Supplementary file of "Differential Evolution Powered by Collective Information"

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Figure Captions

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Table S1. Error values of the four compared mutation strategies on the 30-dimensional CEC2013 benchmark set over 51 independent runs.

Func	DE/current-to-best/1/bin	DE/current-to-pbest/1/bin	DE/current-to-gr_best/1/bin	CIMDE
F1	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F2	3.06E+07 - (8.39E+06)	4.72E+07 - (8.82E+06)	5.08E+07 - (1.20E+07)	**2.37E+07** (5.15E+06)
F3	4.53E+05 = (2.52E+06)	**5.14E-03** + (1.97E-02)	1.44E-02 + (4.98E-02)	2.95E+05 (6.27E+05)
F4	1.61E+04 - (3.03E+03)	1.74E+04 - (2.70E+03)	1.95E+04 - (3.79E+03)	**1.21E+04** (1.99E+03)
F5	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F6	1.97E+01 - (1.45E+01)	1.48E+01 - (1.67E+00)	1.51E+01 - (2.32E+00)	**1.35E+01** (6.22E-01)
F7	8.34E+00 - (1.17E+01)	1.31E+00 - (1.24E+00)	1.59E+00 - (1.21E+00)	**3.45E-01** (6.12E-01)
F8	2.10E+01 = (4.04E-02)	**2.09E+01** = (5.77E-02)	2.10E+01 = (3.99E-02)	**2.09E+01** (6.02E-02)
F9	**3.42E+01** + (6.29E+00)	3.83E+01 - (9.65E-01)	3.86E+01 - (1.08E+00)	3.73E+01 (1.43E+00)
F10	8.36E-03 = (7.98E-03)	2.22E-03 + (4.13E-03)	**6.80E-04** + (2.37E-03)	1.07E-02 (9.40E-03)
F11	1.07E+02 - (8.49E+00)	1.07E+02 - (6.85E+00)	1.08E+02 - (8.25E+00)	**9.17E+01** (7.39E+00)
F12	1.84E+02 - (1.12E+01)	1.85E+02 - (8.60E+00)	1.87E+02 - (1.07E+01)	**1.63E+02** (1.25E+01)
F13	1.83E+02 - (9.60E+00)	1.83E+02 - (9.31E+00)	1.86E+02 - (8.46E+00)	**1.63E+02** (9.38E+00)
F14	4.60E+03 = (2.87E+02)	4.68E+03 - (2.30E+02)	4.67E+03 - (2.85E+02)	**4.56E+03** (2.24E+02)
F15	7.19E+03 - (2.71E+02)	7.19E+03 - (2.39E+02)	7.23E+03 - (2.58E+02)	**7.03E+03** (2.84E+02)
F16	2.44E+00 = (3.05E-01)	2.44E+00 = (3.03E-01)	**2.43E+00** = (2.97E-01)	2.49E+00 (3.31E-01)
F17	1.41E+02 - (7.63E+00)	1.41E+02 - 6.76E+00)	1.41E+02 - (6.95E+00)	**1.24E+02** (5.75E+00)
F18	2.14E+02 - (1.23E+01)	2.13E+02 - (1.02E+01)	2.16E+02 - (1.03E+01)	**1.92E+02** (7.88E+00)
F19	1.23E+01 - (7.64E-01)	1.25E+01 - (7.38E-01)	1.27E+01 - (6.37E-01)	**1.10E+01** (6.51E-01)
F20	1.24E+01 - (2.88E-01)	1.23E+01 - (1.84E-01)	1.23E+01 - (2.42E-01)	**1.20E+01** (2.31E-01)
F21	**2.73E+02** + (6.40E+01)	2.95E+02 + (3.44E+01)	2.83E+02 + (4.61E+01)	2.96E+02 (4.25E+01)
F22	4.56E+03 = (3.31E+02)	4.77E+03 - (3.04E+02)	4.78E+03 - (2.91E+02)	**4.44E+03** (3.24E+02)
F23	7.16E+03 - (2.71E+02)	7.17E+03 - (3.27E+02)	7.23E+03 - (2.78E+02)	**7.01E+03** (2.69E+02)
F24	2.18E+02 - (1.85E+01)	**2.00E+02** - (5.94E-01)	**2.00E+02** - (1.49E-01)	**2.00E+02** (1.31E-02)
F25	2.50E+02 - (7.77E+00)	2.50E+02 - (1.06E+01)	2.60E+02 - (1.36E+01)	**2.42E+02** (9.98E+00)
F26	2.04E+02 - (1.40E+01)	2.05E+02 - (1.37E+01)	2.04E+02 - (6.73E-01)	**2.01E+02** (3.72E-01)
F27	7.19E+02 - (2.67E+02)	4.97E+02 - (2.91E+02)	4.64E+02 - (2.64E+02)	**3.00E+02** (3.00E-01)
F28	3.00E+02 + (2.63E-13)	3.00E+02 + (2.70E-13)	3.00E+02 + (2.83E-13)	3.00E+02 (3.13E-13)
-	17	20	20	
=	8	4	4	
+	3	4	4	

Table S2. Error values of the four compared mutation strategies on the 50-dimensional CEC2013 benchmark set over 51 independent runs.

Func	DE/current-to-best/1/bin	DE/current-to-pbest/1/bin	DE/current-to-gr_best/1/bin	CIMDE
F1	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F2	1.14E+08 - (2.03E+07)	1.74E+08 - (2.64E+07)	2.03E+08 - (2.87E+07)	**8.62E+07** (1.36E+07)
F3	1.18E+08 - (4.99E+08)	4.81E+03 + (9.63E+03)	**3.80E+03** + (7.35E+03)	6.26E+04 (1.71E+05)
F4	2.83E+04 - (4.88E+03)	3.24E+04 - (4.26E+03)	3.55E+04 - (4.15E+03)	**1.55E+04** (2.02E+03)
F5	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F6	4.35E+01 - (3.79E-01)	4.35E+01 - (7.04E-02)	4.35E+01 - (6.72E-02)	**4.34E+01** (7.49E-14)
F7	2.82E+01 - (1.54E+01)	8.33E+00 - (5.21E+00)	1.03E+01 - (5.30E+00)	**6.44E-01** (1.45E+00)
F8	2.11E+01 = (4.01E-02)	2.11E+01 = (3.56E-02)	2.11E+01 = (3.06E-02)	2.11E+01 (3.53E-02)
F9	**6.87E+01** = (5.55E+00)	7.15E+01 - (1.82E+00)	7.21E+01 - (1.32E+00)	7.02E+01 (1.66E+00)
F10	2.90E-02 + (1.26E-02)	**1.55E-02** + (9.48E-03)	1.74E-02 + (1.06E-02)	5.52E-02 (2.90E-02)
F11	2.54E+02 - (1.55E+01)	2.54E+02 - (1.14E+01)	2.58E+02 - (1.04E+01)	**2.20E+02** (9.03E+00)
F12	3.80E+02 - (1.41E+01)	3.73E+02 - (1.62E+01)	3.76E+02 - (1.34E+01)	**3.35E+02** (1.49E+01)
F13	3.79E+02 - (1.49E+01)	3.75E+02 - (1.42E+01)	3.76E+02 - (1.66E+01)	**3.36E+02** (1.39E+01)
F14	1.01E+04 - (3.27E+02)	1.01E+04 - (2.82E+02)	1.01E+04 - (4.02E+02)	**9.85E+03** (3.51E+02)
F15	1.40E+04 - (3.34E+02)	1.39E+04 = (3.61E+02)	1.39E+04 = (4.51E+02)	**1.38E+04** (3.59E+02)
F16	**3.33E+00** = (3.53E-01)	3.38E+00 = (3.09E-01)	**3.33E+00** + (2.68E-01)	3.45E+00 (2.62E-01)
F17	3.15E+02 - (1.24E+01)	3.14E+02 - (1.08E+01)	3.14E+02 - (1.17E+01)	**2.74E+02** (9.70E+00)
F18	4.27E+02 - (1.34E+01)	4.25E+02 - (1.41E+01)	4.25E+02 - (1.33E+01)	**3.82E+02** (1.35E+01)
F19	2.70E+01 - (1.21E+00)	2.77E+01 - (9.44E-01)	2.76E+01 - (1.41E+00)	**2.45E+01** (1.05E+00)
F20	2.21E+01 - (3.42E-01)	2.21E+01 - (2.71E-01)	2.21E+01 - (2.30E-01)	**2.17E+01** (2.75E-01)
F21	6.48E+02 = (4.50E+02)	**5.99E+02** = (4.49E+02)	6.23E+02 = (4.56E+02)	8.54E+02 (3.97E+02)
F22	1.01E+04 - (5.09E+02)	9.85E+03 - (3.82E+02)	9.94E+03 - (3.48E+02)	**9.28E+03** (4.15E+02)
F23	1.39E+04 - (3.98E+02)	1.37E+04 - (3.88E+02)	1.37E+04 - (4.18E+02)	**1.35E+04** (3.60E+02)
F24	2.45E+02 - (2.35E+01)	2.08E+02 - (1.68E+01)	**2.03E+02** - (1.07E+01)	2.03E+02 (7.81E+00)
F25	2.88E+02 - (1.32E+01)	2.93E+02 - (1.91E+01)	3.08E+02 - (2.95E+01)	**2.76E+02** (1.39E+01)
F26	3.85E+02 - (8.43E+01)	3.73E+02 - (8.30E+01)	3.43E+02 - (1.01E+02)	**2.86E+02** (4.08E+01)
F27	1.13E+03 - (4.07E+02)	1.24E+03 - (5.22E+02)	1.34E+03 - (5.18E+02)	**4.23E+02** (1.43E+02)
F28	7.57E+02 - (9.87E+02)	4.61E+02 = (4.38E+02)	**4.00E+02** = (2.87E-13)	4.00E+02 (2.87E-13)
-	21	19	19	
=	6	7	6	
+	1	2	3	

Table S3. Error values of CIMDE and CIMXDE on the 30 and 50-dimensional CEC2013 benchmark set over 51 independent runs.

Func	CIMDE ($D = 30$)	CIMXDE ($D = 30$)	CIMDE ($D = 50$)	CIMXDE ($D = 50$)
F1	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F2	2.37E+07 - (5.15E+06)	**3.75E+05** (1.57E+05)	8.62E+07 - (1.36E+07)	**6.54E+05** (1.94E+05)
F3	2.95E+05 = (6.27E+05)	**2.18E+05** (5.42E+05)	**6.26E+04** = (1.71E+05)	1.79E+05 (5.99E+05)
F4	1.21E+04 - (1.99E+03)	**2.32E+02** (1.67E+02)	1.55E+04 - (2.02E+03)	**4.98E+02** (2.56E+02)
F5	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F6	1.35E+01 - (6.22E-01)	**1.30E+01** (8.37E+00)	4.34E+01 + (7.49E-14)	4.34E+01 (1.53E-13)
F7	3.45E-01 = (6.12E-01)	**2.55E-01** (2.91E-01)	**6.44E-01** + (1.45E+00)	1.75E+00 (1.59E+00)
F8	2.09E+01 = (6.02E-02)	2.09E+01 (5.03E-02)	2.11E+01 = (3.53E-02)	2.11E+01 (3.22E-02)
F9	3.73E+01 - (1.43E+00)	**6.65E+00** (1.90E+00)	7.02E+01 - (1.66E+00)	**1.27E+01** (3.16E+00)
F10	**1.07E-02** + (9.40E-03)	1.50E-02 (9.96E-03)	5.52E-02 = (2.90E-02)	**5.37E-02** (2.84E-02)
F11	9.17E+01 - (7.39E+00)	**1.46E+01** (1.85E+01)	2.20E+02 - (9.03E+00)	**1.87E+01** (5.26E+00)
F12	1.63E+02 - (1.25E+01)	**8.95E+00** (2.81E+00)	3.35E+02 - (1.49E+01)	**2.19E+01** (5.04E+00)
F13	1.63E+02 - (9.38E+00)	**2.10E+01** (1.35E+01)	3.36E+02 - (1.39E+01)	**5.83E+01** (2.28E+01)
F14	4.56E+03 - (2.24E+02)	**1.14E+03** (6.54E+02)	9.85E+03 - (3.51E+02)	**1.54E+03** (8.27E+02)
F15	7.03E+03 - (2.84E+02)	**2.51E+03** (1.70E+03)	1.38E+04 - (3.59E+02)	**5.66E+03** (3.29E+03)
F16	2.49E+00 = (3.31E-01)	**2.46E+00** (2.59E-01)	3.45E+00 = (2.62E-01)	**3.43E+00** (2.52E-01)
F17	1.24E+02 - (5.75E+00)	**1.17E+02** (1.57E+01)	2.74E+02 - (9.70E+00)	**2.19E+02** (5.18E+01)
F18	1.92E+02 - (7.88E+00)	**1.66E+02** (1.02E+01)	3.82E+02 - (1.35E+01)	**3.37E+02** (1.17E+01)
F19	1.10E+01 - (6.51E-01)	**4.36E+00** (2.99E+00)	2.45E+01 - (1.05E+00)	**5.14E+00** (3.05E+00)
F20	1.20E+01 - (2.31E-01)	**1.04E+01** (8.61E-01)	2.17E+01 - (2.75E-01)	**1.94E+01** (1.29E+00)
F21	2.96E+02 = (4.25E+01)	**2.89E+02** (4.11E+01)	**8.54E+02** = (3.97E+02)	9.33E+02 (3.35E+02)
F22	4.44E+03 - (3.24E+02)	**1.30E+03** (1.12E+03)	9.28E+03 - (4.15E+02)	**1.23E+03** (1.16E+03)
F23	7.01E+03 - (2.69E+02)	**1.70E+03** (1.10E+03)	1.35E+04 - (3.60E+02)	**3.79E+03** (8.97E+02)
F24	2.00E+02 = (1.31E-02)	2.00E+02 (1.50E+00)	2.03E+02 = (7.81E+00)	**2.01E+02** (5.11E+00)
F25	2.42E+02 = (9.98E+00)	**2.41E+02** (4.80E+00)	2.76E+02 = (1.39E+01)	2.77E+02 (6.53E+00)
F26	**2.01E+02** - (3.72E-01)	2.02E+02 (1.41E+01)	2.86E+02 = (4.08E+01)	**2.80E+02** (4.51E+01)
F27	3.00E+02 = (3.00E-01)	3.00E+02 (3.73E-01)	**4.23E+02** + (1.43E+02)	5.28E+02 (1.62E+02)
F28	3.00E+02 = (3.13E-13)	3.00E+02 (2.89E-13)	**4.00E+02** - (2.87E-13)	4.57E+02 (4.06E+02)
-	16		15	
=	11		10	
+	1		3	

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Table S4. Error values of CIPDE and seven state-of-the-art DE variants on the 30-dimensional CEC2013 benchmark set over 51 independent runs.

Func.	JADE	SaDE	EPSDE	jDE	CoDE	SHADE	CoBiDE	CIPDE
F1	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	**9.23E+03** =	1.71E+05 -	1.43E+06 -	1.26E+05 -	8.82E+04 -	1.36E+04 =	8.70E+04 -	1.00E+04
	(7.64E+03)	(7.83E+04)	(5.47E+06)	(6.64E+04)	(4.07E+04)	(9.19E+03)	(4.99E+04)	(7.54E+03)
F3	1.33E+05 +	3.55E+06 -	1.05E+08 -	4.52E+05 -	6.69E+05 -	2.55E+05 +	**6.83E+03** =	6.76E+05
	(5.75E+05)	(4.88E+06)	(2.38E+08)	(9.30E+05)	(1.45E+06)	(1.64E+06)	(3.07E+04)	(1.85E+06)
F4	5.14E+03 +	1.86E+01 -	1.94E+03 -	1.79E+01 -	7.29E-02 -	**9.22E-04** +	1.24E-03 =	5.13E+03
	(1.23E+04)	(4.86E+01)	(1.14E+04)	(1.59E+01)	(1.16E-01)	(1.40E-03)	(2.07E-03)	(9.06E+03)
F5	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	**0.00E+00** =	2.61E+01 -	9.25E+00 -	1.21E+01 -	1.48E+00 -	5.25E-01 =-	5.29E+00 -	**0.00E+00**
	(0.00E+00)	(2.49E+01)	(1.46E+00)	(2.34E+00)	(5.10E+00)	(3.70E+00)	(7.92E+00)	(0.00E+00)
F7	4.67E+00 -	8.91E+00 -	4.87E+01 -	**2.24E+00** =	1.02E+01 -	2.87E+00 =	3.81E+00 =	2.80E+00
	(4.60E+00)	(6.25E+00)	(2.85E+01)	(1.77E+00)	(7.45E+00)	(3.32E+00)	(3.32E+00)	(2.37E+00)
F8	2.09E+01 =	2.09E+01 -	2.09E+01 =	2.09E+01 =	**2.08E+01** +	**2.08E+01** +	2.09E+01 =	2.09E+01
	(5.87E-02)	(5.46E-02)	(5.43E-02)	(5.52E-02)	(1.35E-01)	(1.95E-01)	(7.71E-02)	(4.05E-02)
F9	2.70E+01 -	1.52E+01 +	3.33E+01 -	2.27E+01 -	1.39E+01 +	2.80E+01 -	**1.10E+01** +	1.93E+01
	(1.55E+00)	(2.50E+00)	(3.62E+00)	(6.08E+00)	(3.29E+00)	(1.67E+00)	(2.91E+00)	(3.18E+00)
F10	6.70E-02 =	1.75E-01 -	8.51E-02 -	3.53E-02 +	3.54E-02 +	1.34E-01 -	**3.26E-02** +	6.10E-02
	(4.26E-02)	(8.22E-02)	(5.20E-02)	(2.10E-02)	(2.04E-02)	(8.48E-02)	(1.99E-02)	(3.51E-02)
F11	**0.00E+00** =	3.14E+00 -	1.95E-02 =	**0.00E+00** +	3.90E-02 -	**0.00E+00** =	**0.00E+00** =	**0.00E+00**
	(0.00E+00)	(1.80E+00)	(1.39E-01)	(0.00E+00)	(1.95E-01)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F12	2.37E+01 -	3.23E+01 -	5.00E+01 -	6.02E+01 -	3.75E+01 -	2.02E+01 -	4.08E+01 -	**1.57E+01**
	(4.56E+00)	(8.81E+00)	(9.12E+00)	(1.18E+01)	(1.28E+01)	(3.14E+00)	(1.23E+01)	(4.50E+00)
F13	4.69E+01 -	7.11E+01 -	7.38E+01 -	8.95E+01 -	7.87E+01 -	4.18E+01 -	8.40E+01 -	**1.93E+01**
	(1.25E+01)	(2.10E+01)	(1.30E+01)	(1.71E+01)	(2.57E+01)	(1.31E+01)	(2.35E+01)	(9.05E+00)
F14	2.53E-02 +	3.78E+02 -	2.73E-01 +	**1.63E-03** +	3.20E+00 -	2.61E-02 +	1.46E+02 -	5.82E-01
	(2.68E-02)	(1.15E+02)	(1.21E-01)	(7.02E-03)	(3.06E+00)	(2.49E-02)	(6.04E+01)	(4.96E-01)
F15	3.21E+03 -	6.05E+03 -	6.58E+03 -	5.18E+03 -	3.49E+03 -	3.15E+03 -	3.05E+03 -	**2.75E+03**
	(2.83E+02)	(4.24E+02)	(6.18E+02)	(3.93E+02)	(5.03E+02)	(2.90E+02)	(5.28E+02)	(6.87E+02)
F16	1.77E+00 +	2.33E+00 =	2.43E+00 =	2.40E+01 -	**3.72E-01** +	9.88E-01 +	5.14E-01 +	2.10E+00
	(7.23E-01)	(3.06E-01)	(2.80E-01)	(2.64E-01)	(2.60E-01)	(1.53E-01)	(8.24E-01)	(7.74E-01)
F17	**3.04E+01** +	4.96E+01 -	**3.04E+01** +	**3.04E+01** +	**3.04E+01** +	**3.04E+01** +	3.60E+01 -	3.05E+01
	(0.00E+00)	(3.58E+00)	(1.96E-03)	(9.43E-07)	(9.34E-03)	(1.80E-14)	(1.55E+00)	(3.05E-02)
F18	7.62E+01 -	1.67E+02 -	1.39E+02 -	1.57E+02 -	6.51E+01 -	7.34E+01 -	7.03E+01 -	**3.96E+01**
	(6.55E+00)	(1.25E+01)	(1.42E+01)	(1.64E+01)	(1.17E+01)	(5.15E+00)	(1.52E+01)	(3.34E+00)
F19	1.44E+00 -	6.64E+00 -	1.83E+00 -	1.63E+00 -	1.56E+00 -	1.40E+00 -	1.93E+00 -	**1.02E+00**
	(9.90E-02)	(1.28E+00)	(2.46E-01)	(1.56E-01)	(2.76E-01)	(9.49E-02)	(4.20E-01)	(1.31E-01)
F20	1.06E+01 -	1.14E+01 -	1.29E+01 -	1.18E+01 -	1.06E+01 -	1.10E+01 -	1.07E+01 -	**9.74E+00**
	(7.89E-01)	(3.76E-01)	(7.66E-01)	(3.78E-01)	(7.00E-01)	(4.47E-01)	(6.07E-01)	(7.23E-01)
F21	**2.88E+02** =	3.33E+02 -	3.07E+02 =	2.94E+02 -	3.22E+02 -	3.05E+02 -	3.41E+02 -	2.90E+02
	(3.25E+01)	(8.16E+01)	(6.96E+01)	(6.35E+01)	(7.52E+01)	(6.04E+01)	(1.01E+02)	(4.82E+01)
F22	**1.07E+02** +	4.05E+02 -	3.52E+02 -	1.15E+02 -	**1.07E+02** -	**1.07E+02** +	2.71E+02 -	1.11E+02
	(2.50E+01)	(2.98E+02)	(1.30E+02)	(1.25E+01)	(2.96E+01)	(1.59E+01)	(9.72E+01)	(1.42E+01)
F23	3.49E+03 -	6.19E+03 -	6.94E+03 -	5.19E+03 -	3.42E+03 -	3.50E+03 -	3.12E+03 -	**2.54E+03**
	(4.06E+02)	(4.72E+02)	(6.46E+02)	(4.41E+02)	(5.48E+02)	(3.76E+02)	(5.45E+02)	(5.59E+02)
F24	2.12E+02 -	2.21E+02 -	2.93E+02 -	**2.07E+02** =	2.23E+02 -	**2.07E+02** =	2.08E+02 =	**2.07E+02**
	(1.10E+01)	(4.95E+00)	(5.36E+00)	(5.73E+00)	(8.94E+00)	(4.05E+00)	(5.73E+00)	(4.16E+00)
F25	2.75E+02 -	2.56E+02 +	2.99E+02 -	2.56E+02 +	2.54E+02 +	2.81E+02 -	**2.49E+02** +	2.63E+02
	(1.29E+01)	(7.02E+00)	(3.11E+00)	(1.46E+01)	(7.22E+00)	(7.98E+00)	(5.78E+00)	(1.02E+01)
F26	2.03E+02 =	2.10E+02 -	3.60E+02 -	**2.00E+02** -	2.08E+02 -	2.02E+02 -	2.05E+02 -	**2.00E+02**
	(2.34E+01)	(3.34E+01)	(5.91E+01)	(6.21E-03)	(3.10E+01)	(1.56E+01)	(2.44E+01)	(8.07E-03)
F27	6.38E+02 -	4.92E+02 -	1.22E+03 -	4.42E+02 -	5.86E+02 -	5.71E+02 -	5.59E+02 -	**4.16E+02**
	(2.31E+02)	(7.87E+01)	(1.28E+02)	(1.14E+02)	(2.17E+02)	(1.00E+02)	(8.36E+01)
F28	3.00E+02 -	3.00E+02 -	3.00E+02 =	3.00E+02 -	3.00E+02 -	3.00E+02 -	3.00E+02 -	3.00E+02
	(1.50E-13)	(2.10E-13)	(9.09E-14)	(9.09E-14)	(0.00E+00)	(1.37E-13)	(2.61E-13)	(4.55E-14)
-	12	22	19	13	17	13	16	
=	10	4	7	11	5	8	8	
+	6	2	2	4	6	7	4	

Table S5. Error values of CIPDE and seven state-of-the-art DE variants on the 50-dimensional CEC2013 benchmark set over 51 independent runs.

Func.	JADE	SaDE	EPSDE	jDE	CoDE	SHADE	CoBiDE	CIPDE
F1	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	2.50E+04 =	5.00E+05 -	9.00E+06 -	4.88E+05 -	2.71E+05 -	3.90E+04 -	3.52E+05 -	**2.33E+04**
	(1.66E+04)	(1.35E+05)	(2.01E+07)	(1.99E+05)	(9.81E+04)	(1.77E+04)	(1.51E+05)	(1.32E+04)
F3	3.92E+06 =	2.46E+07 -	4.85E+08 -	3.91E+06 =	1.32E+07 -	**8.37E+05** +	4.54E+06 -	5.08E+06
	(7.47E+06)	(2.35E+07)	(1.56E+09)	(5.50E+06)	(1.42E+07)	(1.14E+06)	(7.60E+06)	(9.12E+06)
F4	4.09E+03 +	1.66E+02 -	9.83E+03 -	8.36E+01 -	1.68E-01 -	**8.39E-03** +	7.12E-02 -	8.74E+03
	(1.43E+04)	(4.53E+02)	(3.24E+04)	(6.37E+01)	(1.80E-01)	(1.07E-02)	(6.81E-02)	(1.37E+04)
F5	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	4.27E+01 =	4.79E+01 -	**3.73E+01** +	4.37E+01 -	4.30E+01 +	4.34E+01 =	4.36E+01 -	4.34E+01
	(5.23E+00)	(1.30E+01)	(6.03E+00)	(4.86E-01)	(4.30E+00)	(1.91E-13)	(8.00E-01)	(1.59E-13)
F7	2.38E+01 -	3.35E+01 -	7.69E+01 -	**1.35E+01** +	4.03E+01 -	1.87E+01 -	2.53E+01 -	1.83E+01
	(9.70E+00)	(8.32E+00)	(3.45E+01)	(6.01E+00)	(1.15E+01)	(6.51E+00)	(1.05E+01)	(6.62E+00)
F8	2.11E+01 =	2.11E+01 =	2.11E+01 -	2.11E+01 =	2.10E+01 -	**2.09E+01** +	2.11E+01 =	2.11E+01
	(8.57E-02)	(3.78E-02)	(3.26E-02)	(3.63E-02)	(6.81E-02)	(1.66E-01)	(9.31E-02)	(3.59E-02)
F9	5.32E+01 -	3.41E+01 +	7.02E+01 -	4.99E+01 -	3.30E+01 +	5.57E+01 -	**2.63E+01** +	4.06E+01
	(2.56E+00)	(4.81E+00)	(3.43E+00)	(7.77E+00)	(5.47E+00)	(1.80E+00)	(4.65E+00)	(4.55E+00)
F10	5.67E-02 +	2.05E-01 -	1.24E-01 -	**4.12E-02** +	5.57E-02 +	1.45E-01 -	7.95E-02 =	9.69E-02
	(3.56E-02)	(9.36E-02)	(8.31E-02)	(2.16E-02)	(3.01E-02)	(7.83E-02)	(4.36E-02)	(6.99E-02)
F11	**0.00E+00** +	1.80E+01 -	3.71E-01 -	**0.00E+00** =	8.00E-01 -	**0.00E+00** =	3.12E-01 -	**0.00E+00**
	(0.00E+00)	(6.51E+00)	(1.45E+00)	(0.00E+00)	(8.68E-01)	(0.00E+00)	(1.55E+00)	(0.00E+00)
F12	5.92E+01 -	9.17E+01 -	1.65E+02 -	1.11E+02 -	9.25E+01 -	**4.01E+01** =	8.90E+01 -	4.12E+01
	(9.89E+00)	(1.85E+01)	(2.56E+01)	(1.82E+01)	(1.96E+01)	(5.15E+00)	(2.06E+01)	(8.07E+00)
F13	1.32E+02 -	2.00E+02 -	2.27E+02 -	1.82E+02 -	2.05E+02 -	1.09E+02 -	1.69E+02 -	**9.54E+01**
	(2.25E+01)	(3.82E+01)	(3.94E+01)	(2.28E+01)	(4.55E+01)	(1.85E+01)	(4.07E+01)	(2.20E+01)
F14	3.89E-02 +	6.08E+02 -	5.95E+02 -	**2.71E-03** +	3.30E+01 -	2.57E-02 +	5.01E+02 -	2.31E+00
	(2.23E-02)	(1.60E+02)	(6.34E+02)	(5.81E-03)	(2.85E+01)	(1.74E-02)	(2.19E+02)	(1.21E+00)
F15	6.87E+03 -	1.19E+04 -	1.40E+04 -	9.99E+03 -	6.90E+03 -	6.81E+03 -	6.45E+03 =	**6.27E+03**
	(4.53E+02)	(1.04E+03)	(6.60E+02)	(6.13E+02)	(7.39E+02)	(4.80E+02)	(7.13E+02)	(9.14E+02)
F16	1.74E+00 +	3.15E+00 -	3.30E+00 -	3.18E+00 -	9.43E-01 +	1.34E+00 +	**6.31E-01** +	2.56E+00
	(7.58E-01)	(3.21E-01)	(3.08E-01)	(3.14E-01)	(4.03E-01)	(1.96E-01)	(9.72E-01)	(1.17E+00)
F17	**5.08E+01** +	8.74E+01 -	**5.08E+01** +	**5.08E+01** +	5.22E+01 -	**5.08E+01** +	7.73E+01 -	5.10E+01
	(4.66E-14)	(7.43E+00)	(1.37E-01)	(4.99E-14)	(4.83E-01)	(5.56E-14)	(5.79E+00)	(7.50E-02)
F18	1.42E+02 -	3.29E+02 -	3.38E+02 -	2.85E+02 -	1.21E+02 -	1.27E+02 -	1.18E+02 -	**7.14E+01**
	(1.23E+01)	(2.13E+01)	(2.47E+01)	(2.23E+01)	(1.71E+01)	(7.81E+00)	(1.99E+01)	(5.32E+00)
F19	2.79E+00 -	1.22E+01 -	6.08E+00 -	2.84E+00 -	3.16E+00 -	2.57E+00 -	3.36E+00 -	**2.05E+00**
	(2.04E-01)	(5.32E+00)	(7.46E-01)	(2.79E-01)	(6.23E-01)	(1.44E-01)	(8.01E-01)	(2.42E-01)
F20	1.94E+01 =	2.09E+01 -	2.23E+01 -	2.12E+01 -	1.99E+01 -	2.00E+01 -	2.01E+01 -	**1.91E+01**
	(7.27E-01)	(4.59E-01)	(8.52E-01)	(5.12E-01)	(7.45E-01)	(5.92E-01)	(6.54E-01)	(7.28E-01)
F21	9.00E+02 =	8.57E+02 =	7.17E+02 =	5.29E+02 +	6.71E+02 +	7.74E+02 +	**4.29E+02** +	8.47E+02
	(3.11E+02)	(3.51E+02)	(4.17E+02)	(4.08E+02)	(4.54E+02)	(4.35E+02)	(3.98E+02)	(4.09E+02)
F22	1.87E+01 +	4.89E+02 -	2.09E+03 -	2.73E+01 -	4.15E+01 -	**1.42E+01** +	5.25E+02 -	2.47E+01
	(2.73E+01)	(4.41E+02)	(5.12E+02)	(3.29E+01)	(4.01E+01)	(8.26E+00)	(2.48E+02)	(2.97E+01)
F23	7.22E+03 -	1.17E+04 -	1.39E+04 -	9.82E+03 -	7.47E+03 -	7.36E+03 -	6.75E+03 -	**6.05E+03**
	(6.37E+02)	(1.18E+03)	(6.01E+02)	(6.76E+02)	(6.60E+02)	(7.26E+02)	(9.49E+02)	(1.02E+03)
F24	2.43E+02 =	2.65E+02 -	3.82E+02 -	2.38E+02 =	2.58E+02 -	**2.31E+02** +	2.41E+02 =	2.38E+02
	(1.41E+01)	(9.89E+00)	(4.40E+00)	(1.13E+01)	(1.32E+01)	(7.67E+00)	(1.34E+01)	(8.72E+00)
F25	3.53E+02 -	3.17E+02 +	3.84E+02 -	3.15E+02 +	3.13E+02 +	3.69E+02 -	**3.01E+02** +	3.30E+02
	(2.38E+01)	(9.38E+00)	(3.76E+00)	(2.70E+01)	(1.15E+01)	(1.39E+01)	(1.20E+01)	(1.39E+01)
F26	3.33E+02 -	2.77E+02 =	4.75E+02 -	2.51E+02 +	2.88E+02 =	3.44E+02 -	**2.50E+02** +	2.99E+02
	(9.69E+01)	(8.58E+01)	(5.90E+00)	(7.89E+01)	(8.76E+01)	(9.99E+01)	(8.06E+01)	(7.40E+01)
F27	1.29E+03 -	1.05E+03 -	2.12E+03 -	9.54E+02 -	1.08E+03 -	1.42E+03 -	9.89E+02 =	**9.44E+02**
	(3.66E+02)	(9.78E+01)	(3.56E+02)	(2.39E+02)	(1.05E+02)	(3.04E+02)	(1.43E+02)	(2.12E+02)
F28	5.75E+02 =	4.62E+02 -	5.79E+02 -	**4.00E+02** =	5.77E+02 +	**4.00E+02** =	**4.00E+02** =	5.16E+02
	(7.08E+02)	(4.40E+02)	(7.25E+02)	(2.87E-13)	(7.13E+02)	(3.57E-13)	(2.93E-13)	(5.78E+02)
-	11	20	21	11	17	13	14	
=	11	6	5	8	3	7	9	
+	6	2	2	9	8	8	5	

Table S6. Error values of CIPDE and seven state-of-the-art DE variants on the 100-dimensional CEC2013 benchmark set over 51 independent runs.

Func.	JADE	SaDE	EPSDE	jDE	CoDE	SHADE	CoBiDE	CIPDE
F1	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F2	3.18E+05 - (7.22E+04)	1.66E+06 - ()3.38E+05)	5.86E+05 - (1.19E+05)	1.66E+06 - (4.74E+05)	9.10E+05 - (2.47E+05)	2.96E+05 - (6.69E+04)	1.17E+06 - (2.80E+05)	**2.48E+05** (5.66E+04)
F3	1.77E+08 + (1.31E+08)	7.82E+08 - (6.73E+08)	9.26E+08 - (2.04E+09)	9.86E+07 + (1.23E+08)	1.57E+08 + (1.15E+08)	**4.84E+07** + (4.18E+07)	1.23E+08 + (1.17E+08)	3.39E+08 (2.99E+08)
F4	1.72E+04 = (3.55E+04)	1.02E+03 - (1.25E+03)	7.06E+03 - (1.58E+04)	4.71E+02 - (4.09E+02)	1.84E+00 - (1.86E+00)	**2.73E-02** = (3.28E-02)	1.53E-01 = (1.02E-01)	2.31E+04 (3.11E+04)
F5	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F6	1.20E+02 = (6.01E+01)	1.08E+02 = (5.38E+01)	**8.43E+01** = (5.07E+01)	2.03E+02 - (3.37E+01)	1.39E+02 - (5.31E+01)	1.43E+02 - (4.93E+01)	1.50E+02 - (4.23E+01)	1.06E+02 (5.89E+01)
F7	7.48E+01 - (1.38E+01)	8.09E+01 - (1.48E+01)	9.62E+01 - (1.89E+01)	**4.49E+01** + (9.74E+00)	6.98E+01 - (1.18E+01)	6.19E+01 = (1.06E+01)	6.38E+01 - (1.50E+01)	6.06E+01 (1.49E+01)
F8	2.13E+01 = (3.87E-02)	2.13E+01 = (2.37E-02)	2.13E+01 = (2.79E-02)	2.13E+01 = (2.75E-02)	**2.12E+01** + (6.32E-02)	**2.12E+01** + (8.15E-02)	2.13E+01 + (3.75E-02)	2.13E+01 (3.78E-02)
F9	1.33E+02 - (2.75E+00)	9.56E+01 + (8.20E+00)	1.44E+02 - (5.27E+00)	1.28E+02 - (3.78E+00)	9.09E+01 + (7.43E+00)	1.37E+02 - (2.52E+00)	**7.70E+01** + (6.76E+00)	1.11E+02 (7.41E+00)
F10	9.52E-02 - (5.63E-02)	1.65E-01 - (9.24E-02)	1.17E-01 - (7.27E-02)	1.47E-01 - (1.03E-01)	8.64E-02 - (4.47E-02)	1.07E-01 - (4.75E-02)	1.43E-01 - (7.58E-02)	**7.06E-02** (4.38E-02)
F11	**0.00E+00** = (0.00E+00)	1.20E+02 - (2.81E+01)	7.09E+01 - (4.80E+01)	**0.00E+00** = (0.00E+00)	2.01E+01 - (5.23E+00)	1.95E-02 - (1.39E-01)	8.72E+00 - (6.78E+00)	**0.00E+00** (0.00E+00)
F12	1.79E+02 = (2.11E+01)	3.38E+02 - (4.71E+01)	6.96E+02 - (5.51E+01)	2.23E+02 - (3.98E+01)	2.96E+02 - (4.32E+01)	**1.35E+02** + (1.84E+01)	2.55E+02 - (4.41E+01)	1.75E+02 (2.17E+01)
F13	4.16E+02 - (4.73E+01)	6.07E+02 - (6.04E+01)	8.08E+02 - (5.16E+01)	4.50E+02 - (5.07E+01)	5.67E+02 - (8.30E+01)	**3.57E+02** = (4.19E+01)	4.74E+02 - (7.52E+01)	3.64E+02 (4.62E+01)
F14	1.30E-01 + (2.40E-02)	1.45E+03 - (3.40E+02)	7.56E+03 - (8.93E+02)	**1.26E-02** + (2.63E-02)	2.13E+02 - (1.26E+02)	6.64E-02 + (1.47E-02)	1.26E+03 - (5.12E+02)	9.38E+00 (3.24E+00)
F15	1.50E+04 - (7.24E+02)	2.09E+04 - (5.61E+03)	3.03E+04 - (6.09E+02)	2.04E+04 - (9.46E+02)	1.44E+04 = (1.25E+03)	1.46E+04 - (7.65E+02)	1.36E+04 - (1.00E+03)	**1.33E+04** (1.36E+03)
F16	2.03E+00 + (4.46E-01)	3.74E+00 = (2.24E-01)	3.95E+00 - (2.62E-01)	3.63E+00 = (3.70E-01)	1.76E+00 + (5.36E-01)	1.83E+00 + (2.25E-01)	**5.02E-01** + (1.89E-01)	3.08E+00 (1.17E+00)
F17	**1.02E+02** + (9.67E-14)	2.06E+02 - (2.03E+01)	2.61E+02 - (2.43E+01)	**1.02E+02** + (1.29E-13)	1.15E+02 - (2.68E+00)	**1.02E+02** + (1.10E-13)	1.92E+02 - (1.91E+01)	**1.02E+02** (1.58E-01)
F18	3.64E+02 - (2.36E+01)	4.60E+02 - (1.97E+02)	9.78E+02 - (5.20E+01)	5.56E+02 - (3.79E+01)	3.53E+02 - (3.91E+01)	3.11E+02 - (1.79E+01)	2.77E+02 - (3.70E+01)	**2.23E+02** (2.11E+01)
F19	8.78E+00 + (1.13E+00)	4.09E+01 - (8.35E+00)	3.76E+01 - (3.87E+00)	**5.57E+00** + (5.24E-01)	9.50E+00 + (2.04E+00)	8.14E+00 + (1.14E+00)	8.93E+00 + (1.34E+00)	1.10E+01 (2.26E+00)
F20	5.00E+01 - (6.29E-06)	5.00E+01 - (3.22E-14)	5.00E+01 - (1.01E-13)	5.00E+01 - (3.55E-07)	4.99E+01 - (2.96E-01)	5.00E+01 - (9.90E-08)	4.99E+01 - (5.13E-01)	**4.95E+01** (4.29E-01)
F21	3.80E+02 + (4.01E+01)	3.96E+02 + (1.96E+01)	3.96E+02 + (1.96E+01)	3.73E+02 + (4.51E+01)	**3.67E+02** + (4.76E+01)	3.86E+02 + (3.48E+01)	3.75E+02 + (4.40E+01)	3.94E+02 (2.38E+01)
F22	**5.37E+01** + (5.46E+01)	9.72E+02 - (4.11E+02)	1.01E+04 - (9.92E+02)	1.36E+02 - (8.50E+01)	2.29E+02 - (1.27E+02)	5.51E+01 + (5.47E+01)	1.04E+03 - (4.31E+02)	6.10E+01 (4.98E+01)
F23	1.71E+04 - (1.06E+03)	1.74E+04 - (4.66E+03)	3.08E+04 - (7.56E+02)	2.09E+04 - (1.04E+03)	1.65E+04 - (1.37E+03)	1.72E+04 - (1.13E+03)	1.57E+04 - (1.73E+03)	**1.45E+04** (1.94E+03)
F24	3.27E+02 = (1.25E+01)	3.88E+02 - (1.51E+01)	3.15E+02 + (5.60E+01)	**2.97E+02** + (1.82E+01)	3.66E+02 - (2.12E+01)	3.05E+02 + (1.38E+01)	3.20E+02 + (1.72E+01)	3.29E+02 (1.52E+01)
F25	6.05E+02 - (1.18E+01)	5.02E+02 + (1.54E+01)	6.26E+02 - (1.28E+01)	**4.59E+02** + (3.93E+01)	4.86E+02 + (2.13E+01)	6.09E+02 - (1.13E+01)	4.64E+02 + (1.84E+01)	5.19E+02 (3.82E+01)
F26	6.12E+02 - (3.01E+01)	4.94E+02 - (1.70E+01)	6.21E+02 - (6.67E+01)	5.24E+02 - (6.73E+01)	4.94E+02 - (2.27E+01)	5.84E+02 - (5.79E+01)	4.71E+02 - (2.35E+01)	**4.50E+02** (3.38E+01)
F27	3.31E+03 - (5.01E+02)	2.34E+03 - (2.25E+02)	2.73E+03 - (1.11E+03)	2.27E+03 - (5.83E+02)	2.36E+03 - (2.21E+02)	2.03E+03 - (6.61E+02)	1.95E+03 = (3.04E+02)	**1.91E+03** (2.84E+02)
F28	3.81E+03 = (1.22E+03)	4.19E+03 - (1.91E+03)	4.02E+03 - (1.58E+03)	**3.38E+03** + (1.07E+03)	3.83E+03 = (1.58E+03)	3.78E+03 = (1.11E+03)	3.44E+03 + (1.07E+03)	3.62E+03 (1.25E+03)
-	12	20	21	14	18	10	15	
=	9	5	5	4	3	8	4	
+	7	3	2	10	7	10	9	

Table S7. Error values of the CIMXDE and CIPDE on the 30 and 50-dimensional CEC2013 benchmark set over 51 independent runs.

Func	CIMXDE ($D = 30$)	CIPDE($D = 30$)	CIMXDE ($D = 50$)	CIPDE($D = 50$)
F1	0.00E+00 =	0.00E+00	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	3.75E+05 -	**1.00E+04**	6.54E+05 -	**2.33E+04**
	(1.57E+05)	(7.54E+03)	(1.94E+05)	(1.32E+04)
F3	**2.18E+05** +	6.76E+05	**1.79E+05** +	5.08E+06
	(5.42E+05)	(1.85E+06)	(5.99E+05)	(9.12E+06)
F4	**2.32E+02** -	5.13E+03	**4.98E+02 -**	8.74E+03
	(1.67E+02)	(9.06E+03)	(2.56E+02)	(1.37E+04)
F5	0.00E+00 =	0.00E+00	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	1.30E+01 -	**0.00E+00**	4.34E+01 =	4.34E+01
	(8.37E+00)	(0.00E+00)	(1.53E-13)	(1.59E-13)
F7	**2.55E-01** +	2.80E+00	**1.75E+00** +	1.83E+01
	(2.91E-01)	(2.37E+00)	(1.59E+00)	(6.62E+00)
F8	2.09E+01 =	2.09E+01	2.11E+01 =	2.11E+01
	(5.03E-02)	(4.05E-02)	(3.22E-02)	(3.59E-02)
F9	**6.65E+00** +	1.93E+01	**1.27E+01** +	4.06E+01
	(1.90E+00)	(3.18E+00)	(3.16E+00)	(4.55E+00)
F10	**1.50E-02** +	6.10E-02	**5.37E-02** +	9.69E-02
	(9.96E-03)	(3.51E-02)	(2.84E-02)	(6.99E-02)
F11	1.46E+01 -	**0.00E+00**	1.87E+01 -	**0.00E+00**
	(1.85E+01)	(0.00E+00)	(5.26E+00)	(0.00E+00)
F12	**8.95E+00** +	1.57E+01	**2.19E+01** +	4.12E+01
	(2.81E+00)	(4.50E+00)	(5.04E+00)	(8.07E+00)
F13	2.10E+01 =	**1.93E+01**	**5.83E+01** +	9.54E+01
	(1.35E+01)	(9.05E+00)	(2.28E+01)	(2.20E+01)
F14	1.14E+03 -	**5.82E-01**	1.54E+03 -	**2.31E+00**
	(6.54E+02)	(4.96E-01)	(8.27E+02)	(1.21E+00)
F15	**2.51E+03** +	2.75E+03	**5.66E+03** +	6.27E+03
	(1.70E+03)	(6.87E+02)	(3.29E+03)	(9.14E+02)
F16	2.46E+00 =	**2.10E+00**	3.43E+00 -	**2.56E+00**
	(2.59E-01)	(7.74E-01)	(2.52E-01)	(1.17E+00)
F17	1.17E+02 -	**3.05E+01**	2.19E+02 -	**5.10E+01**
	(1.57E+01)	(3.05E-02)	(5.18E+01)	(7.50E-02)
F18	1.66E+02 -	**3.96E+01**	3.37E+02 -	**7.14E+01**
	(1.02E+01)	(3.34E+00)	(1.17E+01)	(5.32E+00)
F19	4.36E+00 -	**1.02E+00**	5.14E+00 -	**2.05E+00**
	(2.99E+00)	(1.31E-01)	(3.05E+00)	(2.42E-01)
F20	1.04E+01 -	**9.74E+00**	1.94E+01 -	**1.91E+01**
	(8.61E-01)	(7.23E-01)	(1.29E+00)	(7.28E-01)
F21	**2.89E+02** -	2.90E+02	9.33E+02 -	**8.47E+02**
	(4.11E+01)	(4.82E+01)	(3.35E+02)	(4.09E+02)
F22	1.30E+03 -	**1.11E+02**	1.23E+03 -	**2.47E+01**
	(1.12E+03)	(1.42E+01)	(1.16E+03)	(2.97E+01)
F23	**1.70E+03** +	2.54E+03	**3.79E+03** +	6.05E+03
	(1.10E+03)	(5.59E+02)	(8.97E+02)	(1.02E+03)
F24	**2.00E+02** +	2.07E+02	**2.01E+02** +	2.38E+02
	(1.50E+00)	(4.16E+00)	(5.11E+00)	(8.72E+00)
F25	**2.41E+02** +	2.63E+02	**2.77E+02** +	3.30E+02
	(4.80E+00)	(1.02E+01)	(6.53E+00)	(1.39E+01
F26	2.02E+02 -	**2.00E+02**	2.80E+02 +	2.99E+02
	(1.41E+01)	(8.07E-03)	(4.51E+01)	(7.40E+01)
F27	**3.00E+02** +	4.16E+02	**5.28E+02** +	9.44E+02
	(3.73E-01)	(8.36E+01)	(1.62E+02)	(2.12E+02)
F28	3.00E+02 -	3.00E+02	**4.57E+02** +	5.16E+02
	(2.89E-13)	(4.55E-14)	(4.06E+02)	(5.78E+02)
-	13		11	
=	5		4	
+	10		13	

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Table S8. Error values of the seven CIPDE variants and CIPDE on the 30-dimensional CEC2013 benchmark set over 51 independent runs.

Func	Variant-I	Variant-II	Variant-III	Variant-IV	CIPDE
F1	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	1.61E+04 -	1.53E+04 -	1.80E+04 -	1.02E+04 =	**1.00E+04**
	(1.06E+04)	(9.17E+03)	(1.21E+04)	(8.45E+03)	(7.54E+03)
F3	2.31E+06 =	5.88E+06 -	3.79E+06 =	8.06E+05 =	**6.76E+05**
	(4.67E+06)	(2.78E+07)	(7.56E+06)	(2.15E+06)	(1.85E+06)
F4	1.05E+03 -	3.81E+03 =	9.88E+03 -	**3.71E+02** +	5.13E+03
	(1.77E+03)	(7.05E+03)	(1.23E+04)	(9.72E+02)	(9.06E+03)
F5	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	2.01E-01 -	1.55E+00 -	6.75E-01 -	5.18E-01 =	**0.00E+00**
	(4.06E-01)	(6.28E+00)	(3.68E+00)	(3.70E+00)	(0.00E+00)
F7	4.14E+00 =	1.67E+01 -	5.29E+00 -	3.68E+00 =	**2.80E+00**
	(4.15E+00)	(1.01E+01)	(5.07E+00)	(3.03E+00)	(2.37E+00)
F8	2.09E+01 +	2.09E+01 =	2.09E+01 +	2.09E+01 =	2.09E+01
	(1.25E-01)	(1.08E-01)	(1.37E-01)	(4.80E-02)	(4.05E-02)
F9	2.73E+01 -	1.98E+01 =	**1.87E+01** =	2.78E+01 -	1.93E+01
	(2.43E+00)	(3.09E+00)	(2.77E+00)	(1.82E+00)	(3.18E+00)
F10	6.45E-02 =	6.63E-02 =	6.75E-02 =	6.41E-02 =	**6.10E-02**
	(3.32E-02)	(3.46E-02)	(4.29E-02)	(4.22E-02)	(3.51E-02)
F11	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F12	2.04E+01 -	3.54E+01 -	1.73E+01 =	1.62E+01 =	**1.57E+01**
	(4.23E+00)	(1.04E+01)	(7.27E+00)	(3.48E+00)	(4.50E+00)
F13	3.63E+01 -	6.62E+01 -	**1.62E+01** =	3.06E+01 -	1.93E+01
	(1.02E+01)	(1.76E+01)	(9.53E+00)	(1.08E+01)	(9.05E+00)
F14	**4.08E-03** +	5.06E-02 +	1.14E-02 +	2.99E+00 -	5.82E-01
	(9.33E-03)	(2.77E-02)	(1.27E-02)	(1.26E+00)	(4.96E-01)
F15	3.53E+03 -	3.46E+03 -	**2.53E+03** =	3.19E+03 -	2.75E+03
	(8.70E+02)	(5.96E+02)	(5.85E+02)	(5.81E+02)	(6.87E+02)
F16	2.32E+00 =	**1.26E+00** +	2.13E+00 =	2.44E+00 =	2.10E+00
	(6.54E-01)	(7.30E-01)	(8.11E-01)	(3.00E-01)	(7.74E-01)
F17	**3.04E+01** +	**3.04E+01** +	**3.04E+01** +	3.06E+01 -	3.05E+01
	(3.28E-14)	(2.44E-14)	(2.27E-14)	(6.56E-02)	(3.05E-02)
F18	6.44E+01 -	6.30E+01 -	4.00E+01 =	6.90E+01 -	**3.96E+01**
	(8.13E+00)	(9.91E+00)	(3.96E+00)	(1.47E+01)	(3.34E+00)
F19	1.73E+00 -	1.09E+00 =	1.07E+00 =	1.60E+00 -	**1.02E+00**
	(2.15E-01)	(1.94E-01)	(1.88E-01)	(1.63E-01)	(1.31E-01)
F20	1.01E+01 -	1.13E+01 -	9.85E+00 =	9.89E+00 =	**9.74E+00**
	(4.91E-01)	(1.51E+00)	(5.31E-01)	(4.68E-01)	(7.23E-01)
F21	2.90E+02 =	**2.73E+02** -	2.77E+02 =	2.94E+02 =	2.90E+02
	(3.00E+01)	(4.51E+01)	(4.99E+01)	(4.46E+01)	(4.82E+01)
F22	**1.07E+02** +	1.13E+02 +	**1.07E+02** +	1.15E+02 -	1.11E+02
	(1.96E+00)	(6.27E+01)	(2.11E+00)	(1.64E+01)	(1.42E+01)
F23	3.20E+03 -	3.47E+03 -	2.64E+03 =	3.01E+03 -	**2.54E+03**
	(6.05E+02)	(6.67E+02)	(7.06E+02)	(4.24E+02)	(5.59E+02)
F24	2.09E+02 -	2.32E+02 -	2.21E+02 -	2.09E+02 -	**2.07E+02**
	(4.11E+00)	(1.33E+01)	(7.53E+00)	(5.24E+00)	(4.16E+00)
F25	2.86E+02 -	**2.61E+02** =	2.69E+02 =	2.69E+02 =	2.63E+02
	(4.82E+00)	(8.59E+00)	(7.44E+00)	(1.57E+01)	(1.02E+01)
F26	2.00E+02 -	2.00E+02 -	2.00E+02 -	2.00E+02 =	2.00E+02
	(2.14E-01)	(4.41E-02)	(8.06E-02)	(6.55E-02)	(8.07E-03)
F27	6.32E+02 -	7.43E+02 -	5.62E+02 -	**3.79E+02** +	4.16E+02
	(2.52E+02)	(1.28E+02)	(6.45E+01)	(5.69E+01)	(8.36E+01)
F28	3.00E+02 =	3.00E+02 -	3.00E+02 =	3.00E+02 =	3.00E+02
	(0.00E+00)	(3.44E-13)	(6.43E-14)	(0.00E+00)	(4.55E-14)
-	15	15	8	11	
=	9	9	16	15	
+	4	4	4	2	

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Table S9. Error values of the seven CIPDE variants and CIPDE on the 30-dimensional CEC2013 benchmark set over 51 independent runs.

Func	Variant-V	Variant-VI	Variant-VII	CIPDE
F1	0.00E+00=	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	1.38E+04 -	1.02E+04 =	1.19E+04 =	**1.00E+04**
	(1.16E+04)	(6.60E+03)	(8.39E+03)	(7.54E+03)
F3	1.40E+06 -	1.46E+06 =	8.35E+05 =	**6.76E+05**
	(4.62E+06)	(3.59E+06)	(2.94E+06)	(1.85E+06)
F4	4.77E+03=	**2.03E+03** =	9.07E+03 -	5.13E+03
	(8.06E+03)	(4.29E+03)	(1.38E+04)	(9.06E+03)
F5	0.00E+00=	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	2.17E+00 -	1.04E+00 -	5.26E-02 -	**0.00E+00**
	(7.16E+00)	(5.18E+00)	(3.26E-01)	(0.00E+00)
F7	1.57E+01 -	2.93E+00 =	2.88E+00 =	**2.80E+00**
	(8.27E+00)	(2.31E+00)	(2.05E+00)	(2.37E+00)
F8	2.09E+01=	2.09E+01 +	2.09E+01 =	2.09E+01
	(9.02E-02)	(7.33E-02)	(4.66E-02)	(4.05E-02)
F9	**1.86E+01**=	1.97E+01 =	2.82E+01 -	1.93E+01
	(2.97E+00)	(2.54E+00)	(2.24E+00)	(3.18E+00)
F10	6.62E-02 =	6.55E-02 =	6.62E-02 =	**6.10E-02**
	(3.91E-02)	(3.56E-02)	(4.38E-02)	(3.51E-02)
F11	0.00E+00=	0.00E+00 =	0.00E+00 =	**0.00E+00**
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F12	2.61E+01 -	2.06E+01 -	**1.12E+01** +	1.57E+01
	(8.63E+00)	(6.93E+00)	(2.78E+00)	(4.50E+00)
F13	4.91E+01 -	3.46E+01 -	**1.57E+01** +	1.93E+01
	(1.91E+01)	(1.23E+01)	(7.87E+00)	(9.05E+00)
F14	**4.90E-02** +	7.19E-01 -	6.64E+01 -	5.82E-01
	(3.19E-02)	(5.81E-01)	(2.91E+01)	(4.96E-01)
F15	2.69E+03=	3.12E+03 -	**2.64E+03** =	2.75E+03
	(6.31E+02)	(6.01E+02)	(4.36E+02)	(6.87E+02)
F16	2.08E+00=	**1.84E+00** =	2.24E+00 =	2.10E+00
	(9.20E-01)	(8.24E-01)	(5.86E-01)	(7.74E-01)
F17	**3.04E+01**+	3.05E+01 =	3.18E+01 -	3.05E+01
	(3.24E-14)	(4.67E-02)	(3.39E-01)	(3.05E-02)
F18	5.51E+01 -	5.64E+01 -	4.52E+01 -	**3.96E+01**
	(8.62E+00)	(2.23E+01)	(6.65E+00)	(3.34E+00)
F19	1.12E+00 -	1.05E+00 =	1.64E+00 -	**1.02E+00**
	(1.62E-01)	(1.58E-01)	(1.93E-01)	(1.31E-01)
F20	1.02E+01 -	1.03E+01 -	9.98E+00 -	**9.74E+00**
	(6.99E-01)	(6.66E-01)	(5.75E-01)	(7.23E-01)
F21	2.93E+02 -	2.94E+02 =	3.01E+02 -	**2.90E+02**
	(5.28E+01)	(4.46E+01)	(4.51E+01)	(4.82E+01)
F22	1.15E+02+	1.15E+02 =	1.86E+02 -	**1.11E+02**
	(5.21E+01)	(1.52E+01)	(2.76E+01)	(1.42E+01)
F23	2.88E+03 -	3.22E+03 -	2.56E+03 =	**2.54E+03**
	(5.74E+02)	(6.75E+02)	(5.87E+02)	(5.59E+02)
F24	2.27E+02 -	2.10E+02 -	2.09E+02 -	**2.07E+02**
	(1.38E+01)	(5.60E+00)	(4.75E+00)	(4.16E+00)
F25	**2.60E+02**=	2.64E+02 =	2.76E+02 -	2.63E+02
	(9.10E+00)	(1.11E+01)	(1.53E+01)	(1.02E+01)
F26	2.03E+02=	2.02E+02 =	2.02E+02 -	**2.00E+02**
	(1.91E+01)	(1.61E+01)	(1.48E+01)	(8.07E-03)
F27	6.91E+02 -	4.69E+02 =	4.33E+02 =	**4.16E+02**
	(1.15E+02)	(1.44E+02)	(1.01E+02)	(8.36E+01)
F28	3.00E+02 -	3.00E+02 =	3.00E+02 -	3.00E+02
	(3.02E-13)	(0.00E+00)	(1.91E-13)	(4.55E-14)
-	14	9	14	
=	11	18	12	
+	3	1	2	

Table S10. Error values of the seven CIPDE variants and CIPDE on the 50-dimensional CEC2013 benchmark set over 51 independent runs.

Func	Variant-I	Variant-II	Variant-III	Variant-IV	CIPDE
F1	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	5.85E+04 -	4.60E+04 -	4.93E+04 -	**2.25E+04** =	2.33E+04
	(2.55E+04)	(3.34E+04)	(2.60E+04)	(1.40E+04)	(1.32E+04)
F3	6.93E+06 =	2.96E+07 -	6.39E+06 =	5.91E+06 =	**5.08E+06**
	(1.70E+07)	(7.36E+07)	(1.16E+07)	(1.91E+07)	(9.12E+06)
F4	5.01E+02 -	1.04E+04 =	2.13E+04 -	**2.35E+02** +	8.74E+03
	(1.16E+03)	(1.49E+04)	(1.83E+04)	(8.30E+02)	(1.37E+04)
F5	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	4.34E+01 =	4.44E+01 -	4.34E+01 =	4.34E+01 +	4.34E+01
	(3.97E-05)	(5.40E+00)	(5.60E-05)	(1.73E-13)	(1.59E-13)
F7	2.48E+01 -	4.70E+01 -	2.63E+01 -	2.07E+01 =	**1.83E+01**
	(1.14E+01)	(1.18E+01)	(1.32E+01)	(8.06E+00)	(6.62E+00)
F8	2.11E+01 =	2.11E+01 =	2.11E+01 =	2.11E+01 =	2.11E+01
	(9.76E-02)	(1.00E-01)	(6.35E-02)	(3.83E-02)	(3.59E-02)
F9	5.61E+01 -	4.31E+01 -	4.08E+01 =	5.61E+01 -	**4.06E+01**
	(2.28E+00)	(5.32E+00)	(4.41E+00)	(2.99E+00)	(4.55E+00)
F10	6.97E-02 =	8.66E-02 =	**5.90E-02** +	7.80E-02 =	9.69E-02
	(4.08E-02)	(5.43E-02)	(3.01E-02)	(4.67E-02)	(6.99E-02)
F11	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F12	4.92E+01 -	8.14E+01 -	5.03E+01 -	4.18E+01 =	**4.12E+01**
	(8.19E+00)	(1.82E+01)	(1.42E+01)	(8.27E+00)	(8.07E+00)
F13	1.09E+02 -	1.68E+02 -	**9.24E+01** =	9.52E+01 =	9.54E+01
	(1.94E+01)	(3.48E+01)	(2.04E+01)	(2.10E+01)	(2.20E+01)
F14	1.80E-02 +	6.81E-02 +	**1.72E-02** +	8.72E+00 -	2.31E+00
	(1.20E-02)	(2.71E-02)	(1.13E-02)	(3.03E+00)	(1.21E+00)
F15	7.12E+03 -	6.67E+03 -	**6.27E+03** =	6.92E+03 -	**6.27E+03**
	(1.07E+03)	(9.56E+02)	(7.85E+02)	(8.29E+02)	(9.14E+02)
F16	2.89E+00 =	**1.88E+00** +	2.42E+00 =	3.27E+00 -	2.56E+00
	(1.07E+00)	(9.77E-01)	(1.27E+00)	(3.39E-01)	(1.17E+00)
F17	**5.08E+01** +	**5.08E+01** +	**5.08E+01** +	5.12E+01 -	5.10E+01
	(5.88E-14)	(5.99E-14)	(5.27E-14)	(9.12E-02)	(7.50E-02)
F18	1.15E+02 -	1.28E+02 -	**7.08E+01** =	1.22E+02 -	7.14E+01
	(1.37E+01)	(2.27E+01)	(6.63E+00)	(3.05E+01)	(5.32E+00)
F19	3.21E+00 -	2.43E+00 -	**1.87E+00** +	3.16E+00 -	2.05E+00
	(3.76E-01)	(4.52E-01)	(2.22E-01)	(3.38E-01)	(2.42E-01)
F20	1.90E+01 =	1.97E+01 -	**1.89E+01** =	1.90E+01 =	1.91E+01
	(6.71E-01)	(9.98E-01)	(9.19E-01)	(8.05E-01)	(7.28E-01)
F21	**6.52E+02** +	8.30E+02 -	7.87E+02 =	9.24E+02 +	8.47E+02
	(4.66E+02)	(4.03E+02)	(4.27E+02)	(2.97E+02)	(4.09E+02)
F22	**1.16E+01** +	1.38E+02 -	1.19E+01 +	4.19E+01 -	2.47E+01
	(7.27E-01)	(9.60E+01)	(1.50E+00)	(5.20E+01)	(2.97E+01)
F23	6.68E+03 -	7.27E+03 -	6.39E+03 -	6.38E+03 =	**6.05E+03**
	(7.55E+02)	(1.10E+03)	(9.48E+02)	(8.79E+02)	(1.02E+03)
F24	**2.35E+02** =	2.82E+02 -	2.49E+02 -	2.39E+02 =	2.38E+02
	(1.32E+01)	(2.06E+01)	(1.49E+01)	(9.32E+00)	(8.72E+00)
F25	3.70E+02 -	3.32E+02 =	3.43E+02 -	3.36E+02 =	**3.30E+02**
	(5.90E+00)	(1.70E+01)	(1.39E+01)	(3.00E+01)	(1.39E+01)
F26	2.16E+02 +	3.57E+02 -	**2.11E+02** +	3.00E+02 =	2.99E+02
	(5.04E+01)	(8.80E+01)	(3.84E+01)	(5.55E+01)	(7.40E+01)
F27	1.40E+03 -	1.36E+03 -	1.18E+03 -	9.54E+02 =	**9.44E+02**
	(3.98E+02)	(2.00E+02)	(1.37E+02)	(2.41E+02)	(2.12E+02)
F28	**4.00E+02** =	7.56E+02 -	**4.00E+02** =	**4.00E+02** =	5.16E+02
	(2.84E-13)	(9.84E+02)	(2.87E-13)	(2.87E-13)	(5.78E+02)
-	12	18	8	8	
=	11	7	14	17	
+	5	3	6	3	

Table S11. Error values of the seven CIPDE variants and CIPDE on the 50-dimensional CEC2013 benchmark set over 51 independent runs.

Func	Variant-V	Variant-VI	Variant-VII	CIPDE
F1	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	5.34E+04 -	2.64E+04 =	3.16E+04 -	**2.33E+04**
	(3.80E+04)	(1.45E+04)	(1.63E+04)	(1.32E+04)
F3	2.40E+07 -	3.83E+06 =	**2.92E+06** =	5.08E+06
	(4.96E+07)	(6.48E+06)	(7.97E+06)	(9.12E+06)
F4	1.19E+04 -	9.72E+03 =	1.47E+04 -	**8.74E+03**
	(1.57E+04)	(1.52E+04)	(2.14E+04)	(1.37E+04)
F5	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	4.37E+01 -	**4.34E+01** =	**4.34E+01** =	**4.34E+01**
	(1.12E+00)	(1.61E-13)	(1.44E-13)	(1.59E-13)
F7	4.68E+01 -	2.13E+01 =	1.88E+01 =	**1.83E+01**
	(1.39E+01)	(7.42E+00)	(7.43E+00)	(6.62E+00)
F8	2.11E+01 =	2.11E+01 =	2.11E+01 =	2.11E+01
	(7.46E-02)	(4.11E-02)	(3.53E-02)	(3.59E-02)
F9	**4.06E+01** =	4.21E+01 =	4.69E+01 -	**4.06E+01**
	(6.46E+00)	(4.97E+00)	(6.65E+00)	(4.55E+00)
F10	9.29E-02 =	**9.07E-02** =	9.24E-02 =	9.69E-02
	(6.45E-02)	(5.76E-02)	(6.05E-02)	(6.99E-02)
F11	**0.00E+00** =	**0.00E+00** =	7.55E-02 -	**0.00E+00**
	(0.00E+00)	(0.00E+00)	(2.28E-01)	(0.00E+00)
F12	7.25E+01 -	4.82E+01 -	**3.53E+01** +	4.12E+01
	(1.82E+01)	(1.44E+01)	(5.16E+00)	(8.07E+00)
F13	1.51E+02 -	1.04E+02 -	**8.93E+01** =	9.54E+01
	(3.33E+01)	(2.28E+01)	(1.98E+01)	(2.20E+01)
F14	**5.98E-02** +	2.76E+00 =	1.75E+02 -	2.31E+00
	(2.74E-02)	(1.37E+00)	(9.44E+01)	(1.21E+00)
F15	6.53E+03 =	6.79E+03 -	6.35E+03 =	**6.27E+03**
	(9.05E+02)	(1.21E+03)	(6.95E+02)	(9.14E+02)
F16	2.59E+00 =	2.63E+00 =	2.99E+00 =	**2.56E+00**
	(1.09E+00)	(1.03E+00)	(7.17E-01)	(1.17E+00)
F17	**5.08E+01** +	5.10E+01 =	5.43E+01 -	5.10E+01
	(5.98E-14)	(8.77E-02)	(7.65E-01)	(7.50E-02)
F18	1.11E+02 -	9.42E+01 -	8.45E+01 -	**7.14E+01**
	(1.64E+01)	(3.34E+01)	(8.62E+00)	(5.32E+00)
F19	2.41E+00 -	**2.04E+00** =	3.16E+00 -	2.05E+00
	(4.13E-01)	(3.40E-01)	(3.90E-01)	(2.42E-01)
F20	1.95E+01 -	**1.90E+01** =	**1.90E+01** =	1.91E+01
	(8.69E-01)	(8.15E-01)	(8.33E-01)	(7.28E-01)
F21	**7.70E+02** =	7.74E+02 =	8.38E+02 =	8.47E+02
	(4.19E+02)	(3.77E+02)	(3.76E+02)	(4.09E+02)
F22	1.28E+02 =	**2.46E+01** =	2.38E+02 -	2.47E+01
	(9.97E+01)	(2.98E+01)	(9.64E+01)	(2.97E+01)
F23	6.44E+03 =	6.65E+03 -	6.12E+03 =	**6.05E+03**
	(1.05E+03)	(1.08E+03)	(1.04E+03)	(1.02E+03)
F24	2.77E+02 -	**2.38E+02** =	2.39E+02 =	**2.38E+02**
	(1.79E+01)	(8.36E+00)	(9.41E+00)	(8.72E+00)
F25	**3.25E+02** =	3.31E+02 =	3.52E+02 -	3.30E+02
	(1.54E+01)	(1.71E+01)	(2.66E+01)	(1.39E+01)
F26	3.88E+02 -	3.14E+02 =	**2.67E+02** +	2.99E+02
	(4.00E+01)	(7.50E+01)	(7.08E+01)	(7.40E+01)
F27	1.25E+03 -	9.37E+02 =	**8.78E+02** =	9.44E+02
	(1.59E+02)	(2.29E+02)	(1.94E+02)	(2.12E+02)
F28	8.15E+02 -	**4.59E+02** -	**4.59E+02** =	5.16E+02
	(1.05E+03)	(4.22E+02)	(4.24E+02)	(5.78E+02)
-	14	6	10	
=	12	22	16	
+	2	0	2	

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Table S12 Complexity (in seconds) of the compared algorithms in the 30-dimensional case.

D	Algorithm	T_0	T_1	T_2	$(T_2 - T_1)/ T_0$
	DE/current-to-best/1/bin		2.4100	3.3951	**8.8588**
	DE/current-to-pbest/1/bin		2.4414	3.4949	9.4739
	DE/current-to-gr_best/1/bin		2.4055	3.8073	12.6061
	CIMDE		2.3942	4.3121	17.2473
	CIMXDE		2.4331	4.4468	18.1088
	CIPDE		2.4451	4.5960	19.3426
30	JADE	0.1112	2.4200	3.7526	11.9838
	SaDE		2.4041	4.3866	17.8282
	EPSDE		2.4302	7.7306	47.6655
	jDE		2.4949	3.5557	9.5396
	CoDE		2.3973	6.6730	38.4505
	SHADE		2.4441	5.4667	27.1817
	CoBiDE		2.4222	6.0329	32.4703
	Variant-VII		2.4468	6.5506	36.9047

Table S13. Complexity (in seconds) of the compared algorithms in the 50-dimensional case.

D	Algorithm	T_0	T_1	T_2	$(T_2 - T_1)/ T_0$
	DE/current-to-best/1/bin		3.2988	4.5486	**11.2392**
	DE/current-to-pbest/1/bin		3.3378	4.6487	11.7887
	DE/current-to-gr_best/1/bin		3.3406	4.9885	14.8192
	CIMDE		3.2851	5.6785	21.5234
	CIMXDE		3.3129	5.7349	21.7806
	CIPDE		3.2934	5.8848	23.3040
50	JADE	0.1112	3.3014	4.9142	14.5036
	SaDE		3.3177	5.5370	19.9577
	EPSDE		3.3138	8.9679	50.8462
	jDE		3.3770	4.6844	11.7572
	CoDE		3.3214	8.0760	42.7572
	SHADE		3.3263	6.5384	28.8858
	CoBiDE		3.3221	8.4007	45.6709
	Variant-VII		3.3690	8.0063	41.7023

Table S14. Average CPU time (in seconds) cost by the compared algorithms on the 30-dimensional functions F2, F9 and F27 over 5 independent runs.

D	Algorithm	F2	F9	F27
	DE/current-to-best/1/bin	4.8965	66.3432	77.6688
	DE/current-to-pbest/1/bin	5.2000	66.8526	77.8622
	DE/current-to-gr_best/1/bin	5.4370	67.0030	78.4915
	CIMDE	7.1951	68.4145	79.9689
	CIMXDE	6.6984	68.5498	79.5446
	CIPDE	7.2562	69.1789	80.2242
30	JADE	5.7670	66.9743	78.1771
	SaDE	7.1557	68.8656	80.8761
	EPSDE	11.6798	73.2372	85.4304
	jDE	4.8127	66.8889	77.7142
	CoDE	8.1948	69.7916	81.4511
	SHADE	7.6882	69.7605	80.6736
	CoBiDE	7.1512	68.8203	80.2277
	Variant-VII	7.9483	70.1827	81.1043

Table S15. Error values of CIPDE with different T values on the 30-dimensional CEC2013 benchmark set over 51 independent runs.

Func	$T = 10$	$T = 50$	$T = 130$	$T = 170$	CIPDE ($T = 90$)
F1	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F2	9.63E+03 = (7.39E+03)	9.72E+03 = (6.81E+03)	**9.51E+03** = (6.59E+03)	9.79E+03 = (6.98E+03)	1.00E+04 (7.54E+03)
F3	1.10E+06 = (3.23E+06)	8.04E+05 = (2.93E+06)	1.47E+06 = (3.45E+06)	**5.65E+05** = (1.79E+06)	6.76E+05 (1.85E+06)
F4	1.15E+04 - (9.05E+03)	1.01E+04 = (1.13E+04)	3.50E+03 = (7.45E+03)	**2.90E+03** = (7.11E+03)	5.13E+03 (9.06E+03)
F5	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 = (0.00E+00)	0.00E+00 (0.00E+00)
F6	**0.00E+00** = (0.00E+00)	7.82E-02 = (5.58E-01)	5.18E-01 = (3.70E+00)	1.66E-09 = (1.19E-08)	**0.00E+00** (0.00E+00)
F7	1.54E+01 - (8.43E+00)	3.93E+00 - (3.13E+00)	3.01E+00 = (2.57E+00)	2.95E+00 = (2.42E+00)	**2.80E+00** (2.37E+00)
F8	2.09E+01 = (5.49E-02)	2.09E+01 = (4.94E-02)	2.09E+01 = (4.90E-02)	2.09E+01 = (6.55E-02)	2.09E+01 (4.05E-02)
F9	**1.50E+01** + (3.88E+00)	1.90E+01 = (3.43E+00)	1.94E+01 = (3.77E+00)	1.91E+01 = (3.26E+00)	1.93E+01 (3.18E+00)
F10	6.65E-02 =- (3.42E-02)	6.07E-02 = (3.41E-02)	7.42E-02 = (5.09E-02)	**6.02E-02** = (3.54E-02)	6.10E-02 (3.51E-02)
F11	5.13E+00 - (2.95E+00)	**0.00E+00** = (0.00E+00)	**0.00E+00** = (0.00E+00)	**0.00E+00** = (0.00E+00)	**0.00E+00** (0.00E+00)
F12	1.63E+01 = (4.86E+00)	**1.51E+01** = (4.70E+00)	1.63E+01 = (4.83E+00)	1.56E+01 = (3.72E+00)	1.57E+01 (4.50E+00)
F13	4.28E+01 - (1.97E+01)	2.71E+01 - (1.26E+01)	2.28E+01 = (1.13E+01)	2.58E+01 - (1.02E+01)	**1.93E+01** (9.05E+00)
F14	5.31E+02 - (1.95E+02)	**2.38E-01** + (1.72E-01)	2.26E+00 - (1.29E+00)	6.05E+00 - (2.59E+00)	5.82E-01 (4.96E-01)
F15	3.10E+03 - (7.35E+02)	2.80E+03 = (6.85E+02)	**2.63E+03** = (6.02E+02)	2.67E+03 = (4.71E+02)	2.75E+03 (6.87E+02)
F16	2.09E+00 = (6.56E-01)	2.08E+00 = (6.72E-01)	**2.06E+00** = (7.31E-01)	2.24E+00 = (5.60E-01)	2.10E+00 (7.74E-01)
F17	3.72E+01 - (2.79E+00)	**3.04E+01** + (4.75E-03)	3.06E+01 - (6.65E-02)	3.07E+01 - (9.35E-02)	3.05E+01 (3.05E-02)
F18	4.42E+01 - (1.04E+01)	3.98E+01 = (4.66E+00)	3.97E+01 = (3.99E+00)	4.04E+01 = (3.50E+00)	**3.96E+01** (3.34E+00)
F19	2.22E+00 - (4.58E-01)	1.14E+00 - (1.89E-01)	9.88E-01 = (1.23E-01)	**9.80E-01** = (1.65E-01)	1.02E+00 (1.31E-01)
F20	1.06E+01 - (6.64E-01)	1.01E+01 - (7.90E-01)	1.01E+01 - (6.32E-01)	9.80E+00 = (6.30E-01)	**9.74E+00** (7.23E-01)
F21	2.89E+02 - (4.11E+01)	**2.83E+02** = (4.61E+01)	2.97E+02 = (4.92E+01)	2.92E+02 = (4.64E+01)	2.90E+02 (4.82E+01)
F22	3.66E+02 - (1.89E+02)	**1.08E+02** = (2.37E+01)	1.17E+02 - (2.96E+01)	1.18E+02 - (2.04E+01)	1.11E+02 (1.42E+01)
F23	3.44E+03 - (7.49E+02)	2.50E+03 = (5.74E+02)	**2.47E+03** = (7.12E+02)	2.69E+03 = (7.03E+02)	2.54E+03 (5.59E+02)
F24	2.16E+02 = (5.99E+00)	2.08E+02 = (5.01E+00)	2.09E+02 = (4.45E+00)	2.10E+02 - (5.14E+00)	**2.07E+02** (4.16E+00)
F25	**2.57E+02** + (7.57E+00)	2.59E+02 + (1.10E+01)	2.61E+02 = (8.51E+00)	2.61E+02 = (1.03E+01)	2.63E+02 (1.02E+01)
F26	2.05E+02 = (2.30E+01)	2.04E+02 = (2.13E+01)	**2.00E+02** = (7.49E-02)	2.02E+02 = (1.49E+01)	**2.00E+02** (8.07E-03)
F27	4.88E+02 - (8.76E+01)	4.25E+02 = (1.06E+02)	4.34E+02 = (9.73E+01)	4.33E+02 = (9.57E+01)	**4.16E+02** (8.36E+01)
F28	3.00E+02 - (2.17E-13)	3.00E+02 = (8.51E-14)	3.00E+02 = (7.19E-14)	3.00E+02 = (9.65E-14)	3.00E+02 (4.55E-14)
-	16	4	4	5	
=	10	21	24	23	
+	2	3	0	0	

Table S16. Error values of CIPDE with different *NP* values on the 30-dimensional CEC2013 benchmark set over 51 independent runs.

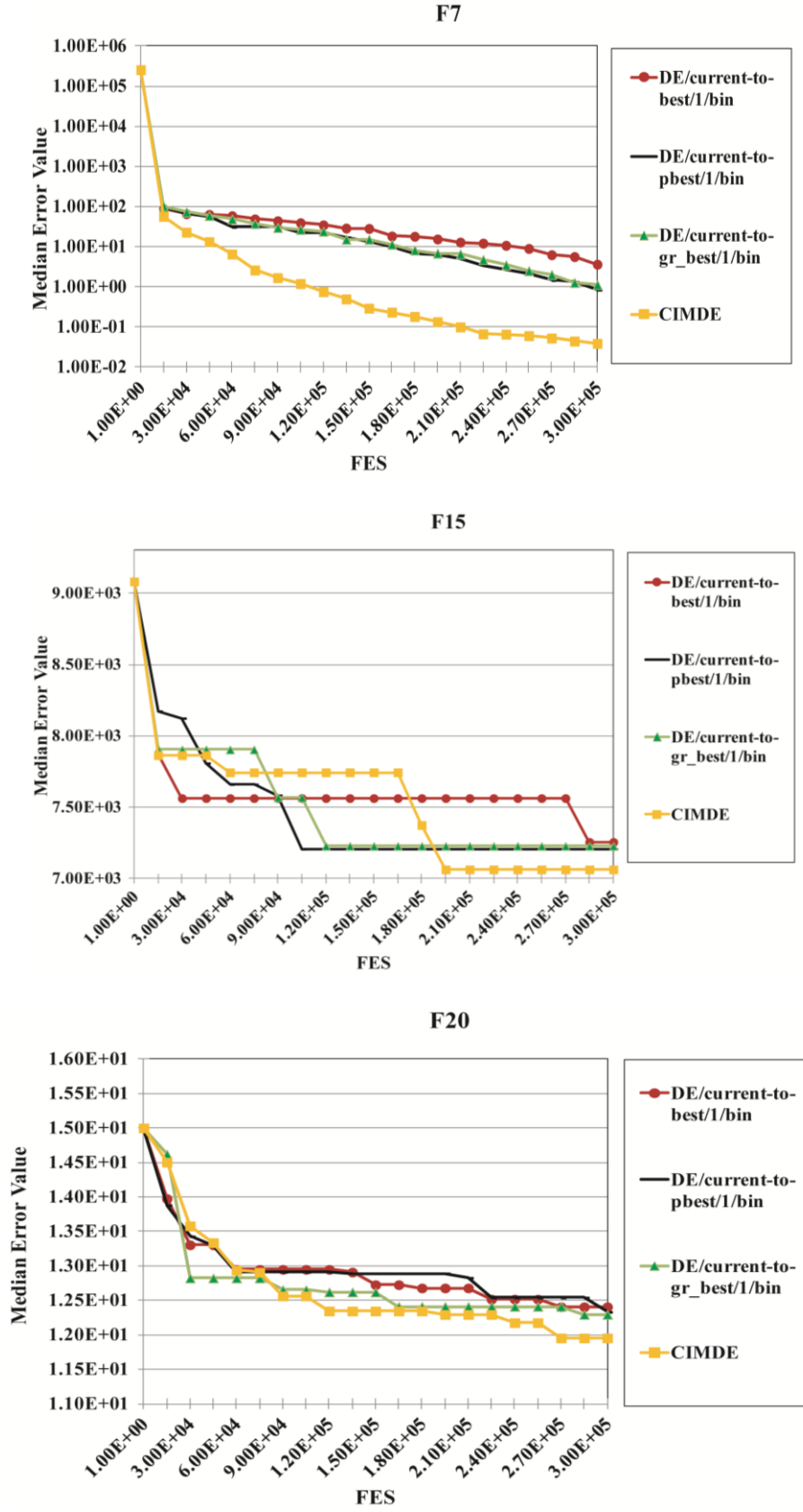|	*NP* = 50	*NP* = 150	*NP* = 200	*NP* = 250	CIPDE (*NP* = 100)
F1	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F2	8.44E+03 =	7.88E+03 +	5.49E+03 +	**2.06E+03** +	1.00E+04
	(6.93E+03)	(7.89E+03)	(4.56E+03)	(2.88E+03)	(7.54E+03)
F3	3.14E+06 -	9.23E+04 =	2.84E+05 =	**8.06E+03** +	6.76E+05
	(7.76E+06)	(5.63E+05)	(8.86E+05)	(5.73E+04)	(1.85E+06)
F4	7.82E+03 -	7.61E+03 =	5.77E+03 =	5.98E+03 =	**5.13E+03**
	(1.20E+04)	(1.01E+04)	(8.94E+03)	(8.32E+03)	(9.06E+03)
F5	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00 =	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
F6	1.38E+00 -	1.58E+00 -	6.51E-01 -	2.27E+00 -	**0.00E+00**
	(3.73E+00)	(6.27E+00)	(3.79E+00)	(1.93E+00)	(0.00E+00)
F7	1.45E+01 -	1.44E+00 +	1.13E+00 +	**6.70E-01** +	2.80E+00
	(8.12E+00)	(1.54E+00)	(8.66E-01)	(3.45E-01)	(2.37E+00)
F8	**2.09E+01** =	**2.09E+01** =	**2.09E+01** =	2.10E+01 =	**2.09E+01**
	(5.94E-02)	(5.27E-02)	(6.51E-02)	(3.66E-02)	(4.05E-02)
F9	2.10E+01 -	1.98E+01 =	1.94E+01 =	1.98E+01 =	**1.93E+01**
	(3.51E+00)	(2.91E+00)	(2.51E+00)	(2.77E+00)	(3.18E+00)
F10	1.03E-01 -	5.53E-02 =	**4.80E-02** =	5.26E-02 =	6.10E-02
	(7.33E-02)	(3.61E-02)	(2.80E-02)	(2.76E-02)	(3.51E-02)
F11	**0.00E+00** =	**0.00E+00** =	2.29E-08 -	3.90E-01 -	**0.00E+00**
	(0.00E+00)	(0.00E+00)	(4.84E-08)	(5.41E-01)	(0.00E+00)
F12	2.21E+01 -	1.24E+01 +	**1.11E+01** +	1.92E+01 -	1.57E+01
	(6.04E+00)	(5.05E+00)	(5.82E+00)	(4.24E+00)	(4.50E+00)
F13	4.38E+01 -	1.38E+01 +	**1.19E+01** +	1.66E+01 =	1.93E+01
	(1.85E+01)	(7.47E+00)	(6.77E+00)	(6.08E+00)	(9.05E+00)
F14	**9.51E-02** +	8.80E+00 -	4.26E+01 -	2.34E+02 -	5.82E-01
	(3.84E-02)	(3.22E+00)	(1.00E+01)	(6.90E+01	(4.96E-01)
F15	3.06E+03 -	**2.53E+03** =	2.54E+03 =	2.70E+03 =	2.75E+03
	(5.94E+02)	(5.75E+02)	(5.27E+02)	(5.28E+02)	(6.87E+02)
F16	**1.91E+00** =	2.08E+00 =	2.24E+00 =	2.32E+00 =	2.10E+00
	(8.38E-01)	(8.36E-01)	(6.42E-01)	(4.82E-01)	(7.74E-01)
F17	**3.04E+01** +	3.09E+01 -	3.20E+01 -	3.61E+01 -	3.05E+01
	(6.49E-05)	(1.55E-01)	(3.20E-01)	(1.01E+00)	(3.05E-02)
F18	4.62E+01 -	4.16E+01 **-**	4.35E+01 -	5.83E+01 -	**3.96E+01**
	(9.10E+00)	(6.13E+00)	(5.49E+00)	(1.05E+01)	(3.34E+00)
F19	1.13E+00 -	1.12E+00 -	1.23E+00 -	1.87E+00 -	**1.02E+00**
	(2.15E-01)	(1.76E-01)	(1.94E-01)	(2.16E-01)	(1.31E-01)
F20	1.02E+01 -	9.66E+00 =	9.54E+00 =	**9.50E+00** =	9.74E+00
	(6.65E-01)	(6.19E-01)	(5.28E-01)	(5.23E-01)	(7.23E-01)
F21	3.00E+02 =	2.94E+02 =	3.00E+02 =	**2.88E+02** =	2.90E+02
	(7.94E+01)	(2.38E+01)	(5.88E+01)	(3.25E+01)	(4.82E+01)
F22	**1.11E+02** +	1.25E+02 -	1.49E+02 -	3.12E+02 -	**1.11E+02**
	(3.79E+00)	(4.37E+00)	(7.90E+00)	(4.68E+01)	(1.42E+01)
F23	3.10E+03 -	2.43E+03 =	**2.23E+03** +	2.60E+03 =	2.54E+03
	(5.26E+02)	(6.18E+02)	(4.76E+02)	(4.99E+02)	(5.59E+02)
F24	2.20E+02 -	2.06E+02 =	2.07E+02 =	**2.01E+02** +	2.07E+02
	(7.44E+00)	(5.12E+00)	(4.72E+00)	(9.88E-01)	(4.16E+00)
F25	2.63E+02 =	**2.59E+02** =	2.61E+02 =	2.62E+02 =	2.63E+02
	(1.03E+01)	(8.09E+00)	(9.35E+00)	(8.95E+00)	(1.02E+01)
F26	2.32E+02 =	2.02E+02 =	2.04E+02 +	**2.00E+02** +	**2.00E+02**
	(5.55E+01)	(1.45E+01)	(1.98E+01)	(2.35E-04)	(8.07E-03)
F27	5.85E+02 -	3.85E+02 +	3.40E+02 +	**3.26E+02** +	4.16E+02
	(1.42E+02)	(9.21E+01)	(4.82E+01)	(4.58E+01)	(8.36E+01)
F28	3.00E+02 -	3.00E+02 =	3.00E+02 =	3.00E+02 -	3.00E+02
	(2.04E-13)	(0.00E+00)	(0.00E+00)	(9.09E-14)	(4.55E-14)
-	16	6	7	9	
=	9	17	14	13	
+	3	5	7	6	

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Fig. S1. The median error values versus function evaluations (FES) obtained by the four compared mutation strategies on three 30-dimensional functions F7, F15 and F20.
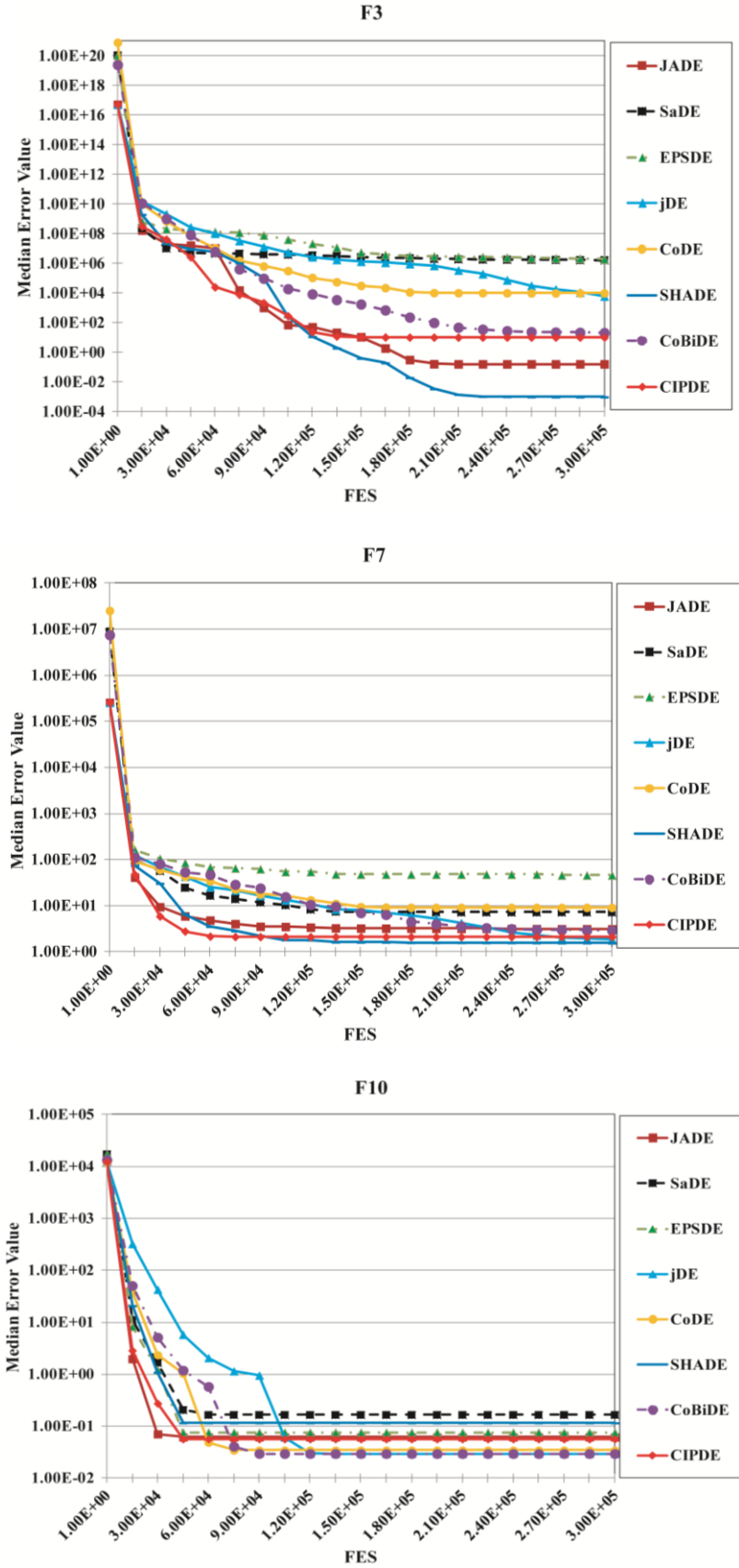
Fig. S2. The median error values versus function evaluations (FES) obtained by JADE, SaDE, EPSDE, jDE, CoDE, SHADE, CoBiDE and CIPDE on the 30-dimensional functions F3, F7 and F10.
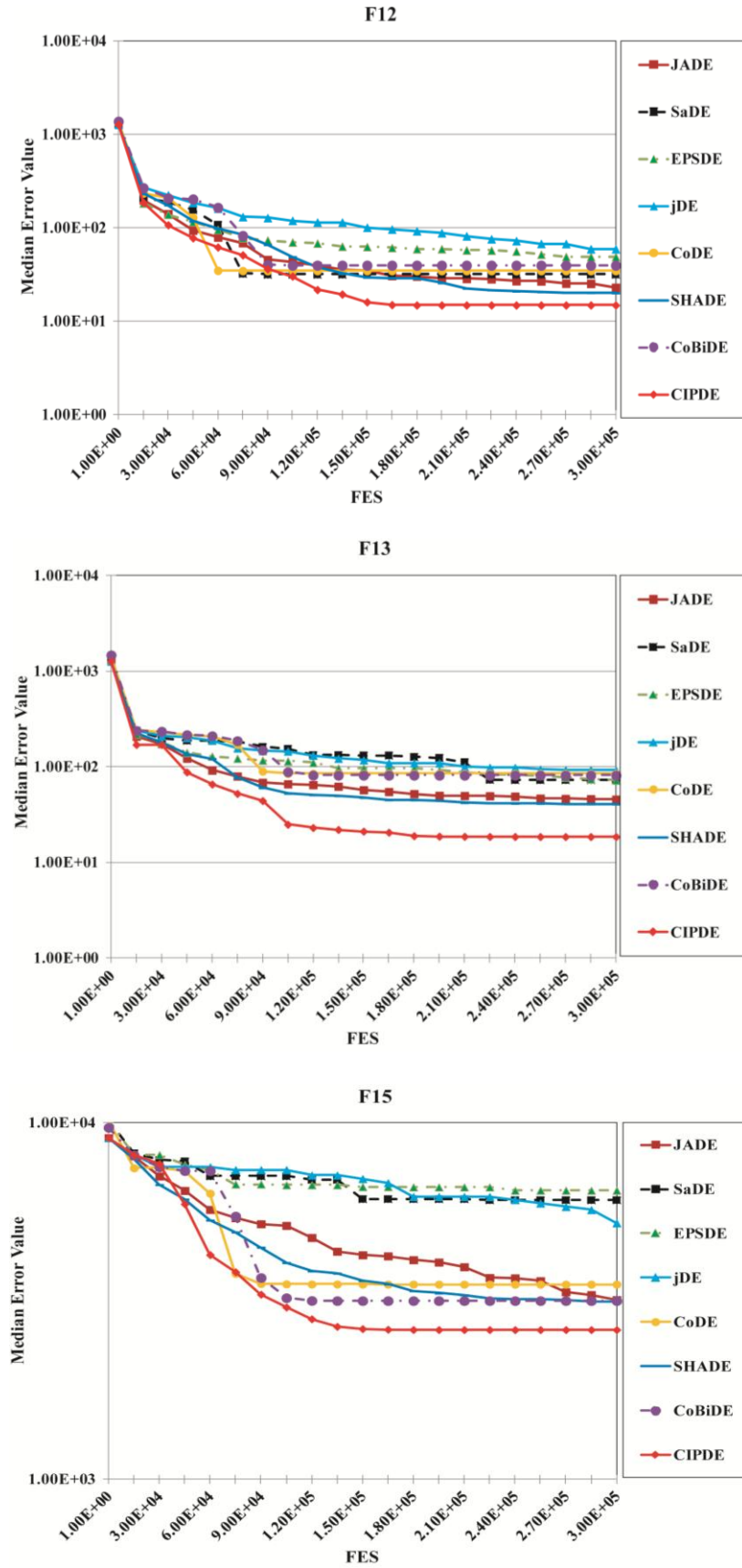
Fig. S3. The median error values versus function evaluations (FES) obtained by JADE, SaDE, EPSDE, jDE, CoDE, SHADE, CoBiDE and CIPDE on the 30-dimensional functions F12, F13 and F15.
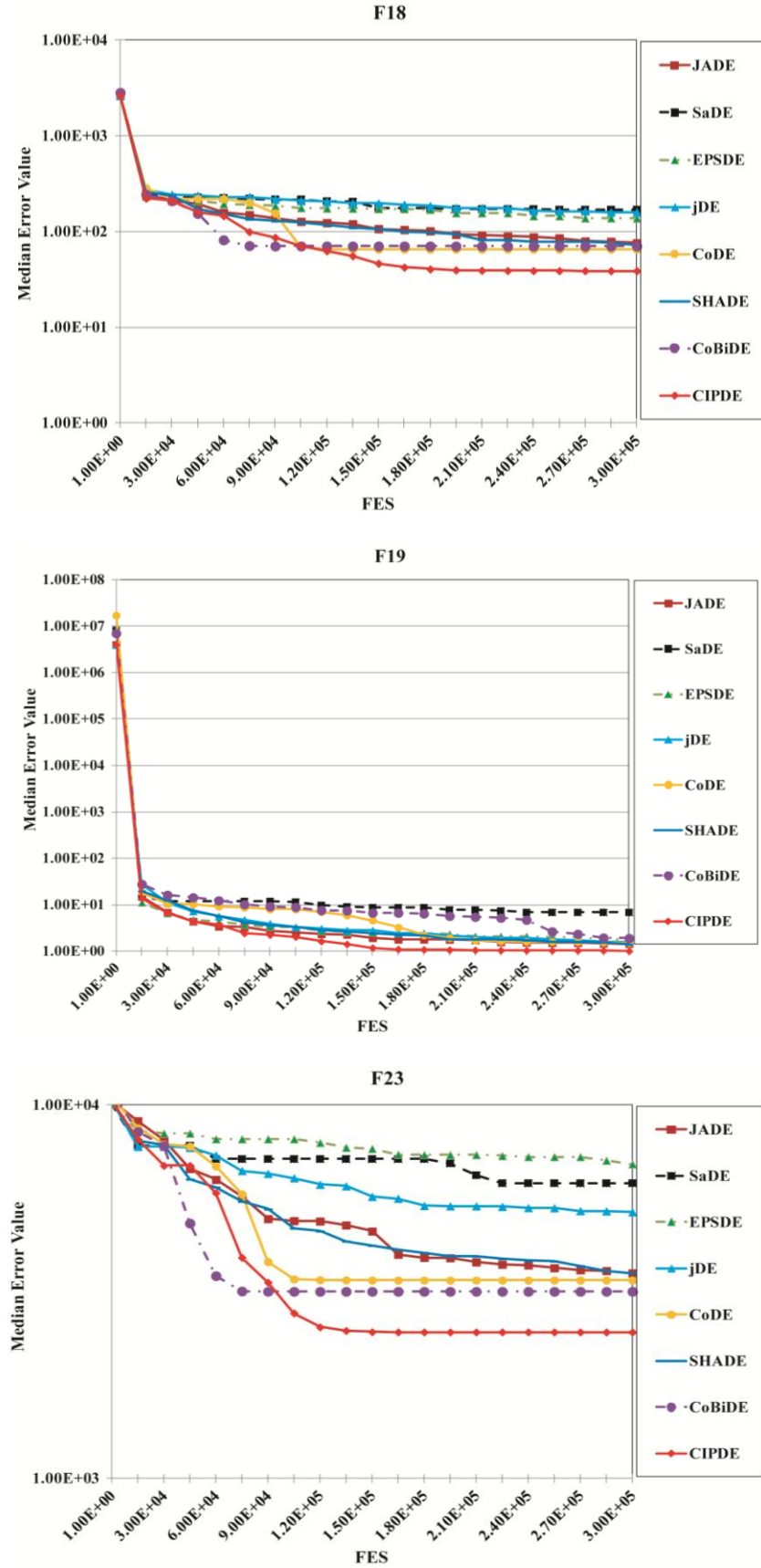
Fig. S4. The median error values versus function evaluations (FES) obtained by JADE, SaDE, EPSDE, jDE, CoDE, SHADE, CoBiDE and CIPDE on the 30-dimensional functions F18, F19 and F23.