

Table 1

Mean and standard deviation of the fitness error for the CEC 2017 test suite of 30D functions F1–F30 on 30 runs (the best entries are in bold).

No.	Metric	SaDE	CoDE	JADE	SHADE	AIWPSO	IMODE	QAGO
F1	Mean	0.00E+00	0.00E+00	2.68E-06	0.00E+00	3.29E+03	9.58E-03	0.00E+00
	Std	2.81E-18	1.35E-19	8.48E-06	7.98E-24	3.75E+03	5.63E-04	0.00E+00
F2	Mean	1.23E-06	7.03E+00	2.23E-06	9.00E-08	3.00E+05	3.02E-04	0.00E+00
	Std	1.47E-06	1.27E+01	6.65E-06	1.62E-07	9.12E+05	2.78E-04	4.81E-12
F3	Mean	0.00E+00	0.00E+00	6.68E+02	0.00E+00	0.00E+00	1.91E-07	0.00E+00
	Std	4.20E-17	6.53E-14	1.18E+03	1.90E-28	2.54E-20	7.79E-09	1.02E-28
F4	Mean	2.29E+01	5.33E+01	2.39E+00	2.63E+01	4.26E+01	2.20E+01	2.68E+01
	Std	3.03E+01	1.88E+01	2.06E+00	3.32E+01	3.84E+01	3.10E+01	3.16E+01
F5	Mean	4.49E+01	3.05E+01	3.24E+01	2.96E+01	1.22E+02	1.01E+02	3.76E+01
	Std	1.25E+01	8.62E+00	4.46E+00	7.60E+00	2.45E+01	1.14E+01	8.58E+00
F6	Mean	3.60E-06	0.00E+00	0.00E+00	4.73E-02	2.78E+00	1.10E+01	0.00E+00
	Std	1.13E-05	7.18E-16	0.00E+00	7.35E-02	7.73E-01	4.18E+00	4.33E-09
F7	Mean	8.26E+01	6.45E+01	5.99E+01	6.59E+01	1.74E+02	1.43E+02	7.86E+01
	Std	1.12E+01	9.25E+00	5.55E+00	1.06E+01	2.72E+01	2.57E+01	7.84E+00
F8	Mean	4.08E+01	3.24E+01	2.76E+01	3.37E+01	1.11E+02	8.06E+01	3.90E+01
	Std	1.33E+01	9.22E+00	5.99E+00	6.76E+00	2.35E+01	2.23E+01	8.60E+00
F9	Mean	2.15E+00	0.00E+00	1.04E+00	6.78E+00	2.08E+03	1.10E+03	0.00E+00
	Std	4.18E+00	0.00E+00	1.42E+00	5.60E+00	9.04E+02	3.00E+02	9.62E-32
F10	Mean	2.72E+03	1.89E+03	2.06E+03	2.07E+03	2.92E+03	2.64E+03	3.94E+03
	Std	1.00E+03	4.95E+02	1.42E+02	3.72E+02	4.30E+02	3.98E+02	3.62E+02
F11	Mean	7.96E+01	1.91E+01	4.35E+01	9.39E+01	1.28E+02	1.18E+02	2.24E+01
	Std	3.88E+01	1.96E+01	2.30E+01	3.00E+01	7.80E+01	3.64E+01	2.41E+01
F12	Mean	5.42E+03	6.11E+03	3.72E+03	2.43E+03	2.17E+04	1.39E+03	5.04E+02
	Std	3.37E+03	6.43E+03	4.72E+03	2.80E+03	9.53E+03	4.78E+02	2.18E+02
F13	Mean	2.23E+03	2.07E+01	1.02E+03	7.38E+02	1.94E+04	2.73E+02	3.99E+01
	Std	3.79E+03	8.56E+00	2.62E+03	8.55E+02	2.10E+04	1.13E+02	2.48E+01
F14	Mean	6.67E+01	7.63E+00	5.80E+02	1.85E+02	4.16E+03	1.28E+02	2.93E+01
	Std	2.17E+01	4.49E+00	1.63E+03	7.26E+01	4.07E+03	4.77E+01	3.22E+00
F15	Mean	6.77E+01	8.11E+00	1.07E+02	3.00E+02	1.07E+04	9.87E+01	1.19E+01
	Std	3.64E+01	3.24E+00	9.41E+01	1.71E+02	9.06E+03	5.11E+01	2.70E+00
F16	Mean	4.59E+02	3.09E+02	3.99E+02	4.71E+02	1.21E+03	6.33E+02	4.13E+02
	Std	1.75E+02	1.52E+02	1.85E+02	1.83E+02	2.25E+02	2.01E+02	1.75E+02
F17	Mean	2.17E+01	4.65E+01	5.87E+01	1.14E+02	5.51E+02	1.60E+02	5.75E+01
	Std	9.17E+00	3.98E+01	4.45E+01	6.26E+01	2.46E+02	6.80E+01	1.23E+01
F18	Mean	1.32E+03	2.33E+01	7.28E+03	3.18E+02	5.50E+04	7.96E+01	2.72E+01
	Std	1.19E+03	1.11E+01	2.26E+04	3.77E+02	4.36E+04	1.79E+01	2.34E+00
F19	Mean	6.03E+01	4.94E+00	6.25E+02	1.73E+02	6.47E+03	6.39E+01	9.41E+00
	Std	5.80E+01	1.68E+00	1.81E+03	5.13E+01	9.43E+03	2.61E+01	2.23E+00
F20	Mean	6.04E+01	7.44E+01	9.63E+01	1.59E+02	5.54E+02	2.50E+02	9.80E+01
	Std	6.47E+01	7.41E+01	6.35E+01	6.97E+01	1.92E+02	3.36E+01	5.97E+01
F21	Mean	2.47E+02	2.38E+02	2.30E+02	2.30E+02	3.12E+02	1.23E+02	2.37E+02
	Std	1.02E+01	6.71E+00	7.03E+00	7.97E+00	1.51E+01	6.82E+01	7.35E+00
F22	Mean	1.01E+02	1.00E+02	1.00E+02	5.92E+02	1.18E+03	1.01E+02	1.00E+02
	Std	2.00E+00	0.00E+00	9.95E-01	1.04E+03	1.72E+03	1.20E+00	9.24E-13
F23	Mean	3.95E+02	3.89E+02	3.79E+02	3.80E+02	4.90E+02	4.46E+02	3.62E+02
	Std	1.16E+01	7.65E+00	7.81E+00	8.85E+00	4.02E+01	2.66E+01	9.22E+00
F24	Mean	4.80E+02	4.58E+02	4.43E+02	4.58E+02	6.34E+02	5.74E+02	4.39E+02
	Std	1.79E+01	1.08E+01	7.52E+00	7.44E+00	7.92E+01	2.52E+01	7.37E+00
F25	Mean	3.96E+02	3.87E+02	3.91E+02	3.86E+02	3.99E+02	3.95E+02	3.87E+02
	Std	1.74E+01	2.06E-02	1.18E+01	2.12E+00	2.25E+01	1.66E+01	1.04E-01
F26	Mean	1.11E+03	1.33E+03	1.11E+03	1.49E+03	1.69E+03	3.71E+02	1.17E+03
	Std	9.49E+02	1.46E+02	4.60E+02	2.23E+02	1.25E+03	2.61E+02	1.51E+02
F27	Mean	5.23E+02	4.95E+02	5.16E+02	5.19E+02	4.91E+02	5.46E+02	5.01E+02
	Std	1.05E+01	1.17E+01	7.49E+00	5.56E+00	1.53E+01	9.43E+00	1.06E+01
F28	Mean	3.25E+02	3.26E+02	3.32E+02	3.46E+02	4.08E+02	3.42E+02	3.00E+02
	Std	5.50E+01	5.55E+01	5.17E+01	6.03E+01	9.57E+01	5.48E+01	5.68E-14
F29	Mean	4.69E+02	4.46E+02	4.89E+02	5.34E+02	7.50E+02	6.35E+02	4.97E+02
	Std	4.96E+01	3.83E+01	2.23E+01	8.98E+01	2.49E+02	9.72E+01	1.13E+01
F30	Mean	4.06E+03	2.07E+03	3.19E+03	2.56E+03	2.66E+05	3.00E+03	2.02E+03
	Std	2.85E+03	1.01E+02	1.48E+03	8.56E+02	4.97E+05	4.26E+02	4.74E+01