**1.8**	**1.7**	**1.7**	**1.9**	**1.6**	**1.1**	**1.3**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	4.9	**2.3**	7.3	5.3	**2.1**	4.4	3.9	4.0	**2.6**	3.3	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	4.2	**2.6**	3.9	8.2	**2.8**	3.3	**2.9**	**2.8**	**2.8**	**2.7**	(1,4s)-CMA-ES [3]
avg NEWUOA	3.8	10	11	5.1	**2.5**	**3.0**	6.8	11	5.9	*12e-4/5e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	211	120	89	24	13	201	1238	*99e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.3	**2.3**	**3.7**	**3.7**	6.1	5.3	3.2	**1.7**	**0.94**	**0.90**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	7.3	3.6	4.6	8.0	4.2	5.1	**3.2**	**1.9**	**0.99**	**0.96**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	**2.2**	6.6	285	16	15	9.1	5.1	**2.7**	**2.6**	CMA+DE-MOS [13]
NEWUOA	22	15	16	15	**2.9**	4.4	9.1	36	*19e-4/5e3*	.	NEWUOA [16]
Basic RCGA	**2.4**	**2.0**	**3.1**	**4.1**	5.1	22	33	39	55	157	Basic RCGA [17]
SPSA	531	198	339	832	1381	*38e-2/1e5*	.	.	.	.	SPSA [9]

Table 11: 02-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{111}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

111 Rosenbrock unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.60	3.7	12	59	359	2707	6359	14589	30930	84555	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	18	7.2	5.9	8.5	12	6.2	*21e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	3.4	8.2	9.0	3.6	11	26	*30e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	20	16	11	8.9	7.3	12	*17e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	36	7.8	8.9	10	6.8	12	*15e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	62	21	12	4.7	**5.5**	3.5	**5.1**	**4.9**	4.8	*61e-4/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	58	15	11	6.7	5.8	**2.9**	11	*47e-4/1e4*	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	20	5.4	**3.6**	4.5	6.3	6.9	11	*12e-3/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	8.7	16	11	7.6	9.2	3.4	7.3	*17e-4/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	72	48	45	29	53	33	*26e-2/6e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	570	605	196	64	22	15	33	101	48	*22e-4/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	4.6	**2.7**	7.5	3.3	**3.9**	**3.2**	**3.9**	**2.4**	**1.3**	**0.51**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**3.3**	4.3	5.0	**3.3**	**4.8**	**2.0**	**4.3**	**2.6**	**1.3**	**0.55**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.7**	**1.4**	**2.0**	**2.2**	44	23	12	6.1	**3.3**	**1.3**	CMA+DE-MOS [13]
NEWUOA	137	33	21	25	19	11	*68e-3/6e3*	.	.	.	NEWUOA [16]
Basic RCGA	**2.5**	**1.1**	**1.1**	**1.5**	9.1	4.0	5.7	16	24	*32e-5/5e4*	Basic RCGA [17]
SPSA	73	23	52	152	173	544	*51e-3/1e5*	.	.	.	SPSA [9]

Table 12: 02-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{112}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.60	2.0	2.7	7.3	312	522	577	618	686	766	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	6.1	4.1	9.2	25	6.2	4.8	5.2	5.7	6.6	6.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.9**	**2.5**	34	81	3.8	3.4	4.2	4.1	3.9	3.6	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.6	3.7	7.8	46	**2.1**	**2.0**	**2.2**	**2.2**	**2.1**	**2.0**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	12	6.8	8.2	104	8.9	15	24	36	33	56	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	6.4	3.7	5.0	11	**0.83**	**0.93**	**1.00**	**1.1**	**1.0**	**1.0**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	7.1	3.9	**4.5**	**4.3**	**0.62**	**0.72**	**0.82**	**0.86**	**0.83**	**0.86**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	4.1	**2.4**	6.3	15	**0.88**	**0.70**	**0.72**	**0.72**	**0.69**	**0.69**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.2	**2.3**	**4.5**	12	**1.1**	**0.95**	**0.97**	**0.99**	**0.94**	**0.91**	(1,4s)-CMA-ES [3]
avg NEWUOA	4.7	**2.5**	5.1	11	**1.1**	4.6	22	118	*19e-4/5e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	36	28	27	44	5.0	79	309	*12e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.1	**1.7**	4.9	16	**1.0**	**0.88**	**0.91**	**0.94**	**0.90**	**0.91**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.7**	**2.2**	**4.0**	**5.1**	**0.64**	**0.92**	**1.1**	**1.2**	**1.1**	**1.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	**2.3**	6.7	11	**1.1**	**1.8**	**2.1**	**2.2**	**2.3**	**2.7**	CMA+DE-MOS [13]
NEWUOA	5.1	**2.7**	5.0	13	**1.2**	**1.7**	10	112	101	*70e-5/5e3*	NEWUOA [16]
Basic RCGA	4.6	3.0	8.9	**9.0**	4.2	43	85	114	240	447	Basic RCGA [17]
SPSA	12128	3760	2996	3330	671	2693	2435	*21e-2/1e5*	.	.	SPSA [9]

Table 13: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{113}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.50	1.1	2.4	16	44	70	87	87	87	438	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1.9**	8.4	8.0	7.3	13	23	34	34	34	12	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.3**	4.6	4.4	**3.9**	**7.6**	**7.8**	10	10	10	4.0	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.8**	4.9	4.5	6.6	12	19	22	22	22	5.0	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	14	8.4	10	9.3	14	18	39	39	39	11	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.0**	**2.0**	**2.9**	15	14	13	16	16	16	4.2	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.8**	16	8.8	6.5	12	12	16	16	16	3.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	3.4	3.8	3.6	7.0	15	12	**10**	**10**	**10**	**2.1**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.9**	5.6	13	8.4	16	17	14	14	14	4.0	(1,4s)-CMA-ES [3]
avg NEWUOA	**2.1**	13	10	6.1	**10**	19	33	33	33	13	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	35	29	17	41	350	978	1184	1184	1184	556	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.4**	3.0	**2.2**	10	17	12	14	14	14	**2.8**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.3**	**2.6**	3.8	19	15	**11**	**9.4**	**9.4**	**9.4**	**2.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.4**	**2.1**	**3.1**	**3.9**	**6.3**	**6.9**	**7.4**	**7.4**	**7.4**	**1.9**	CMA+DE-MOS [13]
NEWUOA	**2.4**	8.7	12	5.8	16	29	42	42	42	14	NEWUOA [16]
Basic RCGA	**1.5**	**1.6**	4.7	**3.7**	85	177	212	212	212	52	Basic RCGA [17]
SPSA	17	18	19	1040	901	3536	2899	2899	2899	761	SPSA [9]

Table 14: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{114}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.83	4.4	21	349	1237	2671	2671	2671	4340	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1.5**	28	7.0	15	6.3	9.2	25	25	25	33	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	17	43	14	12	4.6	6.2	6.9	6.9	6.9	*32e-4 /1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	8.8	41	26	19	5.7	6.6	17	17	17	*63e-4 /1e4*	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	17	33	12	13	8.3	7.4	7.8	7.8	7.8	16	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.9**	43	17	12	**3.8**	4.1	4.8	4.8	4.8	17	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.5**	19	7.6	15	5.7	6.4	5.1	5.1	5.1	8.0	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	4.5	71	31	20	4.5	**3.4**	7.0	7.0	7.0	10	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.4**	44	14	19	7.1	13	7.6	7.6	7.6	**4.7**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.5**	66	29	16	26	21	33	33	33	20	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	618	605	211	197	60	33	21	21	21	45	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.8**	14	8.6	10	**2.8**	**1.7**	**1.7**	**1.7**	**1.7**	**1.3**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.9**	**4.2**	**2.6**	**5.6**	**1.6**	**0.73**	**0.84**	**0.84**	**0.84**	**0.83**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.4**	**2.8**	**1.3**	**3.8**	8.9	4.3	**2.2**	**2.2**	**2.2**	5.0	CMA+DE-MOS [13]
NEWUOA	**1.9**	41	69	53	38	71	33	33	33	*21e-2 /6e3*	NEWUOA [16]
Basic RCGA	**1.8**	**1.8**	**1.1**	**6.3**	18	22	20	20	20	17	Basic RCGA [17]
SPSA	99	270	107	184	81	88	118	118	118	*63e-4 /1e5*	SPSA [9]

Table 15: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{115}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	1.0	1.6	6.4	112	180	197	197	197	271	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**2.0**	3.8	5.0	7.0	**1.8**	4.3	6.9	6.9	6.9	19	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.2**	**2.4**	6.2	5.1	**1.6**	**2.3**	5.5	5.5	5.5	16	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.9**	**2.1**	5.3	4.9	**1.5**	**2.9**	6.0	6.0	6.0	13	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1.7**	**1.9**	5.2	7.3	**1.6**	7.4	9.1	9.1	9.1	18	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.4**	**2.2**	4.7	**4.9**	**1.1**	**2.2**	**2.5**	**2.5**	**2.5**	3.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.3**	**2.5**	**3.1**	**4.9**	**1.3**	**2.3**	**2.2**	**2.2**	**2.2**	**2.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.9**	**2.2**	**3.4**	5.9	**0.91**	**1.2**	**2.0**	**2.0**	**2.0**	**1.8**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.5**	4.3	6.1	**3.9**	**0.89**	**1.9**	**2.2**	**2.2**	**2.2**	**2.6**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.5**	**2.8**	6.5	7.3	**2.9**	6.1	7.1	7.1	7.1	12	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	12	14	18	99	325	551	551	551	1224	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.3**	3.3	**3.8**	5.4	**1.4**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.7**	4.5	5.2	14	**2.2**	**2.4**	**2.5**	**2.5**	**2.5**	**2.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.4**	**2.1**	4.1	5.6	**1.9**	**2.0**	6.3	6.3	6.3	5.3	CMA+DE-MOS [13]
NEWUOA	**2.0**	**2.5**	4.5	12	**2.9**	4.4	11	11	11	11	NEWUOA [16]
Basic RCGA	**1.6**	**1.9**	5.2	59	24	101	113	113	113	136	Basic RCGA [17]
SPSA	47	48	110	435	151	268	778	778	778	2416	SPSA [9]

Table 16: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{116}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	3.3	6.8	25	50	78	103	138	165	521	894	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	12	12	13	23	31	70	102	194	131	160	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.0**	9.4	22	28	48	128	116	159	64	50	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.4**	4.4	11	**10**	35	69	88	189	135	166	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	13	40	16	26	39	165	*12e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.9**	**2.2**	15	20	35	44	42	**36**	16	9.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.9**	**2.5**	10	25	34	49	48	46	18	12	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.8**	8.0	15	20	**21**	**34**	**35**	37	14	9.4	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.5**	**2.3**	**6.4**	24	**30**	49	51	50	19	14	(1,4s)-CMA-ES [3]
avg NEWUOA	7.9	6.2	12	**15**	32	98	125	479	*14e-3/5e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	67	132	512	1079	3593	6360	10202	*34e-2/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.2	**2.9**	25	22	**19**	**15**	**14**	**12**	**3.9**	**2.4**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.7**	3.8	28	42	36	**36**	**30**	**26**	**8.4**	**5.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.2**	3.7	33	83	70	56	44	38	**13**	**7.9**	CMA+DE-MOS [13]
NEWUOA	5.4	4.6	**6.3**	**18**	38	107	571	*50e-3/5e3*	.	.	NEWUOA [16]
Basic RCGA	**1.9**	4.5	**4.6**	102	476	859	1611	2102	670	817	Basic RCGA [17]
SPSA	20	19	61	307	1150	4537	10864	*43e-3/1e5*	.	.	SPSA [9]

Table 17: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{117}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

117 Ellipsoid unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	4.8	17	84	673	3227	6957	14112	14949	18210	21616	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	9.2	8.6	8.9	6.0	5.6	*12e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	6.6	7.5	8.0	5.4	5.7	21	11	*11e-2/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	8.8	7.7	10	**3.7**	6.9	*14e-2/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	10	8.4	9.4	8.6	13	*31e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	11	9.3	10	3.8	**2.0**	10	*36e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	14	6.2	7.3	**3.3**	6.0	10	*12e-2/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	15	13	10	4.6	3.3	6.0	10	*59e-3/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	7.9	8.7	**4.8**	4.5	**2.7**	**3.9**	11	*33e-3/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	15	32	24	10	8.4	*78e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	50	112	115	32	62	103	103	*17e-2/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	5.5	5.5	**5.0**	**3.6**	**1.8**	**0.99**	**0.67**	**0.67**	**0.61**	**0.63**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**3.2**	**4.8**	10	4.5	**2.0**	**1.5**	**0.95**	**0.96**	**0.95**	**0.93**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	**1.2**	**1.6**	3.7	4.2	4.3	**2.4**	**2.6**	**2.4**	**2.9**	CMA+DE-MOS [13]
NEWUOA	43	25	29	12	26	*97e-2/6e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.7**	**1.6**	5.9	22	15	13	11	*73e-3/5e4*	.	.	Basic RCGA [17]
SPSA	58	41	80	129	131	214	105	*35e-2/1e5*	.	.	SPSA [9]

Table 18: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{118}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	2.1	2.5	10	52	66	252	292	326	388	486	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
(1,2)-CMA-ES	7.5	12	55	19	18	5.4	5.1	5.5	5.1	4.6	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.6**	5.5	45	18	17	4.7	4.3	4.0	3.6	3.2	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.4	11	20	8.4	7.7	**2.8**	**2.7**	**2.7**	**2.4**	**2.1**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	3.2	14	131	52	64	24	25	23	20	16	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	3.6	6.6	12	4.7	4.1	**1.4**	**1.3**	**1.2**	**1.1**	**1.0**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	3.7	6.6	9.1	3.5	3.9	**1.2**	**1.1**	**1.2**	**1.0**	**1.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	3.6	7.3	5.9	**2.0**	**2.2**	**0.68**	**0.65**	**0.65**	**0.60**	**0.56**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.4**	**3.9**	**4.8**	**2.8**	**3.2**	**0.93**	**0.93**	**0.91**	**0.82**	**0.72**	(1,4s)-CMA-ES [3]
avg NEWUOA	**2.4**	**2.3**	**2.8**	3.8	12	9.0	21	221	*90e-5/5e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	42	142	61	44	533	615	1377	1231	3617	2888	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.0	8.1	7.9	**3.4**	**3.7**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	3.8	6.5	12	4.8	5.7	**2.4**	**2.5**	**2.4**	**2.2**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.5**	10	8.6	4.8	6.0	**2.0**	**2.2**	**2.5**	**2.5**	**2.9**	CMA+DE-MOS [13]
NEWUOA	**2.1**	**2.6**	**5.6**	4.2	11	10	35	71	187	*11e-4/5e3*	NEWUOA [16]
Basic RCGA	4.0	5.4	76	100	462	253	280	1078	907	*16e-3/5e4*	Basic RCGA [17]
SPSA	61	400	1210	755	4425	5579	*20e-2/1e5*	.	.	.	SPSA [9]

Table 19: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{119}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

119 Sum of diff powers Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.70	5.4	36	88	520	950	2384	5041	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.1**	**2.5**	4.0	6.4	6.7	3.9	7.4	7.7	29	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**2.0**	3.1	8.4	4.0	**2.8**	**1.2**	**2.2**	3.3	14	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.2**	**2.0**	5.4	**2.8**	**2.4**	**2.1**	3.1	**2.9**	8.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.6**	**2.2**	4.9	4.4	7.0	4.8	15	61	*90e-6/1e4*	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**2.1**	3.3	4.0	3.9	**1.9**	**1.1**	**1.5**	**1.9**	8.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.1**	**2.1**	6.8	**2.3**	**1.5**	**1.5**	**2.0**	**1.6**	6.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.9**	**3.0**	5.6	**1.4**	**1.6**	**0.70**	**1.3**	**1.3**	14	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.4**	**3.0**	13	3.6	3.1	**1.0**	**2.2**	**2.1**	9.0	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.4**	**2.9**	18	8.0	14	5.9	6.6	6.8	*67e-6/5e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	12	20	17	**3.7**	**1.8**	13	81	83	183	*34e-6/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.1**	**1.7**	6.6	**1.7**	**1.3**	**0.78**	**1.6**	**1.0**	**0.76**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.7**	3.8	7.9	**2.2**	**1.5**	**1.1**	**2.5**	**1.6**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.2**	**1.9**	**2.8**	5.1	5.7	**1.5**	**1.2**	**0.67**	**0.55**	CMA+DE-MOS [13]
NEWUOA	**1**	**2.6**	3.1	15	8.6	23	7.1	19	33	15	NEWUOA [16]
Basic RCGA	**1**	**1.2**	**1.4**	**2.2**	3.2	8.8	4.5	11	10	19	Basic RCGA [17]
SPSA	15	32	35	933	1158	2645	838	*21e-3/1e5*	.	.	SPSA [9]

Table 20: 02-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{120}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

120 Sum of diff powers unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.70	5.7	187	1257	2862	12965	37703	94320	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.7**	19	34	6.0	7.5	*76e-4/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.1**	19	19	4.7	14	*12e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**2.9**	22	19	4.9	8.2	*52e-4/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.1**	12	33	9.3	13	52	*15e-3/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.3**	**2.6**	41	4.4	7.4	**15**	*56e-4/1e4*	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.5**	36	26	5.0	**4.3**	49	*25e-4/1e4*	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.5**	17	26	4.9	4.3	*54e-4/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.6**	9.5	3.9	7.9	*79e-4/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	9.5	37	74	42	15	*94e-3/6e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	423	709	620	222	37	66	247	*53e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.2**	**2.0**	**8.7**	**2.4**	**0.94**	**1.1**	**0.68**	**0.53**	**0.56**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.5**	3.5	23	**3.5**	**1.5**	**1.5**	**0.78**	**0.45**	**0.64**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	**1.9**	**4.5**	**3.0**	4.4	16	**11**	**4.1**	**5.7**	CMA+DE-MOS [13]
NEWUOA	**1**	3.1	48	61	41	34	*98e-3/6e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**2.0**	**1.6**	6.8	13	19	16	19	*31e-5/5e4*	Basic RCGA [17]
SPSA	57	173	152	151	107	254	*13e-3/1e5*	.	.	.	SPSA [9]

Table 21: 02-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{121}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.70	3.5	21	72	164	376	560	851	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.6**	**2.3**	3.8	**2.5**	4.1	6.6	5.9	7.5	10	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.3**	**2.2**	**2.5**	**2.0**	**1.1**	**1.5**	**2.9**	3.5	4.9	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.3**	**2.5**	3.4	**1.0**	**1.1**	**1.3**	**1.7**	**2.2**	**2.7**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.3**	4.1	5.0	**1.8**	3.4	16	18	30	84	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.2**	3.1	3.2	**1.5**	**0.99**	**0.92**	**0.85**	**1.1**	**1.4**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.5**	**2.9**	3.2	**1.6**	**1.3**	**1.3**	**1.4**	**1.3**	**1.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.2**	**2.2**	**2.0**	**0.97**	**0.68**	**0.70**	**0.72**	**0.71**	**0.71**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.7**	**2.7**	**2.8**	**1.1**	**0.78**	**0.69**	**0.72**	**0.73**	**0.79**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.6**	**2.6**	5.7	4.4	6.3	22	35	*31e-5/5e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	15	25	22	31	10	10	61	339	2516	*13e-5/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.3**	**2.7**	3.1	**1.4**	**1.2**	**1.3**	**1.1**	**1.2**	**1.4**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**2.0**	4.1	3.7	**1.6**	**1.0**	**1.6**	**2.0**	**2.2**	**2.6**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.2**	**2.1**	4.1	5.7	3.8	3.9	**2.9**	**2.9**	3.3	CMA+DE-MOS [13]
NEWUOA	**1**	**1.6**	**2.7**	4.4	3.0	7.6	14	57	121	*40e-5/5e3*	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**1.7**	**2.0**	8.0	6.2	14	15	37	104	Basic RCGA [17]
SPSA	33	60	126	806	2749	1758	1936	*13e-3/1e5*	.	.	SPSA [9]

Table 22: 02-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{122}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	1.5	48	261	705	1122	1676	2176	4781	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**2.9**	14	5.0	4.8	12	61	*53e-4/1e4*	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.3**	**2.3**	**3.3**	**1.6**	4.9	10	19	32	*98e-5/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.7**	12	3.7	3.1	4.1	38	*32e-4/1e4*	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.6**	23	4.2	7.0	22	*16e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.3**	5.7	5.9	3.3	3.1	4.7	14	32	*23e-5/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.1**	4.7	3.8	**2.5**	**2.8**	**3.3**	6.0	7.6	31	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.4**	31	**2.2**	**2.1**	**2.4**	5.9	14	20	*38e-5/1e4*	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.9**	36	4.4	5.7	7.3	20	27	67	*32e-4/1e4*	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.3**	14	10	33	55	*11e-2/5e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	12	16	16	21	37	91	195	*53e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.3**	3.5	**1.2**	**0.81**	**0.78**	**0.75**	**0.69**	**0.90**	**0.60**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.3**	29	3.9	**2.5**	**1.2**	**1.1**	**1.00**	**0.98**	**0.74**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.4**	**2.1**	30	21	10	7.5	**5.8**	**5.1**	**2.9**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.7**	10	16	30	54	*99e-3/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.2**	10	22	14	21	25	45	*25e-6/5e4*	Basic RCGA [17]
SPSA	21	38	60	803	*44e-2/1e5*	.	.	.	.	.	SPSA [9]

Table 23: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{123}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif

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	0.50	0.50	1.6	106	3186	12428	19367	28294	50007	1.09e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.8**	26	7.1	47	*24e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.2**	**2.8**	18	**4.8**	7.2	*13e-2/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.1**	6.1	30	7.5	45	*23e-2/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.2**	48	10	22	*18e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.8**	21	8.6	**3.5**	*83e-3/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.3**	**7.3**	**4.7**	11	*13e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**2.0**	29	6.3	4.4	**12**	*98e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**2.8**	78	6.8	11	*11e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	10	66	24	28	*46e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	261	1354	557	126	20	25	*48e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.0**	19	5.7	**0.88**	**0.54**	**0.71**	**0.81**	**0.67**	**0.82**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.6**	18	**3.7**	**0.74**	**0.69**	**1.0**	**0.90**	**0.75**	**0.72**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.5**	**1.9**	40	39	18	**15**	**11**	**7.9**	**5.2**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	56	32	28	*44e-2/6e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.5**	**2.9**	21	23	*11e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	32	64	137	76	221	*22e-2/1e5*	.	.	.	.	SPSA [9]

Table 24: 02-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{124}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy

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	0.50	0.50	1.8	32	158	340	996	1737	2798	4510	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**2.1**	3.9	13	14	26	69	*60e-4/1e4*	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.8**	**3.0**	3.4	**1.9**	4.5	12	*98e-5/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.9**	3.1	**2.8**	4.5	5.5	8.4	82	*89e-5/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.7**	15	12	13	44	*16e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	3.9	3.3	7.8	4.5	6.4	8.0	25	*23e-5/1e4*	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.4**	3.2	4.5	**1.4**	**2.7**	3.2	10	50	*23e-5/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.8**	26	5.1	**1.8**	**1.6**	**1.7**	11	51	*23e-5/1e4*	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.1**	**1.5**	**1.8**	10	4.6	5.0	8.0	85	*42e-5/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.7**	12	9.3	22	61	*98e-3/5e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	20	36	11	38	142	226	814	*19e-4/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.8**	**2.2**	**1.0**	**0.89**	**1.5**	**1.1**	**1.1**	**1.5**	**2.0**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.4**	3.5	**1.2**	**0.69**	**0.81**	**1.3**	**1.4**	**2.0**	**2.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.5**	**1.9**	3.1	15	20	10	**6.2**	**7.8**	**7.4**	CMA+DE-MOS [13]
NEWUOA	**1**	**2.2**	5.6	6.5	14	46	*33e-3/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**1.2**	3.0	23	25	33	56	130	*19e-5/5e4*	Basic RCGA [17]
SPSA	48	90	4547	844	468	2050	*37e-3/1e5*	.	.	.	SPSA [9]

Table 25: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{125}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.50	0.50	0.50	74	575	1228	1927	3778	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	5.6	14	105	4.4	4.1	4.0	6.1	*63e-7/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	5.8	54	**1.6**	**2.8**	3.1	5.5	12	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	**3.9**	**34**	**2.6**	3.4	4.4	7.0	18	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.1**	11	137	3.2	5.5	4.4	7.6	38	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	**4.5**	**25**	**1.9**	5.7	5.2	7.9	12	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.1**	5.9	49	**2.5**	4.0	3.5	3.8	4.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	5.5	61	3.1	3.4	**2.1**	3.1	6.5	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.2**	5.2	**31**	**1.8**	6.1	6.0	6.2	18	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**2.3**	6.9	46	**1.8**	**2.7**	**2.4**	**2.3**	6.2	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	20	25	34	87	5.0	5.4	6.8	14	40	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.1**	**4.7**	53	**1.4**	**1.5**	**1.0**	**1.4**	**0.94**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.2**	5.9	34	**2.1**	**2.0**	**1.3**	**1.9**	**1.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	5.8	44	**1.2**	**0.47**	3.3	**2.2**	**1.2**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.0**	6.1	77	**1.4**	**2.6**	**2.1**	**2.6**	10	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.2**	6.4	58	**1.9**	**2.7**	4.7	5.0	13	Basic RCGA [17]
SPSA	22	32	37	61	169	**2.2**	98	230	344	*45e-5/1e5*	SPSA [9]

Table 26: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{126}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif

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	0.50	0.50	0.50	0.50	0.50	151	1709	3408	5528	18193	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**2.3**	53	300	7.2	6.8	20	26	*75e-5/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.1**	**4.2**	141	6.3	4.8	6.0	8.0	*23e-5/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	**3.5**	236	4.0	8.9	7.9	27	*81e-5/1e4*	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.1**	39	246	9.1	8.5	12	25	*12e-4/1e4*	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	6.3	336	4.4	3.6	9.0	12	7.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	7.4	111	3.3	3.9	3.8	5.6	*64e-6/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1.1**	41	113	**2.3**	3.1	3.6	5.5	8.0	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	12	256	3.4	4.8	4.7	*18e-5/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	26	95	667	15	11	7.8	*18e-4/6e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	284	472	608	704	1604	57	22	40	37	*32e-6/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	4.5	230	**1.9**	**1.4**	**1.0**	**0.97**	**1.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	**4.2**	**73**	**1.9**	**1.1**	**2.0**	**2.2**	**1.6**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	**3.9**	**49**	**0.58**	12	18	20	19	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.1**	200	595	15	52	*32e-4/6e3*	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	4.6	**47**	**0.72**	**0.98**	**1.3**	**1.4**	**2.0**	Basic RCGA [17]
SPSA	16	50	86	193	1851	88	111	95	80	*18e-4/1e5*	SPSA [9]

Table 27: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{127}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/D$	0.50	0.50	0.50	0.50	0.50	93	593	2014	3386	3638	$\mathrm{ERT}_{\text{best}}/D$
(1,2)-CMA-ES	**1**	**1**	**1**	10	53	**2.5**	5.1	**2.8**	**2.7**	4.9	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.1**	6.4	39	**1.2**	**2.0**	**0.95**	**0.86**	**1.6**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	4.9	33	**1.1**	**2.7**	**1.6**	**1.4**	**1.6**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.2**	11	86	**2.5**	8.2	3.6	3.7	19	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	**3.5**	**17**	**2.7**	3.5	**2.1**	**1.3**	**1.6**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	4.3	**21**	**2.6**	3.0	**1.7**	**1.4**	**1.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1.1**	4.3	**21**	**2.7**	**2.7**	**1.2**	**0.81**	**0.97**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	**3.3**	82	**2.1**	**2.4**	**0.94**	**0.72**	**0.69**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.3**	7.2	72	**1.6**	3.5	**1.8**	**2.5**	*16e-6/5e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	12	17	19	28	70	**1.6**	**2.2**	4.6	12	66	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.4**	6.1	39	**2.5**	**2.7**	**1.1**	**0.77**	**0.85**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	4.2	78	**1.2**	**1.7**	**1.0**	**0.72**	**1.6**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	3.9	31	**0.89**	**0.88**	**1.5**	**2.6**	3.5	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.1**	6.2	95	**1.8**	4.9	3.8	**2.8**	9.0	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.2**	**3.7**	41	**1.4**	4.0	**2.6**	**2.5**	29	Basic RCGA [17]
SPSA	26	39	94	636	4930	125	181	165	*40e-5/1e5*	.	SPSA [9]

Table 28: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{128}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.90	21	67	157	194	205	297	310	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	4.1	10	9.4	6.2	6.9	7.2	5.6	6.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**0.93**	**5.6**	**6.1**	5.3	6.2	5.9	4.6	5.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1.7**	**2.7**	**3.7**	**3.9**	**4.8**	**5.7**	**4.5**	4.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	7.3	8.8	**5.5**	**3.9**	7.1	10	10	11	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1.7**	21	14	6.4	6.9	6.6	4.6	**4.5**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.1**	12	12	7.1	6.1	**5.8**	**4.0**	**4.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1.8**	14	10	**4.2**	**3.6**	**3.7**	**2.6**	**2.5**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.2**	6.7	10	5.9	**5.2**	7.2	5.6	5.4	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**2.9**	21	9.3	7.9	7.4	8.7	10	32	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	13	19	15	16	44	20	48	76	244	563	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.0**	26	16	7.8	11	19	13	14	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**0.78**	9.4	11	8.9	7.3	7.3	5.2	5.2	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.4**	35	84	50	41	40	28	29	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**1.9**	17	10	10	10	16	14	20	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	**1.8**	18	16	30	66	57	149	Basic RCGA [17]
SPSA	10	22	35	309	656	812	2220	2096	*83e-4/1e5*	.	SPSA [9]

Table 29: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{129}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.90	33	110	261	951	1622	2972	5330	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	9.3	8.2	13	13	10	17	16	27	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.8**	11	10	7.6	4.7	15	48	*12e-5/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1.3**	11	11	11	3.9	12	8.3	27	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	18	8.5	**6.5**	11	8.6	6.3	10	*60e-6/1e4*	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1.3**	8.1	8.9	8.3	3.8	**4.6**	**3.3**	**6.4**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.7**	**7.0**	**5.7**	**4.3**	**3.0**	**4.9**	**3.7**	8.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1.6**	11	9.2	**5.0**	4.3	5.2	5.6	13	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**0.81**	7.6	**5.6**	7.3	**3.6**	5.0	11	*31e-6/1e4*	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	52	25	31	27	9.4	25	29	16	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	288	439	273	92	53	95	39	69	56	274	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.6**	13	13	**6.5**	**2.2**	**2.4**	**3.2**	**5.4**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.7**	7.4	12	9.3	5.6	8.2	4.7	**3.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.4**	**1.4**	13	49	28	20	11	6.9	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	24	23	21	26	19	25	31	*37e-4/6e3*	NEWUOA [16]
Basic RCGA	**1**	**1**	**0.85**	**0.64**	13	15	13	11	24	135	Basic RCGA [17]
SPSA	5.1	48	96	100	66	108	55	81	150	*86e-6/1e5*	SPSA [9]

Table 30: 02-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{130}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.50	0.50	0.77	23	99	248	399	824	886	2221	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**2.0**	40	33	18	13	6.2	7.8	3.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.4**	30	16	8.8	5.7	**2.8**	**2.7**	**1.1**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1.5**	14	15	11	7.2	4.5	4.2	**1.8**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**2.6**	41	54	32	20	10	10	4.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**2.0**	22	13	6.2	4.5	**2.2**	**2.0**	**0.84**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.4**	15	10	7.0	4.6	**2.3**	**2.2**	**0.89**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1.4**	**6.5**	8.8	**5.2**	**3.3**	**1.6**	**1.9**	**0.76**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.3**	9.0	13	5.3	**3.4**	**1.6**	**1.5**	**0.63**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	3.2	8.2	**3.7**	**2.6**	**3.6**	3.9	7.5	6.9	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	8.8	12	11	7.8	22	18	30	71	130	127	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.5**	6.6	6.5	39	26	13	12	33	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.2**	8.3	18	8.7	5.8	3.1	**3.0**	**1.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.7**	**1.1**	**0.97**	10	24	20	18	15	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.8**	10	**5.4**	**3.7**	3.8	3.6	4.7	6.6	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.0**	**1.1**	8.5	21	37	45	63	76	Basic RCGA [17]
SPSA	22	34	84	662	510	298	243	285	486	311	SPSA [9]

Table 31: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{101}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss

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	0.33	0.33	1.2	4.4	6.3	6.7	9.3	11	11	13	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	5.6	4.9	7.3	12	10	10	12	13	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.6**	**2.8**	6.0	7.7	7.6	8.3	9.3	11	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.2**	4.7	3.1	5.7	7.0	6.4	7.3	8.5	10	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	6.9	5.3	7.4	10	10	11	12	14	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	3.6	**3.0**	4.2	5.9	5.5	6.2	7.4	8.2	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.6**	**2.9**	3.6	5.2	5.1	5.7	6.4	7.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	3.3	**2.6**	**3.1**	**4.1**	**3.9**	**4.2**	**4.9**	**5.5**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	3.6	3.2	3.6	5.0	4.5	4.8	5.5	6.5	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.1**	3.4	**1.6**	**1.7**	**1.9**	**1.5**	**1.4**	**1.4**	**1.4**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	21	16	12	112	384	484	694	1414	1256	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	4.0	3.8	5.0	7.6	7.2	7.9	9.2	11	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	3.8	3.0	5.1	7.5	7.2	8.1	9.3	11	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**2.5**	10	21	28	28	30	36	42	CMA+DE-MOS [13]
NEWUOA	**1**	**1.5**	**2.8**	**2.0**	**2.5**	**2.9**	**2.4**	**2.2**	**2.3**	**2.2**	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**2.4**	10	36	73	88	132	182	315	Basic RCGA [17]
SPSA	30	46	198	295	846	1989	1524	1398	1375	3664	SPSA [9]

Table 32: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{102}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	1.2	4.0	7.6	9.3	11	12	13	16	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	5.6	5.6	5.9	7.2	8.1	9.5	11	11	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.3	3.9	4.6	5.4	6.2	7.1	7.6	8.6	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	3.1	3.1	4.1	4.9	5.4	6.5	7.1	7.6	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	4.3	5.8	5.3	7.4	8.1	8.9	8.6	14	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	3.2	**2.7**	**2.9**	3.6	4.3	5.1	5.6	6.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	4.2	3.3	3.3	4.0	4.7	5.2	5.7	6.0	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.6**	**2.2**	**2.2**	**3.1**	**3.4**	**3.9**	**4.1**	**4.5**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	3.0	**2.6**	**2.5**	**3.4**	**3.9**	**4.3**	**4.6**	**5.1**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.9**	3.6	**2.8**	**2.9**	**2.6**	**2.8**	**2.7**	**2.5**	**2.2**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	28	45	21	14	15	19	21	149	1947	4298	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	4.2	3.9	4.1	5.3	6.4	7.2	7.7	8.5	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	4.4	4.2	4.4	5.6	6.7	7.8	8.4	8.8	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**2.5**	11	17	21	25	29	30	34	CMA+DE-MOS [13]
NEWUOA	**1**	**1.5**	5.9	5.7	5.4	7.2	6.8	8.1	9.1	10	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**1.7**	17	29	43	77	115	167	242	Basic RCGA [17]
SPSA	24	38	470	396	697	2079	2142	2293	5383	87971	SPSA [9]

Table 33: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{103}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	1.2	4.3	6.4	6.4	6.4	6.6	7.7	14	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	6.2	5.1	6.7	10	14	18	19	14	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**2.5**	**2.8**	4.5	7.5	10	12	13	10	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**2.7**	3.0	4.4	7.2	8.7	11	12	9.1	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	3.9	4.3	5.2	7.7	12	15	17	13	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	4.0	3.5	4.0	6.1	7.8	10	11	8.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.5**	**2.1**	3.9	5.8	7.8	9.4	10	**7.3**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1.9**	**2.0**	**2.6**	**4.1**	**5.1**	**6.8**	**6.9**	**5.3**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	3.8	**2.3**	3.3	5.0	6.7	**8.5**	**8.0**	**6.1**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.9**	3.3	**1.7**	**1.6**	**2.0**	**5.6**	9.2	10	9.0	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	17	30	19	16	22	27	34	1298	2202	2619	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.4**	**2.9**	4.6	7.8	10	13	13	10	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	4.0	3.5	4.8	7.9	11	14	14	11	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**2.5**	11	20	31	42	53	62	51	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	3.4	**2.1**	**2.6**	**3.4**	**4.8**	**5.9**	**5.8**	10	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**2.3**	13	39	69	140	225	281	291	Basic RCGA [17]
SPSA	40	142	360	216	228	400	565	1216	4576	11577	SPSA [9]

Table 34: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{104}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	1.4	7.2	10	69	201	212	216	218	219	223	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	4.2	3.1	6.6	10	14	36	50	88	88	86	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.5**	**1.4**	3.9	4.5	5.7	8.2	8.4	8.9	9.0	9.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.5	**1.6**	**2.4**	**2.5**	6.5	11	11	11	11	11	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	15	9.1	17	15	23	62	116	115	145	143	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.7**	**1.5**	**2.2**	5.3	3.3	3.3	3.4	3.5	3.5	3.6	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	3.6	**1.3**	**2.0**	**2.0**	**1.2**	**1.4**	**1.5**	**1.6**	**1.6**	**1.7**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.1**	**1.1**	**1.5**	**1.8**	**1.1**	**1.3**	**1.3**	**1.4**	**1.4**	**1.5**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.9	**1.5**	**2.1**	5.6	4.3	5.8	5.8	5.9	5.9	5.9	(1,4s)-CMA-ES [3]
avg NEWUOA	**2.5**	**0.83**	**0.89**	3.0	**2.6**	3.3	3.4	4.1	4.1	4.1	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	61	19	29	138	255	242	239	314	312	315	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.4**	**1.2**	**2.7**	**1.9**	**1.3**	**1.5**	**1.7**	**1.8**	**1.9**	**2.0**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.7**	**2.1**	3.3	**2.7**	**2.0**	**2.5**	**2.8**	**2.9**	3.1	3.3	IPOP-CMA-ES [15]
CMA+DE-MOS	3.4	3.3	8.6	3.2	**3.0**	3.9	4.6	5.1	5.4	6.1	CMA+DE-MOS [13]
NEWUOA	**2.8**	**0.92**	**0.95**	**0.95**	**2.7**	8.2	18	28	34	40	NEWUOA [16]
Basic RCGA	3.4	4.0	11	40	169	561	1528	1543	*66e-3/5e4*	.	Basic RCGA [17]
SPSA	611	299	28922	*15e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 35: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{105}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

105 Rosenbrock moderate unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	1.4	5.6	9.3	169	357	1076	1082	1087	1090	1099	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	4.1	7.1	8.6	4.9	14	13	27	40	40	131	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.6**	7.5	6.2	**1.7**	6.9	8.4	18	22	30	29	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.7**	**2.5**	**2.9**	**1.1**	4.6	5.5	13	40	40	40	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	5.9	7.2	7.0	3.8	12	13	25	42	133	*91e-4/1e4*	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	3.5	**2.3**	3.8	3.3	5.6	4.0	7.0	7.3	7.4	7.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	3.7	3.1	3.2	**1.9**	**2.8**	**2.2**	**2.2**	**2.7**	**2.7**	**2.7**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.0**	**1.5**	**1.6**	**1.9**	5.3	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	4.0	**2.6**	**2.3**	**2.2**	9.1	4.6	8.1	13	16	16	(1,4s)-CMA-ES [3]
avg NEWUOA	**2.7**	**1.8**	**1.8**	**0.75**	**1.6**	3.2	8.2	35	75	*20e-4/6e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	20	9.1	14	126	410	392	603	601	1289	1279	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.0	**2.6**	3.5	**1.7**	**1.9**	**0.77**	**0.81**	**0.84**	**0.85**	**0.89**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.9**	**2.8**	4.2	**2.4**	4.4	**1.6**	**1.7**	**1.7**	**1.8**	**1.8**	IPOP-CMA-ES [15]
CMA+DE-MOS	3.5	4.2	10	**1.4**	**1.7**	**0.71**	**0.78**	**0.86**	**0.93**	**1.1**	CMA+DE-MOS [13]
NEWUOA	5.0	**2.2**	**1.5**	**0.67**	**1.9**	**2.0**	7.5	21	69	70	NEWUOA [16]
Basic RCGA	**1.4**	5.0	14	11	104	109	220	675	*26e-3/5e4*	.	Basic RCGA [17]
SPSA	514	176	1.51e5	*18e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 36: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{106}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

106 Rosenbrock moderate Cauchy

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	7.2	10	23	52	148	253	276	431	482	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	5.2	3.6	4.0	11	12	5.8	4.1	4.1	**2.7**	**2.6**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	3.1	**2.0**	3.8	13	10	4.3	**2.8**	**2.8**	**1.9**	**1.8**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.0	**2.3**	4.1	8.3	6.5	**2.9**	**2.0**	**2.0**	**1.3**	**1.3**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	12	9.2	10	40	29	13	8.8	8.8	5.7	5.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	5.3	**2.6**	3.1	9.5	6.6	**2.8**	**1.9**	**1.8**	**1.2**	**1.1**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.8**	**1.6**	3.3	9.0	6.1	**2.6**	**1.7**	**1.6**	**1.1**	**1.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.7**	**1.2**	**2.1**	5.0	**3.8**	**1.6**	**1.1**	**1.0**	**0.69**	**0.67**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.3	**1.4**	**2.3**	7.3	5.4	**2.3**	**1.5**	**1.5**	**0.98**	**0.92**	(1,4s)-CMA-ES [3]
avg NEWUOA	3.1	**1.1**	**1.1**	**2.4**	**1.9**	**1.0**	**2.1**	3.3	5.0	7.5	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	40	17	17	40	24	10	7.1	7.0	4.8	5.4	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.8**	**1.5**	**2.7**	**3.7**	**4.3**	**2.0**	**1.3**	**1.3**	**0.90**	**0.90**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	3.2	**2.3**	3.3	5.1	6.5	3.1	**2.1**	**2.1**	**1.4**	**1.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	3.4	3.9	10	8.6	10	4.8	3.0	3.2	**2.2**	**2.4**	CMA+DE-MOS [13]
NEWUOA	3.0	**0.95**	**1.0**	**3.3**	5.6	4.4	7.4	14	13	33	NEWUOA [16]
Basic RCGA	3.2	4.6	14	145	911	1110	2842	*43e-3/5e4*	.	.	Basic RCGA [17]
SPSA	1188	595	815	9052	*19e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 37: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{107}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	2.0	16	51	77	108	138	168	228	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	22	12	10	22	27	45	203	*28e-6/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	7.4	**1.9**	**1.9**	**2.1**	**2.1**	**2.7**	3.2	4.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	7.0	**2.2**	**2.2**	3.5	4.7	4.6	7.3	8.2	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	5.9	8.4	13	17	48	115	95	642	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	8.9	3.4	**2.9**	3.3	3.5	4.4	6.2	5.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	3.7	**1.2**	**0.71**	**0.82**	**0.96**	**1.2**	**1.1**	**1.5**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.1**	14	**2.5**	**1.2**	**1.6**	**1.6**	**1.9**	3.1	4.2	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.1**	**2.2**	**1.5**	3.7	3.3	3.9	4.4	10	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	17	20	45	115	360	592	*16e-3/6e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	24	37	13	5.0	6.1	14	49	226	555	6150	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.0**	5.4	**1.4**	**0.99**	**0.97**	**0.96**	**1.0**	**1.0**	**1.0**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.7**	**1.2**	**0.80**	**0.96**	**1.0**	**0.95**	**0.98**	**1.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.6**	3.3	5.3	7.2	7.2	7.2	7.2	7.0	CMA+DE-MOS [13]
NEWUOA	**1**	**1.1**	12	29	61	65	150	532	*57e-4/5e3*	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.6**	7.8	9.2	11	13	20	26	31	Basic RCGA [17]
SPSA	36	53	199	8554	13692	18097	13131	*11e-1/1e5*	.	.	SPSA [9]

Table 38: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{108}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif

Δftarget $\mathrm{ERT}_{\text{best}}$/D	1e+03 0.33	1e+02 0.33	1e+01 1.9	1e+00 33	1e-01 655	1e-02 1842	1e-03 3608	1e-04 5060	1e-05 5729	1e-07 10727	Δftarget $\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	34	29	53	*15e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	23	24	25	13	37	*84e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	54	25	23	81	*10e-2/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	30	41	19	79	*88e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.1**	30	**10**	6.0	38	*42e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	30	19	**5.9**	**14**	*18e-3/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.1**	**10**	14	9.3	38	*38e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	35	20	8.6	77	*39e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.5**	121	82	126	*39e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1294	1758	2673	269	44	25	**17**	**25**	**44**	68	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	14	**8.4**	**1.8**	**1.1**	**0.96**	**0.80**	**1.1**	**0.81**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.1**	97	11	**1.3**	**1.0**	**0.89**	**0.92**	**1.1**	**1.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.6**	66	138	91	61	49	45	**29**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	108	56	36	*41e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.1**	**10**	24	20	22	33	129	*18e-4/5e4*	Basic RCGA [17]
SPSA	111	264	275	166	58	390	*28e-3/1e5*	.	.	.	SPSA [9]

Table 39: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{109}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	1.2	6.8	31	48	64	65	84	84	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	5.4	3.5	**2.0**	**1.9**	**2.8**	3.6	3.9	6.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.9	**2.9**	**1.3**	**1.6**	**1.7**	**2.3**	**2.4**	3.7	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	3.5	**1.8**	**0.83**	**0.96**	**1.1**	**1.4**	**1.5**	**2.4**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	8.9	7.6	**2.5**	3.1	3.5	4.5	6.1	8.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**2.4**	**1.9**	**0.92**	**1.1**	**1.2**	**1.8**	**1.7**	3.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	4.1	**2.0**	**1.1**	**1.2**	**1.3**	**1.8**	**1.7**	**2.6**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.1**	**1.3**	**0.66**	**0.72**	**0.72**	**0.99**	**0.94**	**1.3**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**2.2**	**1.6**	**0.75**	**0.84**	**0.90**	**1.2**	**1.2**	**1.8**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.5**	3.4	7.6	5.9	8.9	17	58	112	262	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	15	30	21	9.5	4.4	33	403	3363	*20e-5/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.6**	**2.6**	**1.3**	**1.4**	**1.6**	**2.0**	**2.1**	3.1	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	4.5	**2.3**	**1.2**	**1.3**	**1.7**	**2.3**	**2.4**	3.6	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**2.5**	6.1	4.2	5.6	6.4	10	12	16	CMA+DE-MOS [13]
NEWUOA	**1**	**1.3**	5.3	6.2	6.4	12	34	146	181	*17e-5/5e3*	NEWUOA [16]
Basic RCGA	**1**	**1.1**	3.4	11	11	14	20	27	33	51	Basic RCGA [17]
SPSA	37	157	448	231	1467	1620	3769	6888	*43e-4/1e5*	.	SPSA [9]

Table 40: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{110}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss

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	8.4	19	307	2092	6819	11776	20403	20660	21190	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	16	11	10	**2.9**	**1.7**	**2.5**	13	*12e-3/1e4*	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	10	4.3	5.5	**1.3**	**1.4**	**1.0**	**1.7**	3.4	*19e-4/1e4*	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.4	4.2	3.6	**1.5**	**1.0**	**1.4**	**2.7**	3.3	*43e-4/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.9	6.9	10	4.5	3.2	3.8	*17e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	6.1	**2.1**	**1.9**	**2.7**	**1.8**	**2.5**	**2.8**	**2.2**	3.4	6.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**3.5**	6.5	6.2	**2.4**	**1.3**	**1.5**	3.7	**2.2**	7.0	*43e-4/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	28	8.1	4.1	**1.3**	**1.1**	**1.2**	**1.7**	3.5	3.5	3.4	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.8**	**1.2**	**2.5**	**2.0**	**1.2**	**0.82**	**2.5**	7.0	*48e-4/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	18	18	15	6.6	8.4	*34e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	119	85	174	60	103	206	*20e-2/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.4**	**1.5**	**1.7**	**1.3**	**2.6**	**1.2**	**0.69**	**0.40**	**0.40**	**0.41**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	3.6	**1.7**	**2.1**	**1.7**	4.9	**2.6**	**1.6**	**0.99**	**0.99**	**0.99**	IPOP-CMA-ES [15]
CMA+DE-MOS	3.7	4.5	6.1	4.9	19	7.6	4.4	**2.6**	**2.6**	**2.6**	CMA+DE-MOS [13]
NEWUOA	23	20	24	9.0	4.3	11	*22e-2/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	4.2	5.3	6.8	5.8	20	23	*94e-3/5e4*	.	.	.	Basic RCGA [17]
SPSA	251	123	1625	*35e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 41: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{111}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

111 Rosenbrock unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	3.4	17	58	1158	9991	25295	64938	2.00e5	4.76e5	4.91e5	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	17	19	24	128	*19e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	7.2	8.8	16	12	*98e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	24	11	21	16	*14e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	20	29	39	31	*29e-1/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	6.4	6.6	**5.0**	3.9	**4.2**	*27e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	8.3	10	5.8	**2.7**	**3.1**	*32e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	16	8.2	9.3	3.0	*35e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	19	7.6	12	11	*85e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	52	66	55	*45e-1/6e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	246	64	94	15	30	27	*13e-2/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	14	13	**5.0**	**0.86**	**4.2**	**10**	**4.7**	**1.8**	**0.88**	**0.90**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.3**	**2.1**	**2.3**	**0.95**	16	16	**6.4**	**2.1**	**0.89**	**0.89**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.0**	**2.0**	17	12	17	**12**	30	*98e-3/1e5*	.	.	CMA+DE-MOS [13]
NEWUOA	32	42	85	32	7.8	*74e-1/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.3**	**2.3**	12	3.2	4.5	**14**	**5.4**	*91e-3/5e4*	.	.	Basic RCGA [17]
SPSA	113	87	191	*16e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 42: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{112}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	1.4	7.2	10	113	523	826	950	993	1035	1178	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	7.7	7.6	17	28	10	8.7	8.0	7.8	8.5	7.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**3.0**	**2.6**	3.3	5.8	**2.5**	**2.0**	**1.9**	**2.0**	**2.0**	**1.9**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	5.1	**2.2**	3.5	5.1	**1.7**	**1.4**	**1.4**	**1.4**	**1.4**	**1.3**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.5	4.4	8.7	27	12	16	17	21	31	28	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.9**	**1.4**	**2.2**	**1.3**	**0.95**	**0.88**	**0.88**	**0.93**	**0.93**	**0.89**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**3.0**	**1.3**	**2.3**	3.1	**1.1**	**0.90**	**0.87**	**0.87**	**0.86**	**0.83**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.9**	**1.2**	**1.9**	**2.1**	**0.76**	**0.58**	**0.56**	**0.56**	**0.56**	**0.52**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.1	**1.6**	**2.7**	4.6	**1.5**	**1.2**	**1.1**	**1.1**	**1.1**	**1.0**	(1,4s)-CMA-ES [3]
avg NEWUOA	**2.8**	**0.93**	**2.1**	**2.2**	**1.8**	10	85	*20e-3/6e3*	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	57	24	23	306	571	1699	*26e-2/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.0	**1.8**	3.8	**1.6**	**0.79**	**0.70**	**0.72**	**0.74**	**0.76**	**0.76**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	4.2	**2.3**	3.7	4.6	**1.8**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	3.4	4.0	10	**2.4**	**1.9**	**1.6**	**1.6**	**1.8**	**1.9**	**2.0**	CMA+DE-MOS [13]
NEWUOA	**2.0**	**0.89**	**1.3**	**1.7**	**1.4**	8.7	37	73	*44e-4/5e3*	.	NEWUOA [16]
Basic RCGA	**2.7**	3.6	11	18	72	93	365	713	*23e-3/5e4*	.	Basic RCGA [17]
SPSA	1314	1782	2830	12462	*29e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 43: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{113}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	1.1	8.8	42	649	1031	1079	1079	1079	1143	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**2.5**	11	6.6	11	**2.6**	6.0	11	11	11	15	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.4**	**1.3**	**2.6**	**4.1**	**0.84**	**2.9**	4.1	4.1	4.1	6.4	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.2**	**2.4**	8.6	7.4	**1.3**	**1.8**	7.3	7.3	7.3	13	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**2.7**	24	12	8.7	3.6	18	41	41	41	125	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.6**	**3.0**	4.2	4.9	**2.0**	**2.3**	3.5	3.5	3.5	3.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.1**	**2.5**	**1.1**	5.7	**1.9**	**2.6**	3.4	3.4	3.4	3.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.3**	4.4	6.3	4.9	**1.6**	**2.7**	**2.8**	**2.8**	**2.8**	**3.2**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.3**	**2.8**	**2.4**	**4.6**	**1.7**	**2.2**	3.3	3.3	3.3	5.8	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.6**	5.6	8.2	15	8.0	25	75	75	75	*57e-3/6e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	28	14	22	19	82	292	392	392	392	1280	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	20	8.4	**2.0**	7.7	**0.88**	**0.60**	**0.77**	**0.77**	**0.77**	**0.75**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.7**	**2.7**	**1.8**	6.6	**1.9**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	**1.7**	**1.3**	**4.1**	3.4	3.4	3.5	3.5	3.5	3.5	CMA+DE-MOS [13]
NEWUOA	**1.5**	14	7.7	14	5.1	12	70	70	70	*74e-3/5e3*	NEWUOA [16]
Basic RCGA	**1.1**	**1.6**	**2.1**	11	19	39	38	38	38	38	Basic RCGA [17]
SPSA	40	24	18	1660	1007	1374	*71e-2/1e5*	.	.	.	SPSA [9]

Table 44: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{114}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.98	8.5	338	2093	6295	9441	9441	9441	10860	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1.1**	5.1	34	11	21	*31e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.1**	8.2	17	6.9	21	*30e-2/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.1**	63	32	22	23	*22e-2/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1.1**	35	30	12	*52e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.3**	67	21	3.6	7.6	23	*11e-2/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.8**	**2.2**	**6.7**	**2.5**	**5.7**	**10**	15	15	15	*83e-3/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.8**	27	25	4.0	12	*16e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	17	14	19	6.4	10	*22e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	143	104	26	*11e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	877	2294	553	127	148	*14e-2/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.4**	34	25	**1.4**	**0.88**	**0.61**	**0.42**	**0.42**	**0.42**	**0.39**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.1**	12	7.1	**2.4**	**1.6**	**0.81**	**0.60**	**0.60**	**0.60**	**0.59**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	**1.9**	**1.9**	9.3	31	20	13	13	13	**14**	CMA+DE-MOS [13]
NEWUOA	**1**	50	71	31	*11e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.5**	**1.8**	**1.6**	8.0	12	14	**12**	**12**	**12**	20	Basic RCGA [17]
SPSA	271	204	223	63	685	*29e-2/1e5*	.	.	.	.	SPSA [9]

Table 45: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{115}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.93	4.0	39	198	280	297	297	297	415	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1.7**	3.2	4.9	**2.7**	7.9	41	63	63	63	*54e-4/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.5**	**2.1**	**1.7**	**2.1**	**2.8**	5.8	12	12	12	21	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.1**	**1.5**	**2.9**	**1.4**	**1.6**	5.0	13	13	13	39	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1.5**	3.8	4.3	3.4	3.4	23	50	50	50	169	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.5**	3.6	**2.9**	**1.4**	**1.6**	**2.8**	4.3	4.3	4.3	6.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.4**	**2.9**	**2.7**	**0.88**	**1.3**	**1.4**	3.4	3.4	3.4	4.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.1**	**1.4**	**2.1**	**1.2**	**0.87**	**1.4**	**1.6**	**1.6**	**1.6**	**2.1**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.1**	**1.9**	4.5	**1.9**	**1.6**	**2.5**	3.1	3.1	3.1	5.3	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.5**	3.1	**1.1**	**2.6**	4.9	19	45	45	45	59	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	24	17	20	122	392	1637	4763	4763	4763	3402	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.2**	**2.7**	**2.0**	**0.88**	**0.91**	**0.80**	**0.90**	**0.90**	**0.90**	**0.78**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.7**	3.2	6.4	**2.4**	**1.8**	**2.4**	**2.4**	**2.4**	**2.4**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	**2.0**	**2.3**	**2.1**	5.0	7.4	7.6	7.6	7.6	5.6	CMA+DE-MOS [13]
NEWUOA	**2.4**	**2.8**	**0.96**	4.0	8.3	66	215	215	215	154	NEWUOA [16]
Basic RCGA	**1.1**	**0.95**	6.1	56	96	145	138	138	138	129	Basic RCGA [17]
SPSA	52	44	49	576	560	1532	*43e-3/1e5*	.	.	.	SPSA [9]

Table 46: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{116}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss

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	6.2	25	56	881	1473	2051	2381	3153	3205	3790	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	14	14	17	9.4	96	*68e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	6.3	11	14	4.0	8.4	10	14	10	46	*54e-3/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	11	12	27	5.6	6.8	34	*45e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	14	36	40	13	46	34	63	*61e-2/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.4**	**2.3**	12	3.8	11	15	18	15	15	19	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	4.6	**5.9**	10	3.1	4.3	4.9	5.4	7.6	14	12	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	11	8.9	11	**1.8**	4.0	4.5	5.5	7.9	10	*96e-5/1e4*	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	17	7.0	**8.2**	**2.2**	3.9	7.1	13	14	*18e-3/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	19	24	65	28	*30e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1443	1318	1980	1701	*97e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	6.8	6.2	**5.9**	**1.3**	**1.2**	**1.0**	**0.90**	**0.71**	**0.71**	**0.63**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	4.5	7.4	11	**2.8**	**2.5**	**2.1**	**1.9**	**1.5**	**1.5**	**1.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.2**	**2.8**	**7.3**	4.4	**3.0**	**2.4**	**2.2**	**1.9**	**2.0**	**1.9**	CMA+DE-MOS [13]
NEWUOA	12	18	45	41	50	*49e-1/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**2.6**	18	61	26	52	65	*67e-3/5e4*	.	.	.	Basic RCGA [17]
SPSA	98	863	4071	1622	*20e+0/1e5*	.	.	.	.	.	SPSA [9]

Table 47: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{117}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

117 Ellipsoid unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	6.2	77	797	4787	13169	18816	20573	23466	24559	26680	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	43	13	16	30	*84e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	13	13	6.7	30	*56e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	12	7.8	13	10	*93e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	38	16	13	*95e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	13	6.8	5.2	14	*34e-1/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	10	**4.6**	5.6	**6.7**	**3.5**	7.9	*18e-1/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	32	6.9	**2.7**	*23e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	21	6.0	5.7	9.3	11	*22e-1/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	66	48	33	*44e+0/6e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	559	157	361	293	107	*20e+0/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**10**	**2.7**	**1.8**	**0.95**	**0.56**	**0.44**	**0.55**	**0.56**	**0.57**	**0.66**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	20	5.3	**2.3**	**1.0**	**0.66**	**0.66**	**0.64**	**0.60**	**0.62**	**0.68**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.2**	**3.3**	6.6	8.1	4.6	**6.0**	**7.0**	**6.2**	**6.0**	**5.6**	CMA+DE-MOS [13]
NEWUOA	46	27	96	*23e+0/5e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**2.7**	5.5	7.4	10	16	38	35	*57e-2/5e4*	.	.	Basic RCGA [17]
SPSA	314	120	133	*81e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 48: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{118}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	4.7	6.8	36	68	237	284	336	392	428	531	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	11	18	9.4	15	7.2	6.5	6.1	5.8	5.6	6.5	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	4.1	8.8	4.2	7.5	3.4	3.4	3.3	**3.0**	3.0	**2.7**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	4.0	7.4	5.5	5.5	**2.0**	**1.8**	**2.0**	**1.9**	**1.8**	**1.6**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	6.9	13	30	46	23	24	27	23	21	20	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.1	6.5	**2.6**	3.2	**1.3**	**1.3**	**1.2**	**1.1**	**1.1**	**1.0**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.5**	6.8	3.2	3.5	**1.2**	**1.2**	**1.1**	**1.1**	**1.1**	**0.99**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.4**	**3.4**	**2.0**	**2.3**	**0.92**	**0.83**	**0.78**	**0.71**	**0.71**	**0.66**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.6**	6.0	3.3	**3.0**	**1.1**	**1.0**	**0.93**	**0.85**	**0.82**	**0.75**	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.98**	**1.4**	**1.0**	5.0	5.4	26	77	*43e-4/6e3*	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	38	81	715	2979	2747	4936	*21e-1/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.3	4.9	3.4	**3.0**	**1.0**	**0.98**	**0.95**	**0.89**	**0.94**	**0.94**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	4.3	7.9	6.2	6.7	**2.6**	**2.4**	**2.2**	**2.0**	**2.0**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	3.3	10	6.0	5.2	**1.9**	**2.0**	**2.3**	**2.5**	**2.8**	3.1	CMA+DE-MOS [13]
NEWUOA	**1.3**	**1.4**	**1.7**	3.7	6.5	43	109	*19e-3/5e3*	.	.	NEWUOA [16]
Basic RCGA	**2.3**	78	142	542	672	1269	2227	*75e-2/5e4*	.	.	Basic RCGA [17]
SPSA	126	254	1406	6641	*41e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 49: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{119}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

119 Sum of diff powers Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	0.73	22	140	203	668	1894	4013	5240	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.3**	6.6	4.3	5.3	17	48	*24e-4/1e4*	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	4.8	3.2	**1.7**	4.2	3.2	8.2	17	*14e-5/1e4*	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	**2.2**	**1.5**	**1.4**	**2.9**	4.5	35	*18e-5/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.1**	28	6.9	3.7	39	110	*50e-4/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**2.1**	9.2	4.3	**1.5**	**3.0**	**2.4**	4.1	18	*63e-6/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.3**	4.7	3.2	**0.92**	**1.5**	**2.3**	3.0	3.9	28	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.8**	12	**1.7**	**0.96**	**1.8**	**2.6**	**2.9**	6.1	*48e-6/1e4*	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	3.7	43	3.7	**2.0**	3.2	4.9	9.3	35	*18e-5/1e4*	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	23	8.2	16	51	*13e-3/6e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	24	36	25	24	25	136	193	367	*11e-4/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.1**	5.5	**1.1**	**0.55**	**0.92**	**0.77**	**0.87**	**0.72**	**0.79**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.9**	8.4	**0.93**	**0.38**	**0.69**	**0.91**	**1.2**	**1.0**	**1.7**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.2**	**1.2**	**2.6**	4.6	**2.1**	**1.0**	**0.68**	**1.0**	CMA+DE-MOS [13]
NEWUOA	**1**	**2.2**	13	18	27	116	114	*31e-3/5e3*	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**2.4**	6.6	6.2	7.6	9.3	8.9	24	*17e-6/5e4*	Basic RCGA [17]
SPSA	35	55	187	5891	10571	7294	*10e-1/1e5*	.	.	.	SPSA [9]

Table 50: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{120}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

120 Sum of diff powers unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.33	0.33	0.73	27	601	2312	10645	25282	40067	88603	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1**	41	43	31	31	*11e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	4.0	58	**7.8**	15	*54e-3/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	65	31	29	63	*14e-2/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.3**	22	37	28	29	*13e-2/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	3.1	9.0	11	13	62	*71e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.4**	27	12	**7.1**	*44e-3/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.7**	**5.3**	17	10	61	*31e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	54	18	14	*51e-3/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	24	120	66	40	*36e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	779	1826	2111	847	151	74	43	58	*11e-3/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.2**	14	8.3	**1.9**	**1.6**	**0.66**	**0.49**	**0.57**	**0.50**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.3**	8.6	11	**1.9**	**0.97**	**0.60**	**0.54**	**0.53**	**0.77**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.2**	**3.5**	78	38	**15**	**10**	**10**	**4.4**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.7**	120	62	62	*42e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.5**	**3.0**	**5.5**	19	**26**	32	*85e-4/5e4*	.	.	Basic RCGA [17]
SPSA	99	281	549	247	338	*12e-2/1e5*	.	.	.	.	SPSA [9]

Table 51: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{121}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	0.73	14	39	83	233	500	766	1107	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.3**	**2.7**	**1.6**	**1.6**	**2.4**	3.1	**2.9**	3.9	5.3	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.0	**1.1**	**1.1**	**1.4**	**1.7**	**2.0**	**2.2**	**3.0**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1.9**	**1.1**	**1.1**	**0.88**	**1.1**	**1.4**	**1.4**	**1.8**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.6**	**2.6**	**2.7**	**2.8**	7.4	7.3	7.1	12	23	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.3**	**1.5**	**0.78**	**0.78**	**1.2**	**1.1**	**1.1**	**0.95**	**1.1**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.3**	3.9	**1.2**	**0.87**	**1.0**	**1.0**	**0.96**	**0.82**	**1.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.4**	**2.3**	**0.99**	**0.64**	**0.66**	**0.66**	**0.54**	**0.52**	**0.56**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.5**	4.6	**1.2**	**0.82**	**0.89**	**0.93**	**0.80**	**0.77**	**0.80**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.3**	**2.9**	3.5	5.3	27	319	*47e-4/5e3*	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	18	34	29	7.9	4.6	266	886	2818	*11e-4/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.8**	**1.1**	**0.92**	**1.0**	**0.90**	**0.80**	**0.87**	**0.90**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.1**	4.3	**1.3**	**1.2**	**1.5**	**1.6**	**1.7**	**1.9**	**2.6**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.2**	**1.4**	4.5	4.7	3.2	**2.4**	**2.3**	**2.6**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.2**	3.2	3.6	7.7	43	*62e-4/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.4**	**1.5**	**2.6**	13	11	37	43	161	*19e-6/5e4*	Basic RCGA [17]
SPSA	36	101	278	2723	3628	2262	6233	*24e-2/1e5*	.	.	SPSA [9]

Table 52: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{122}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss

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	0.33	0.33	1.9	119	601	1439	2532	3458	4081	6336	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	5.3	7.0	6.8	53	*15e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.8**	5.1	**1.6**	5.0	24	*21e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.3**	6.4	3.1	10	47	*35e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.7**	10	5.2	56	*16e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.3**	6.1	3.5	6.1	47	*20e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	4.5	**1.9**	**3.6**	9.3	*85e-4/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.3**	3.0	**0.74**	5.3	11	58	*18e-3/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**2.3**	11	5.1	11	103	*61e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.1**	13	22	*37e-2/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	29	35	11	4.1	49	147	165	406	*52e-3/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.3**	**2.9**	**1.4**	**0.80**	**0.70**	**0.67**	**0.61**	**0.81**	**0.90**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.1**	**1.9**	**1.1**	**1.1**	**0.69**	**0.76**	**0.84**	**0.96**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	**1.5**	**2.7**	9.2	15	15	17	**22**	**17**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.1**	8.5	21	122	*65e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.1**	**1.1**	**1.4**	7.9	13	**8.6**	**13**	**16**	87	*67e-6/5e4*	Basic RCGA [17]
SPSA	69	158	103	2636	*20e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 53: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{123}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif

Δftarget $\mathrm{ERT}_{\text{best}}$/D	1e+03 0.33	1e+02 0.33	1e+01 1.6	1e+00 515	1e-01 7277	1e-02 16727	1e-03 31053	1e-04 43067	1e-05 63620	1e-07 1.47e5	Δftarget $\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	5.9	29	11	*73e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**2.3**	34	7.4	*62e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	20	48	5.0	*65e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.2**	49	15	*90e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.5**	27	7.2	19	*34e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.4**	**4.6**	**3.1**	*32e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.4**	30	5.2	*45e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	37	82	10	*59e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	12	118	33	*16e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	374	549	697	46	**17**	89	*75e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.1**	25	**2.9**	**0.56**	**0.71**	**0.75**	**0.75**	**0.84**	**0.92**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.4**	8.5	**1.7**	**0.90**	**0.98**	**0.89**	**0.82**	**0.85**	**1.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	**1.8**	171	51	**22**	**16**	**16**	**11**	**4.8**	CMA+DE-MOS [13]
NEWUOA	**1**	12	132	20	*12e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.2**	**2.2**	13	47	*36e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	64	46353	22910	1289	*14e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 54: 03-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{124}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy

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	0.33	0.33	1.2	65	309	1139	2364	3098	4301	4961	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1.4**	43	7.4	34	*82e-3/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.5**	**2.3**	**0.46**	**2.7**	4.1	60	*70e-4/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.6**	3.9	**2.2**	3.7	7.6	*73e-4/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.3**	6.4	10	78	*13e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.9**	34	17	8.5	11	60	*79e-4/1e4*	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.1**	**2.8**	**0.89**	**2.1**	**2.9**	6.5	46	*10e-4/1e4*	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.4**	3.7	**2.4**	**1.2**	**1.5**	**5.7**	*91e-5/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**2.1**	22	**2.6**	4.2	5.5	63	*45e-4/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.5**	11	7.7	59	*18e-2/5e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	15	24	16	6.2	30	103	*11e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.0**	4.2	**0.54**	**0.82**	**0.50**	**0.55**	**0.87**	**1.2**	**1.4**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.5**	3.2	**0.59**	**2.0**	**1.1**	**0.79**	**0.96**	**1.5**	**2.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	**2.4**	**2.5**	27	10	5.8	**5.0**	**5.0**	**5.0**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.5**	5.6	13	36	*14e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.2**	**1.8**	4.5	22	11	18	50	170	*80e-5/5e4*	Basic RCGA [17]
SPSA	27	51	6155	2182	4845	*11e-1/1e5*	.	.	.	.	SPSA [9]

Table 55: 03-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{125}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss

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	0.33	0.33	0.33	0.33	0.33	1473	8226	11656	12117	12667	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1**	**1**	19	572	6.4	*69e-4/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	**8.7**	**207**	3.9	18	13	*38e-4/1e4*	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	10	289	**2.8**	18	13	*53e-4/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.3**	11	791	5.8	*68e-4/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	**8.1**	677	4.8	8.6	*55e-4/1e4*	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	10	508	3.1	8.6	13	12	*31e-4/1e4*	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	**8.9**	298	**2.5**	4.0	13	*31e-4/1e4*	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	14	556	5.3	18	*69e-4/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.4**	9.3	326	**1.6**	3.0	6.9	6.7	*40e-4/6e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	30	38	49	79	569	**1.8**	21	38	57	115	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.3**	9.5	289	**0.69**	**0.67**	**0.70**	**0.76**	**0.75**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.2**	11	**243**	**1.4**	**1.1**	**0.98**	**0.97**	**0.99**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	13	**222**	**1.8**	4.0	6.3	6.1	**5.9**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.8**	10	332	**0.88**	**2.8**	**2.0**	**1.9**	*19e-4/5e3*	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.3**	9.3	291	**1.0**	5.2	8.1	59	*54e-5/5e4*	Basic RCGA [17]
SPSA	25	38	41	66	21710	14	*36e-4/1e5*	.	.	.	SPSA [9]

Table 56: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{126}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif

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	0.33	0.33	0.33	0.33	0.33	4499	37712	1.11e5	2.08e5	3.20e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1.1**	135	3640	15	*26e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	87	3050	16	*22e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	148	1434	7.1	*20e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	209	5363	*38e-3/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1.2**	15	1230	10	*18e-3/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	**11**	1618	3.4	*10e-3/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	**6.5**	1116	7.3	*12e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	32	97	1584	5.4	*12e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.7**	258	6248	*49e-3/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	630	728	1797	2592	7997	8.5	4.1	6.1	*22e-4/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	74	933	**0.68**	**0.89**	**0.66**	**0.49**	**0.49**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	15	**645**	**0.85**	**0.88**	**0.81**	**0.95**	**0.91**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	16	**237**	**0.11**	15	*27e-4/1e5*	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	13	266	8605	17	*48e-3/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	**7.1**	**350**	**0.31**	**0.65**	**1.1**	**3.5**	*15e-5/5e4*	Basic RCGA [17]
SPSA	18	46208	75111	2.01e5	3.07e5	159	*54e-3/1e5*	.	.	.	SPSA [9]

Table 57: 03-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{127}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy

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	0.33	0.33	0.33	0.33	0.33	1168	13028	15016	15116	15332	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1**	**1.3**	11	367	6.1	*76e-4/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.1**	6.9	**184**	**2.1**	**1.8**	4.7	4.6	4.6	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	10	644	3.5	5.5	*54e-4/1e4*	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	12	644	7.3	11	*73e-4/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	**4.8**	423	6.0	5.4	10	9.5	9.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.1**	9.3	417	3.7	5.4	10	10	10	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	**4.7**	217	**1.5**	**2.2**	**2.0**	**2.0**	**1.9**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	13	204	4.5	**2.3**	4.5	4.5	4.4	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**2.1**	11	295	4.5	*61e-4/5e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	24	30	55	224	10	24	94	*17e-4/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**6.4**	**179**	3.7	**1.2**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	14	**189**	4.3	**0.83**	**1.4**	**1.5**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	12	190	**0.19**	**1.9**	**2.7**	**2.7**	**2.8**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.1**	18	278	**1.6**	**2.3**	4.3	4.2	*61e-4/4e3*	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	12	293	**1.1**	**2.3**	8.3	15	46	Basic RCGA [17]
SPSA	31	47	82	1530	45810	582	*22e-3/1e5*	.	.	.	SPSA [9]

Table 58: 03-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{128}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	1.8	142	375	449	639	903	905	1447	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	4.7	3.7	**2.3**	4.7	4.7	6.8	7.1	7.7	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.9**	**1.6**	**2.3**	**2.5**	**1.8**	**1.4**	**1.7**	**1.1**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**2.3**	**2.9**	4.0	3.7	3.1	**2.3**	**2.6**	**1.9**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	3.5	3.1	3.4	5.7	5.0	3.9	3.9	4.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**2.6**	**2.7**	**2.4**	**2.5**	**1.8**	**1.3**	**1.3**	**0.91**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.0**	3.3	4.1	4.0	**2.8**	**2.4**	**2.4**	**1.9**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	3.6	3.1	3.1	**3.6**	**2.5**	**1.9**	**1.9**	**1.2**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**2.7**	3.1	4.8	4.8	3.7	**2.7**	**2.8**	**2.4**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	4.3	10	19	25	18	17	45	*45e-3/6e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	30	40	12	14	48	84	146	264	471	*90e-5/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.2**	7.3	16	36	26	76	76	48	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**2.2**	7.3	12	11	15	11	11	7.3	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.3**	33	52	46	32	24	24	16	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**1.7**	7.0	9.1	14	35	84	*89e-4/5e3*	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.3**	18	33	58	49	35	43	41	Basic RCGA [17]
SPSA	20	31	150	1406	1931	3251	2283	*13e-1/1e5*	.	.	SPSA [9]

Table 59: 03-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{129}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif

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	0.33	0.33	1.6	121	1131	2617	3861	8261	9454	12845	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	53	15	5.2	54	*23e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	21	13	4.8	17	36	*61e-3/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	31	18	7.9	18	38	*27e-3/1e4*	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	28	25	11	28	*90e-3/1e4*	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	14	14	**4.0**	5.7	**11**	18	15	*11e-3/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	5.1	**7.3**	**3.2**	**5.3**	12	**8.5**	*47e-4/1e4*	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	10	11	**4.5**	6.2	37	*30e-3/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	22	**11**	5.5	7.6	38	18	*14e-3/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	51	34	12	15	21	**10**	*23e-2/6e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	181	2286	6231	223	74	45	88	56	157	116	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.4**	**5.9**	5.0	**2.8**	**12**	**10**	**9.1**	**6.9**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	7.5	12	4.7	**3.3**	**6.1**	13	**11**	**22**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.4**	239	81	72	77	51	45	48	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	56	63	21	30	21	*79e-2/5e3*	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.6**	11	12	11	24	14	**13**	**27**	Basic RCGA [17]
SPSA	54	279	1008	171	308	271	*14e-2/1e5*	.	.	.	SPSA [9]

Table 60: 03-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{130}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.33	0.33	1.8	82	172	305	501	2264	3981	4782	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**2.9**	38	43	24	15	3.4	**2.3**	**2.0**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**2.7**	17	14	**7.9**	5.5	**1.2**	**0.71**	**0.60**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1.2**	8.1	**10**	10	5.9	**1.7**	**0.97**	**0.82**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	4.0	32	53	31	19	5.0	**2.8**	**2.4**	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	21	10	13	10	6.0	**1.3**	**0.76**	**0.64**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.1**	11	15	8.6	**5.2**	**1.2**	**0.67**	**0.56**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	14	8.5	**7.6**	**5.2**	**3.2**	**0.70**	**0.40**	**0.34**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**2.4**	**7.7**	15	**8.4**	**5.2**	**1.1**	**0.65**	**0.55**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**2.6**	**3.9**	12	8.5	11	5.6	5.7	*90e-5/5e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	22	37	12	54	155	216	204	131	104	*99e-5/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.3**	19	46	51	57	35	20	17	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	3.1	53	57	33	153	34	19	16	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.8**	90	332	398	389	86	87	73	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.0**	**3.0**	**9.4**	18	21	6.6	17	*86e-4/5e3*	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.3**	15	84	132	139	31	23	26	Basic RCGA [17]
SPSA	15	30	103	523	486	574	1367	648	369	*51e-3/1e5*	SPSA [9]

Table 61: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{101}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	2.2	7.4	8.8	10	12	13	14	15	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.2**	8.3	4.4	6.3	8.1	8.5	10	11	13	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	3.1	4.3	3.3	4.9	6.0	5.8	6.6	7.4	8.9	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	3.8	**2.9**	4.1	5.0	5.1	5.8	6.7	7.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	7.0	4.7	6.7	8.0	7.6	8.7	10	12	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**2.8**	**2.8**	3.6	4.5	4.6	5.5	6.1	7.1	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.3**	**2.4**	**2.1**	**2.8**	4.0	4.1	4.5	5.1	6.4	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.2**	**2.4**	**1.7**	**2.3**	**2.9**	**3.0**	**3.5**	**3.9**	**4.6**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	3.3	**2.7**	**2.1**	**2.7**	3.5	3.5	4.0	4.4	5.3	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.6**	**2.9**	**1.5**	**1.6**	**1.7**	**1.5**	**1.5**	**1.5**	**1.5**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	41	61	22	13	14	17	16	18	20	24	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.2**	**3.0**	**3.0**	4.2	5.8	5.8	6.7	7.6	9.3	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.2**	3.3	3.4	4.7	6.0	6.0	6.9	7.8	9.3	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	7.3	12	19	23	24	27	31	37	CMA+DE-MOS [13]
NEWUOA	**1**	3.6	**2.5**	**1.6**	**2.1**	**2.5**	**2.6**	**2.9**	**3.0**	**3.1**	NEWUOA [16]
Basic RCGA	**1**	**1.1**	7.7	25	48	88	113	155	206	293	Basic RCGA [17]
SPSA	40	64	83	171	386	434	455	494	568	9667	SPSA [9]

Table 62: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{102}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif

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	0.20	0.20	2.2	7.1	10	13	14	16	17	20	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.4**	9.2	5.8	6.2	6.5	7.7	9.1	10	11	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.4**	3.9	3.3	3.6	4.2	4.9	5.4	6.0	6.8	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**2.4**	4.2	3.3	3.9	3.9	4.7	5.1	5.4	6.3	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**2.3**	4.1	5.2	6.4	6.6	8.0	8.6	9.3	10	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	3.2	**2.5**	**2.9**	**3.0**	3.7	4.2	4.6	5.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.7**	**2.4**	**2.4**	**2.7**	**2.7**	3.4	3.9	4.1	4.5	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.3**	**1.7**	**2.1**	**2.3**	**2.7**	**3.0**	**3.2**	**3.7**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.6**	**2.8**	**2.1**	**2.4**	**2.7**	**3.2**	**3.4**	**3.6**	**4.4**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.3**	**2.7**	**1.4**	**1.5**	**1.4**	**1.5**	**1.5**	**1.6**	**1.5**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	45	79	21	14	14	14	16	18	18	20	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.4**	3.5	3.4	3.8	4.3	5.0	5.8	6.1	7.0	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.5**	3.4	3.1	4.1	4.2	5.1	6.0	6.5	7.3	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	5.7	12	17	18	20	22	25	27	CMA+DE-MOS [13]
NEWUOA	**1**	3.9	6.3	6.0	7.0	15	20	27	33	41	NEWUOA [16]
Basic RCGA	**1**	**1.2**	10	29	39	57	88	123	155	209	Basic RCGA [17]
SPSA	41	60	1987	4868	9895	9681	9199	11030	24495	*31e-3/1e5*	SPSA [9]

Table 63: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{103}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	2.2	5.5	6.0	6.0	6.3	6.4	7.0	23	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.5**	6.2	6.7	9.0	13	18	22	25	10	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**2.5**	3.4	3.8	5.5	8.4	10	13	15	6.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	3.8	3.6	5.4	7.5	9.4	12	13	5.4	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**2.1**	8.2	7.0	10	12	16	20	22	9.2	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.6**	**2.1**	3.0	**4.4**	6.5	8.5	10	12	5.0	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.3**	**2.6**	**2.8**	4.6	**6.3**	**7.8**	**10**	**11**	**4.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.2**	**2.4**	**2.1**	**3.5**	**4.9**	**6.1**	**7.5**	**8.1**	**3.4**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.6**	**2.9**	**2.9**	4.8	6.7	**8.0**	**10**	**10**	**4.2**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.5**	**2.5**	**1.6**	**3.6**	**5.4**	13	26	42	34	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	32	57	20	15	20	27	30	37	42	20	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.9**	4.1	6.3	8.8	11	14	16	6.5	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.4**	3.6	4.0	6.6	9.4	12	15	17	7.1	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	7.6	13	28	38	48	60	72	30	CMA+DE-MOS [13]
NEWUOA	**1**	3.5	**2.4**	**1.9**	5.7	9.4	60	85	178	136	NEWUOA [16]
Basic RCGA	**1**	**1.3**	7.1	27	60	133	234	353	434	222	Basic RCGA [17]
SPSA	51	202	151	119	165	251	415	5261	93276	*42e-6/1e5*	SPSA [9]

Table 64: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{104}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	3.8	11	35	155	257	315	354	385	408	457	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	7.1	7.7	3.9	13	54	222	*98e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.9**	8.2	3.3	4.3	13	14	13	13	12	11	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.2	**2.9**	**1.6**	9.3	14	24	24	22	21	18	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.0	8.0	3.5	13	50	98	410	*69e-3/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.0**	3.7	**1.6**	4.2	4.9	4.2	6.6	6.1	5.8	5.3	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.3**	3.4	**1.5**	5.0	**3.3**	3.9	3.6	3.3	3.2	**2.9**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.1**	3.1	**1.3**	4.3	5.0	4.2	3.8	3.5	3.3	3.0	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.6**	**2.7**	**1.3**	8.9	14	18	16	15	14	13	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.3**	**2.8**	**1.0**	5.0	7.6	14	23	21	20	24	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	22	13	5.5	583	448	367	327	300	284	254	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.2	**2.7**	**1.5**	**2.0**	**1.7**	**1.6**	**1.6**	**1.5**	**1.5**	**1.4**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.1**	**2.2**	**1.4**	**3.4**	**2.9**	**2.8**	**2.7**	**2.6**	**2.5**	**2.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.0	8.4	5.1	4.0	3.6	**3.3**	**3.2**	**3.0**	**3.0**	**2.9**	CMA+DE-MOS [13]
NEWUOA	**1.1**	**2.8**	**1.2**	**3.4**	6.0	14	24	100	*14e-4/5e3*	.	NEWUOA [16]
Basic RCGA	7.1	7.8	10	381	432	1080	963	1891	*12e-1/5e4*	.	Basic RCGA [17]
SPSA	189	148	*36e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 65: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{105}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

105 Rosenbrock moderate unif

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	3.6	12	33	287	1035	2000	2078	2129	2165	2240	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	8.3	4.9	3.1	7.8	19	35	70	69	*18e-2/1e4*	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	4.5	3.8	**2.1**	6.0	10	10	20	*88e-3/1e4*	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.4	4.4	**2.1**	3.5	5.0	23	*38e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	6.6	3.5	4.9	10	19	*14e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	3.6	6.0	**2.8**	12	14	16	34	70	*14e-2/1e4*	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.4**	6.0	**2.6**	5.9	12	21	34	33	67	64	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.5**	**1.8**	**1.0**	4.3	8.7	23	69	67	66	64	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.7**	**1.5**	**1.6**	6.6	16	22	70	68	*12e-2/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.3**	3.7	**1.7**	**2.4**	**1.9**	4.4	14	47	46	*45e-4/7e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	20	12	5.7	989	1355	702	675	659	648	626	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.8**	5.3	**2.8**	**3.0**	**1.3**	**0.71**	**0.70**	**0.70**	**0.70**	**0.70**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.3**	**2.7**	**1.6**	3.8	**1.6**	**0.89**	**0.90**	**0.90**	**0.90**	**0.90**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.3	6.9	4.8	5.9	**2.2**	**1.3**	**1.5**	**1.6**	**1.6**	**1.6**	CMA+DE-MOS [13]
NEWUOA	**0.91**	**2.8**	**1.7**	**2.7**	3.3	5.0	*38e-3/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	8.4	11	13	106	121	183	177	*51e-2/5e4*	.	.	Basic RCGA [17]
SPSA	499	250	*36e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 66: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{106}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

106 Rosenbrock moderate Cauchy

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	3.6	14	18	106	210	354	533	556	577	617	ERT_{best}/D
(1,2)-CMA-ES	5.4	7.0	7.0	13	8.6	5.7	4.1	4.0	3.9	3.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	4.4	3.8	4.0	3.1	**2.5**	**1.8**	**1.3**	**1.3**	**1.3**	**1.3**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.2**	**2.4**	3.2	3.2	**2.4**	**1.7**	**1.2**	**1.2**	**1.2**	**1.2**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	7.1	6.6	7.9	8.5	6.8	4.7	3.4	3.4	3.4	3.4	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.3**	**2.4**	**2.7**	3.6	**2.4**	**1.6**	**1.2**	**1.2**	**1.1**	**1.1**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.8**	**1.3**	**2.0**	**2.8**	**2.0**	**1.4**	**0.96**	**0.96**	**0.96**	**0.95**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.6**	**0.92**	**1.3**	**2.0**	**1.4**	**0.96**	**0.68**	**0.68**	**0.68**	**0.67**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.4**	**1.2**	**2.1**	**1.8**	**1.5**	**1.0**	**0.74**	**0.74**	**0.74**	**0.73**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.9**	**0.85**	**0.85**	**1.5**	**2.4**	5.8	9.1	30	200	*21e-5/8e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	16	7.9	8.4	7.5	4.9	22	15	15	14	14	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.0**	**1.7**	**2.3**	**1.9**	**1.6**	**1.2**	**0.87**	**0.89**	**0.90**	**0.92**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.1**	**2.1**	3.1	**2.5**	**2.2**	**1.7**	**1.2**	**1.3**	**1.3**	**1.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	5.9	4.6	8.3	5.3	4.0	**2.8**	**2.0**	**2.1**	**2.2**	**2.3**	CMA+DE-MOS [13]
NEWUOA	**1.1**	**0.73**	**0.93**	**2.2**	5.0	27	59	*79e-4/7e3*	.	.	NEWUOA [16]
Basic RCGA	7.6	7.2	21	363	476	490	662	*44e-2/5e4*	.	.	Basic RCGA [17]
SPSA	609	1375	2049	*26e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 67: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{107}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss

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	0.20	0.20	8.0	46	91	138	188	234	275	370	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1.3**	17	43	329	*18e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	3.8	7.7	6.7	28	76	315	*91e-5/1e4*	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	6.3	7.7	21	44	141	292	527	*17e-4/1e4*	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	12	44	451	*23e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.9**	13	8.9	13	24	57	109	*62e-5/1e4*	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	3.3	6.4	6.9	5.3	**7.1**	13	**14**	28	392	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	5.1	4.8	5.2	8.4	**12**	26	70	392	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.1**	14	10	26	80	123	605	*66e-4/1e4*	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.7**	68	317	*14e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	52	72	4.7	**2.5**	**4.9**	11	50	124	272	1086	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.2**	**1.9**	**2.8**	**1.9**	**1.6**	**1.4**	**1.4**	**1.3**	**1.4**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**2.0**	**2.1**	**0.98**	**1.1**	**1.3**	**1.3**	**1.2**	**1.2**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	3.1	24	20	17	18	19	19	18	CMA+DE-MOS [13]
NEWUOA	**1**	**2.7**	60	194	*17e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.5**	**1.6**	10	10	11	13	15	**17**	**17**	Basic RCGA [17]
SPSA	50	82	8500	*88e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 68: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{108}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.20	0.20	17	1029	2894	4930	6187	8237	11726	16133	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1**	**1.7**	43	*23e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**2.7**	27	22	*18e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	32	44	*19e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**2.8**	90	69	*22e-1/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.7**	**5.9**	15	51	*11e-1/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.4**	25	**7.7**	*84e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	3.7	15	13	*94e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**2.7**	25	69	*15e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	3.0	155	44	*27e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	5825	9728	290	14	**7.8**	**7.2**	**8.6**	**10**	**13**	**46**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	12	11	**0.68**	**0.64**	**0.64**	**0.64**	**0.75**	**0.66**	**0.94**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.7**	9.1	**0.80**	**0.67**	**0.64**	**0.77**	**0.70**	**0.62**	**0.69**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**2.5**	95	125	157	267	201	141	*89e-2/1e5*	CMA+DE-MOS [13]
NEWUOA	**1**	48	77	64	*41e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**0.79**	13	30	70	*16e-2/5e4*	.	.	.	Basic RCGA [17]
SPSA	436	1305	89	10	242	*15e-2/1e5*	.	.	.	.	SPSA [9]

Table 69: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{109}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy

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	0.20	0.20	2.2	11	43	75	114	139	175	189	ERT_{best}/D
(1,2)-CMA-ES	**1**	**2.7**	5.5	**2.8**	**1.8**	**1.9**	**1.9**	**2.5**	**2.5**	3.4	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	3.3	4.1	**2.5**	**1.2**	**1.1**	**1.0**	**1.1**	**1.0**	**1.3**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.3**	3.4	**2.1**	**1.0**	**0.86**	**0.77**	**0.89**	**0.89**	**1.1**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	5.8	3.5	**2.0**	**2.0**	**2.2**	**2.4**	**2.4**	3.4	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.1**	3.4	**2.2**	**1.0**	**0.98**	**1.0**	**1.1**	**1.1**	**1.4**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**2.9**	**1.4**	**0.79**	**0.82**	**0.81**	**0.88**	**0.93**	**1.2**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.6**	**1.9**	**1.1**	**0.57**	**0.52**	**0.50**	**0.53**	**0.52**	**0.67**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.2**	**3.0**	**1.3**	**0.79**	**0.76**	**0.68**	**0.68**	**0.66**	**0.88**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.5**	4.3	3.6	26	47	*67e-4/6e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	41	62	21	8.3	3.1	110	2422	*17e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.1**	3.1	**1.9**	**1.1**	**1.0**	**0.92**	**1.1**	**1.2**	**1.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**2.9**	**2.2**	**1.2**	**1.1**	**1.0**	**1.1**	**1.1**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	6.1	8.7	4.9	4.9	4.7	5.2	5.3	7.4	CMA+DE-MOS [13]
NEWUOA	**1**	**1.7**	4.8	13	83	885	*41e-3/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	9.0	20	12	14	16	20	25	53	Basic RCGA [17]
SPSA	50	101	138	953	3515	*13e-2/1e5*	.	.	.	.	SPSA [9]

Table 70: 05-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{110}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	10	48	190	6725	24004	1.12e5	1.19e5	1.19e5	1.21e5	1.22e5	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	18	8.0	32	*69e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	3.1	3.9	3.4	**2.3**	**2.8**	**0.61**	*10e-1/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	6.2	3.2	**2.1**	**1.5**	**2.9**	**1.3**	*67e-2/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	26	21	46	*92e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	8.3	5.0	**3.0**	**1.3**	6.0	**1.3**	*74e-2/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	4.5	3.6	**1.5**	**0.66**	**1.0**	**1.3**	*37e-2/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.6**	**2.0**	**1.6**	**1.1**	**1.0**	**1.3**	*28e-2/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.8	**2.4**	3.6	**1.6**	**2.8**	*79e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	20	34	241	*27e+0/6e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	62	37	13	*33e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.1**	**1.1**	**0.54**	4.3	3.2	**0.82**	**0.79**	**0.79**	**0.79**	**0.79**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.81**	**0.65**	**0.73**	8.3	3.4	**0.75**	**0.72**	**0.73**	**0.73**	**0.74**	IPOP-CMA-ES [15]
CMA+DE-MOS	3.1	4.6	10	36	65	14	**13**	**13**	**13**	**13**	CMA+DE-MOS [13]
NEWUOA	17	23	118	10	*13e+0/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**2.3**	3.1	4.8	35	30	6.5	*18e-1/5e4*	.	.	.	Basic RCGA [17]
SPSA	92	288	7418	*31e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 71: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{111}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

111 Rosenbrock unif

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	214	1371	1.22e5	1.77e6	4.59e6	4.61e6	4.62e6	6.20e6	6.26e6	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	48	115	*12e+1/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	27	26	*71e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	45	35	*72e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	64	81	*10e+1/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	23	11	54	*20e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	10	8.2	22	*18e+0/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	12	11	30	*22e+0/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	23	22	104	*42e+0/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	142	60	*20e+1/6e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	121	39	22	12	*36e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**3.6**	**1.6**	**0.54**	**7.3**	**7.9**	*88e-2/1e6*	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.5**	**1.1**	**0.78**	15	**3.9**	**3.2**	**3.2**	**3.2**	**2.4**	**2.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.5	34	16	**2.8**	**0.89**	*20e-1/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	78	97	*36e+1/5e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**2.8**	**2.6**	**2.4**	**6.0**	*26e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	79	60	1064	*20e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 72: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{112}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy

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	3.6	14	21	337	684	832	900	963	1026	1119	ERT_{best}/D
(1,2)-CMA-ES	4.7	8.9	8.0	9.3	7.0	7.8	7.8	7.7	7.4	7.1	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.8**	**2.1**	**2.2**	**2.7**	**2.1**	**2.0**	**2.1**	**2.0**	**2.0**	**1.9**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.6	**3.0**	**2.7**	**1.7**	**1.4**	**1.3**	**1.3**	**1.3**	**1.3**	**1.2**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	10	6.5	6.4	8.6	11	11	14	14	13	12	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.4**	**1.8**	**1.8**	**2.4**	**1.8**	**1.7**	**1.7**	**1.7**	**1.6**	**1.6**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.7**	**1.9**	**2.0**	**1.2**	**1.0**	**1.0**	**1.1**	**1.0**	**1.0**	**1.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.0**	**2.3**	**2.1**	**1.1**	**0.81**	**0.76**	**0.76**	**0.74**	**0.72**	**0.70**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.6**	**1.8**	**1.8**	**1.5**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.4**	**1.8**	3.1	4.9	23	110	*14e-2/7e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	22	7.7	7.1	828	962	*20e-1/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.9**	**2.0**	**2.2**	**1.2**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.9**	**2.0**	**2.1**	**1.4**	**1.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.3	4.9	7.3	**2.6**	**2.2**	**2.3**	**2.4**	**2.5**	**2.5**	**2.7**	CMA+DE-MOS [13]
NEWUOA	**0.94**	**0.71**	**1.9**	7.7	105	*44e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	7.6	8.1	25	130	174	859	*70e-2/5e4*	.	.	.	Basic RCGA [17]
SPSA	331	364	1070	*45e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 73: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{113}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss

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	0.20	1.9	27	377	1616	4804	4826	4826	4826	4880	ERT_{best}/D
(1,2)-CMA-ES	4.4	24	20	51	*11e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.9**	15	7.1	3.1	13	31	*12e-2/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.1**	6.3	6.1	3.4	26	30	*18e-2/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1.1**	17	21	37	*91e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.4**	6.2	8.8	3.3	11	14	29	29	29	*19e-2/1e4*	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.3**	4.7	**4.5**	**2.8**	**4.9**	14	14	14	14	14	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.8**	**1.9**	6.7	4.0	8.2	14	14	14	14	14	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	16	6.0	6.4	10	15	15	15	15	15	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.7**	23	14	31	55	*13e-1/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	67	13	19	132	251	*58e-2/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.9**	4.7	**4.4**	**0.78**	**0.77**	**0.27**	**0.32**	**0.32**	**0.32**	**0.32**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.4**	**2.0**	**3.7**	**1.4**	**1.4**	**0.61**	**0.67**	**0.67**	**0.67**	**0.67**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.5**	**1.8**	26	12	7.5	**3.6**	**4.0**	**4.0**	**4.0**	**4.2**	CMA+DE-MOS [13]
NEWUOA	**2.1**	15	13	44	*18e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.7**	**1.9**	10	22	23	18	35	35	35	48	Basic RCGA [17]
SPSA	72	23	1892	*56e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 74: 05-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{114}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	2.3	153	2944	11262	15778	16654	16654	16654	16990	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1.3**	144	101	*11e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.5**	87	25	*63e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.3**	139	54	*79e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	38	56	56	*73e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.3**	55	18	*46e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.3**	**17**	14	*30e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	53	26	19	50	*21e-1/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.4**	23	21	*53e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.3**	112	74	*11e+0/6e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1787	721	152	61	*19e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.3**	35	**3.3**	**0.61**	**0.49**	**0.62**	**0.60**	**0.60**	**0.60**	**0.61**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.3**	41	**3.2**	**0.45**	**0.48**	**0.80**	**0.79**	**0.79**	**0.79**	**0.80**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.5**	**2.5**	60	130	34	**33**	**48**	**48**	**48**	**47**	CMA+DE-MOS [13]
NEWUOA	**1**	150	43	*89e-1/5e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.2**	**1.2**	**12**	**16**	**31**	*41e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	1025	531	181	245	*29e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 75: 05-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{115}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	2.0	13	97	366	455	510	510	510	594	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**2.2**	3.8	5.3	5.7	66	*13e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.7**	**2.5**	**1.9**	**2.4**	6.6	54	137	137	137	240	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.9**	**3.0**	**2.3**	**1.6**	7.5	44	88	88	88	247	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1.3**	3.1	4.7	11	50	*17e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.9**	**1.7**	**1.7**	**1.7**	5.5	23	134	134	134	119	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.6**	**1.4**	**1.2**	**1.3**	**2.6**	**13**	26	26	26	70	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.7**	**1.4**	**2.9**	**1.7**	4.6	26	49	49	49	55	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.7**	**1.6**	**1.9**	**1.8**	6.9	45	89	89	89	*11e-3/1e4*	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.1**	**1.6**	**1.1**	4.2	28	*10e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	63	13	8.6	422	1803	3116	2779	2779	2779	*31e-2/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.2**	**2.0**	**1.8**	**0.81**	**1.1**	**1.1**	**1.4**	**1.4**	**1.4**	**1.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.3**	**1.2**	**1.7**	**2.4**	**2.7**	**2.9**	**3.1**	**3.1**	**3.1**	**2.7**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.5**	**2.5**	5.3	18	31	25	**23**	**23**	**23**	**20**	CMA+DE-MOS [13]
NEWUOA	**2.1**	**1.2**	**2.9**	14	42	*34e-2/4e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.4**	**1.7**	74	68	108	769	703	703	703	604	Basic RCGA [17]
SPSA	58	64	222	1640	3866	*12e-1/1e5*	.	.	.	.	SPSA [9]

Table 76: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{116}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss

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	23	268	1146	2894	4462	5249	5374	5521	6066	6332	ERT_{best}/D
(1,2)-CMA-ES	30	22	*42e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	8.2	5.0	8.0	16	*37e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	10	8.3	27	50	*17e+0/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	40	36	126	*72e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	7.2	5.3	6.6	15	*57e-1/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	5.0	**2.8**	**3.9**	11	*33e-1/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	6.0	4.2	4.0	**6.0**	32	27	27	*28e-1/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	9.2	5.6	10	*86e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	29	35	*95e+0/6e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	565	5262	*33e+1/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.7**	**1.1**	**0.88**	**0.62**	**0.57**	**0.59**	**0.73**	**0.73**	**0.68**	**0.68**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**3.7**	3.8	**3.1**	**2.3**	**1.9**	**1.7**	**1.8**	**1.8**	**1.7**	**1.7**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.1**	**1.4**	8.3	6.1	**4.9**	**5.3**	**5.2**	**5.1**	**4.7**	**4.5**	CMA+DE-MOS [13]
NEWUOA	27	20	*74e+0/5e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	4.4	20	29	55	161	*22e-1/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	2007	5359	*74e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 77: 05-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{117}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

117 Ellipsoid unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	34	865	5337	15210	21947	25722	27362	30258	34557	38341	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	92	82	*32e+1/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	28	49	*19e+1/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	45	170	*31e+1/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	103	167	*31e+1/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	11	28	*13e+1/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	13	**10**	*82e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	12	35	*13e+1/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	21	24	*14e+1/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	38	100	*30e+1/6e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	721	308	135	*14e+1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	8.1	**1.8**	**0.65**	**0.48**	**0.44**	**0.44**	**0.47**	**0.45**	**0.43**	**0.46**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**6.5**	**1.5**	**1.1**	**0.95**	**0.77**	**0.70**	**0.73**	**0.71**	**0.67**	**0.69**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.8**	28	15	**8.5**	**8.8**	**7.6**	**7.2**	**6.5**	**6.7**	**6.1**	CMA+DE-MOS [13]
NEWUOA	41	*41e+1/5e3*	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**4.9**	10	**12**	48	*45e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	629	226	*13e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 78: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{118}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	6.6	11	86	243	311	355	400	441	486	583	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	6.1	15	9.2	6.5	6.4	7.3	7.8	7.9	8.2	8.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	6.1	10	4.6	**2.4**	**2.2**	**2.2**	**2.2**	**2.0**	**2.0**	**1.8**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	5.0	7.2	**2.6**	**1.6**	**1.8**	**1.8**	**1.7**	**1.6**	**1.5**	**1.4**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	6.6	16	18	10	16	17	19	24	39	44	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	3.4	7.0	**2.3**	**1.4**	**1.3**	**1.4**	**1.3**	**1.3**	**1.3**	**1.2**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.6**	5.7	**2.0**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.0**	**4.1**	**1.1**	**0.71**	**0.77**	**0.78**	**0.75**	**0.73**	**0.70**	**0.65**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	3.6	7.2	**1.9**	**1.0**	**0.96**	**0.97**	**0.95**	**0.92**	**0.88**	**0.84**	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.92**	**0.97**	**1.8**	8.3	64	*18e-2/7e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	27	689	337	622	889	3954	*21e-1/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.5**	6.1	**1.7**	**0.88**	**0.91**	**0.91**	**0.91**	**0.92**	**0.91**	**0.90**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**3.0**	9.0	3.2	**2.0**	**1.9**	**2.0**	**2.0**	**1.9**	**1.9**	**1.7**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.6	17	3.7	**1.8**	**1.7**	**1.8**	**2.1**	**2.3**	**2.5**	**2.8**	CMA+DE-MOS [13]
NEWUOA	**0.80**	**1.3**	4.3	10	116	*30e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	5.4	520	495	1424	*45e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	46	255	2588	*18e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 79: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{119}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

119 Sum of diff powers Gauss

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	0.20	0.20	2.3	131	227	473	2074	6191	7059	9949	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.1**	15	7.8	86	*12e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**2.5**	6.4	**2.5**	6.1	70	*16e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**2.6**	5.0	**2.7**	15	67	*18e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	11	34	10	626	*20e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.1**	10	**2.2**	11	29	*62e-4/1e4*	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.9**	15	**1.1**	**3.7**	**7.8**	22	23	*42e-4/1e4*	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**2.1**	8.9	**1.9**	5.6	13	68	*55e-4/1e4*	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	6.0	4.0	12	88	*23e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	3.4	19	23	*42e-2/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	62	92	14	9.3	26	129	99	*23e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.4**	**1.5**	**0.55**	**0.58**	**0.75**	**0.55**	**0.51**	**0.49**	**0.61**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.1**	**0.35**	**0.70**	**0.78**	**0.83**	**0.79**	**1.0**	**1.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.2**	**2.6**	50	33	22	6.6	**3.3**	**3.3**	**2.5**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.7**	26	35	*90e-2/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.2**	**1.4**	6.3	11	8.2	**6.1**	20	*20e-5/5e4*	.	Basic RCGA [17]
SPSA	51	67	3075	*32e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 80: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{120}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

120 Sum of diff powers unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	3.2	580	3740	6898	14488	35436	66660	1.10e5	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.5**	77	33	*14e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	34	46	79	40	*11e-1/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.7**	34	26	*10e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	63	51	34	*14e-1/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	11	36	16	*77e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**2.9**	13	**6.6**	*66e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	56	64	10	*69e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.9**	38	15	*83e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	42	94	49	*15e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1223	2182	675	85	33	24	49	*13e-3/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.3**	18	**0.76**	**0.65**	**0.82**	**0.83**	**0.53**	**0.43**	**0.66**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.1**	**6.0**	**1.6**	**0.68**	**0.73**	**0.69**	**0.46**	**0.55**	**0.83**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.2**	**2.5**	63	130	71	**34**	**22**	**24**	**15**	CMA+DE-MOS [13]
NEWUOA	**1**	34	130	55	*24e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**0.87**	17	**12**	**23**	*50e-3/5e4*	.	.	.	Basic RCGA [17]
SPSA	194	1082	276	165	*84e-2/1e5*	.	.	.	.	.	SPSA [9]

Table 81: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{121}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy

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	0.20	0.20	1.7	22	55	107	317	525	774	1239	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1.3**	4.5	**2.9**	**1.9**	3.3	**2.9**	3.8	4.5	9.0	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.6**	**2.4**	**1.2**	**0.94**	**1.2**	**1.1**	**1.7**	**1.9**	**2.8**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	**2.7**	**1.1**	**0.87**	**0.84**	**0.90**	**1.0**	**1.2**	**1.3**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	4.4	5.3	**2.9**	**2.2**	**2.8**	5.7	5.5	9.4	27	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**2.1**	**1.7**	**1.2**	**0.91**	**1.1**	**0.96**	**1.1**	**1.2**	**1.3**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.7**	3.4	**1.2**	**0.86**	**1.1**	**0.91**	**0.93**	**1.0**	**1.2**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.2**	**2.0**	**0.72**	**0.57**	**0.70**	**0.51**	**0.58**	**0.60**	**0.56**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	3.1	**2.6**	**0.98**	**0.75**	**0.86**	**0.62**	**0.70**	**0.77**	**0.80**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	3.3	4.3	3.3	45	788	*38e-3/6e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	46	62	16	4.3	**2.9**	482	4519	*55e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	3.3	3.0	**1.1**	**1.1**	**1.1**	**0.78**	**0.79**	**0.84**	**0.82**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.6**	**1.9**	**1.1**	**1.0**	**1.1**	**1.1**	**1.7**	**2.1**	**2.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.2**	3.5	4.9	4.0	4.0	**2.3**	**2.4**	**2.3**	**2.5**	CMA+DE-MOS [13]
NEWUOA	**1**	3.9	4.8	15	76	*86e-3/4e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**2.1**	11	11	11	30	1408	*22e-5/5e4*	.	Basic RCGA [17]
SPSA	42	74	119	6850	*11e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 82: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{122}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	2.0	345	1838	4316	6017	8140	10749	22299	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.2**	11	30	*80e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.1**	6.0	**4.7**	*34e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.4**	7.1	6.2	*57e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.1**	38	40	*96e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.1**	8.7	11	*53e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	5.3	5.2	*38e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	4.9	4.8	*35e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	20	12	*57e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.5**	6.1	34	*11e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	33	46	13	7.1	28	81	*62e-3/3e4*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.1**	**2.9**	**1.4**	**0.71**	**0.53**	**0.48**	**0.42**	**0.66**	**0.58**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.3**	4.8	**0.94**	**0.44**	**0.51**	**0.56**	**0.57**	**0.68**	**0.67**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.8**	110	65	35	26	19	**15**	**10**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.9**	14	91	*18e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**2.4**	8.0	**3.7**	**5.4**	**10**	**19**	*72e-5/5e4*	.	Basic RCGA [17]
SPSA	53	87	117	*46e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 83: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{123}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	2.2	3213	16301	45479	67138	90334	1.34e5	4.43e5	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.1**	75	*28e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	61	44	*22e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	75	*29e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	33	87	*26e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.2**	40	44	*15e-1/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	9.1	39	**21**	*15e-1/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	39	46	*18e-1/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	69	46	*14e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.5**	80	*26e-1/6e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1886	2342	1444	43	*14e-1/4e4*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.3**	28	**0.94**	**0.66**	**0.46**	**0.67**	**0.62**	**0.56**	**0.60**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.4**	**23**	**0.62**	**0.52**	**0.46**	**0.74**	**0.80**	**0.65**	**0.45**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.7**	71	**96**	*18e-1/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1.3**	65	*37e-1/5e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**2.1**	30	*11e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	77217	77493	12178	*71e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 84: 05-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{124}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	1.9	40	208	1795	4096	5279	9067	19040	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1.1**	11	127	700	*52e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.1**	3.4	**2.7**	30	83	*65e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.3**	4.3	5.5	22	*60e-3/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1.8**	96	277	*88e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	3.1	**2.8**	21	119	*13e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.1**	**2.4**	**2.5**	15	39	*41e-3/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.3**	**1.8**	7.6	18	79	*46e-3/1e4*	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.7**	17	19	72	*10e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.1**	6.1	89	*63e-2/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	54	76	19	5.7	80	*44e-3/6e4*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.3**	**2.6**	**1.2**	**2.1**	**0.85**	**0.93**	**0.93**	**0.94**	**0.59**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.8**	**2.8**	**1.3**	**4.0**	**1.0**	**1.2**	**1.1**	**0.93**	**0.65**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	**1.7**	5.9	**15**	**3.5**	**2.4**	**2.2**	**3.3**	**1.9**	CMA+DE-MOS [13]
NEWUOA	**1**	**1.1**	**3.0**	158	*11e-1/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**2.4**	63	41	10	11	66	*55e-5/5e4*	.	Basic RCGA [17]
SPSA	59	96	516	16583	*39e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 85: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{125}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss

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	0.20	0.20	0.20	0.20	0.20	25031	47750	48260	48600	49199	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	120	59424	*92e-3/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.3**	69	14809	*69e-3/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	36	32993	*81e-3/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	247	1.04e5	*11e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	**21**	12610	*58e-3/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	24	12571	*58e-3/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	**20**	12034	*54e-3/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	48	23166	*82e-3/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**2.0**	81	9966	*36e-3/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	49	65	70	153	3423	5.7	*10e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	26	3142	**0.75**	**0.53**	**0.56**	**0.57**	**0.57**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	27	**2599**	**0.79**	**0.78**	**1.3**	**1.3**	**1.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.2**	34	**810**	5.0	**16**	**16**	**16**	**16**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	3.9	**15**	6088	**2.8**	*40e-3/5e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	26	**1574**	**1.3**	*82e-4/5e4*	.	.	.	Basic RCGA [17]
SPSA	41	60	35786	35837	52690	56	*51e-3/1e5*	.	.	.	SPSA [9]

Table 86: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{126}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	0.20	0.20	0.20	1.75e5	∞	∞	∞	∞	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1.1**	2015	7.40e5	*25e-2/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	618	*22e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	719	*20e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	32	585	7.17e5	*26e-2/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	532	*15e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	356	2.33e5	*12e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	82	1.14e5	*12e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.2**	282	3.57e5	*18e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	22	1636	4.54e5	*26e-2/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	1548	1777	5228	7914	99874	8.3	*23e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**62**	**7882**	**1.4**	*51e-4/4e5*	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	63	10254	**1.2**	**1.21e7**	**1.87e7**	**1.88e7**	**1.89e7**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.2**	**34**	**568**	*23e-3/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**1.2**	1053	3.47e5	*26e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	**33**	**1409**	**0.59**	*11e-3/5e4*	.	.	.	Basic RCGA [17]
SPSA	1.00e6	2.00e6	3.25e6	3.25e6	7.17e6	*16e+2/1e5*	.	.	.	.	SPSA [9]

Table 87: 05-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{127}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	0.20	0.20	0.20	25716	68336	77023	77898	79070	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	85	13853	5.8	*55e-3/1e4*	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	31	5212	**2.7**	*44e-3/1e4*	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	27	4508	5.8	*29e-3/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.3**	60	37537	*64e-3/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	18	7947	*32e-3/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	17	3986	5.6	*24e-3/1e4*	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	24	7806	*42e-3/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	**17**	9717	5.7	*29e-3/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**2.0**	18	5233	*53e-3/6e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	44	62	77	181	1992	3.6	*92e-4/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.1**	30	3085	**0.65**	**0.50**	**0.45**	**0.46**	**0.46**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	**15**	**1542**	**0.69**	**0.58**	**0.63**	**0.64**	**0.65**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.2**	35	**656**	**0.96**	**4.6**	**20**	**20**	**19**	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.5**	**14**	7248	*62e-3/4e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	41	**991**	**1.8**	*95e-4/5e4*	.	.	.	Basic RCGA [17]
SPSA	45	56	122	21588	3.40e6	*15e-2/1e5*	.	.	.	.	SPSA [9]

Table 88: 05-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{128}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss

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	0.20	0.20	22	850	1562	2100	2489	2984	3443	4232	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1**	4.8	5.9	10	16	29	24	*80e-3/1e4*	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**2.1**	**1.7**	**2.1**	**1.9**	**1.8**	3.1	3.1	**2.9**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**2.2**	**1.8**	**2.0**	**2.3**	**2.2**	**1.8**	**2.1**	3.7	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	10	4.8	21	71	60	*31e-2/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	3.1	**2.8**	**2.9**	**2.5**	3.6	3.9	4.6	7.4	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.9**	**2.7**	**1.6**	**1.9**	**1.8**	**1.6**	**1.5**	**1.6**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	3.4	**1.9**	**2.1**	**2.2**	**2.2**	**1.9**	**1.9**	**2.0**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	4.3	3.1	4.1	5.8	6.0	5.2	13	16	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	11	9.3	7.5	42	*31e-2/6e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	37	52	**2.5**	84	134	193	163	136	118	155	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.6**	**1.8**	47	35	30	25	22	18	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.0**	14	166	216	183	152	132	108	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.7**	58	108	81	68	57	50	41	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	12	17	43	*19e-1/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**0.69**	13	16	16	21	19	16	17	Basic RCGA [17]
SPSA	27	55	3631	*89e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 89: 05-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{129}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.20	0.20	13	2142	11889	46274	56948	72928	1.02e5	1.16e5	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	168	*33e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	111	*34e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	120	22	*23e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	192	70	*56e-1/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	32	**12**	**12**	*20e-1/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	28	21	*17e-1/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	32	16	*19e-1/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	37	15	**12**	**3.1**	*20e-1/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	68	20	*30e-1/6e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	2252	4483	2336	116	120	31	25	20	14	12	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	11	**10**	16	8.7	**7.0**	**5.5**	**3.9**	**3.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**8.5**	13	18	**8.2**	**6.7**	**5.2**	**3.8**	**3.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**3.9**	68	42	16	13	10	7.5	6.6	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	124	16	*61e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.7**	**8.5**	**13**	**7.4**	**6.1**	**10**	**7.2**	**6.4**	Basic RCGA [17]
SPSA	626	2123	1131	*58e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 90: 05-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{130}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy

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	0.20	0.20	11	162	607	1640	6565	6746	6778	6906	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	14	48	23	10	**2.9**	**2.8**	**2.8**	3.6	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	7.2	17	8.7	**3.3**	**0.82**	**0.80**	**0.80**	**0.79**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	5.3	14	**5.1**	**1.9**	**0.47**	**0.46**	**0.46**	**0.46**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	37	58	41	15	3.8	3.7	3.8	3.8	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	5.4	25	12	4.5	**1.1**	**1.1**	**1.2**	**1.2**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.0**	15	10	3.8	**0.95**	**0.93**	**0.93**	**0.92**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	6.8	**4.2**	**3.5**	**1.3**	**0.33**	**0.32**	**0.32**	**0.32**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	3.3	14	15	5.5	**1.4**	**1.3**	**1.3**	**1.3**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.3**	**6.4**	**5.9**	6.0	**3.0**	13	*14e-3/6e3*	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	35	57	5.2	203	146	124	104	102	*31e-3/1e5*	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.4**	143	391	145	36	35	35	35	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.2**	59	321	147	37	36	36	35	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**2.4**	295	221	121	30	29	29	29	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.3**	**11**	10	19	*62e-3/4e3*	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**2.5**	250	74	29	7.5	9.2	9.3	10	Basic RCGA [17]
SPSA	40	62	142	1955	*19e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 91: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{101}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.10	0.10	2.6	4.0	18	19	19	20	21	23	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	50	13	14	4.3	5.1	6.0	6.7	7.4	8.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	14	7.1	7.8	**2.4**	3.2	3.8	4.2	4.6	5.5	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	29	5.6	5.8	**1.9**	**2.5**	**3.0**	3.4	3.8	4.5	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	54	14	13	4.2	5.2	6.1	6.9	7.8	9.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	10	5.1	6.0	**2.0**	**2.6**	**3.0**	3.5	3.8	4.7	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	10	4.0	5.0	**1.6**	**2.2**	**2.6**	3.0	3.3	4.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	12	**3.0**	**3.9**	**1.3**	**1.7**	**2.0**	**2.3**	**2.6**	**3.2**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	14	4.7	5.4	**1.7**	**2.2**	**2.6**	**3.0**	3.3	4.0	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	20	**2.9**	**3.4**	**0.99**	**1.2**	**1.2**	**1.3**	**1.3**	**1.4**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	153	253	33	32	8.5	10	11	12	12	14	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**6.6**	5.1	7.2	**2.4**	3.2	3.8	4.5	5.0	6.1	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	11	5.6	7.4	**2.5**	3.4	4.1	4.7	5.2	6.1	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.9**	17	33	8.8	12	15	16	18	22	CMA+DE-MOS [13]
NEWUOA	**1**	15	**2.1**	**3.0**	**1.0**	**1.6**	**1.9**	**2.1**	**2.3**	**2.9**	NEWUOA [16]
Basic RCGA	**1**	**7.1**	28	63	28	46	121	229	288	377	Basic RCGA [17]
SPSA	104	177	4405	5820	2316	4151	5693	6382	7916	*34e-5/1e5*	SPSA [9]

Table 92: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{102}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif

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	0.10	0.10	2.6	4.1	20	21	23	24	27	30	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	50	15	15	4.4	5.2	5.7	6.4	6.8	7.9	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	25	7.3	7.7	**2.3**	**2.8**	3.1	3.6	3.7	4.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	23	4.9	6.3	**1.9**	**2.3**	**2.6**	**2.9**	3.1	3.5	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	26	22	21	5.8	6.6	7.4	8.2	8.6	12	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	21	5.8	6.4	**2.0**	**2.5**	**2.9**	3.2	3.4	3.8	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	7.7	4.6	5.1	**1.6**	**1.9**	**2.2**	**2.6**	**2.7**	3.1	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	14	**3.6**	**4.4**	**1.3**	**1.6**	**1.9**	**2.1**	**2.2**	**2.5**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	17	4.7	**4.9**	**1.6**	**2.0**	**2.2**	**2.5**	**2.7**	**3.0**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	31	**2.9**	**3.2**	**0.89**	**1.1**	**1.2**	**1.3**	**1.4**	**1.7**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	147	242	35	32	8.9	10	10	11	11	11	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	10	5.0	6.9	**2.2**	**2.8**	3.3	3.7	4.0	4.4	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**6.0**	5.3	7.2	**2.3**	**2.9**	3.3	3.8	4.0	4.4	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.9**	19	32	8.3	11	13	13	15	16	CMA+DE-MOS [13]
NEWUOA	**1**	18	**3.5**	7.9	8.0	30	48	81	146	547	NEWUOA [16]
Basic RCGA	**1**	**4.1**	26	57	26	42	102	193	234	285	Basic RCGA [17]
SPSA	124	183	1.56e5	3.44e5	*21e+0/1e5*	.	.	.	.	.	SPSA [9]

Table 93: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{103}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.10	0.10	2.6	4.7	13	14	36	36	36	36	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1**	34	14	12	6.4	7.4	3.6	4.3	5.2	6.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	27	6.8	6.4	3.3	4.0	**2.1**	**2.5**	**3.0**	3.8	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	16	6.1	6.0	3.0	3.5	**1.7**	**2.1**	**2.4**	3.1	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	26	12	11	5.5	6.3	3.1	3.8	4.7	6.1	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	16	5.8	5.7	**3.0**	3.6	**1.8**	**2.2**	**2.6**	3.5	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	13	4.7	4.6	**2.6**	**3.1**	**1.5**	**1.9**	**2.2**	**2.9**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	14	**3.5**	**3.4**	**1.9**	**2.2**	**1.1**	**1.4**	**1.6**	**2.1**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	17	4.8	4.4	**2.4**	**2.8**	**1.4**	**1.7**	**2.1**	**2.7**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	31	**3.0**	**2.9**	**1.8**	6.8	25	100	1518	*39e-6/8e3*	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	121	223	32	25	12	12	5.5	6.6	7.7	10	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**7.8**	4.9	6.0	3.5	4.2	**2.1**	**2.6**	3.1	4.0	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	11	5.0	6.0	3.4	4.2	**2.1**	**2.6**	3.1	4.0	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.9**	16	28	13	17	8.4	11	13	18	CMA+DE-MOS [13]
NEWUOA	**1**	15	**2.3**	**3.6**	5.2	29	95	243	1050	*15e-5/6e3*	NEWUOA [16]
Basic RCGA	**1**	**5.3**	33	55	43	74	83	157	201	253	Basic RCGA [17]
SPSA	105	725	112	109	57	88	1065	4244	*18e-5/1e5*	.	SPSA [9]

Table 94: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{104}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	9.4	30	61	999	1664	1842	1936	2015	2076	2201	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	4.6	3.5	3.8	43	*24e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.4**	**2.7**	**2.1**	11	41	78	74	71	*72e-2/1e4*	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.0**	**2.0**	**1.5**	15	26	76	72	70	*16e-1/1e4*	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	7.1	4.9	3.2	26	*15e-1/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.8**	**2.5**	**2.1**	7.4	87	*56e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.5**	**0.98**	**1.3**	32	41	77	73	70	68	64	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.1**	**1.8**	**1.2**	13	43	*92e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.6**	**1.8**	**1.4**	8.2	26	77	*40e-2/1e4*	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.51**	**0.78**	**0.74**	7.1	22	*67e-2/8e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	10	4.7	3.5	38	23	21	20	19	18	17	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.9**	**1.2**	**1.2**	**2.0**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.9**	**1.9**	**2.2**	**1.6**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**	**0.99**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.3	4.4	3.9	**3.5**	**2.5**	**2.6**	**2.8**	**2.7**	**2.7**	**2.7**	CMA+DE-MOS [13]
NEWUOA	**0.51**	**1.6**	5.4	4.6	47	*55e-2/5e3*	.	.	.	.	NEWUOA [16]
Basic RCGA	8.1	11	74	*73e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	41	24	*70e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 95: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{105}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

105 Rosenbrock moderate unif

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	9.0	33	95	2149	7015	7257	7422	7734	7819	7973	ERT_{best}/D
(1,2)-CMA-ES	5.5	5.1	4.5	15	20	*21e-1/1e4*	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.7**	**1.9**	**1.7**	10	*19e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.9**	**2.7**	**1.8**	7.5	6.2	20	*14e-1/1e4*	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	5.5	6.0	5.6	32	21	*35e-1/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.0**	**1.9**	**1.3**	7.5	9.5	*15e-1/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.6**	**1.9**	**1.1**	12	10	*20e-1/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.2**	**1.9**	**1.4**	6.6	10	*59e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.6**	**1.6**	**1.1**	6.2	3.8	10	19	*38e-2/1e4*	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.64**	**1.7**	**2.5**	**5.1**	**3.7**	16	*88e-2/8e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	11	5.0	**2.5**	304	93	90	88	85	84	176	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.8**	**1.2**	**1.0**	**2.0**	**0.64**	**0.63**	**0.63**	**0.61**	**0.61**	**0.61**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.1**	**1.4**	**2.2**	**2.4**	**0.82**	**0.82**	**0.82**	**0.80**	**0.80**	**0.81**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.5	3.9	**2.4**	13	3.9	**3.8**	**3.7**	**3.6**	**3.6**	**3.5**	CMA+DE-MOS [13]
NEWUOA	**0.35**	**1.2**	11	10	*52e-1/5e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	10	10	45	328	*61e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	29	20	*70e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 96: 10-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{106}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

106 Rosenbrock moderate Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	9.0	19	29	342	771	819	850	874	897	937	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	5.6	6.9	8.3	4.6	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.4**	**2.5**	3.2	**2.2**	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**2.4**	3.2	3.2	**1.5**	**0.85**	**0.89**	**0.90**	**0.91**	**0.91**	**0.90**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.8	8.0	8.1	7.9	4.1	4.1	4.1	4.1	4.0	4.0	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.0**	**2.3**	**2.5**	**1.5**	**0.85**	**0.88**	**0.90**	**0.91**	**0.91**	**0.92**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.8**	**2.1**	**2.2**	**1.4**	**0.77**	**0.80**	**0.81**	**0.82**	**0.82**	**0.82**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.2**	**1.1**	**1.8**	**0.84**	**0.48**	**0.50**	**0.51**	**0.51**	**0.52**	**0.52**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.9**	**2.3**	**2.5**	**1.6**	**0.85**	**0.86**	**0.86**	**0.87**	**0.87**	**0.87**	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.56**	**0.67**	**1.3**	5.4	19	162	*13e-2/9e3*	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	9.2	6.6	6.6	3.0	**1.6**	**1.7**	**1.7**	**1.8**	**1.9**	**2.1**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.9**	**1.9**	**2.4**	**1.7**	**0.96**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.8**	**2.4**	**2.8**	**2.0**	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.3	6.9	7.9	3.3	**1.8**	**1.8**	**1.9**	**1.9**	**2.0**	**2.1**	CMA+DE-MOS [13]
NEWUOA	**0.38**	**0.86**	**1.6**	7.5	14	26	*11e-2/7e3*	.	.	.	NEWUOA [16]
Basic RCGA	7.5	15	138	463	443	888	*66e-1/5e4*	.	.	.	Basic RCGA [17]
SPSA	165	1194	22845	*16e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 97: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{107}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.10	0.10	95	225	387	521	735	960	1134	1430	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1**	512	199	*11e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	22	15	632	*35e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	53	22	646	*54e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	415	702	*14e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	127	36	*54e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	30	12	139	*21e-1/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	170	10	*34e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	20	36	299	*54e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	32	227	*15e+0/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	113	194	**1.3**	**1.3**	**2.1**	**3.4**	**3.3**	**5.2**	**5.9**	17	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**6.1**	**0.97**	**1.1**	**1.4**	**1.3**	**1.1**	**0.89**	**0.96**	**0.94**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	10	**0.85**	**0.86**	**0.93**	**1.1**	**1.0**	**0.96**	**0.90**	**0.82**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.9**	16	64	45	36	30	24	21	17	CMA+DE-MOS [13]
NEWUOA	**1**	15	130	*23e+0/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**2.4**	3.3	3.4	**2.9**	3.4	4.7	5.7	6.3	**6.4**	Basic RCGA [17]
SPSA	82	145	14817	*28e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 98: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{108}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.10	0.10	1002	3143	4759	7751	10929	13571	17900	30809	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1**	1016	*28e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	1587	*26e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	926	*29e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	758	*27e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	924	67	*18e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	965	149	*17e+0/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	707	33	*16e+0/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	896	*22e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	1432	*27e+0/7e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	11234	22743	**4.5**	**3.5**	**4.3**	**4.4**	**4.6**	**4.9**	**7.5**	**12**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	376	**1.0**	**0.63**	**0.98**	**0.88**	**0.98**	**1.0**	**1.1**	**0.88**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**63**	**0.78**	**0.64**	**0.69**	**0.77**	**0.70**	**0.82**	**0.78**	**0.77**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.9**	46	479	*74e-1/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	593	*28e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**5.1**	4.6	225	*21e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	3022	8166	5.7	22	*78e-2/1e5*	.	.	.	.	.	SPSA [9]

Table 99: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{109}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.10	0.10	2.8	29	50	82	116	146	179	242	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,2)-CMA-ES	**1**	55	15	**2.5**	**2.8**	**2.3**	**2.2**	**2.2**	**2.3**	**2.5**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	31	6.0	**1.2**	**1.1**	**1.1**	**0.98**	**1.0**	**1.0**	**1.1**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	28	5.8	**1.0**	**0.94**	**0.83**	**0.77**	**0.79**	**0.78**	**0.75**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	55	14	**2.6**	**2.4**	**1.9**	**1.8**	**1.8**	**2.0**	**2.1**	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	16	5.4	**1.1**	**1.1**	**1.0**	**1.1**	**1.1**	**1.1**	**1.2**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	13	**4.2**	**0.84**	**0.83**	**0.83**	**0.82**	**0.81**	**0.83**	**0.87**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	12	**3.4**	**0.69**	**0.66**	**0.55**	**0.52**	**0.52**	**0.52**	**0.53**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	19	4.4	**0.99**	**0.94**	**0.83**	**0.77**	**0.77**	**0.76**	**0.77**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	20	11	38	665	*31e-2/7e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	125	202	31	4.7	3.5	485	*49e-4/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	10	4.5	**1.2**	**1.2**	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**6.3**	**4.4**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**	**1.1**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.9**	16	4.6	4.8	4.5	4.9	5.0	5.3	5.6	CMA+DE-MOS [13]
NEWUOA	**1**	16	12	77	*57e-2/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**4.4**	28	10	12	23	47	48	46	41	Basic RCGA [17]
SPSA	101	733	495	368	13065	*36e-2/1e5*	.	.	.	.	SPSA [9]

Table 100: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{110}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss

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	35	141	1122	3.32e6	7.03e6	1.64e7	∞	∞	∞	∞	ERT_{best}/D
(1,2)-CMA-ES	*50e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	41	159	*16e+1/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	123	1016	*44e+1/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*65e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	36	229	*11e+1/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	8.0	29	*64e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	14	35	*79e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	50	472	*21e+1/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	623	*16e+2/7e3*	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	14	12	5.7	*76e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.1**	**2.5**	**0.94**	*55e-1/1e6*	.	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.95**	**1.4**	**0.92**	*57e-1/1e6*	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	8.6	9.0	12	**0.47**	*74e-1/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	101	*83e+1/4e3*	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**3.8**	**5.2**	**2.7**	*85e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	67	886	*10e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 101: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{111}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

111 Rosenbrock unif

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	384	1951	8293	∞	∞	∞	∞	∞	∞	∞	ERT_{best}/D
(1,2)-CMA-ES	380	*68e+2/1e4*	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	371	*45e+2/1e4*	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*76e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*65e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	*46e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	121	*21e+2/1e4*	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	120	*43e+2/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	388	*46e+2/1e4*	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	263	*10e+3/7e3*	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	11	5.3	**7.9**	*93e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.79**	**0.47**	**0.72**	*70e-1/9e5*	.	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.63**	**0.57**	**0.85**	*70e-1/1e6*	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	17	17	15	*89e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	*74e+2/4e3*	.	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**0.93**	**0.57**	25	*10e+0/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	9.2	35	*87e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 102: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{112}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy

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	10	39	88	1158	1611	1739	1824	1891	1946	2044	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	5.2	**3.0**	**2.0**	6.3	5.8	5.9	7.3	7.3	8.4	9.4	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.0**	**1.4**	**1.4**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.6**	**1.1**	**1.8**	**0.83**	**0.78**	**0.81**	**0.82**	**0.82**	**0.81**	**0.81**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	3.6	**2.5**	10	8.6	9.4	13	15	15	14	24	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.6**	**1.5**	**1.5**	**2.1**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	**1.8**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.4**	**1.0**	**1.1**	**1.3**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.0**	**0.92**	**0.81**	**0.56**	**0.50**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.6**	**1.2**	**0.87**	**1.1**	**0.99**	**0.98**	**0.99**	**0.99**	**0.98**	**0.98**	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.54**	**0.83**	10	98	71	*42e-1/8e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	9.0	3.3	**2.2**	*77e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.6**	**0.92**	**0.83**	**0.95**	**0.92**	**0.97**	**0.98**	**0.99**	**0.99**	**0.98**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.6**	**0.88**	**0.76**	**1.2**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.4	3.4	**2.8**	**1.9**	**1.9**	**2.4**	**3.0**	**3.0**	**3.0**	**3.0**	CMA+DE-MOS [13]
NEWUOA	**0.37**	**0.39**	27	*81e-1/5e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	7.8	9.2	52	646	*77e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	127	468	16041	*29e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 103: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{113}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss

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	0.10	15	447	2763	10288	10882	10898	10898	10898	11235	ERT_{best}/D
(1,2)-CMA-ES	71	99	*37e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	10	17	29	*97e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	151	16	335	*16e+0/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	10	203	*50e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.9**	18	70	*13e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	3.2	9.2	18	*77e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	30	13	11	*77e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	34	21	156	*19e+0/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	4.9	59	*40e+0/7e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	306	5.1	12	63	*11e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	8.6	**1.3**	**0.77**	**0.61**	**0.31**	**0.33**	**0.33**	**0.33**	**0.33**	**0.32**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	5.7	**3.1**	**1.1**	**0.71**	**0.66**	**0.65**	**0.66**	**0.66**	**0.66**	**0.64**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	4.9	23	13	**5.9**	**5.6**	**5.6**	**5.6**	**5.6**	**5.4**	CMA+DE-MOS [13]
NEWUOA	32	47	*39e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**2.7**	**2.7**	**3.0**	**4.5**	21	*53e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	188	7.8	*32e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 104: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{114}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif

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	0.10	31	3661	12781	33069	38641	39025	39025	39025	40649	ERT_{best}/D
(1,2)-CMA-ES	515	382	*98e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	244	402	*97e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	247	294	*83e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	516	536	*11e+1/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	229	285	*82e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	270	91	*58e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	678	160	*79e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	398	375	*88e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	104	242	*82e+0/7e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	28455	402	16	**56**	*41e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	136	**7.5**	**0.60**	**0.44**	**0.45**	**0.43**	**0.44**	**0.44**	**0.44**	**0.43**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**3.6**	**6.3**	**0.66**	**0.66**	**0.60**	**0.60**	**0.62**	**0.62**	**0.62**	**0.61**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	38	*21e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	32	114	*88e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**3.1**	**10**	**4.0**	*57e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	11115	267	46	*14e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 105: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{115}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy

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	0.10	3.8	40	290	859	1232	1260	1260	1260	1281	ERT_{best}/D
(1,2)-CMA-ES	22	6.7	11	253	*23e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.8**	4.3	**2.5**	16	174	*69e-2/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	11	3.1	**2.0**	14	*65e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	7.5	9.3	14	*27e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.1	**2.5**	3.1	15	173	*75e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	4.5	**1.8**	**1.2**	15	78	*61e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.7**	**1.9**	**1.6**	**10**	**50**	*39e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	6.9	**2.5**	**2.7**	18	164	*69e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	7.0	**2.6**	4.2	386	*24e-1/7e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	185	13	3.9	953	*13e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	3.5	**1.9**	**0.91**	**1.3**	**1.5**	**1.5**	**1.4**	**1.4**	**1.4**	**1.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	3.5	**2.0**	**1.0**	**3.7**	**5.3**	**4.1**	**4.1**	**4.1**	**4.1**	**4.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.6**	8.1	3.4	53	93	**122**	**120**	**120**	**120**	**118**	CMA+DE-MOS [13]
NEWUOA	11	**2.4**	19	*41e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**2.6**	6.2	37	45	269	579	566	566	566	557	Basic RCGA [17]
SPSA	177	41	34	*31e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 106: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{116}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss

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	105	1652	7144	10554	10911	11251	11584	11938	12316	16727	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	1414	*59e+2/1e4*	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	683	*24e+2/1e4*	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*28e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*55e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	131	*99e+1/1e4*	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	39	*36e+1/1e4*	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	122	*90e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	220	*13e+2/1e4*	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	974	*35e+2/7e3*	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	790	426	*70e+1/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.9**	**0.87**	**0.34**	**0.38**	**0.42**	**0.42**	**0.43**	**0.44**	**0.44**	**0.35**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**4.4**	**1.9**	**0.98**	**0.94**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	**0.84**	IPOP-CMA-ES [15]
CMA+DE-MOS	24	14	**6.2**	**5.3**	**5.1**	**5.0**	**4.9**	**4.8**	**4.6**	**3.4**	CMA+DE-MOS [13]
NEWUOA	*28e+2/4e3*	.	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**6.6**	**12**	32	*23e+0/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	4342	*29e+2/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 107: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{117}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

117 Ellipsoid unif

Δftarget ERT_{best}/D	1e+03 2241	1e+02 10129	1e+01 22785	1e+00 39931	1e-01 48902	1e-02 62584	1e-03 65419	1e-04 68653	1e-05 71653	1e-07 79447	Δftarget ERT_{best}/D
(1,2)-CMA-ES	*44e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	*55e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*51e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*76e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	*32e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	*33e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	*32e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	*39e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	*46e+2/7e3*	.	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	114	*13e+2/1e5*	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.58**	**0.50**	**0.36**	**0.33**	**0.42**	**0.36**	**0.38**	**0.39**	**0.40**	**0.47**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.88**	**0.71**	**0.73**	**0.72**	**0.71**	**0.60**	**0.63**	**0.65**	**0.66**	**0.70**	IPOP-CMA-ES [15]
CMA+DE-MOS	20	50	**70**	*21e+1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	27	*51e+2/4e3*	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.2**	**10**	*12e+1/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	662	*24e+2/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 108: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{118}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy

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	31	135	324	434	530	610	651	707	806	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	12	11	7.4	8.4	9.1	9.4	11	14	13	22	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	6.3	5.0	**2.9**	**2.7**	**2.4**	**2.2**	**2.0**	**2.0**	**1.9**	**1.8**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	5.1	4.2	**2.5**	**1.7**	**1.6**	**1.5**	**1.4**	**1.4**	**1.4**	**1.3**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	11	12	15	12	17	22	25	41	38	43	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	4.7	4.1	**2.4**	**2.0**	**1.9**	**1.9**	**1.8**	**2.0**	**1.9**	**1.9**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	3.9	**2.9**	**2.0**	**1.6**	**1.5**	**1.4**	**1.4**	**1.4**	**1.3**	**1.3**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**3.2**	**2.3**	**1.3**	**0.87**	**0.85**	**0.81**	**0.75**	**0.75**	**0.72**	**0.68**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	4.2	3.6	**2.1**	**1.5**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.1**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.0**	**3.2**	17	*37e-1/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	18	13	377	1238	3227	*60e-1/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	4.2	3.5	**1.4**	**0.89**	**0.89**	**0.88**	**0.87**	**0.88**	**0.88**	**0.88**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	4.8	5.2	**2.9**	**2.2**	**2.2**	**2.1**	**2.0**	**2.0**	**2.0**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	12	8.6	3.4	**1.9**	**1.8**	**1.9**	**2.0**	**2.1**	**2.2**	**2.4**	CMA+DE-MOS [13]
NEWUOA	**1.2**	3.9	57	*99e-1/5e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	31	433	1202	*22e+0/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	26	133	11012	*29e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 109: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{119}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

119 Sum of diff powers Gauss

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	0.10	0.10	13	312	497	1120	3654	17910	30139	39964	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	42	53	*38e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	7.6	16	143	*17e-1/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	20	15	457	*17e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	35	68	*45e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	5.3	24	222	*18e-1/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	20	16	149	*14e-1/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	12	15	47	*10e-1/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	6.2	19	466	*21e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	25	195	*65e-1/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	144	220	5.2	6.1	6.0	33	*32e-4/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**5.1**	**3.5**	**1.2**	**1.5**	**1.3**	**0.67**	**0.31**	**0.27**	**0.28**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	5.3	**1.3**	**1.2**	**1.2**	**0.90**	**1.1**	**0.65**	**0.62**	**0.72**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**3.0**	64	62	69	32	**12**	**2.9**	**1.8**	**1.5**	CMA+DE-MOS [13]
NEWUOA	**1**	11	120	*60e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.9**	**3.3**	**3.0**	**3.2**	**2.7**	194	*22e-4/5e4*	.	.	Basic RCGA [17]
SPSA	80	117	8904	*10e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 110: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{120}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

120 Sum of diff powers unif

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	0.10	0.10	47	3991	7463	15677	43945	93047	1.27e5	2.50e5	ERT_{best}/D
(1,2)-CMA-ES	**1**	307	893	*12e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	397	315	*11e+0/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	463	251	*97e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	704	275	*95e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**22**	108	*67e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	233	57	*57e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	168	57	*65e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	82	129	*69e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	439	157	*97e-1/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	5333	13323	200	**10**	**13**	**7.6**	*34e-4/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	112	**6.2**	**0.69**	**0.70**	**0.75**	**0.54**	**0.44**	**0.57**	**0.54**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	42	**6.6**	**0.60**	**0.57**	**0.74**	**0.64**	**0.60**	**0.63**	**0.55**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**3.0**	38	188	*44e-1/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	179	152	*11e+0/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**2.3**	**6.6**	13	*80e-2/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	2288	9582	300	*55e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 111: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{121}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy

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	0.10	0.10	7.2	32	63	148	368	694	999	1821	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	20	5.8	3.3	3.0	**2.7**	**2.3**	**2.7**	4.0	80	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	10	**2.4**	**1.3**	**1.2**	**1.0**	**0.95**	**1.1**	**1.4**	**2.0**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	5.1	**1.7**	**0.92**	**0.93**	**0.71**	**0.66**	**0.70**	**0.89**	**1.3**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	17	4.5	**2.9**	**2.4**	**2.1**	**2.6**	4.1	5.8	81	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	9.1	**1.5**	**1.2**	**1.3**	**1.1**	**1.0**	**1.1**	**1.5**	**1.4**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	13	**1.3**	**0.91**	**0.93**	**0.85**	**0.77**	**0.83**	**1.0**	**1.1**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	10	**1.1**	**0.71**	**0.61**	**0.48**	**0.44**	**0.46**	**0.51**	**0.57**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	11	**1.1**	**1.00**	**0.90**	**0.75**	**0.65**	**0.61**	**0.74**	**0.81**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	15	**2.1**	153	1671	*76e-2/7e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	142	200	8.6	5.0	4.1	9513	*20e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	7.1	**1.4**	**1.0**	**1.1**	**0.94**	**0.78**	**0.70**	**0.72**	**0.69**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**4.3**	**1.2**	**1.1**	**1.2**	**1.0**	**1.2**	**1.5**	**1.7**	**2.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**3.0**	4.2	4.0	4.2	3.7	**2.9**	**2.5**	**2.6**	**2.3**	CMA+DE-MOS [13]
NEWUOA	**1**	7.9	3.4	215	*11e-1/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.9**	3.3	12	12	23	423	*22e-4/5e4*	.	.	Basic RCGA [17]
SPSA	100	206	236	20545	*46e-1/1e5*	.	.	.	.	.	SPSA [9]

Table 112: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{122}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss

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	0.10	0.10	5.5	1156	3317	9790	14074	17571	43863	81680	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1.1**	58	*41e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.6**	13	*28e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.8**	17	*27e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	17	53	*45e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	4.1	19	*33e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.2**	21	*26e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	4.1	12	*30e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**2.1**	22	*32e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	3.7	28	*42e-1/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	118	217	11	**2.9**	*10e-1/2e3*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.5**	**1.5**	**0.85**	**0.87**	**0.50**	**0.61**	**0.74**	**0.50**	**0.72**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.6**	**0.61**	**0.89**	**0.63**	**0.67**	**0.63**	**0.58**	**0.80**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.4**	3.6	42	28	15	**13**	**10**	**4.9**	**3.2**	CMA+DE-MOS [13]
NEWUOA	**1**	**2.5**	45	*47e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.5**	**2.1**	**1.7**	**6.9**	**8.4**	15	*56e-3/5e4*	.	.	Basic RCGA [17]
SPSA	1.54e5	1.54e5	6624	*76e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 113: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{123}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif

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	0.10	0.10	4.0	9439	38928	66490	1.29e5	1.99e5	3.33e5	1.03e6	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	1677	*82e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	85	591	*67e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.2**	674	*65e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	1094	*71e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	143	*56e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	32	215	*46e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1.3**	157	*52e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.1**	238	*61e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1.3**	181	*68e-1/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	9772	12675	709	*63e-1/5e3*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**27**	**0.66**	**0.65**	**0.76**	**0.79**	**0.79**	**0.79**	**0.72**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**2.0**	**22**	**0.67**	**0.63**	**0.72**	**0.61**	**0.74**	**0.82**	**0.96**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.4**	202	*42e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	31	192	*64e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**3.7**	*23e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	1.14e6	1.15e6	3.51e5	*66e+2/1e5*	.	.	.	.	.	.	SPSA [9]

Table 114: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{124}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy

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	0.10	0.10	3.7	61	1045	3430	5289	7378	13712	33136	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.3**	45	*45e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1.3**	4.8	192	*77e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1.1**	4.3	153	*85e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	361	*47e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	4.1	**2.7**	302	*12e-1/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1.6**	**2.3**	112	*65e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	3.1	**1.7**	74	*55e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	3.1	24	1113	*15e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	3.5	12	*24e-1/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	112	177	14	**3.5**	33	*13e-2/5e3*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.9**	**1.2**	**1.1**	**1.1**	**1.0**	**1.2**	**0.83**	**0.51**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	3.9	**1.8**	**1.2**	**1.5**	**1.1**	**1.2**	**1.1**	**1.2**	**1.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.4**	3.1	257	15	**7.2**	**5.4**	**4.6**	**3.0**	**1.6**	CMA+DE-MOS [13]
NEWUOA	**1**	5.0	11	*34e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.2**	3.5	13	**13**	11	14	*10e-4/5e4*	.	.	Basic RCGA [17]
SPSA	71512	71549	4897	*76e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 115: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{125}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.10	1e+02 0.10	1e+01 0.10	1e+00 0.10	1e-01 0.10	1e-02 1.05e5	1e-03 2.97e5	1e-04 6.38e5	1e-05 6.40e5	1e-07 6.44e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	2738	*50e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	1214	*39e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	469	*41e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	4806	*54e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	947	*38e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	381	*37e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	500	*34e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	1304	*40e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	5.9	**39**	*19e-2/7e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	129	163	186	372	**2.30e5**	**3.2**	*14e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	115	**2.71e5**	**0.66**	**0.57**	**0.40**	**0.41**	**0.41**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	**94**	**2.69e5**	**0.82**	**0.70**	**0.43**	**0.43**	**0.44**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	426	3.25e5	15	*26e-3/1e5*	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	3.8	**84**	*22e-2/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	178	4.66e5	*88e-3/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	71510	71522	71531	71588	2.87e6	*12e-2/1e5*	.	.	.	.	SPSA [9]

Table 116: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{126}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif

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	0.10	0.10	0.10	0.10	0.10	∞	∞	∞	∞	∞	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1**	**1**	50600	*88e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	30608	*74e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	56376	*84e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	53386	*86e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	10553	*59e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	8849	*56e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.9**	8027	*57e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	9144	*72e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	9.4	49115	*89e-2/7e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	2497	3030	3915	13974	4.50e6	*12e-2/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**304**	**3.12e6**	**1.92e7**	**6.27e7**	*80e-3/3e5*	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	558	**3.54e6**	*86e-3/3e5*	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	**485**	7.12e6	*17e-2/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	29	11670	*66e-2/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	**147**	**1.11e6**	*12e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	1.40e7	*89e+2/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 117: 10-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{127}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.10	1e+02 0.10	1e+01 0.10	1e+00 0.10	1e-01 0.10	1e-02 79920	1e-03 1.35e5	1e-04 2.06e5	1e-05 2.08e5	1e-07 2.11e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	418	*30e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	137	4.77e5	*18e-2/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	131	1.43e6	*22e-2/1e4*	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	534	*34e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	116	2.11e5	*15e-2/1e4*	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	78	1.59e5	*11e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	99	1.46e5	*12e-2/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	122	4.70e5	*15e-2/1e4*	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1**	**40**	*20e-2/7e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	115	148	159	397	4.47e5	*72e-3/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**78**	**75310**	**0.40**	**0.57**	**0.49**	**0.49**	**0.50**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	**66**	**1.08e5**	**0.63**	**0.80**	**0.62**	**0.63**	**0.64**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	273	**35137**	**1.0**	*66e-4/1e5*	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.4**	79	*25e-2/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.2**	206	2.25e5	*25e-3/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	112	144	652	1.34e5	1.41e7	*59e-2/1e5*	.	.	.	.	SPSA [9]

Table 118: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{128}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.10	0.10	915	13803	14050	14393	29169	29302	38266	52875	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	**1**	155	*15e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	8.5	4.9	**10**	*80e-1/1e4*	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	15	*78e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	77	*20e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	11	*81e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	3.7	**3.2**	*46e-1/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	6.5	**2.2**	*53e-1/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	10	*82e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	32	*21e+0/7e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	124	170	**2.1**	6.9	**6.8**	**8.9**	**5.4**	**10**	**7.5**	13	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**0.65**	29	29	**28**	14	14	11	**7.7**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**0.47**	29	29	28	**14**	**14**	**11**	**7.7**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	52	51	51	106	52	52	40	29	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	*24e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	3.3	**4.9**	**5.1**	**5.1**	**2.6**	**4.0**	**3.1**	**4.1**	Basic RCGA [17]
SPSA	79	101	*64e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 119: 10-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{129}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.10	1e+02 0.10	1e+01 5397	1e+00 1.36e5	1e-01 1.41e5	1e-02 1.42e5	1e-03 1.43e5	1e-04 1.44e5	1e-05 1.45e5	1e-07 1.47e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	*44e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	*34e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	27	*32e+0/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	28	*38e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	13	*21e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	*24e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	*23e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	*28e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	*39e+0/7e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	5487	16432	13	5.3	**10**	**10**	**10**	**10**	**10**	**10**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**0.69**	**2.5**	**4.0**	**4.0**	**3.9**	**3.9**	**3.9**	**4.9**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**0.63**	**5.0**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	25	*11e+0/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	*39e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**4.4**	**2.7**	*65e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	1935	9633	*41e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 120: 10-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{130}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy

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	0.10	0.10	48	588	3747	7052	7091	7151	7219	7334	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1**	12	40	8.1	4.3	4.3	4.3	4.3	4.2	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	10	6.4	**1.6**	**0.83**	**0.83**	**0.82**	**0.82**	**0.81**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	4.4	**2.4**	**0.84**	**0.45**	**0.45**	**0.45**	**0.44**	**0.44**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	11	8.0	**2.6**	**1.6**	**1.8**	**2.3**	3.3	3.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	5.1	5.9	**1.5**	**0.82**	**0.82**	**0.82**	**0.81**	**0.81**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	3.8	**5.5**	**1.3**	**0.68**	**0.68**	**0.68**	**0.68**	**0.67**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**2.9**	**2.3**	**0.77**	**0.41**	**0.41**	**0.41**	**0.41**	**0.40**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	5.0	5.7	**1.7**	**0.89**	**0.88**	**0.88**	**0.87**	**0.86**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1.9**	6.0	8.6	*41e-2/7e3*	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	108	153	**2.5**	121	41	40	198	*15e-2/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**2.3**	309	49	26	26	25	25	25	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	3.6	582	126	67	67	66	66	65	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	324	378	81	43	43	42	42	41	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**2.6**	11	8.0	8.8	8.7	*14e-1/4e3*	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	53	55	11	5.8	6.1	6.2	9.3	23	Basic RCGA [17]
SPSA	121	152	1111	*73e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 121: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{101}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss

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	3.0	21	29	34	35	36	37	39	ERT_{best}/D
(1,2)-CMA-ES	**1**	107	17	3.4	3.3	3.5	4.0	4.5	5.0	5.8	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	51	9.1	**1.8**	**1.8**	**1.9**	**2.1**	**2.4**	**2.7**	3.1	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	45	7.4	**1.5**	**1.5**	**1.5**	**1.8**	**2.0**	**2.2**	**2.6**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	94	16	3.1	**2.9**	3.1	3.5	4.0	4.5	5.4	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	38	7.4	**1.5**	**1.5**	**1.6**	**1.9**	**2.2**	**2.5**	**2.9**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	29	5.9	**1.3**	**1.3**	**1.4**	**1.6**	**1.8**	**2.0**	**2.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	27	**5.0**	**1.0**	**0.99**	**1.0**	**1.2**	**1.4**	**1.5**	**1.9**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	32	6.0	**1.2**	**1.2**	**1.3**	**1.5**	**1.7**	**2.0**	**2.3**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	19	**3.3**	**0.98**	**0.85**	**0.88**	**0.94**	**1.0**	**1.0**	**1.1**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	319	144	40	7.5	6.4	6.0	6.3	6.7	7.0	7.7	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**15**	6.1	**1.5**	**1.6**	**1.7**	**2.1**	**2.4**	**2.7**	3.3	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**16**	6.0	**1.5**	**1.5**	**1.7**	**2.0**	**2.3**	**2.6**	3.2	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	44	29	6.0	5.2	6.2	7.7	8.1	8.9	11	CMA+DE-MOS [13]
NEWUOA	**1**	**8.9**	**3.1**	**0.85**	**0.90**	**0.97**	**1.1**	**1.2**	**1.5**	**1.6**	NEWUOA [16]
Basic RCGA	**1**	32	39	14	57	165	240	282	314	351	Basic RCGA [17]
SPSA	172	133	83636	*25e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 122: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{102}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif

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	0.29	12	20	29	38	46	49	58	70	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	109	5.0	4.1	3.7	3.7	4.1	5.0	5.3	10	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	54	**2.5**	**2.0**	**1.8**	**1.7**	**1.7**	**1.8**	**1.7**	**1.8**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	44	**1.9**	**1.6**	**1.4**	**1.4**	**1.3**	**1.5**	**1.5**	**1.5**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	143	6.0	4.7	4.4	5.5	7.4	13	18	50	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	34	**2.0**	**1.8**	**1.6**	**1.6**	**1.6**	**1.7**	**1.7**	**1.8**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	28	**1.5**	**1.4**	**1.3**	**1.3**	**1.3**	**1.4**	**1.4**	**1.4**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	19	**1.2**	**1.0**	**0.99**	**0.97**	**0.97**	**1.1**	**1.0**	**1.1**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	28	**1.5**	**1.3**	**1.3**	**1.3**	**1.3**	**1.4**	**1.4**	**1.6**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	19	**0.92**	**1.1**	**0.93**	**0.90**	**0.88**	**0.99**	**1.1**	**1.3**	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	291	131	10	7.7	6.1	5.3	4.8	4.9	4.5	4.3	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**11**	**1.5**	**1.6**	**1.6**	**1.5**	**1.6**	**1.7**	**1.7**	**1.8**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**15**	**1.6**	**1.6**	**1.6**	**1.5**	**1.6**	**1.8**	**1.7**	**1.8**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	47	9.0	6.3	5.1	5.6	5.8	5.8	5.7	6.1	CMA+DE-MOS [13]
NEWUOA	**1**	**10**	**2.9**	6.1	6.3	22	45	505	*31e-5/5e3*	.	NEWUOA [16]
Basic RCGA	**1**	30	11	15	56	152	178	203	200	195	Basic RCGA [17]
SPSA	218	212	*43e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 123: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{103}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy

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	0.28	3.3	21	31	52	66	80	95	123	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	119	18	3.7	3.1	**2.3**	**2.2**	**2.1**	**2.1**	**2.0**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	51	7.7	**1.7**	**1.6**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	39	6.4	**1.5**	**1.3**	**1.00**	**0.95**	**0.92**	**0.89**	**0.88**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	103	15	3.1	**2.7**	**2.1**	**2.1**	**2.0**	**2.0**	**1.9**	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	36	6.3	**1.5**	**1.4**	**1.0**	**1.1**	**1.0**	**1.0**	**1.0**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	28	5.1	**1.3**	**1.2**	**0.93**	**0.91**	**0.90**	**0.88**	**0.87**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	23	**4.3**	**0.99**	**0.92**	**0.70**	**0.67**	**0.66**	**0.65**	**0.63**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	32	5.2	**1.3**	**1.2**	**0.88**	**0.86**	**0.84**	**0.83**	**0.82**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	19	**3.0**	**0.95**	**2.0**	20	655	*14e-4/1e4*	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	305	146	36	7.4	5.6	3.8	3.3	3.1	3.1	**3.0**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**14**	5.4	**1.5**	**1.5**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**13**	5.5	**1.5**	**1.4**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	33	23	6.0	4.6	4.0	4.1	4.3	4.2	4.4	CMA+DE-MOS [13]
NEWUOA	**1**	**9.5**	**2.3**	**1.00**	5.9	44	1231	*48e-4/5e3*	.	.	NEWUOA [16]
Basic RCGA	**1**	26	32	13	72	230	212	195	179	151	Basic RCGA [17]
SPSA	352	615	125	31	30	34	84	17508	*37e-5/1e5*	.	SPSA [9]

Table 124: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{104}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss

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	48	1185	4283	8566	8897	9124	9293	9472	9809	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	4.2	6.0	63	*14e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.0**	**1.2**	28	34	*12e+0/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.7**	**2.3**	13	*12e+0/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	3.7	5.0	119	*14e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.7**	**1.9**	17	*13e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.3**	**0.82**	12	*97e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.2**	**1.0**	10	35	17	*91e-1/1e4*	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.3**	**1.1**	21	*12e+0/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.63**	**1.4**	11	*98e-1/1e4*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	7.1	3.1	**1.8**	**4.5**	**2.3**	**2.2**	**2.2**	**2.2**	**2.1**	**2.1**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.6**	**0.90**	**4.9**	**1.6**	**0.82**	**0.81**	**0.80**	**0.80**	**0.79**	**0.77**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.6**	**0.97**	**7.5**	**2.5**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.2**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.1	**3.0**	35	10	4.9	4.7	4.6	4.6	4.5	4.3	CMA+DE-MOS [13]
NEWUOA	**0.35**	**1.5**	68	*17e+0/6e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	8.5	10	*18e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	25	*14e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 125: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{105}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

105 Rosenbrock moderate unif

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	15	59	9594	30547	31585	32129	32475	32754	33011	33512	ERT_{best}/D
(1,2)-CMA-ES	3.7	4.0	16	4.9	*17e+0/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.0**	**1.8**	**2.7**	*12e+0/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.6**	**1.9**	6.9	*13e+0/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.9	6.7	16	*16e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.7**	**1.5**	7.4	*13e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.4**	**3.0**	6.9	*13e+0/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.1**	**1.3**	**2.6**	*13e+0/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.3**	**2.7**	4.9	*15e+0/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.67**	**1.6**	7.2	*12e+0/1e4*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	6.4	**2.4**	70	*13e+0/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.5**	**1.5**	**1.2**	**0.43**	**0.43**	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.4**	**2.6**	**1.9**	**0.76**	**0.76**	**0.77**	**0.77**	**0.77**	**0.77**	**0.76**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.0	**2.2**	9.2	**2.9**	**2.9**	**2.8**	**2.8**	**2.8**	**2.7**	**2.7**	CMA+DE-MOS [13]
NEWUOA	**0.98**	7.2	*24e+0/5e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	8.8	10	*18e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	37	*14e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 126: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{106}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

106 Rosenbrock moderate Cauchy

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	14	29	574	1083	1187	1239	1274	1301	1325	1368	ERT_{best}/D
(1,2)-CMA-ES	4.3	5.4	**2.3**	3.9	3.9	4.1	4.1	4.1	4.1	4.1	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**2.1**	**1.7**	**0.88**	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.8**	**1.7**	**0.71**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.1**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	3.9	3.6	**2.2**	3.9	3.9	3.9	3.9	3.8	3.8	3.8	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.7**	**2.8**	**0.97**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.6**	**1.8**	**0.64**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.1**	**1.3**	**0.55**	**0.59**	**0.61**	**0.62**	**0.62**	**0.62**	**0.62**	**0.62**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.5**	**1.7**	**0.68**	**0.89**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	**0.91**	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.70**	**1.4**	8.1	*74e-1/1e4*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	7.4	5.0	**2.1**	**2.5**	**2.5**	**2.5**	**2.5**	**2.6**	**2.6**	14	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.6**	**1.5**	**0.77**	**0.76**	**0.84**	**0.88**	**0.89**	**0.90**	**0.91**	**0.91**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.7**	**1.5**	**1.0**	**1.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.8	5.2	**2.0**	9.0	8.7	8.4	8.3	8.2	8.1	8.0	CMA+DE-MOS [13]
NEWUOA	**0.44**	**0.87**	7.0	31	*49e-1/8e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	9.3	18	*17e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	133	1736	*52e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 127: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{107}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss

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	8.8	429	679	811	1055	1368	2174	2624	3253	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	433	*83e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	151	*67e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	215	*61e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	998	*87e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	205	*67e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	123	*54e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	148	*56e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	259	*70e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	108	*64e+0/9e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	327	**5.3**	**0.69**	**0.82**	**1.4**	**1.9**	**2.1**	**2.1**	**2.1**	**2.6**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	8.6	**0.81**	**0.97**	**1.3**	**1.4**	**1.5**	**1.4**	**1.3**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**4.3**	**1.1**	**0.95**	**1.1**	**1.1**	**0.96**	**0.72**	**0.68**	**0.65**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	25	109	160	140	109	87	55	46	37	CMA+DE-MOS [13]
NEWUOA	**1**	96	*57e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.3**	**1.7**	**1.9**	4.7	7.0	6.8	5.1	4.7	4.4	Basic RCGA [17]
SPSA	213	812	*65e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 128: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{108}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif

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	19	2903	4861	10152	19820	22282	25366	31511	44879	ERT_{best}/D
(1,2)-CMA-ES	**1**	685	*11e+1/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	804	*10e+1/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	594	*98e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	575	*94e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	694	*93e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	601	*96e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	660	*95e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	710	*10e+1/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	698	*11e+1/9e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	18344	114	**2.5**	**3.0**	**2.4**	**1.6**	**2.2**	**3.8**	**6.1**	*13e-6/1e5*	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**14**	**0.74**	**0.98**	**1.0**	**0.84**	**1.1**	**1.6**	**1.5**	**1.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	15	**0.72**	**0.87**	**0.66**	**0.57**	**0.77**	**0.89**	**0.94**	**1.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**4.5**	*43e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	259	*91e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**0.42**	*22e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	9320	90	11	*59e-1/1e5*	.	.	.	.	.	.	SPSA [9]

Table 129: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{109}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy

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	0.28	17	32	57	84	114	150	179	248	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	107	3.6	3.5	**2.7**	**2.7**	**2.4**	**2.3**	**2.3**	**2.2**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	56	**1.7**	**1.5**	**1.4**	**1.2**	**1.1**	**1.1**	**1.0**	**0.96**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	35	**1.3**	**1.2**	**0.97**	**0.90**	**0.84**	**0.77**	**0.77**	**0.72**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	107	3.4	**2.8**	**2.3**	**2.1**	**2.0**	**1.9**	**1.8**	**1.8**	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	34	**1.3**	**1.4**	**1.3**	**1.2**	**1.1**	**1.1**	**1.2**	**1.2**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	20	**1.1**	**1.1**	**1.0**	**0.96**	**0.95**	**0.91**	**0.91**	**0.88**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	25	**0.92**	**0.81**	**0.67**	**0.62**	**0.57**	**0.53**	**0.52**	**0.50**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	33	**1.1**	**1.0**	**0.89**	**0.79**	**0.73**	**0.68**	**0.70**	**0.68**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	19	17	*25e-1/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	325	141	7.1	5.4	3.7	16693	*19e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**12**	**1.1**	**1.2**	**1.2**	**1.1**	**1.2**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**15**	**1.1**	**1.2**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**	**1.00**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	50	6.2	4.1	4.3	4.3	4.2	4.1	4.1	4.0	CMA+DE-MOS [13]
NEWUOA	**1**	**10**	17	*33e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	34	7.4	10	117	127	111	97	87	70	Basic RCGA [17]
SPSA	311	551	54	2319	5124	*30e-2/1e5*	.	.	.	.	SPSA [9]

Table 130: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{110}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss

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	185	1271	∞	∞	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	*62e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	*72e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*56e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*65e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	*63e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	*35e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	*55e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	*53e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	*55e+3/9e3*	.	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	**2.6**	**0.84**	*18e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.3**	**0.61**	*17e+0/1e6*	.	.	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.84**	**1.1**	*17e+0/1e6*	.	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	49	19	*19e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	*19e+3/4e3*	.	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.4**	**0.63**	*20e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	149	*42e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 131: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{111}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

111 Rosenbrock unif

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	1022	4353	∞	∞	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	*77e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	*84e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*70e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*77e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	*79e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	*71e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	*70e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	*63e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	*94e+3/9e3*	.	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	**2.4**	**2.1**	*20e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.76**	**0.69**	*18e+0/9e5*	.	.	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.76**	**0.75**	*18e+0/9e5*	.	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	42	164	*28e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	*63e+3/4e3*	.	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**0.73**	**1.9**	*49e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	30	*48e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 132: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{112}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy

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	43	1278	3206	3481	3609	3678	3745	3807	3912	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	3.9	5.0	3.1	8.4	20	20	40	39	39	38	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1.9**	**1.2**	**0.98**	**1.2**	**1.2**	**1.2**	**1.2**	**1.3**	**1.3**	**1.3**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1.7**	**2.3**	**0.60**	**0.68**	**0.71**	**0.72**	**0.73**	**0.73**	**0.73**	**0.73**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	4.2	4.0	3.8	11	43	*38e-1/1e4*	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1.7**	**2.5**	**1.4**	**1.6**	**2.1**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1.6**	**2.3**	**0.75**	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1.0**	**0.95**	**0.35**	**0.48**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1.3**	**2.8**	**0.59**	**0.63**	**0.69**	**0.71**	**0.72**	**0.72**	**0.73**	**0.74**	(1,4s)-CMA-ES [3]
avg NEWUOA	**0.58**	**3.0**	*20e+0/1e4*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	7.7	3.8	*18e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.4**	**1.2**	**0.84**	**0.84**	**0.89**	**0.92**	**0.93**	**0.94**	**0.94**	**0.93**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.6**	**1.9**	**0.95**	**0.94**	**1.0**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.3	3.1	**1.9**	3.8	3.8	4.0	4.0	4.0	3.9	3.9	CMA+DE-MOS [13]
NEWUOA	**0.46**	**2.6**	*29e+0/5e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	8.3	11	*18e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	74	1330	*53e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 133: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{113}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss

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	0.59	90	2506	18176	28020	29382	29383	29383	29383	29554	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	2007	*51e+1/1e4*	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	262	*26e+1/1e4*	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	561	*31e+1/1e4*	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	2018	*51e+1/1e4*	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	459	*25e+1/1e4*	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	221	532	*14e+1/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	103	*18e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	268	*29e+1/1e4*	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	434	*29e+1/9e3*	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	74	**2.2**	**1.6**	81	*21e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	15	**2.7**	**0.60**	**0.27**	**0.27**	**0.29**	**0.29**	**0.29**	**0.29**	**0.29**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**11**	**2.3**	**1.0**	**0.53**	**0.58**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.0**	8.5	27	**9.3**	**10**	**10**	**10**	**10**	**10**	**12**	CMA+DE-MOS [13]
NEWUOA	297	*24e+1/4e3*	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.9**	3.9	**0.77**	*23e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	58	1044	*98e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 134: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{114}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif

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	0.59	1656	10409	55895	72257	78465	78525	78525	78525	79096	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	2239	*67e+1/1e4*	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	2473	*55e+1/1e4*	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3076	*58e+1/1e4*	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	1875	*53e+1/1e4*	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	2210	*56e+1/1e4*	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	2064	*51e+1/1e4*	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	1088	*53e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	1208	*52e+1/1e4*	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	695	*44e+1/9e3*	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	6491	9.4	**13**	*74e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**70**	**0.84**	**0.64**	**0.35**	**0.53**	**0.62**	**0.62**	**0.62**	**0.62**	**0.63**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	160	**0.80**	**0.59**	**0.68**	**0.84**	**0.91**	**0.91**	**0.91**	**0.91**	**0.92**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.4**	107	*15e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	366	*47e+1/4e3*	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.7**	**8.0**	*46e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	5058	37	*71e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 135: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{115}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy

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	0.53	17	120	1513	4587	6334	6340	6340	6340	6450	ERT_{best}/D
(1,2)-CMA-ES	26	5.8	1201	*16e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	15	**1.6**	7.0	*50e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	11	**1.3**	11	*52e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	30	5.7	*21e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	6.5	**1.3**	18	*61e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	6.3	**1.1**	5.9	*40e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	5.9	**0.88**	6.9	*45e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	7.5	**1.3**	26	*65e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	7.2	**0.89**	108	*93e-1/1e4*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	45	4.4	**1.1**	431	*14e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**3.2**	**1.1**	**1.4**	**1.2**	**0.54**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.9**	**0.94**	**1.1**	**4.8**	**2.2**	**1.8**	**1.8**	**1.8**	**1.8**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	**2.9**	5.7	**1.3**	191	317	*17e-1/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	3.3	**0.58**	236	*18e+0/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	4.1	4.8	14	**104**	**77**	*11e-1/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	45	10	966	*12e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 136: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{116}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss

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	1812	9507	24887	34689	44640	50231	51660	52791	54036	56166	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	*29e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	*33e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*34e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*29e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	*27e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	*24e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	*23e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	*28e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	*20e+3/9e3*	.	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	24	75	*26e+1/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.87**	**0.58**	**0.36**	**0.28**	**0.23**	**0.22**	**0.22**	**0.23**	**0.23**	**0.24**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.4**	**1.3**	**1.2**	**1.1**	**1.00**	**0.92**	**0.92**	**0.92**	**0.93**	**0.93**	IPOP-CMA-ES [15]
CMA+DE-MOS	13	**11**	**5.3**	**4.0**	**3.1**	**2.8**	**2.7**	**2.7**	**2.6**	**2.8**	CMA+DE-MOS [13]
NEWUOA	*22e+3/4e3*	.	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1.9**	35	*22e+1/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	*11e+3/1e5*	.	.	.	.	.	.	.	.	.	SPSA [9]

Table 137: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{117}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

117 Ellipsoid unif

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 10122	1e+02 35527	1e+01 89270	1e+00 1.23e5	1e-01 1.30e5	1e-02 1.38e5	1e-03 1.45e5	1e-04 1.54e5	1e-05 1.62e5	1e-07 1.81e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	*30e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	*30e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	*30e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	*28e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	*29e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	*30e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	*32e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	*31e+3/1e4*	.	.	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	*24e+3/9e3*	.	.	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	*75e+2/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.40**	**0.45**	**0.37**	**0.35**	**0.41**	**0.44**	**0.45**	**0.46**	**0.47**	**0.56**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.68**	**0.71**	**0.55**	**0.61**	**0.66**	**0.67**	**0.69**	**0.70**	**0.71**	**0.72**	IPOP-CMA-ES [15]
CMA+DE-MOS	147	*22e+2/1e5*	.	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	*26e+3/4e3*	.	.	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**11**	*14e+2/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	*13e+3/1e5*	.	.	.	.	.	.	.	.	.	SPSA [9]

Table 138: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{118}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy

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	26	184	345	589	876	1110	1317	1394	1503	1633	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	6.5	3.2	4.6	10	20	42	55	105	98	*11e-2/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	3.3	**1.4**	**1.7**	**1.7**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.4**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	3.1	**1.00**	**1.2**	**1.3**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	5.7	**3.0**	5.1	14	13	17	56	*13e-3/1e4*	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**2.9**	**1.1**	**1.8**	**1.9**	**2.1**	**2.1**	**1.9**	**2.0**	**2.0**	**2.0**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**2.3**	**0.89**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.3**	**1.2**	**1.2**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**2.0**	**0.71**	**0.83**	**0.81**	**0.74**	**0.69**	**0.64**	**0.64**	**0.61**	**0.60**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**2.4**	**0.97**	**1.1**	**1.1**	**1.1**	**1.2**	**1.1**	**1.2**	**1.2**	**1.2**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1.3**	7.9	*43e+0/1e4*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	8.3	**2.5**	3.0	1105	*21e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.8**	**0.88**	**0.82**	**0.78**	**0.71**	**0.66**	**0.63**	**0.65**	**0.64**	**0.66**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	4.0	**1.8**	**2.0**	**1.8**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.1	**2.0**	**1.9**	**2.1**	**2.0**	**1.8**	**1.7**	**1.8**	**1.8**	**1.8**	CMA+DE-MOS [13]
NEWUOA	**1.2**	7.9	*62e+0/6e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	46	363	*10e+1/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	20	184	*63e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 139: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{119}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

119 Sum of diff powers Gauss

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	0.05	139	1468	1796	3164	20535	47098	69961	95143	ERT_{best}/D
(1,2)-CMA-ES	**1**	2220	*21e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	319	517	*13e+0/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	413	508	*14e+0/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	836	*20e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	518	*15e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	67	316	*13e+0/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	208	*13e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	723	505	*15e+0/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	304	*15e+0/9e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	352	545	**1.3**	**1.3**	**1.5**	**3.9**	70	*19e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**18**	**1.6**	**0.62**	**0.83**	**0.92**	**0.42**	**0.29**	**0.25**	**0.28**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	31	**1.9**	**0.58**	**0.69**	**0.80**	**0.58**	**0.58**	**0.59**	**0.97**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.1**	9.5	22	28	21	**5.8**	**3.3**	**2.6**	**5.4**	CMA+DE-MOS [13]
NEWUOA	**1**	33	398	*18e+0/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**5.2**	**1.8**	**1.6**	**2.4**	6.9	*57e-4/5e4*	.	.	.	Basic RCGA [17]
SPSA	282	359	*19e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 140: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{120}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

120 Sum of diff powers unif

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	1802	8940	14054	42575	79607	2.70e5	3.37e5	6.75e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	3441	*29e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	4298	*34e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	3333	*33e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	4780	*28e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	4498	*29e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	1819	*30e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	2797	*35e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	4040	*32e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	757	*29e+0/9e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	12827	20132	**4.7**	**5.6**	**5.1**	**4.5**	*16e-3/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	369	**0.62**	**0.64**	**0.79**	**0.83**	**0.78**	**0.43**	**0.44**	**0.40**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**240**	**0.69**	**0.60**	**0.74**	**0.57**	**0.67**	**0.52**	**0.69**	**0.69**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.1**	45	*92e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	593	*30e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**3.5**	4.8	*61e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	10758	31179	231	*12e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 141: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{121}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy

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	12	38	71	172	465	1099	1722	2870	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	217	4.8	3.4	**3.0**	**2.3**	**1.9**	**1.8**	3.8	*35e-7/1e4*	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	163	**2.2**	**1.4**	**1.2**	**0.93**	**0.81**	**0.69**	**0.80**	6.2	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	133	**1.9**	**1.2**	**1.0**	**0.74**	**0.58**	**0.51**	**0.59**	5.3	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	215	4.5	**2.8**	**2.7**	**1.9**	**1.5**	**1.5**	3.8	*44e-7/1e4*	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	62	**1.8**	**1.5**	**1.4**	**1.1**	**0.87**	**0.79**	**1.0**	**2.1**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	26	**1.4**	**1.1**	**1.0**	**0.87**	**0.73**	**0.62**	**0.75**	**1.2**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	43	**1.1**	**0.80**	**0.71**	**0.52**	**0.41**	**0.35**	**0.39**	**0.53**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	24	**1.5**	**1.1**	**0.90**	**0.69**	**0.55**	**0.46**	**0.58**	**0.98**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	82	49	*40e-1/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	301	475	8.1	5.5	5.5	*46e-3/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	20	**1.2**	**1.0**	**1.1**	**0.98**	**0.77**	**0.58**	**0.56**	**0.64**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**18**	**1.3**	**1.1**	**1.1**	**1.1**	**1.1**	**1.2**	**1.4**	**1.9**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**5.1**	6.6	3.4	3.7	3.4	**2.5**	**2.3**	**2.2**	**2.2**	CMA+DE-MOS [13]
NEWUOA	**1**	29	31	*52e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**5.3**	5.0	10	36	76	*41e-4/5e4*	.	.	.	Basic RCGA [17]
SPSA	210	876	12355	*10e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 142: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{122}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss

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	35	2600	6978	18826	39669	54172	99925	2.91e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	25	99	*87e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	7.9	45	*67e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	6.0	29	*78e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	128	*88e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	9.2	78	*69e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	7.4	34	*68e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	8.5	44	*75e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	7.3	32	*77e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**2.3**	125	*77e-1/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
IPOP-aCMA-ES	**1**	6.0	**2.3**	**0.81**	**0.97**	**0.66**	**0.56**	**0.65**	**0.66**	**0.81**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**2.0**	**2.0**	**0.92**	**0.74**	**0.55**	**0.63**	**0.67**	**0.95**	**0.64**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	4.9	84	72	*14e-1/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	6.8	82	*80e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.1**	**1.6**	**6.7**	**7.7**	**6.0**	*98e-3/5e4*	.	.	.	Basic RCGA [17]
SPSA	1.00e6	1.00e6	5840	*11e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 143: 20-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{123}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.05	0.05	53	26479	74388	1.63e5	2.64e5	4.89e5	1.36e6	7.92e6	$\mathrm{ERT}_{\text{best}}$/D
(1,2)-CMA-ES	**1**	148	1303	*12e+0/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	*12e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	215	1341	*12e+0/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	245	627	*13e+0/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	103	651	*11e+0/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	275	*10e+0/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	113	490	*11e+0/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	120	803	*12e+0/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	128	405	*11e+0/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
IPOP-aCMA-ES	**1**	**1.3**	**6.4**	**0.72**	**0.88**	**0.73**	**0.94**	**0.86**	**0.50**	**1.9**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.7**	**7.2**	**0.72**	**0.61**	**0.69**	**0.80**	**0.71**	**0.62**	*28e-7/1e6*	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	71	*68e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	53	174	*10e+0/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.4**	**7.0**	*48e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	1.76e6	2.41e6	*20e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 144: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{124}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy

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	10	98	2042	3225	6346	14253	19427	39957	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1.3**	407	*86e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	6.7	3.7	*33e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	4.6	3.5	1524	*36e-1/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	33	707	*84e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1.2**	143	*46e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	7.0	**2.4**	*23e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	50	*40e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1.5**	22	*50e-1/1e4*	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	3.3	95	*59e-1/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
IPOP-aCMA-ES	**1**	3.4	**1.1**	**3.9**	**1.0**	**1.0**	**0.91**	**0.71**	**0.76**	**0.62**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.1**	**0.99**	**0.75**	**0.98**	**0.98**	**0.66**	**0.84**	**0.78**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.1**	4.3	**2.5**	**0.45**	**1.4**	**2.1**	**1.6**	**1.6**	**1.9**	CMA+DE-MOS [13]
NEWUOA	**1**	10	91	*66e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1.2**	**2.3**	8.1	3.6	6.0	6.1	15	*39e-5/5e4*	.	Basic RCGA [17]
SPSA	1.00e6	1.00e6	31557	*13e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 145: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{125}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.05	1e+02 0.05	1e+01 0.05	1e+00 0.05	1e-01 0.05	1e-02 6.24e5	1e-03 1.25e6	1e-04 3.12e6	1e-05 4.01e6	1e-07 4.03e6	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	9.05e5	*12e-1/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	1.46e5	*94e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	1.22e5	*96e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	*13e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	1.61e5	*95e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	81397	*88e-2/1e4*	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	81829	*95e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	2.36e5	*10e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	**1**	**493**	*45e-2/9e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	283	321	364	738	9.45e6	*23e-2/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	827	**3.85e6**	**0.47**	**1.1**	**0.81**	**1.7**	**1.7**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	957	7.10e6	**0.70**	**0.79**	**0.56**	**1.8**	**1.8**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	1527	6.76e6	*18e-2/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	**1**	**414**	*49e-2/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	**322**	**2.34e6**	*33e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	1.00e6	1.00e6	1.00e6	1.00e6	**3.44e6**	*12e-2/1e5*	.	.	.	.	SPSA [9]

Table 146: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{126}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif

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	0.05	0.05	0.05	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	*15e-1/1e4*	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	*15e-1/1e4*	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	*15e-1/1e4*	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	*14e-1/1e4*	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	*14e-1/1e4*	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	*13e-1/1e4*	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	2.92e6	*13e-1/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	2.86e6	*13e-1/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	122	2.60e6	*16e-1/9e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	2514	3109	3338	13054	*33e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	6417	*30e-2/2e5*	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	**5759**	*28e-2/2e5*	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	**1527**	*39e-2/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	4.2	1.32e5	*12e-1/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.1**	**335**	**4.18e6**	*32e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	2.80e7	2.80e7	2.80e7	2.80e7	*45e+3/1e5*	.	.	.	.	.	SPSA [9]

Table 147: 20-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{127}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.05	1e+02 0.05	1e+01 0.05	1e+00 0.05	1e-01 0.05	1e-02 79507	1e-03 2.22e5	1e-04 3.40e5	1e-05 3.63e5	1e-07 3.71e5	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	**1**	7537	*70e-2/1e4*	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1**	595	*52e-2/1e4*	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**1**	843	*48e-2/1e4*	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1**	7404	*67e-2/1e4*	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1**	1139	*44e-2/1e4*	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1**	756	2.91e6	*39e-2/1e4*	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**1**	654	*23e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1**	1149	*53e-2/1e4*	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	7.7	**219**	*43e-2/9e3*	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	292	335	353	754	*28e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**193**	**2.82e5**	**0.75**	**1.0**	**1.2**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	267	**9.58e5**	**1.0**	**0.81**	**0.89**	**0.84**	**0.85**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	1526	**2.24e5**	*44e-3/1e5*	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	3.7	**253**	*45e-2/4e3*	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1**	314	1.07e6	*59e-3/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	226	276	960	2.30e6	8.02e6	*10e-1/1e5*	.	.	.	.	SPSA [9]

Table 148: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{128}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss

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	7017	6.69e5	8.61e5	8.61e5	8.61e5	8.62e5	8.62e5	8.62e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	*71e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	*65e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	*66e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	*70e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	*66e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	*64e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	*65e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	*68e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	*69e+0/9e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	284	367	**1.8**	**0.12**	**0.12**	**0.12**	**0.12**	**0.16**	**0.16**	**0.17**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**0.51**	**0.72**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	12	**1.0**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	96	*50e+0/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	*70e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**4.7**	**0.10**	**0.10**	**0.10**	**0.10**	**0.13**	**0.13**	**0.14**	Basic RCGA [17]
SPSA	309	350	*73e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 149: 20-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{129}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.05	1e+02 0.05	1e+01 3.91e5	1e+00 2.07e6	1e-01 2.08e6	1e-02 2.08e6	1e-03 2.09e6	1e-04 2.10e6	1e-05 2.10e6	1e-07 2.12e6	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
(1,2)-CMA-ES	**1**	**1**	*73e+0/1e4*	.	.	.	.	.	.	.	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	*74e+0/1e4*	.	.	.	.	.	.	.	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	*73e+0/1e4*	.	.	.	.	.	.	.	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	*72e+0/1e4*	.	.	.	.	.	.	.	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	*70e+0/1e4*	.	.	.	.	.	.	.	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	*72e+0/1e4*	.	.	.	.	.	.	.	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	*72e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	*72e+0/1e4*	.	.	.	.	.	.	.	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	*74e+0/9e3*	.	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	3132	3641	**0.43**	**0.35**	**0.35**	**0.71**	**0.71**	**0.71**	**0.70**	**0.70**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**0.16**	**0.27**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**0.29**	**0.30**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	*59e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	*73e+0/4e3*	.	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	**1.9**	*34e+0/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	2290	9084	*69e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 150: 20-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{130}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy

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	0.05	245	4657	12618	12648	12688	12729	12755	12860	ERT_{best}/D
(1,2)-CMA-ES	**1**	**1**	**2.1**	**1.8**	**0.96**	**0.97**	**0.97**	**0.97**	**0.97**	**0.97**	(1,2)-CMA-ES [4, 2]
(1,2m)-CMA-ES	**1**	**1**	**1.0**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	**0.61**	(1,2m)-CMA-ES [4]
(1,2ms)-CMA-ES	**1**	**1**	**0.95**	**0.62**	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	(1,2ms)-CMA-ES [4]
(1,2s)-CMA-ES	**1**	**1**	**1.9**	3.2	3.4	3.4	3.4	3.4	3.3	3.3	(1,2s)-CMA-ES [2]
(1,4)-CMA-ES	**1**	**1**	**1.0**	**0.97**	**0.63**	**0.63**	**0.63**	**0.63**	**0.63**	**0.63**	(1,4)-CMA-ES [5, 3]
(1,4m)-CMA-ES	**1**	**1**	**1.8**	**0.83**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	(1,4m)-CMA-ES [5]
(1,4ms)-CMA-ES	**1**	**1**	**0.83**	**0.37**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	(1,4ms)-CMA-ES [1, 5]
(1,4s)-CMA-ES	**1**	**1**	**1.2**	**0.95**	**0.95**	**0.95**	**0.94**	**0.94**	**0.94**	**0.94**	(1,4s)-CMA-ES [3]
avg NEWUOA	**1**	**1**	6.6	*45e-1/9e3*	.	.	.	.	.	.	avg NEWUOA [16]
CMA-EGS (IPOP,r1)	295	351	30	15	12	16	*76e-2/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.5**	66	54	54	54	54	54	53	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	4.9	76	37	37	37	37	37	37	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	103	59	52	52	51	51	51	51	CMA+DE-MOS [13]
NEWUOA	**1**	**1**	9.1	*77e-1/4e3*	.	.	.	.	.	.	NEWUOA [16]
Basic RCGA	**1**	**1**	16	8.7	5.0	5.2	6.6	7.2	7.2	9.0	Basic RCGA [17]
SPSA	292	365	5718	*73e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 151: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{101}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

101 Sphere moderate Gauss

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	0.03	6.5	15	23	31	39	48	56	64	81	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1.7**	**1.2**	**1.1**	**1.0**	**1.0**	**0.98**	**0.97**	**0.96**	**0.94**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	736	15	12	10	7.8	6.7	5.9	5.4	5.0	4.5	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.4**	**1.5**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.5**	**1.6**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	6.0	7.1	5.3	4.4	4.2	5.0	4.7	4.4	4.4	CMA+DE-MOS [13]
Basic RCGA	**1**	4.1	10	97	270	307	305	298	285	253	Basic RCGA [17]
SPSA	536	48	*52e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 152: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{102}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

102 Sphere moderate unif

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	0.03	8.4	21	32	44	55	66	77	89	113	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1.5**	**1.0**	**0.92**	**0.88**	**0.87**	**0.88**	**0.88**	**0.92**	**0.98**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	686	11	8.5	6.8	5.6	4.8	4.4	4.0	3.8	3.4	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	6.1	5.1	3.8	3.1	**3.0**	3.7	3.4	3.1	3.3	CMA+DE-MOS [13]
Basic RCGA	**1**	**3.0**	7.3	68	199	218	222	214	204	181	Basic RCGA [17]
SPSA	488	927	*78e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 153: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{103}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

103 Sphere moderate Cauchy

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	0.03	5.9	13	31	42	54	68	82	95	124	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**2.1**	**1.5**	**0.86**	**0.79**	**0.76**	**0.72**	**0.69**	**0.68**	**0.64**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	739	16	14	7.7	6.1	5.1	4.4	4.0	3.9	3.8	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.5**	**1.7**	**1.2**	**1.1**	**1.2**	**1.1**	**1.2**	**1.2**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.5**	**1.7**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	6.4	7.9	3.9	3.3	3.4	3.7	3.4	3.5	3.4	CMA+DE-MOS [13]
Basic RCGA	**1**	4.2	11	83	424	381	334	299	269	221	Basic RCGA [17]
SPSA	864	36	34	24	25	63	231	*52e-5/1e5*	.	.	SPSA [9]

Table 154: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{104}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

104 Rosenbrock moderate Gauss

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	19	243	77238	89865	91381	92161	92647	93045	93422	94099	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1.1**	**0.51**	*32e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	6.4	**0.81**	*25e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.4**	**0.42**	**0.33**	**0.31**	**0.31**	**0.31**	**0.32**	**0.32**	**0.32**	**0.32**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.4**	**0.42**	**0.97**	**0.88**	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**	**0.89**	IPOP-CMA-ES [15]
CMA+DE-MOS	5.7	30	*38e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	9.4	21	*38e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	24	*27e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 155: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{105}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

105 Rosenbrock moderate unif

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	24	166	1.40e5	1.48e5	1.51e5	1.52e5	1.53e5	1.54e5	1.55e5	1.57e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**0.88**	**1.9**	*40e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	5.2	**1.4**	*34e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.1**	**0.51**	**0.49**	**0.50**	**0.50**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.1**	**0.95**	**0.79**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.81**	IPOP-CMA-ES [15]
CMA+DE-MOS	4.4	**0.80**	*38e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	7.5	35	*38e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	23	*27e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 156: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{106}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

106 Rosenbrock moderate Cauchy

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	17	48	1731	2271	2388	2452	2488	2518	2544	2596	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1.2**	**1.1**	**0.54**	**0.65**	**0.66**	**0.65**	**0.66**	**0.66**	**0.66**	**0.66**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	6.6	4.0	12	24	23	23	27	49	82	110	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.5**	**1.4**	**0.81**	**0.94**	**0.97**	**0.98**	**0.99**	**1.00**	**1.00**	**1.00**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.4**	**1.00**	**1.1**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	IPOP-CMA-ES [15]
CMA+DE-MOS	6.2	3.0	3.9	4.5	4.7	4.8	4.9	5.0	5.0	5.0	CMA+DE-MOS [13]
Basic RCGA	11	112	*37e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	85	5844	*25e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 157: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{107}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

107 Sphere Gauss

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	0.03	225	960	1444	1873	2170	2443	2724	3015	3617	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	*24e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	738	**1.1**	**1.5**	**1.9**	**2.3**	**2.8**	**3.2**	**3.2**	**3.6**	**4.3**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**2.2**	**1.2**	**1.2**	**1.2**	**1.6**	**2.1**	**2.2**	**2.8**	**2.6**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.8**	**1.1**	**0.96**	**0.92**	**0.94**	**0.95**	**0.97**	**0.98**	**1.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	241	1545	1028	*57e+0/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**2.3**	16	12	13	15	14	13	17	18	Basic RCGA [17]
SPSA	476	2924	*14e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 158: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{108}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

108 Sphere unif

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	0.03	2343	5366	14044	23379	37376	45909	52525	70438	1.06e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	*25e+1/1e4*	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	29020	**2.0**	**2.8**	**2.4**	**2.9**	**3.2**	**16**	*78e-4/1e5*	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**0.91**	**1.2**	**1.3**	**1.2**	**1.1**	**1.6**	**2.0**	**1.8**	**1.6**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**0.71**	**0.88**	**0.76**	**0.76**	**0.67**	**0.76**	**0.87**	**0.83**	**0.87**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	286	*15e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	16	*92e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	27994	**2.0**	*20e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 159: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{109}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

109 Sphere Cauchy

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	0.03	7.7	21	36	63	92	124	156	188	251	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1.5**	**0.94**	**0.85**	**0.68**	**0.61**	**0.56**	**0.52**	**0.50**	**0.48**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	689	12	8.4	6.3	4.3	*38e-3/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.1**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	5.1	4.9	3.5	3.9	3.2	3.3	3.2	3.1	3.1	CMA+DE-MOS [13]
Basic RCGA	**1**	3.4	8.2	251	234	194	161	139	122	98	Basic RCGA [17]
SPSA	683	30	371	1563	22528	*82e-2/1e5*	.	.	.	.	SPSA [9]

Table 160: 40-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{110}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

110 Rosenbrock Gauss

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	388	4139	∞	∞	∞	∞	∞	∞	∞	∞	ERT_{best}/D
(1,4ms)-CMA-ES	*32e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	299	98	*12e+2/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.3**	**0.53**	*37e+0/1e6*	.	.	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.4**	**0.54**	*37e+0/9e5*	.	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	152	179	*47e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**0.87**	**2.6**	*51e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	722	*17e+2/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 161: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{111}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

111 Rosenbrock unif

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	2641	15539	∞	∞	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	*29e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	*97e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.86**	**0.79**	*38e+0/1e6*	.	.	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.86**	**0.66**	*38e+0/1e6*	.	.	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	*39e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**8.4**	*63e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	26	*77e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 162: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{112}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

112 Rosenbrock Cauchy

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	72	4454	6347	6669	6799	6887	6959	7031	7155	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1.2**	**0.68**	**0.41**	**0.51**	**0.51**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	7.0	**2.7**	*38e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.3**	**0.84**	**0.92**	**1.0**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.3**	**0.60**	**1.00**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	5.7	**2.0**	**2.3**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	CMA+DE-MOS [13]
Basic RCGA	10	81	*37e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	61	1905	*10e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 163: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{113}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

113 Step-ellipsoid Gauss

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	52	1434	10997	63545	67375	75001	75001	75001	75001	75144	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	*17e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	**2.3**	**0.86**	4.4	*52e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**2.1**	**0.79**	**0.54**	**0.24**	**0.26**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**2.5**	**0.71**	**0.75**	**0.63**	**0.72**	**0.69**	**0.69**	**0.69**	**0.69**	**0.69**	IPOP-CMA-ES [15]
CMA+DE-MOS	7.7	169	*11e+1/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1.0**	**1.6**	**3.1**	*70e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	3.1	*21e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 164: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{114}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

114 Step-ellipsoid unif

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	7217	41989	1.64e5	2.51e5	2.88e5	2.88e5	2.88e5	2.88e5	2.92e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	*16e+2/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	27	**3.1**	**34**	*25e+0/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**4.0**	**0.72**	**0.52**	**0.41**	**0.35**	**0.45**	**0.45**	**0.45**	**0.45**	**0.45**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**4.3**	**0.72**	**0.60**	**0.75**	**0.66**	**0.65**	**0.65**	**0.65**	**0.65**	**0.65**	IPOP-CMA-ES [15]
CMA+DE-MOS	167	*74e+1/1e5*	.	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1.2**	*32e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	26	*28e+1/1e5*	.	.	.	.	.	.	.	.	SPSA [9]

Table 165: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{115}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

115 Step-ellipsoid Cauchy

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	4.1	27	514	4858	9316	10456	10456	10456	10456	10493	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1.8**	**1.7**	*24e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	13	4.0	**0.41**	*30e-1/1e5*	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1.4**	**1.1**	**0.83**	**0.84**	**0.57**	**0.56**	**0.56**	**0.56**	**0.56**	**0.57**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.1**	**0.96**	**1.5**	**3.7**	**2.5**	**2.7**	**2.7**	**2.7**	**2.7**	**2.7**	IPOP-CMA-ES [15]
CMA+DE-MOS	5.2	4.0	49	*58e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**2.9**	6.3	21	*45e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	6.3	7.2	*21e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 166: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{116}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

116 Ellipsoid Gauss

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	13071	60167	1.04e5	1.08e5	1.13e5	1.17e5	1.21e5	1.25e5	1.28e5	1.36e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	*13e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	*12e+4/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.39**	**0.26**	**0.22**	**0.25**	**0.25**	**0.26**	**0.27**	**0.28**	**0.28**	**0.29**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.97**	**0.68**	**0.77**	**0.88**	**0.91**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	IPOP-CMA-ES [15]
CMA+DE-MOS	*47e+2/1e5*	.	.	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**2.0**	*70e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	*40e+3/1e5*	.	.	.	.	.	.	.	.	.	SPSA [9]

Table 167: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{117}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

117 Ellipsoid unif

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	31303	1.35e5	2.11e5	2.97e5	3.40e5	3.65e5	4.33e5	4.57e5	4.79e5	5.28e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	*12e+4/1e4*	.	.	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	*31e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.38**	**0.32**	**0.31**	**0.31**	**0.37**	**0.38**	**0.35**	**0.36**	**0.38**	**0.52**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.72**	**0.54**	**0.66**	**0.74**	**0.72**	**0.81**	**0.76**	**0.78**	**0.80**	**0.81**	IPOP-CMA-ES [15]
CMA+DE-MOS	*47e+3/1e5*	.	.	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	*95e+2/5e4*	.	.	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	*42e+3/1e5*	.	.	.	.	.	.	.	.	.	SPSA [9]

Table 168: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{118}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

118 Ellipsoid Cauchy

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	139	363	980	1197	2046	2406	2717	2918	3113	3289	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**0.50**	**0.50**	**0.37**	**0.51**	**0.41**	**0.45**	**0.50**	**0.53**	**0.55**	**0.57**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	**2.3**	**1.9**	**1.1**	546	*20e-1/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**0.78**	**0.71**	**0.50**	**0.67**	**0.53**	**0.54**	**0.57**	**0.58**	**0.60**	**0.63**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**0.94**	**1.2**	**1.0**	**1.4**	**1.1**	**1.1**	**1.2**	**1.3**	**1.3**	**1.4**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.7**	**1.7**	**1.4**	**1.8**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.6**	CMA+DE-MOS [13]
Basic RCGA	76	*30e+1/5e4*	.	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	7.5	3935	*18e+1/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 169: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{119}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

119 Sum of diff powers Gauss

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	0.03	1.3	1060	3076	3928	13306	53029	1.18e5	2.51e5	3.20e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	260	*50e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	1209	34	**1.3**	**4.6**	**4.1**	**2.6**	*27e-4/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	4.3	**3.8**	**0.79**	**0.71**	**0.95**	**0.68**	**0.53**	**0.35**	**0.19**	**0.21**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1.3**	**6.6**	**0.65**	**0.65**	**0.66**	**0.52**	**0.83**	**0.88**	**0.87**	**0.91**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	10	113	482	378	*88e-1/1e5*	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1.9**	4.0	18	19	54	*25e-2/5e4*	.	.	.	Basic RCGA [17]
SPSA	437	14	*34e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 170: 40-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{120}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

120 Sum of diff powers unif

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	0.03	1.0	4090	17701	43288	84093	2.84e5	6.09e5	1.08e6	5.96e6	ERT_{best}/D
(1,4ms)-CMA-ES	**1**	4473	*81e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	17083	1524	**6.7**	**13**	**8.4**	*24e-1/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	122	**0.81**	**1.00**	**1.3**	**1.2**	**0.64**	**0.47**	**0.30**	**0.22**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**102**	**0.83**	**0.72**	**0.72**	**0.83**	**0.83**	**0.76**	**0.79**	**2.5**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	**19**	*28e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**3.0**	*19e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	34780	1644	*23e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 171: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{121}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

121 Sum of diff powers Cauchy

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	0.03	1.4	18	43	84	205	689	1429	2435	5045	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	5.7	**1.2**	**0.86**	**0.67**	**0.50**	**0.32**	**0.32**	**0.35**	**0.50**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	673	20	10	9.3	612	*89e-3/1e5*	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1.8**	**1.2**	**1.1**	**1.1**	**0.94**	**0.68**	**0.63**	**0.59**	**0.60**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1.7**	**1.2**	**1.1**	**1.1**	**1.1**	**1.00**	**1.3**	**1.6**	**2.0**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1.1**	**2.3**	5.2	**2.9**	3.2	**2.9**	**2.2**	**2.2**	**2.2**	**2.1**	CMA+DE-MOS [13]
Basic RCGA	**1**	**1.5**	5.9	21	112	82	*38e-4/5e4*	.	.	.	Basic RCGA [17]
SPSA	517	65	35833	*18e+0/1e5*	.	.	.	.	.	.	SPSA [9]

Table 172: 40-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{122}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

122 Schaffer F7 Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.03	0.03	123	6832	16079	26832	70248	1.12e5	3.02e5	8.23e5	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	13	1135	*12e+0/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
IPOP-aCMA-ES	**1**	**1**	**3.5**	**0.67**	**0.83**	**1.2**	**0.77**	**0.66**	**0.45**	**0.71**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	6.4	**3.1**	**0.78**	**0.77**	**0.90**	**0.53**	**0.63**	**0.50**	**0.84**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	14	*64e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1.5**	**1.1**	**49**	*30e-1/5e4*	.	.	.	.	.	Basic RCGA [17]
SPSA	6.00e6	6.01e6	11348	*68e+3/1e5*	.	.	.	.	.	.	SPSA [9]

Table 173: 40-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{123}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

123 Schaffer F7 unif

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.03	0.03	331	59218	2.36e5	3.88e5	5.98e5	9.40e5	5.67e6	1.83e7	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	*17e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
IPOP-aCMA-ES	**1**	**1**	**3.4**	**0.88**	**0.78**	**1.1**	**2.9**	**7.8**	*12e-4/1e6*	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	14	**2.8**	**0.90**	**0.93**	**0.97**	**0.86**	**1.3**	*25e-6/1e6*	.	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	246	*97e-1/1e5*	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1.2**	**2.7**	*75e-1/5e4*	.	.	.	.	.	.	Basic RCGA [17]
SPSA	1.60e7	1.60e7	*10e+4/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 174: 40-D, running time excess ERT/$\text{ERT}_{\text{best 2009}}$ on f_{124}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

124 Schaffer F7 Cauchy

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	0.03	0.03	14	754	5312	6585	9160	20490	28640	55992	ERT_{best}/D
(1,4ms)-CMA-ES	**1**	18	30	*58e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
IPOP-aCMA-ES	**1**	**3.0**	**1.1**	4.3	**1.8**	**1.8**	**1.5**	**0.94**	**0.86**	**0.64**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	3.3	**0.97**	**0.83**	**0.53**	**0.72**	**0.81**	**0.50**	**0.63**	**0.73**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1.3**	6.2	**2.0**	**0.68**	**0.92**	**1.1**	**0.84**	**0.90**	**0.83**	CMA+DE-MOS [13]
Basic RCGA	**1**	**1.3**	**1.6**	**1.5**	**2.4**	3.3	4.9	11	*21e-5/5e4*	.	Basic RCGA [17]
SPSA	1.60e7	1.60e7	*94e+3/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 175: 40-D, running time excess ERT/$\mathrm{ERT}_{\text{best 2009}}$ on f_{125}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

125 Griewank-Rosenbrock Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}$/D	0.03	0.03	0.03	115	2.64e6	2.74e6	1.36e7	∞	∞	∞	$\mathrm{ERT}_{\text{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**1**	*16e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	717	916	1032	**0.36**	*45e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**2.9**	**0.21**	**0.40**	**0.40**	*95e-4/1e6*	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	3.2	**0.55**	**0.75**	*48e-2/3e5*	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	**0.66**	*51e-2/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1**	**1.1**	**0.10**	**0.08**	*52e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	*11e+4/1e5*	.	.	.	.	.	.	.	.	.	SPSA [9]

Table 176: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{126}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

126 Griewank-Rosenbrock unif

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	0.03	0.03	0.03	218	∞	∞	∞	∞	∞	∞	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**1**	*17e-1/1e4*	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	3014	3562	3755	**1.3**	*52e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	3.8	*51e-2/2e5*	.	.	.	.	.	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	3.3	*50e-2/2e5*	.	.	.	.	.	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	**0.35**	*54e-2/1e5*	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1**	**1.1**	**0.06**	**1.36e7**	*55e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	2.60e7	2.60e7	2.60e7	2979	*93e+3/1e5*	.	.	.	.	.	SPSA [9]

Table 177: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{127}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

127 Griewank-Rosenbrock Cauchy

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	0.03	0.03	0.03	18	44721	2.63e5	3.78e5	6.24e5	6.49e5	6.66e5	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**1**	10	*78e-2/1e4*	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	711	818	968	**2.3**	*47e-2/1e5*	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1**	**1.0**	**1.1**	**0.39**	**0.89**	**0.93**	**0.95**	**0.94**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1**	**1.1**	3.6	**0.92**	**0.73**	**0.59**	**0.75**	**0.81**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	**1.1**	4.3	**2.6**	*10e-2/1e5*	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1**	**1**	**0.57**	**3.1**	*16e-2/5e4*	.	.	.	.	Basic RCGA [17]
SPSA	431	527	4104	6726	31	*19e-1/1e5*	.	.	.	.	SPSA [9]

Table 178: 40-D, running time excess $\mathrm{ERT}/\mathrm{ERT}_{\text{best 2009}}$ on f_{128}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

128 Gallagher Gauss

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\text{best}}/\mathrm{D}$	0.03	0.03	1.03e5	9.57e5	2.82e6	2.82e6	2.82e6	2.82e6	2.82e6	2.82e6	$\mathrm{ERT}_{\text{best}}/\mathrm{D}$
(1,4ms)-CMA-ES	**1**	**1**	*81e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	673	930	**1.1**	**0.45**	**0.15**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**0.16**	**0.62**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**0.75**	**1.3**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	*77e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1**	*69e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	560	629	*80e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 179: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{129}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

129 Gallagher unif

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	0.03	0.03	8.67e5	9.40e5	2.54e6	2.55e6	2.56e6	2.58e6	2.59e6	2.62e6	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	*82e+0/1e4*	.	.	.	.	.	.	.	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	1358	1503	*69e+0/1e5*	.	.	.	.	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**0.61**	**1.3**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**0.38**	**0.82**	**0.62**	**0.62**	**0.62**	**0.62**	**0.63**	**0.63**	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	*76e+0/1e5*	.	.	.	.	.	.	.	CMA+DE-MOS [13]
Basic RCGA	**1**	**1**	*69e+0/5e4*	.	.	.	.	.	.	.	Basic RCGA [17]
SPSA	3993	8599	*78e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

Table 180: 40-D, running time excess ERT/$\mathrm{ERT}_{\mathrm{best\ 2009}}$ on f_{130}, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

130 Gallagher Cauchy

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	0.03	0.03	317	6925	42118	42165	42224	42282	42361	42474	$\mathrm{ERT}_{\mathrm{best}}$/D
(1,4ms)-CMA-ES	**1**	**1**	**0.52**	**0.41**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	(1,4ms)-CMA-ES [1, 5]
CMA-EGS (IPOP,r1)	658	840	25	40	**6.6**	**6.7**	*20e-1/1e5*	.	.	.	CMA-EGS (IPOP,r1) [8]
IPOP-aCMA-ES	**1**	**1**	**1.1**	47	23	23	23	23	23	23	IPOP-aCMA-ES [12]
IPOP-CMA-ES	**1**	**1**	**1.8**	83	57	57	57	57	57	57	IPOP-CMA-ES [15]
CMA+DE-MOS	**1**	**1**	49	**40**	10	10	**9.5**	**9.5**	**9.5**	**9.4**	CMA+DE-MOS [13]
Basic RCGA	**1**	**1**	29	**9.4**	**2.6**	**2.9**	**2.9**	**3.0**	**3.0**	**3.0**	Basic RCGA [17]
SPSA	606	755	*84e+0/1e5*	.	.	.	.	.	.	.	SPSA [9]

References

[1] Anne Auger, Dimo Brockhoff, and Nikolaus Hansen. Benchmarking the (1, 4)-CMA-ES with mirrored sampling and sequential selection on the noisy BBOB-2010 testbed. In Pelikan and Branke [14], pages 1625–1632.

[2] Anne Auger, Dimo Brockhoff, and Nikolaus Hansen. Investigating the impact of sequential selection in the (1, 2)-CMA-ES on the noisy BBOB-2010 testbed. In Pelikan and Branke [14], pages 1605–1610.

[3] Anne Auger, Dimo Brockhoff, and Nikolaus Hansen. Investigating the impact of sequential selection in the (1, 4)-CMA-ES on the noisy BBOB-2010 testbed. In Pelikan and Branke [14], pages 1611–1616.

[4] Anne Auger, Dimo Brockhoff, and Nikolaus Hansen. Mirrored variants of the (1, 2)-CMA-ES compared on the noisy BBOB-2010 testbed. In Pelikan and Branke [14], pages 1575–1582.

[5] Anne Auger, Dimo Brockhoff, and Nikolaus Hansen. Mirrored variants of the (1, 4)-CMA-ES compared on the noisy BBOB-2010 testbed. In Pelikan and Branke [14], pages 1583–1590.

[6] Anne Auger, Steffen Finck, Nikolaus Hansen, and Raymond Ros. BBOB 2009: Comparison tables of all algorithms on all noisy functions. Technical Report RT-0384, INRIA, 04 2010.

[7] S. Finck, N. Hansen, R. Ros, and A. Auger. Real-parameter black-box optimization benchmarking 2010: Presentation of the noisy functions. Technical Report 2009/21, Research Center PPE, 2010.

[8] Steffen Finck and Hans-Georg Beyer. Benchmarking CMA-EGS on the BBOB 2010 noisy function testbed. In Pelikan and Branke [14], pages 1641–1648.

[9] Steffen Finck and Hans-Georg Beyer. Benchmarking SPSA on BBOB-2010 noisy function testbed. In Pelikan and Branke [14], pages 1665–1672.

[10] N. Hansen, A. Auger, S. Finck, and R. Ros. Real-parameter black-box optimization benchmarking 2010: Experimental setup. Technical Report RR-7215, INRIA, 2010.

[11] N. Hansen, S. Finck, R. Ros, and A. Auger. Real-parameter black-box optimization benchmarking 2009: Noisy functions definitions. Technical Report RR-6869, INRIA, 2009. Updated February 2010.

[12] Nikolaus Hansen and Raymond Ros. Benchmarking a weighted negative covariance matrix update on the BBOB-2010 noisy testbed. In Pelikan and Branke [14], pages 1681–1688.

[13] Antonio LaTorre, Santiago Muelas, and José María Peña. Benchmarking a MOS-based algorithm on the BBOB-2010 noisy function testbed. In Pelikan and Branke [14], pages 1725–1730.

[14] Martin Pelikan and Jürgen Branke, editors. *Genetic and Evolutionary Computation Conference, GECCO 2010, Proceedings, Portland, Oregon, USA, July 7-11, 2010, Companion Material*. ACM, 2010.

[15] Raymond Ros. Black-box optimization benchmarking the IPOP-CMA-ES on the noisy testbed: comparison to the BIPOP-CMA-ES. In Pelikan and Branke [14], pages 1511–1518.

[16] Raymond Ros. Comparison of NEWUOA with different numbers of interpolation points on the BBOB noisy testbed. In Pelikan and Branke [14], pages 1495–1502.

[17] Thanh-Do Tran and Gang-Gyoo Jin. Benchmarking real-coded genetic algorithm on noisy black-box optimization testbed. In Pelikan and Branke [14], pages 1739–1744.