

Table 2

Mean and standard deviation of the fitness error for the CEC 2017 test suite of 50D functions F1–F30 on 30 runs (the best entries are in bold).

No.	Metric	SaDE	CoDE	JADE	SHADE	AIWPSO	IMODE	QAGO
F1	Mean	3.27E+03	1.89E-02	0.00E+00	0.00E+00	3.98E+03	1.55E-02	0.00E+00
	Std	3.00E+03	5.06E-02	6.11E-17	9.84E-17	5.69E+03	2.32E-03	0.00E+00
F2	Mean	3.62E+01	2.41E+08	1.69E+01	2.91E+03	1.45E+15	3.44E+27	0.00E+00
	Std	6.61E+01	6.45E+08	5.33E+01	6.14E+03	3.92E+15	1.09E+28	3.41E-10
F3	Mean	2.88E-03	7.91E-08	5.91E+03	5.63E+02	7.58E-03	8.92E-07	0.00E+00
	Std	4.40E-03	6.65E-08	9.59E+03	1.78E+03	1.59E-02	1.00E-07	1.02E-17
F4	Mean	6.54E+01	4.30E+01	3.54E+01	2.29E+01	9.90E+01	4.91E+01	2.17E+01
	Std	4.65E+01	5.05E+01	4.57E+01	2.43E+01	4.93E+01	5.28E+01	3.08E+01
F5	Mean	1.31E+02	7.33E+01	7.67E+01	8.26E+01	2.42E+02	3.04E+02	4.04E+01
	Std	1.39E+01	1.68E+01	1.58E+01	1.89E+01	3.18E+01	1.81E+01	2.86E+01
F6	Mean	2.96E-02	0.00E+00	0.00E+00	5.15E-01	2.97E+00	3.49E+01	1.84E-06
	Std	4.50E-02	1.52E-08	0.00E+00	3.59E-01	5.63E-01	4.93E+00	3.14E-06
F7	Mean	2.32E+02	1.16E+02	1.35E+02	1.43E+02	3.23E+02	5.05E+02	1.71E+02
	Std	5.66E+01	1.50E+01	8.34E+00	9.57E+00	6.02E+01	8.10E+01	2.98E+01
F8	Mean	1.22E+02	7.78E+01	6.67E+01	7.60E+01	2.61E+02	3.17E+02	6.01E+01
	Std	1.55E+01	1.93E+01	1.03E+01	1.21E+01	3.17E+01	2.75E+01	3.77E+01
F9	Mean	3.17E+02	6.54E-01	4.81E+01	3.27E+02	7.80E+03	9.83E+03	9.98E-02
	Std	5.00E+02	1.13E+00	5.72E+01	3.10E+02	2.47E+03	2.13E+03	2.11E-01
F10	Mean	4.08E+03	4.35E+03	4.05E+03	3.98E+03	5.70E+03	5.37E+03	7.49E+03
	Std	4.43E+02	1.28E+03	4.10E+02	4.28E+02	5.97E+02	7.91E+02	9.54E+02
F11	Mean	1.07E+02	4.24E+01	1.24E+02	2.38E+02	2.26E+02	2.53E+02	6.16E+01
	Std	3.76E+01	1.04E+01	4.86E+01	6.85E+01	5.47E+01	6.09E+01	2.87E+01
F12	Mean	3.04E+04	4.96E+04	1.18E+05	8.33E+03	1.58E+05	2.26E+03	5.89E+04
	Std	1.57E+04	2.98E+04	1.05E+05	1.36E+04	9.94E+04	7.91E+02	2.38E+04
F13	Mean	3.60E+03	2.47E+03	3.13E+03	1.54E+03	3.43E+03	4.46E+02	1.55E+02
	Std	3.82E+03	3.77E+03	3.94E+03	1.78E+03	2.42E+03	1.22E+02	3.99E+01
F14	Mean	7.36E+02	3.83E+01	9.77E+03	5.95E+02	3.07E+04	2.73E+02	5.03E+01
	Std	6.37E+02	1.22E+01	2.04E+04	6.60E+02	3.14E+04	5.90E+01	4.81E+00
F15	Mean	4.03E+03	6.40E+01	9.66E+02	5.01E+02	9.26E+03	3.53E+02	6.53E+01
	Std	4.26E+03	4.05E+01	2.28E+03	2.02E+02	7.67E+03	1.24E+02	2.49E+01
F16	Mean	7.18E+02	8.85E+02	8.51E+02	9.43E+02	1.84E+03	1.30E+03	6.07E+02
	Std	1.62E+02	3.15E+02	2.07E+02	2.24E+02	4.45E+02	3.20E+02	2.14E+02
F17	Mean	5.29E+02	6.69E+02	5.64E+02	8.30E+02	1.30E+03	1.69E+03	6.15E+02
	Std	2.02E+02	1.87E+02	1.02E+02	1.72E+02	4.45E+02	2.48E+02	1.59E+02
F18	Mean	1.02E+04	1.41E+03	1.06E+05	1.11E+03	9.48E+04	1.84E+02	5.91E+01
	Std	8.06E+03	1.26E+03	3.32E+05	1.19E+03	5.28E+04	4.49E+01	1.70E+01
F19	Mean	3.48E+03	1.42E+01	3.51E+03	1.78E+02	1.33E+04	1.67E+02	1.97E+01
	Std	5.34E+03	6.27E+00	8.94E+03	6.15E+01	4.64E+03	7.29E+01	4.27E+00
F20	Mean	3.60E+02	4.40E+02	3.27E+02	5.54E+02	1.07E+03	9.43E+02	2.88E+02
	Std	1.77E+02	1.57E+02	1.61E+02	1.13E+02	4.05E+02	1.35E+02	9.16E+01
F21	Mean	3.15E+02	2.67E+02	2.69E+02	2.79E+02	4.99E+02	4.80E+02	2.34E+02
	Std	1.75E+01	1.75E+01	1.19E+01	6.77E+00	7.77E+01	4.58E+01	8.21E+00
F22	Mean	4.31E+03	3.66E+03	3.11E+03	4.85E+03	5.90E+03	3.33E+03	6.81E+03
	Std	1.62E+03	1.51E+03	2.59E+03	3.33E+02	6.33E+02	2.57E+03	2.48E+03
F23	Mean	5.72E+02	5.08E+02	5.10E+02	5.30E+02	7.24E+02	8.82E+02	4.65E+02
	Std	2.86E+01	1.58E+01	1.44E+01	2.09E+01	4.05E+01	7.87E+01	1.63E+01
F24	Mean	6.68E+02	5.67E+02	5.74E+02	5.95E+02	1.22E+03	1.07E+03	5.55E+02
	Std	4.20E+01	1.03E+01	2.04E+01	1.95E+01	1.96E+02	1.36E+02	1.55E+01
F25	Mean	5.40E+02	5.06E+02	5.36E+02	5.38E+02	5.52E+02	5.35E+02	5.24E+02
	Std	4.60E+01	3.34E+01	4.37E+01	3.46E+01	3.37E+01	3.39E+01	3.94E+01
F26	Mean	2.76E+03	1.73E+03	2.10E+03	2.50E+03	4.19E+03	4.66E+03	1.63E+03
	Std	1.43E+03	1.80E+02	3.21E+02	3.20E+02	2.84E+03	2.09E+03	1.24E+02
F27	Mean	8.29E+02	5.23E+02	6.58E+02	7.08E+02	5.06E+02	1.12E+03	5.51E+02
	Std	7.47E+01	1.47E+01	5.78E+01	6.20E+01	1.04E+01	1.02E+02	2.74E+01
F28	Mean	4.97E+02	4.82E+02	4.91E+02	4.88E+02	5.09E+02	4.89E+02	4.90E+02
	Std	3.72E+01	2.42E+01	4.00E+01	2.00E+01	2.48E+01	2.17E+01	2.27E+01
F29	Mean	6.30E+02	5.78E+02	5.91E+02	7.63E+02	1.28E+03	1.77E+03	4.59E+02
	Std	2.01E+02	1.44E+02	1.11E+02	1.86E+02	4.24E+02	2.45E+02	8.08E+01
F30	Mean	8.36E+05	5.94E+05	8.03E+05	7.37E+05	2.41E+06	6.01E+05	5.89E+05
	Std	1.46E+05	2.35E+04	9.16E+04	1.39E+05	2.47E+06	2.08E+04	2.10E+04