Supplemental file of "Differential evolution with evolutionary scale adaptation"

TABLE CAPTIONS

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

Table S2 Performance comparison of ESA with other multi-strategy methods on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

Table S3 Performance comparison of ESADE with the variants on 50-D CEC2017 benchmark set over 51 independent runs

Table S4 Comparison of ESA with other multi-strategy methods on the real-world problems

Table S5 Comparison of ESA with single mutation strategy on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	30-D														
	PaDE			SCSS-L-SHADE			EaDE			L-SHADE-RSP			EJADE		
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std	sig	mean	std	sig
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	=
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	7.88E-06	2.31E-05	+
F4	5.15E+01	2.04E+01	+	5.86E+01	2.78E-14	+	5.86E+01	4.71E-13	+	5.86E+01	1.14E-14	+	5.29E+01	1.96E+01	+
F5	8.32E+00	1.86E+00	+	7.27E+00	1.35E+00	=	4.04E+00	2.46E+00	-	6.91E+00	1.98E+00	-	2.11E+01	4.69E+00	+
F6	3.35E-09	1.97E-08	-	0.00E+00	0.00E+00	-	2.68E-09	1.92E-08	-	9.39E-09	3.29E-08	-	0.00E+00	0.00E+00	-
F7	3.86E+01	1.41E+00	=	3.81E+01	1.73E+00	=	3.66E+01	1.47E+00	-	3.84E+01	1.97E+00	=	5.07E+01	4.33E+00	+
F8	9.19E+00	1.75E+00	+	7.34E+00	1.92E+00	=	4.33E+00	2.58E+00	-	6.93E+00	1.92E+00	-	2.08E+01	5.20E+00	+
F9	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	=
F10	1.50E+03	2.15E+02	=	1.44E+03	2.17E+02	-	1.30E+03	2.95E+02	-	1.57E+03	2.94E+02	=	1.64E+03	4.21E+02	=
F11	1.44E+01	2.08E+01	+	1.72E+01	2.41E+01	+	1.83E+01	2.48E+01	+	1.00E+01	1.86E+01	=	1.86E+01	2.47E+01	+
F12	1.02E+03	3.83E+02	+	5.65E+02	2.65E+02	+	5.82E+02	2.73E+02	+	1.46E+02	1.01E+02	+	1.03E+03	7.22E+02	+
F13	1.54E+01	5.27E+00	-	1.60E+01	4.83E+00	-	1.56E+01	6.48E+00	-	1.88E+01	2.23E+00	=	2.06E+01	1.02E+01	=
F14	2.11E+01	5.59E+00	+	2.15E+01	4.26E+00	+	2.21E+01	3.14E+00	+	2.16E+01	1.13E+00	+	1.46E+01	1.01E+01	-
F15	3.07E+00	1.58E+00	=	2.30E+00	1.03E+00	=	2.53E+00	1.70E+00	=	1.01E+00	7.69E-01	-	5.73E+00	2.72E+00	+
F16	1.00E+02	8.31E+01	+	4.76E+01	4.41E+01	+	3.15E+01	5.44E+01	+	2.08E+01	1.79E+01	+	2.39E+02	1.61E+02	+
F17	2.90E+01	5.96E+00	-	3.39E+01	5.40E+00	=	3.58E+01	7.91E+00	=	3.51E+01	6.52E+00	=	1.83E+01	1.81E+01	-
F18	2.14E+01	9.76E-01	+	2.08E+01	6.07E-01	=	2.07E+01	4.47E-01	=	2.03E+01	2.85E+00	+	2.40E+01	1.41E+01	+
F19	5.24E+00	1.54E+00	-	5.11E+00	1.79E+00	-	5.60E+00	1.96E+00	=	3.57E+00	1.02E+00	-	5.49E+00	2.74E+00	=
F20	3.48E+01	7.21E+00	+	3.00E+01	6.48E+00	=	2.78E+01	8.51E+00	-	3.18E+01	5.18E+00	=	1.92E+01	3.63E+01	-
F21	2.08E+02	1.67E+00	=	2.08E+02	1.57E+00	=	2.06E+02	2.39E+00	-	2.07E+02	2.09E+00	=	2.20E+02	4.94E+00	+
F22	1.00E+02	1.44E-14	=	1.00E+02	1.44E-14	=	1.00E+02	1.83E-13	-	1.00E+02	1.44E-14	=	1.00E+02	1.44E-14	=
F23	3.45E+02	3.19E+00	-	3.50E+02	2.88E+00	=	3.49E+02	2.52E+00	=	3.50E+02	2.66E+00	=	3.67E+02	6.73E+00	+
F24	4.21E+02	2.16E+00	-	4.26E+02	1.60E+00	=	4.25E+02	1.95E+00	=	4.28E+02	3.04E+00	+	4.37E+02	5.65E+00	+
F25	3.87E+02	2.55E-02	+	3.87E+02	1.52E-02	+	3.87E+02	1.60E-02	+	3.87E+02	5.87E-03	+	3.87E+02	5.71E-02	+
F26	8.76E+02	4.16E+01	=	9.27E+02	3.84E+01	+	9.32E+02	3.88E+01	+	9.39E+02	4.02E+01	+	1.09E+03	8.77E+01	+
F27	5.07E+02	5.27E+00	+	5.01E+02	6.20E+00	+	5.01E+02	6.53E+00	+	4.98E+02	6.42E+00	=	5.01E+02	5.53E+00	+
F28	3.38E+02	5.49E+01	=	3.25E+02	4.62E+01	=	3.23E+02	4.64E+01	-	3.06E+02	2.54E+01	-	3.39E+02	5.64E+01	=
F29	4.35E+02	1.02E+01	=	4.38E+02	1.21E+01	=	4.37E+02	1.04E+01	=	4.41E+02	1.17E+01	+	4.18E+02	7.86E+00	-
F30	2.05E+03	8.82E+01	+	1.97E+03	3.37E+01	=	1.98E+03	4.32E+01	=	1.97E+03	1.84E+01	=	2.00E+03	5.98E+01	+
W	**12**			**8**			**8**			**9**			**17**		
T	**11**			**17**			**11**			**14**			**7**		
L	**6**			**4**			**10**			**6**			**5**		

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	30-D										
	DISH			SCSS-jSO			DTDE			ESADE	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
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
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	5.86E+01	3.22E-14	+	5.86E+01	1.97E-14	+	5.86E+01	3.31E-14	+	4.96E+01	1.90E+00
F5	7.85E+00	2.05E+00	=	7.90E+00	1.75E+00	=	1.33E+00	1.03E+00	-	7.57E+00	1.45E+00
F6	5.37E-09	2.68E-08	-	1.74E-08	4.45E-08	=	2.68E-09	1.92E-08	-	5.40E-08	1.28E-07
F7	3.87E+01	1.70E+00	=	3.79E+01	1.75E+00	=	3.37E+01	8.17E-01	-	3.85E+01	1.62E+00
F8	7.57E+00	2.01E+00	=	7.69E+00	1.69E+00	=	1.56E+00	1.06E+00	-	7.58E+00	1.46E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	1.68E+03	2.69E+02	+	1.48E+03	2.07E+02	=	5.45E+01	8.42E+01	-	1.54E+03	1.93E+02
F11	5.73E+00	1.40E+01	-	4.58E+00	1.16E+01	-	1.44E+01	2.18E+01	+	7.72E+00	1.50E+01
F12	1.12E+02	9.84E+01	=	9.29E+01	8.20E+01	=	5.08E+02	2.66E+02	+	1.01E+02	8.54E+01
F13	2.06E+01	2.74E+00	+	1.52E+01	4.22E+00	-	1.78E+01	5.08E+00	=	1.74E+01	5.93E+00
F14	2.20E+01	1.36E+00	+	2.14E+01	2.86E+00	+	2.28E+01	5.09E+00	+	1.96E+01	4.49E+00
F15	2.26E+00	1.04E+00	=	1.14E+00	8.28E-01	-	5.66E+00	2.29E+00	+	2.76E+00	2.06E+00
F16	4.48E+01	6.63E+01	+	3.99E+01	5.30E+01	+	1.41E+01	1.88E+00	-	2.13E+01	2.48E+01
F17	3.70E+01	6.84E+00	+	3.20E+01	7.87E+00	=	2.10E+01	5.21E+00	-	3.35E+01	5.88E+00
F18	2.09E+01	3.46E-01	+	2.04E+01	2.81E+00	+	2.54E+01	3.40E+00	+	2.06E+01	3.40E-01
F19	4.71E+00	1.78E+00	-	3.73E+00	1.12E+00	-	5.12E+00	1.50E+00	=	5.59E+00	1.03E+00
F20	3.26E+01	5.97E+00	=	2.84E+01	5.72E+00	-	1.78E+01	7.86E+00	-	3.20E+01	5.70E+00
F21	2.08E+02	2.19E+00	=	2.08E+02	1.92E+00	=	2.03E+02	1.72E+00	-	2.08E+02	1.60E+00
F22	1.00E+02	1.37E-13	=	1.00E+02	1.24E-13	=	1.00E+02	1.44E-14	=	1.00E+02	1.08E-13
F23	3.51E+02	3.03E+00	+	3.50E+02	3.33E+00	=	3.47E+02	2.88E+00	-	3.50E+02	2.20E+00
F24	4.27E+02	2.57E+00	+	4.26E+02	2.58E+00	=	4.24E+02	1.36E+00	-	4.26E+02	1.65E+00
F25	3.87E+02	6.02E-03	+	3.87E+02	6.87E-03	+	3.87E+02	1.67E-02	+	3.87E+02	3.90E-03
F26	9.31E+02	5.11E+01	+	9.51E+02	4.27E+01	+	8.92E+02	4.16E+01	=	8.87E+02	2.93E+01
F27	4.95E+02	7.98E+00	=	4.94E+02	6.56E+00	-	5.01E+02	6.23E+00	+	4.98E+02	6.43E+00
F28	3.00E+02	2.36E-13	=	3.02E+02	1.60E+01	-	3.38E+02	5.40E+01	=	3.13E+02	3.65E+01
F29	4.45E+02	1.36E+01	+	4.31E+02	2.00E+01	=	4.10E+02	6.55E+00	-	4.36E+02	1.19E+01
F30	1.97E+03	9.65E+00	=	1.97E+03	1.20E+01	=	1.98E+03	4.69E+01	=	1.98E+03	3.25E+01
W	**12**			**6**			**8**				
T	**14**			**16**			**9**				
L	**3**			**7**			**12**				

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	50-D														
	PaDE			SCSS-L-SHADE			EaDE			L-SHADE-RSP			EJADE		
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std	sig	mean	std	sig
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	=
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	1.73E+02	4.19E+02	+
F4	7.92E+01	4.77E+01	=	7.91E+01	5.07E+01	=	7.10E+01	5.33E+01	=	5.27E+01	4.72E+01	=	5.59E+01	4.81E+01	=
F5	1.74E+01	2.62E+00	+	1.17E+01	2.66E+00	=	7.98E+00	3.12E+00	-	1.20E+01	3.61E+00	=	4.18E+01	9.59E+00	+
F6	3.67E-04	1.28E-03	-	3.08E-08	7.95E-08	-	5.33E-08	1.21E-07	-	1.58E-07	2.73E-07	-	2.69E-04	1.92E-03	-
F7	6.49E+01	1.99E+00	=	6.31E+01	1.79E+00	-	6.14E+01	1.64E+00	-	6.58E+01	3.30E+00	+	8.82E+01	7.82E+00	+
F8	1.80E+01	2.14E+00	+	1.19E+01	2.06E+00	-	7.72E+00	3.38E+00	-	1.31E+01	3.82E+00	=	4.36E+01	8.91E+00	+
F9	3.51E-03	1.76E-02	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	3.94E-01	5.88E-01	+
F10	3.13E+03	3.14E+02	=	3.14E+03	3.11E+02	=	3.03E+03	4.31E+02	=	3.48E+03	3.94E+02	+	3.33E+03	5.44E+02	+
F11	6.36E+01	1.29E+01	+	3.12E+01	4.36E+00	+	3.22E+01	4.56E+00	+	2.43E+01	3.70E+00	+	4.57E+01	1.05E+01	+
F12	2.23E+03	5.08E+02	+	2.11E+03	4.27E+02	+	2.06E+03	5.20E+02	+	1.56E+03	4.19E+02	+	8.70E+03	1.12E+04	+
F13	5.72E+01	3.54E+01	+	4.95E+01	3.04E+01	=	4.82E+01	2.64E+01	=	2.82E+01	1.83E+01	-	7.52E+01	5.75E+01	+
F14	3.07E+01	3.66E+00	+	2.51E+01	2.12E+00	+	2.65E+01	2.85E+00	+	2.24E+01	1.53E+00	-	4.84E+01	2.08E+01	+
F15	4.36E+01	1.06E+01	+	2.66E+01	4.11E+00	+	2.66E+01	3.50E+00	+	2.09E+01	2.48E+00	=	5.32E+01	4.50E+01	+
F16	3.66E+02	9.94E+01	+	2.89E+02	1.17E+02	=	3.15E+02	1.22E+02	=	3.19E+02	1.47E+02	=	6.36E+02	2.46E+02	+
F17	2.85E+02	5.72E+01	+	2.13E+02	7.97E+01	=	2.15E+02	9.59E+01	=	2.26E+02	8.68E+01	=	4.77E+02	1.80E+02	+
F18	4.23E+01	1.22E+01	+	2.64E+01	2.93E+00	+	2.70E+01	2.58E+00	+	2.29E+01	1.36E+00	=	1.39E+02	1.21E+02	+
F19	2.57E+01	7.73E+00	+	1.48E+01	2.37E+00	+	1.61E+01	2.54E+00	+	1.09E+01	2.31E+00	-	3.85E+01	3.93E+01	=
F20	1.81E+02	7.15E+01	+	1.68E+02	6.59E+01	+	2.16E+02	1.21E+02	+	1.46E+02	7.91E+01	=	3.09E+02	1.81E+02	+
F21	2.18E+02	2.28E+00	+	2.13E+02	2.77E+00	-	2.08E+02	3.79E+00	-	2.14E+02	4.28E+00	-	2.42E+02	8.87E+00	+
F22	3.24E+02	8.67E+02	-	2.66E+03	1.60E+03	=	2.31E+03	1.69E+03	=	2.34E+03	1.92E+03	=	2.91E+03	1.91E+03	=
F23	4.27E+02	5.56E+00	=	4.28E+02	5.08E+00	=	4.28E+02	4.74E+00	=	4.32E+02	5.82E+00	+	4.63E+02	1.33E+01	+
F24	5.04E+02	4.73E+00	-	5.06E+02	2.54E+00	-	5.06E+02	2.88E+00	=	5.09E+02	3.47E+00	+	5.27E+02	8.90E+00	+
F25	5.02E+02	3.17E+01	+	4.81E+02	2.79E+00	+	4.81E+02	3.14E+00	+	4.81E+02	2.32E+00	+	5.21E+02	3.64E+01	+
F26	1.13E+03	6.56E+01	+	1.12E+03	4.43E+01	+	1.13E+03	4.09E+01	+	1.13E+03	4.72E+01	+	1.45E+03	1.23E+02	+
F27	5.38E+02	7.98E+00	+	5.32E+02	1.87E+01	+	5.30E+02	1.90E+01	+	5.10E+02	1.03E+01	-	5.27E+02	1.67E+01	+
F28	5.01E+02	1.70E+01	+	4.61E+02	9.58E+00	+	4.62E+02	1.16E+01	+	4.59E+02	1.75E-13	+	4.87E+02	2.22E+01	+
F29	3.54E+02	1.20E+01	-	3.63E+02	1.44E+01	=	3.62E+02	1.13E+01	=	3.65E+02	1.46E+01	+	3.49E+02	6.66E+01	-
F30	6.18E+05	3.22E+04	=	6.45E+05	6.15E+04	=	6.40E+05	5.50E+04	=	6.25E+05	5.22E+04	=	6.27E+05	5.42E+04	=
W	**17**			**11**			**11**			**10**			**22**		
T	**8**			**13**			**13**			**13**			**5**		
L	**4**			**5**			**5**			**6**			**2**		

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	50-D										
	DISH			SCSS-jSO			DTDE			ESADE	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
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
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	5.80E+01	4.83E+01	=	4.57E+01	3.79E+01	=	6.84E+01	5.74E+01	=	7.56E+01	5.21E+01
F5	1.32E+01	4.18E+00	=	1.24E+01	2.74E+00	=	1.95E+00	1.60E+00	-	1.25E+01	2.06E+00
F6	2.09E-07	3.22E-07	-	3.16E-07	5.68E-07	-	3.22E-08	1.04E-07	-	1.02E-06	1.24E-06
F7	6.78E+01	3.93E+00	+	6.27E+01	2.82E+00	-	5.66E+01	1.07E+00	-	6.42E+01	2.13E+00
F8	1.42E+01	3.96E+00	=	1.30E+01	3.11E+00	=	1.85E+00	1.38E+00	-	1.34E+01	2.24E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	3.53E+03	3.78E+02	+	3.16E+03	3.78E+02	=	1.51E+02	8.81E+01	-	3.04E+03	3.47E+02
F11	2.42E+01	3.59E+00	+	2.45E+01	3.55E+00	+	3.11E+01	4.07E+00	+	2.16E+01	2.49E+00
F12	1.38E+03	4.14E+02	+	1.27E+03	3.70E+02	+	2.01E+03	5.25E+02	+	8.55E+02	3.13E+02
F13	4.04E+01	2.67E+01	=	2.41E+01	1.66E+01	-	5.18E+01	2.88E+01	=	4.43E+01	2.93E+01
F14	2.45E+01	2.84E+00	=	2.44E+01	1.85E+00	+	2.39E+01	6.30E+00	+	2.35E+01	1.25E+00
F15	2.18E+01	2.38E+00	+	2.09E+01	1.84E+00	=	2.64E+01	3.00E+00	+	2.03E+01	1.80E+00
F16	4.10E+02	1.54E+02	+	3.90E+02	1.34E+02	+	1.35E+02	4.10E+01	-	3.00E+02	1.25E+02
F17	2.95E+02	9.14E+01	+	2.44E+02	1.01E+02	=	6.02E+01	5.97E+01	-	2.09E+02	8.32E+01
F18	2.30E+01	1.27E+00	=	2.27E+01	1.35E+00	=	3.38E+01	5.57E+00	+	2.27E+01	1.15E+00
F19	1.13E+01	2.42E+00	-	1.09E+01	2.56E+00	-	9.44E+00	2.52E+00	-	1.32E+01	1.87E+00
F20	1.76E+02	9.30E+01	+	1.29E+02	6.79E+01	=	2.40E+01	2.93E+00	-	1.21E+02	5.21E+01
F21	2.14E+02	4.12E+00	=	2.14E+02	3.08E+00	-	2.03E+02	2.36E+00	-	2.15E+02	2.35E+00
F22	2.07E+03	2.11E+03	=	2.51E+03	1.68E+03	=	3.49E+02	1.58E+02	-	2.51E+03	1.67E+03
F23	4.32E+02	6.66E+00	+	4.29E+02	5.80E+00	=	4.22E+02	7.11E+00	-	4.27E+02	4.89E+00
F24	5.08E+02	3.84E+00	=	5.07E+02	3.95E+00	=	5.00E+02	2.58E+00	-	5.07E+02	3.27E+00
F25	4.81E+02	2.27E+00	+	4.81E+02	3.15E+00	+	4.83E+02	1.19E+01	+	4.81E+02	2.81E+00
F26	1.12E+03	4.82E+01	+	1.13E+03	5.02E+01	+	1.04E+03	5.72E+01	-	1.09E+03	4.91E+01
F27	5.03E+02	7.81E+00	-	5.07E+02	1.03E+01	-	5.26E+02	1.11E+01	+	5.17E+02	1.27E+01
F28	4.59E+02	2.10E-13	+	4.59E+02	1.95E-13	+	4.62E+02	1.16E+01	+	4.58E+02	1.73E-01
F29	3.72E+02	1.22E+01	+	3.59E+02	1.48E+01	=	3.02E+02	6.91E+00	-	3.59E+02	1.05E+01
F30	6.05E+05	3.74E+04	-	5.98E+05	2.70E+04	-	6.63E+05	7.30E+04	+	6.31E+05	5.25E+04
W	**13**			**7**			**9**				
T	**12**			**15**			**5**				
L	**4**			**7**			**15**				

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	100-D														
	PaDE			SCSS-L-SHADE			EaDE			L-SHADE-RSP			EJADE		
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std	sig	mean	std	sig
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	=	4.17E-10	2.08E-09	=
F3	5.53E-08	5.82E-08	-	2.15E-04	6.33E-05	+	1.05E-04	9.47E-05	+	2.15E-07	3.19E-07	=	4.15E+03	4.02E+03	+
F4	1.41E+02	6.85E+01	-	2.09E+02	7.77E+00	+	1.96E+02	1.73E+01	=	2.00E+02	9.13E+00	=	4.18E+01	6.22E+01	-
F5	4.33E+01	3.04E+00	+	2.86E+01	4.01E+00	+	2.52E+01	7.21E+00	=	2.91E+01	7.99E+00	+	1.20E+02	2.20E+01	+
F6	1.68E-02	1.23E-02	+	1.69E-03	8.24E-04	+	2.07E-03	1.89E-03	+	2.80E-05	7.09E-05	=	6.30E-02	7.13E-02	+
F7	1.42E+02	9.44E+00	+	1.30E+02	2.08E+00	+	1.30E+02	4.29E+00	+	1.37E+02	7.37E+00	+	2.23E+02	1.87E+01	+
F8	4.31E+01	2.95E+00	+	3.02E+01	3.70E+00	+	2.44E+01	6.38E+00	=	2.82E+01	9.22E+00	=	1.19E+02	1.76E+01	+
F9	1.31E+00	6.23E-01	+	1.24E-01	1.60E-01	+	5.47E-02	1.20E-01	+	0.00E+00	0.00E+00	=	2.77E+01	1.86E+01	+
F10	9.66E+03	5.26E+02	+	1.03E+04	3.90E+02	+	9.36E+03	7.27E+02	+	1.07E+04	8.13E+02	+	1.04E+04	1.53E+03	+
F11	5.68E+02	6.95E+01	+	1.77E+02	2.18E+01	+	1.67E+02	4.77E+01	+	6.70E+01	1.92E+01	+	4.67E+02	3.53E+02	+
F12	2.74E+04	1.31E+04	+	2.20E+04	1.10E+04	+	1.74E+04	6.49E+03	+	1.15E+04	4.84E+03	+	3.41E+04	1.97E+04	+
F13	7.44E+02	4.15E+02	+	2.13E+02	1.90E+01	+	1.82E+02	5.50E+01	+	1.32E+02	3.76E+01	+	4.45E+02	4.53E+02	+
F14	2.83E+02	1.76E+01	+	9.27E+01	1.01E+01	+	8.36E+01	1.89E+01	+	4.31E+01	5.36E+00	+	3.67E+02	2.10E+02	+
F15	2.22E+02	4.13E+01	+	2.70E+02	5.18E+01	+	2.48E+02	4.73E+01	+	1.24E+02	3.42E+01	+	4.05E+02	3.71E+02	+
F16	1.44E+03	1.33E+02	=	1.45E+03	2.12E+02	=	1.50E+03	2.74E+02	=	1.49E+03	3.38E+02	=	2.03E+03	4.92E+02	+
F17	1.12E+03	1.65E+02	+	9.71E+02	1.86E+02	-	9.93E+02	2.84E+02	=	1.09E+03	3.10E+02	=	1.58E+03	3.83E+02	+
F18	1.89E+02	1.77E+01	+	1.94E+02	6.21E+01	+	2.21E+02	5.92E+01	+	1.54E+02	4.01E+01	+	3.02E+03	2.95E+03	+
F19	1.96E+02	2.02E+01	+	1.70E+02	2.34E+00	+	1.68E+02	2.15E+01	+	6.75E+01	1.13E+01	+	1.80E+02	6.16E+01	+
F20	1.43E+03	1.46E+02	+	1.56E+03	9.87E+01	+	1.46E+03	3.21E+02	+	1.37E+03	2.71E+02	+	1.60E+03	3.38E+02	+
F21	2.67E+02	2.81E+00	+	2.52E+02	2.78E+00	=	2.50E+02	6.35E+00	=	2.49E+02	6.72E+00	=	3.40E+02	1.65E+01	+
F22	1.11E+04	5.19E+02	+	1.11E+04	3.90E+02	+	1.02E+04	9.20E+02	+	1.11E+04	7.43E+02	+	1.13E+04	1.47E+03	+
F23	5.94E+02	1.44E+01	+	5.54E+02	4.69E+00	=	5.61E+02	9.45E+00	+	5.64E+02	7.89E+00	+	6.29E+02	1.85E+01	+
F24	9.21E+02	2.87E+00	+	9.09E+02	6.40E+00	+	9.04E+02	6.95E+00	+	8.99E+02	6.53E+00	=	9.89E+02	2.39E+01	+
F25	7.29E+02	2.85E+01	+	7.39E+02	2.40E+01	+	7.30E+02	4.09E+01	+	7.32E+02	3.65E+01	+	7.38E+02	4.71E+01	+
F26	3.56E+03	9.74E+01	+	3.11E+03	5.78E+01	=	3.23E+03	8.01E+01	+	3.16E+03	1.02E+02	+	4.22E+03	2.77E+02	+
F27	6.62E+02	2.77E+01	+	6.12E+02	8.16E+00	+	6.22E+02	1.83E+01	+	5.79E+02	1.59E+01	=	6.47E+02	2.63E+01	+
F28	5.19E+02	1.55E+01	+	5.22E+02	2.56E+00	+	5.33E+02	2.26E+01	+	5.23E+02	2.35E+01	+	5.29E+02	4.07E+01	+
F29	1.15E+03	1.53E+02	-	1.32E+03	1.41E+02	+	1.26E+03	1.92E+02	=	1.21E+03	2.14E+02	=	1.63E+03	3.90E+02	+
F30	2.66E+03	8.33E+01	+	2.36E+03	7.97E+01	+	2.32E+03	1.18E+02	+	2.33E+03	1.54E+02	+	2.54E+03	1.94E+02	+
W	**24**			**23**			**21**			**17**			**27**		
T	**2**			**5**			**8**			**12**			**1**		
L	**3**			**1**			**0**			**0**			**1**		

Table S1 Performance comparison of ESADE with other state-of-the-art DEs on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	100-D										
	DISH			SCSS-jSO			DTDE			ESADE	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
F1	6.58E-08	1.32E-07	+	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F3	3.94E-05	3.75E-05	+	1.07E-04	1.03E-04	+	1.19E-04	1.58E-04	+	2.11E-07	2.35E-07
F4	2.03E+02	9.85E+00	+	1.97E+02	1.29E+01	=	1.96E+02	8.93E+00	=	2.03E+02	1.14E+01
F5	2.57E+01	8.89E+00	=	2.86E+01	5.36E+00	+	4.70E+00	2.59E+00	-	2.57E+01	3.41E+00
F6	6.12E-06	6.24E-06	-	1.78E-05	1.86E-05	-	2.44E-03	2.23E-03	+	1.97E-05	1.20E-05
F7	1.41E+02	9.64E+00	+	1.26E+02	3.78E+00	=	1.11E+02	1.67E+00	-	1.27E+02	3.32E+00
F8	2.66E+01	9.32E+00	=	2.86E+01	4.93E+00	+	4.57E+00	2.31E+00	-	2.64E+01	3.90E+00
F9	0.00E+00	0.00E+00	=	1.76E-03	1.25E-02	=	8.84E-02	1.56E-01	+	0.00E+00	0.00E+00
F10	1.12E+04	7.13E+02	+	9.38E+03	6.34E+02	+	3.49E+02	2.51E+02	-	8.97E+03	4.66E+02
F11	5.40E+01	2.20E+01	+	6.67E+01	3.17E+01	+	1.65E+02	4.54E+01	+	4.85E+01	3.20E+01
F12	1.22E+04	5.15E+03	+	1.31E+04	6.56E+03	+	1.68E+04	5.71E+03	+	4.95E+03	8.95E+02
F13	1.17E+02	3.37E+01	+	1.13E+02	3.08E+01	+	1.73E+02	5.39E+01	+	7.13E+01	2.76E+01
F14	3.73E+01	3.85E+00	-	4.07E+01	4.72E+00	=	8.19E+01	1.71E+01	+	3.91E+01	3.77E+00
F15	1.17E+02	3.62E+01	+	8.96E+01	3.28E+01	=	2.52E+02	5.29E+01	+	7.98E+01	3.14E+01
F16	1.83E+03	3.81E+02	+	1.77E+03	2.85E+02	+	2.19E+02	1.25E+02	-	1.45E+03	2.13E+02
F17	1.26E+03	3.08E+02	+	1.19E+03	1.95E+02	+	8.00E+01	7.37E+01	-	1.03E+03	1.95E+02
F18	1.18E+02	2.71E+01	+	1.09E+02	2.86E+01	+	2.28E+02	3.93E+01	+	5.57E+01	1.42E+01
F19	5.62E+01	6.71E+00	+	5.28E+01	6.94E+00	+	1.64E+02	3.02E+01	+	4.79E+01	5.57E+00
F20	1.52E+03	3.42E+02	+	1.33E+03	2.14E+02	+	1.65E+02	3.60E+01	-	1.19E+03	1.38E+02
F21	2.49E+02	7.77E+00	-	2.51E+02	5.15E+00	=	2.27E+02	4.54E+00	-	2.51E+02	4.41E+00
F22	1.19E+04	6.67E+02	+	1.01E+04	6.05E+02	+	9.56E+02	2.90E+02	-	9.78E+03	4.93E+02
F23	5.63E+02	9.41E+00	+	5.68E+02	9.38E+00	+	5.49E+02	7.83E+00	=	5.52E+02	1.09E+01
F24	8.94E+02	6.19E+00	-	8.94E+02	8.54E+00	-	8.95E+02	6.56E+00	-	8.99E+02	5.65E+00
F25	7.00E+02	4.91E+01	+	7.05E+02	3.88E+01	+	7.34E+02	3.87E+01	+	6.64E+02	4.34E+01
F26	3.10E+03	8.05E+01	=	3.10E+03	9.25E+01	=	3.16E+03	8.31E+01	+	3.10E+03	8.69E+01
F27	5.68E+02	1.69E+01	=	5.77E+02	1.69E+01	=	6.23E+02	1.60E+01	+	5.76E+02	2.02E+01
F28	5.21E+02	2.47E+01	+	5.28E+02	2.88E+01	+	5.28E+02	2.64E+01	+	5.13E+02	2.55E+01
F29	1.26E+03	2.43E+02	=	1.18E+03	2.07E+02	=	8.54E+02	1.68E+02	-	1.22E+03	1.56E+02
F30	2.34E+03	1.41E+02	+	2.29E+03	1.13E+02	=	2.34E+03	1.44E+02	+	2.28E+03	1.76E+02
W	**19**			**16**			**15**				
T	**6**			**11**			**3**				
L	**4**			**2**			**11**				

Table S2 Performance comparison of ESA with other multi-strategy methods on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	30-D										
	Sa			EPS			SaM			ESA	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
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
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	4.54E+01	8.06E+00	-	4.64E+01	1.04E+01	=	2.98E+01	6.03E+00	-	4.96E+01	1.90E+00
F5	7.78E+00	1.32E+00	=	7.89E+00	1.46E+00	=	8.34E+00	2.44E+00	+	7.57E+00	1.45E+00
F6	8.05E-09	3.25E-08	-	5.37E-09	2.10E-08	-	2.68E-09	1.92E-08	-	5.40E-08	1.28E-07
F7	3.92E+01	1.37E+00	+	3.92E+01	1.68E+00	+	4.05E+01	2.50E+00	+	3.85E+01	1.62E+00
F8	8.41E+00	1.57E+00	+	8.13E+00	1.35E+00	=	9.52E+00	2.26E+00	+	7.58E+00	1.46E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	1.43E+03	2.13E+02	-	1.45E+03	2.56E+02	=	1.39E+03	2.93E+02	-	1.54E+03	1.93E+02
F11	9.44E+00	1.65E+01	=	5.91E+00	1.22E+01	=	6.31E+00	1.22E+01	=	7.72E+00	1.50E+01
F12	3.03E+02	1.89E+02	+	2.74E+02	1.48E+02	+	4.15E+02	2.09E+02	+	1.01E+02	8.54E+01
F13	1.52E+01	6.31E+00	-	1.62E+01	6.01E+00	=	1.93E+01	1.73E+01	=	1.74E+01	5.93E+00
F14	1.95E+01	5.53E+00	=	2.01E+01	5.01E+00	+	2.00E+01	4.88E+00	=	1.96E+01	4.49E+00
F15	2.41E+00	1.56E+00	=	2.15E+00	1.33E+00	=	2.92E+00	1.66E+00	=	2.76E+00	2.06E+00
F16	2.51E+01	3.39E+01	=	3.76E+01	5.97E+01	=	1.83E+01	1.93E+01	-	2.13E+01	2.48E+01
F17	2.91E+01	7.12E+00	-	2.95E+01	7.68E+00	-	2.58E+01	5.88E+00	-	3.35E+01	5.88E+00
F18	2.09E+01	6.11E-01	=	2.10E+01	6.64E-01	=	2.14E+01	8.29E-01	+	2.06E+01	3.40E-01
F19	5.32E+00	1.61E+00	=	5.44E+00	1.66E+00	=	5.71E+00	1.43E+00	=	5.59E+00	1.03E+00
F20	2.84E+01	6.09E+00	-	2.81E+01	5.47E+00	-	2.82E+01	7.54E+00	-	3.20E+01	5.70E+00
F21	2.09E+02	1.65E+00	+	2.08E+02	1.77E+00	=	2.08E+02	1.62E+00	=	2.08E+02	1.60E+00
F22	1.00E+02	1.44E-14	=	1.00E+02	1.44E-14	=	1.00E+02	6.39E-14	=	1.00E+02	1.08E-13
F23	3.49E+02	3.19E+00	=	3.50E+02	3.51E+00	=	3.50E+02	3.73E+00	=	3.50E+02	2.20E+00
F24	4.25E+02	2.18E+00	=	4.26E+02	2.09E+00	=	4.26E+02	1.76E+00	=	4.26E+02	1.65E+00
F25	3.87E+02	1.13E-02	=	3.87E+02	1.28E-02	=	3.87E+02	1.12E-02	-	3.87E+02	3.90E-03
F26	9.05E+02	4.71E+01	+	9.01E+02	4.15E+01	=	8.85E+02	4.40E+01	=	8.87E+02	2.93E+01
F27	5.02E+02	6.90E+00	+	5.03E+02	5.25E+00	+	5.03E+02	5.41E+00	+	4.98E+02	6.43E+00
F28	3.09E+02	3.09E+01	=	3.21E+02	4.36E+01	=	3.15E+02	3.86E+01	+	3.13E+02	3.65E+01
F29	4.35E+02	8.20E+00	=	4.31E+02	9.59E+00	-	4.33E+02	7.40E+00	-	4.36E+02	1.19E+01
F30	1.97E+03	3.39E+01	=	1.98E+03	3.92E+01	=	1.99E+03	5.37E+01	=	1.98E+03	3.25E+01
W	**6**			**4**			**7**				
T	**17**			**21**			**14**				
L	**6**			**4**			**8**				
	CSM			UM			SCSS			ESA	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
F1	3.77E-09	2.69E-08	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	4.83E+01	2.50E+01	+	5.70E+01	1.24E+00	+	4.81E+01	8.94E+00	=	4.96E+01	1.90E+00
F5	6.15E+00	1.58E+00	-	1.10E+01	1.91E+00	+	7.54E+00	1.72E+00	=	7.57E+00	1.45E+00
F6	4.15E-04	2.80E-03	=	1.05E-07	1.74E-07	=	3.35E-09	1.97E-08	-	5.40E-08	1.28E-07
F7	3.53E+01	9.32E-01	-	4.22E+01	2.13E+00	+	3.87E+01	1.47E+00	=	3.85E+01	1.62E+00
F8	5.78E+00	1.52E+00	-	1.18E+01	2.00E+00	+	8.20E+00	1.47E+00	=	7.58E+00	1.46E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	1.44E+03	2.44E+02	=	1.49E+03	2.57E+02	=	1.41E+03	2.04E+02	-	1.54E+03	1.93E+02
F11	4.37E+01	2.51E+01	+	7.02E+00	1.12E+01	+	8.19E+00	1.65E+01	=	7.72E+00	1.50E+01
F12	2.70E+03	1.69E+03	+	1.25E+02	9.74E+01	+	2.81E+02	1.54E+02	+	1.01E+02	8.54E+01
F13	1.99E+03	3.18E+02	+	1.89E+01	5.38E+00	=	1.48E+01	6.72E+00	-	1.74E+01	5.93E+00
F14	7.28E+01	1.05E+01	+	1.85E+01	7.31E+00	+	1.99E+01	5.63E+00	+	1.96E+01	4.49E+00
F15	1.53E+02	2.67E+01	+	5.54E+00	1.07E+00	+	2.09E+00	1.09E+00	=	2.76E+00	2.06E+00
F16	1.11E+02	8.92E+01	+	4.71E+01	5.79E+01	+	2.18E+01	3.81E+01	-	2.13E+01	2.48E+01
F17	4.52E+01	1.77E+01	+	3.34E+01	6.99E+00	=	3.03E+01	6.18E+00	-	3.35E+01	5.88E+00
F18	1.04E+02	2.21E+01	+	2.08E+01	1.99E-01	+	2.08E+01	4.97E-01	=	2.06E+01	3.40E-01
F19	7.70E+01	1.32E+01	+	7.19E+00	2.38E+00	+	4.81E+00	1.55E+00	-	5.59E+00	1.03E+00
F20	4.46E+01	2.30E+01	+	2.57E+01	7.68E+00	-	2.69E+01	5.91E+00	-	3.20E+01	5.70E+00
F21	2.06E+02	2.96E+00	-	2.12E+02	1.95E+00	+	2.08E+02	1.87E+00	=	2.08E+02	1.60E+00
F22	1.00E+02	1.44E-14	=	1.00E+02	1.68E-13	=	1.00E+02	1.44E-14	=	1.00E+02	1.08E-13
F23	3.60E+02	5.55E+00	+	3.53E+02	3.07E+00	+	3.49E+02	3.45E+00	=	3.50E+02	2.20E+00
F24	4.29E+02	3.59E+00	+	4.28E+02	2.54E+00	+	4.25E+02	2.19E+00	-	4.26E+02	1.65E+00
F25	3.88E+02	6.62E-01	+	3.87E+02	2.78E-03	+	3.87E+02	9.56E-03	+	3.87E+02	3.90E-03
F26	1.01E+03	6.72E+01	+	9.49E+02	4.00E+01	+	8.92E+02	4.42E+01	=	8.87E+02	2.93E+01
F27	5.14E+02	5.93E+00	+	4.94E+02	8.18E+00	-	5.03E+02	6.43E+00	+	4.98E+02	6.43E+00
F28	3.06E+02	2.45E+01	+	3.04E+02	2.02E+01	=	3.19E+02	4.21E+01	=	3.13E+02	3.65E+01
F29	4.53E+02	1.48E+01	+	4.34E+02	1.66E+01	=	4.33E+02	1.44E+01	=	4.36E+02	1.19E+01
F30	2.28E+03	1.04E+02	+	1.97E+03	1.15E+01	=	1.98E+03	3.02E+01	=	1.98E+03	3.25E+01
W	**19**			**16**			**4**				
T	**6**			**11**			**17**				
L	**4**			**2**			**8**				

Table S2 Performance comparison of ESA with other multi-strategy methods on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	50-D										
	Sa			EPS			SaM			ESA	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
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
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	4.63E+01	4.36E+01	-	4.87E+01	4.19E+01	-	5.35E+01	4.50E+01	-	7.56E+01	5.21E+01
F5	1.67E+01	2.43E+00	+	1.65E+01	2.72E+00	+	1.63E+01	3.56E+00	+	1.25E+01	2.06E+00
F6	7.55E-08	1.33E-07	-	1.16E-07	1.68E-07	-	1.07E-07	1.67E-07	-	1.02E-06	1.24E-06
F7	6.85E+01	2.50E+00	+	6.75E+01	2.70E+00	+	6.99E+01	4.71E+00	+	6.42E+01	2.13E+00
F8	1.61E+01	2.78E+00	+	1.63E+01	2.31E+00	+	1.63E+01	3.25E+00	+	1.34E+01	2.24E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	3.17E+03	2.41E+02	=	3.13E+03	3.81E+02	=	3.04E+03	3.54E+02	=	3.04E+03	3.47E+02
F11	2.32E+01	2.38E+00	+	2.27E+01	3.27E+00	+	2.12E+01	2.33E+00	=	2.16E+01	2.49E+00
F12	1.69E+03	4.30E+02	+	1.53E+03	3.57E+02	+	1.58E+03	3.91E+02	+	8.55E+02	3.13E+02
F13	6.90E+01	3.89E+01	+	6.08E+01	4.02E+01	+	5.99E+01	3.81E+01	+	4.43E+01	2.93E+01
F14	2.56E+01	1.88E+00	+	2.54E+01	1.71E+00	+	2.71E+01	2.98E+00	+	2.35E+01	1.25E+00
F15	2.56E+01	3.61E+00	+	2.49E+01	2.70E+00	+	2.73E+01	4.66E+00	+	2.03E+01	1.80E+00
F16	3.19E+02	1.10E+02	=	3.22E+02	1.17E+02	=	2.63E+02	1.05E+02	=	3.00E+02	1.25E+02
F17	2.34E+02	7.52E+01	=	2.18E+02	6.85E+01	=	2.34E+02	5.56E+01	=	2.09E+02	8.32E+01
F18	2.53E+01	2.29E+00	+	2.61E+01	2.20E+00	+	2.55E+01	2.49E+00	+	2.27E+01	1.15E+00
F19	1.70E+01	3.36E+00	+	1.66E+01	2.67E+00	+	1.78E+01	3.31E+00	+	1.32E+01	1.87E+00
F20	1.02E+02	4.09E+01	-	1.11E+02	4.93E+01	=	1.00E+02	3.28E+01	-	1.21E+02	5.21E+01
F21	2.16E+02	3.24E+00	=	2.18E+02	2.91E+00	+	2.18E+02	3.24E+00	+	2.15E+02	2.35E+00
F22	1.07E+03	1.53E+03	-	1.41E+03	1.73E+03	-	1.50E+03	1.70E+03	-	2.51E+03	1.67E+03
F23	4.31E+02	4.51E+00	+	4.31E+02	4.76E+00	+	4.31E+02	5.89E+00	+	4.27E+02	4.89E+00
F24	5.07E+02	3.54E+00	=	5.08E+02	3.31E+00	=	5.07E+02	3.48E+00	=	5.07E+02	3.27E+00
F25	4.81E+02	2.42E+00	=	4.81E+02	2.94E+00	=	4.82E+02	2.68E+00	-	4.81E+02	2.81E+00
F26	1.07E+03	4.77E+01	=	1.10E+03	6.20E+01	=	1.08E+03	5.18E+01	=	1.09E+03	4.91E+01
F27	5.27E+02	1.37E+01	+	5.26E+02	1.37E+01	+	5.39E+02	2.63E+01	+	5.17E+02	1.27E+01
F28	4.61E+02	1.45E+01	-	4.60E+02	1.33E+01	-	4.58E+02	1.36E+01	-	4.58E+02	1.73E-01
F29	3.53E+02	1.01E+01	-	3.53E+02	1.12E+01	-	3.54E+02	1.14E+01	-	3.59E+02	1.05E+01
F30	6.50E+05	7.85E+04	=	6.23E+05	5.81E+04	=	6.54E+05	8.05E+04	=	6.31E+05	5.25E+04
W	**12**			**13**			**12**				
T	**11**			**11**			**10**				
L	**6**			**5**			**7**				
	CSM			UM			SCSS			ESA	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
F1	1.16E-01	2.06E-01	+	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	4.95E+01	4.27E+01	=	5.55E+01	4.50E+01	=	4.54E+01	4.30E+01	-	7.56E+01	5.21E+01
F5	1.38E+01	2.70E+00	+	2.24E+01	4.03E+00	+	1.49E+01	2.21E+00	+	1.25E+01	2.06E+00
F6	8.23E-04	2.33E-03	-	1.20E-06	1.66E-06	=	2.91E-08	7.12E-08	-	1.02E-06	1.24E-06
F7	6.08E+01	1.99E+00	-	7.48E+01	4.16E+00	+	6.62E+01	3.01E+00	+	6.42E+01	2.13E+00
F8	1.31E+01	2.67E+00	=	2.17E+01	3.80E+00	+	1.47E+01	2.31E+00	+	1.34E+01	2.24E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	2.99E+03	3.76E+02	=	3.13E+03	3.78E+02	=	3.06E+03	3.19E+02	=	3.04E+03	3.47E+02
F11	7.56E+01	1.10E+01	+	2.73E+01	2.48E+00	+	2.27E+01	3.43E+00	=	2.16E+01	2.49E+00
F12	6.70E+03	2.30E+03	+	8.95E+02	3.74E+02	=	1.61E+03	3.65E+02	+	8.55E+02	3.13E+02
F13	1.20E+03	1.24E+03	+	6.64E+01	3.38E+01	+	5.42E+01	3.50E+01	=	4.43E+01	2.93E+01
F14	1.42E+02	1.51E+01	+	2.51E+01	1.73E+00	+	2.54E+01	2.20E+00	+	2.35E+01	1.25E+00
F15	3.03E+02	3.75E+01	+	2.17E+01	2.40E+00	+	2.33E+01	3.10E+00	+	2.03E+01	1.80E+00
F16	3.14E+02	7.58E+01	=	3.92E+02	1.52E+02	+	3.12E+02	1.14E+02	=	3.00E+02	1.25E+02
F17	2.84E+02	5.54E+01	+	2.62E+02	7.99E+01	+	2.25E+02	8.10E+01	=	2.09E+02	8.32E+01
F18	1.88E+02	3.48E+01	+	2.34E+01	1.44E+00	+	2.45E+01	1.96E+00	+	2.27E+01	1.15E+00
F19	7.41E+01	1.23E+01	+	1.48E+01	3.61E+00	+	1.62E+01	2.42E+00	+	1.32E+01	1.87E+00
F20	8.00E+01	1.39E+01	-	1.30E+02	7.29E+01	=	1.09E+02	4.81E+01	=	1.21E+02	5.21E+01
F21	2.15E+02	2.79E+00	=	2.23E+02	3.55E+00	+	2.16E+02	2.71E+00	=	2.15E+02	2.35E+00
F22	7.95E+02	1.43E+03	-	1.52E+03	1.80E+03	=	1.41E+03	1.73E+03	-	2.51E+03	1.67E+03
F23	4.44E+02	7.98E+00	+	4.32E+02	5.89E+00	+	4.29E+02	4.78E+00	+	4.27E+02	4.89E+00
F24	5.15E+02	4.92E+00	+	5.12E+02	4.58E+00	+	5.06E+02	3.74E+00	=	5.07E+02	3.27E+00
F25	5.16E+02	3.08E+01	+	4.81E+02	3.48E+00	+	4.81E+02	3.00E+00	+	4.81E+02	2.81E+00
F26	1.20E+03	7.95E+01	+	1.17E+03	5.66E+01	+	1.10E+03	5.29E+01	=	1.09E+03	4.91E+01
F27	5.79E+02	1.93E+01	+	5.09E+02	1.45E+01	-	5.25E+02	1.35E+01	+	5.17E+02	1.27E+01
F28	5.07E+02	1.59E+00	+	4.59E+02	1.14E-01	+	4.61E+02	1.46E+01	-	4.58E+02	1.73E-01
F29	4.39E+02	4.88E+01	+	3.64E+02	1.52E+01	+	3.60E+02	1.05E+01	=	3.59E+02	1.05E+01
F30	5.96E+05	2.67E+04	-	6.18E+05	6.44E+04	-	6.43E+05	6.70E+04	=	6.31E+05	5.25E+04
W	**17**			**18**			**11**				
T	**7**			**9**			**14**				
L	**5**			**2**			**4**				

Table S2 Performance comparison of ESA with other multi-strategy methods on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	100-D										
	Sa			EPS			SaM			ESA	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
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
F3	2.06E-08	4.96E-08	-	3.32E-08	4.13E-08	-	2.21E-09	7.30E-09	-	2.11E-07	2.35E-07
F4	1.94E+02	1.19E+01	-	1.93E+02	1.05E+01	-	1.92E+02	1.13E+01	-	2.03E+02	1.14E+01
F5	3.84E+01	5.99E+00	+	3.84E+01	5.95E+00	+	3.83E+01	4.63E+00	+	2.57E+01	3.41E+00
F6	2.01E-06	1.13E-06	-	2.31E-06	1.55E-06	-	2.10E-06	9.85E-07	-	1.97E-05	1.20E-05
F7	1.41E+02	5.78E+00	+	1.36E+02	6.83E+00	+	1.42E+02	8.06E+00	+	1.27E+02	3.32E+00
F8	3.69E+01	5.11E+00	+	3.78E+01	6.19E+00	+	3.83E+01	4.67E+00	+	2.64E+01	3.90E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	9.32E+03	4.82E+02	+	9.34E+03	7.24E+02	+	9.14E+03	5.60E+02	=	8.97E+03	4.66E+02
F11	7.08E+01	2.73E+01	+	7.33E+01	2.20E+01	+	6.70E+01	2.47E+01	+	4.85E+01	3.20E+01
F12	9.34E+03	4.34E+03	+	8.71E+03	2.83E+03	+	7.64E+03	3.01E+03	+	4.95E+03	8.95E+02
F13	1.72E+02	5.11E+01	+	1.63E+02	4.94E+01	+	1.94E+02	5.00E+01	+	7.13E+01	2.76E+01
F14	6.35E+01	8.74E+00	+	6.49E+01	1.02E+01	+	6.58E+01	1.17E+01	+	3.91E+01	3.77E+00
F15	1.37E+02	3.76E+01	+	1.41E+02	3.16E+01	+	1.45E+02	3.92E+01	+	7.98E+01	3.14E+01
F16	1.42E+03	2.60E+02	=	1.42E+03	3.20E+02	=	1.23E+03	2.74E+02	-	1.45E+03	2.13E+02
F17	1.03E+03	1.83E+02	=	1.11E+03	2.17E+02	=	9.72E+02	1.75E+02	=	1.03E+03	1.95E+02
F18	1.39E+02	3.94E+01	+	1.52E+02	3.92E+01	+	1.35E+02	3.73E+01	+	5.57E+01	1.42E+01
F19	7.32E+01	1.39E+01	+	7.46E+01	9.04E+00	+	6.63E+01	8.42E+00	+	4.79E+01	5.57E+00
F20	1.12E+03	1.97E+02	=	1.18E+03	1.96E+02	=	1.08E+03	1.49E+02	-	1.19E+03	1.38E+02
F21	2.60E+02	4.72E+00	+	2.61E+02	5.22E+00	+	2.64E+02	9.83E+00	+	2.51E+02	4.41E+00
F22	1.01E+04	6.19E+02	+	1.01E+04	6.63E+02	+	9.67E+03	6.23E+02	=	9.78E+03	4.93E+02
F23	5.55E+02	9.29E+00	=	5.56E+02	8.10E+00	=	5.60E+02	8.04E+00	+	5.52E+02	1.09E+01
F24	9.02E+02	7.27E+00	=	9.04E+02	7.76E+00	+	9.06E+02	8.21E+00	+	8.99E+02	5.65E+00
F25	7.06E+02	3.99E+01	+	7.17E+02	4.49E+01	+	6.84E+02	4.63E+01	=	6.64E+02	4.34E+01
F26	3.10E+03	8.47E+01	=	3.14E+03	7.53E+01	+	3.09E+03	7.80E+01	=	3.10E+03	8.69E+01
F27	5.89E+02	2.07E+01	+	5.89E+02	2.18E+01	+	5.90E+02	2.24E+01	+	5.76E+02	2.02E+01
F28	5.24E+02	2.76E+01	=	5.23E+02	2.49E+01	=	5.21E+02	2.19E+01	=	5.13E+02	2.55E+01
F29	1.12E+03	1.67E+02	-	1.09E+03	1.54E+02	-	1.07E+03	1.32E+02	-	1.22E+03	1.56E+02
F30	2.46E+03	1.66E+02	+	2.43E+03	1.92E+02	+	2.44E+03	2.01E+02	+	2.28E+03	1.76E+02
W	**16**			**18**			**15**				
T	**9**			**7**			**8**				
L	**4**			**4**			**6**				
	CSM			UM			SCSS			ESA	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
F1	3.42E+01	4.19E+01	+	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F3	0.00E+00	0.00E+00	-	2.23E-04	2.14E-04	+	7.25E-08	9.96E-08	-	2.11E-07	2.35E-07
F4	1.85E+02	3.18E+01	-	2.00E+02	1.04E+01	=	1.94E+02	1.07E+01	-	2.03E+02	1.14E+01
F5	3.33E+01	4.12E+00	+	4.76E+01	8.43E+00	+	3.24E+01	5.15E+00	+	2.57E+01	3.41E+00
F6	1.54E-03	1.84E-03	+	2.37E-05	1.04E-05	+	1.80E-06	1.19E-06	-	1.97E-05	1.20E-05
F7	1.21E+02	3.77E+00	-	1.49E+02	7.68E+00	+	1.29E+02	5.35E+00	=	1.27E+02	3.32E+00
F8	3.22E+01	4.64E+00	+	4.84E+01	7.70E+00	+	3.14E+01	5.24E+00	+	2.64E+01	3.90E+00
F9	7.31E-02	2.31E-01	+	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	9.10E+03	7.00E+02	=	9.75E+03	6.94E+02	+	9.15E+03	4.84E+02	=	8.97E+03	4.66E+02
F11	4.08E+02	5.18E+01	+	1.14E+02	4.75E+01	+	6.98E+01	4.02E+01	+	4.85E+01	3.20E+01
F12	4.81E+04	1.15E+04	+	1.13E+04	6.12E+03	+	9.40E+03	4.48E+03	+	4.95E+03	8.95E+02
F13	3.71E+03	4.49E+02	+	1.28E+02	4.18E+01	+	1.40E+02	3.30E+01	+	7.13E+01	2.76E+01
F14	2.50E+02	2.99E+01	+	4.50E+01	7.49E+00	+	5.63E+01	8.55E+00	+	3.91E+01	3.77E+00
F15	2.11E+02	2.64E+01	+	9.45E+01	4.19E+01	=	1.28E+02	3.77E+01	+	7.98E+01	3.14E+01
F16	1.13E+03	2.69E+02	-	1.76E+03	2.82E+02	+	1.38E+03	2.41E+02	=	1.45E+03	2.13E+02
F17	9.71E+02	2.00E+02	=	1.28E+03	2.15E+02	+	1.02E+03	1.68E+02	=	1.03E+03	1.95E+02
F18	1.97E+02	3.09E+01	+	8.25E+01	2.27E+01	+	1.38E+02	3.56E+01	+	5.57E+01	1.42E+01
F19	1.76E+02	1.85E+01	+	5.52E+01	6.83E+00	+	6.69E+01	1.03E+01	+	4.79E+01	5.57E+00
F20	9.85E+02	1.96E+02	-	1.26E+03	2.05E+02	+	1.14E+03	1.84E+02	=	1.19E+03	1.38E+02
F21	2.59E+02	5.58E+00	+	2.71E+02	8.29E+00	+	2.56E+02	5.21E+00	+	2.51E+02	4.41E+00
F22	9.31E+03	8.28E+02	-	1.08E+04	5.51E+02	+	9.68E+03	6.61E+02	=	9.78E+03	4.93E+02
F23	6.07E+02	1.36E+01	+	5.66E+02	8.03E+00	+	5.56E+02	8.42E+00	+	5.52E+02	1.09E+01
F24	9.30E+02	1.26E+01	+	9.05E+02	9.77E+00	+	9.01E+02	8.38E+00	=	8.99E+02	5.65E+00
F25	7.54E+02	5.67E+01	+	6.71E+02	3.78E+01	+	7.10E+02	4.09E+01	+	6.64E+02	4.34E+01
F26	3.28E+03	1.06E+02	+	3.19E+03	9.99E+01	+	3.10E+03	9.92E+01	=	3.10E+03	8.69E+01
F27	6.37E+02	2.27E+01	+	5.71E+02	2.10E+01	=	5.86E+02	2.47E+01	+	5.76E+02	2.02E+01
F28	5.48E+02	3.95E+01	+	5.19E+02	2.60E+01	+	5.15E+02	2.16E+01	=	5.13E+02	2.55E+01
F29	1.28E+03	1.82E+02	=	1.31E+03	1.73E+02	+	1.14E+03	1.64E+02	-	1.22E+03	1.56E+02
F30	2.61E+03	2.23E+02	+	2.27E+03	1.35E+02	=	2.35E+03	1.32E+02	+	2.28E+03	1.76E+02
W	**20**			**23**			**14**				
T	**3**			**6**			**11**				
L	**6**			**0**			**4**				

Table S3 Performance comparison of ESADE with the variants on 50-D CEC2017 benchmark set over 51 independent runs

	Variant-reverse			Variant-random			Variant-Amean			ESADE	
	mean	std	sig	mean	std	sig	mean	std	sig	mean	std
F1	1.09E-08	3.91E-08	+	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F3	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F4	4.33E+01	3.35E+01	=	4.37E+01	4.23E+01	-	7.28E+01	4.59E+01	=	7.56E+01	5.21E+01
F5	3.80E+01	5.34E+01	+	1.72E+01	2.75E+00	+	1.48E+01	2.16E+00	+	1.25E+01	2.06E+00
F6	6.64E-08	1.09E-07	-	1.28E-07	1.92E-07	-	8.36E-08	1.59E-07	-	1.02E-06	1.24E-06
F7	1.33E+02	9.71E+01	+	6.95E+01	2.66E+00	+	6.43E+01	1.77E+00	=	6.42E+01	2.13E+00
F8	2.96E+01	5.96E+00	+	1.67E+01	3.28E+00	+	1.53E+01	2.00E+00	+	1.34E+01	2.24E+00
F9	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00	=	0.00E+00	0.00E+00
F10	1.02E+04	2.12E+03	+	3.09E+03	3.67E+02	=	3.25E+03	2.82E+02	+	3.04E+03	3.47E+02
F11	3.54E+01	4.99E+00	+	2.32E+01	2.62E+00	+	3.19E+01	6.40E+00	+	2.16E+01	2.49E+00
F12	2.58E+03	5.52E+02	+	1.61E+03	3.77E+02	+	1.95E+03	5.21E+02	+	8.55E+02	3.13E+02
F13	1.10E+02	5.91E+01	+	5.65E+01	3.58E+01	+	5.62E+01	3.79E+01	=	4.43E+01	2.93E+01
F14	5.57E+01	1.48E+01	+	2.60E+01	2.11E+00	+	2.62E+01	2.20E+00	+	2.35E+01	1.25E+00
F15	5.58E+01	1.37E+01	+	2.46E+01	3.66E+00	+	2.99E+01	5.05E+00	+	2.03E+01	1.80E+00
F16	7.89E+02	6.44E+02	+	3.03E+02	1.15E+02	=	3.83E+02	1.09E+02	+	3.00E+02	1.25E+02
F17	1.11E+03	3.44E+02	+	2.44E+02	8.14E+01	+	2.71E+02	7.02E+01	+	2.09E+02	8.32E+01
F18	4.59E+01	1.11E+01	+	2.63E+01	3.03E+00	+	2.69E+01	2.87E+00	+	2.27E+01	1.15E+00
F19	3.60E+01	6.32E+00	+	1.73E+01	2.83E+00	+	2.01E+01	3.06E+00	+	1.32E+01	1.87E+00
F20	6.25E+02	2.55E+02	+	1.09E+02	5.34E+01	=	1.19E+02	3.00E+01	=	1.21E+02	5.21E+01
F21	2.47E+02	6.41E+01	+	2.18E+02	2.96E+00	+	2.16E+02	2.19E+00	+	2.15E+02	2.35E+00
F22	8.19E+02	2.92E+03	-	1.46E+03	1.72E+03	-	1.92E+03	1.86E+03	=	2.51E+03	1.67E+03
F23	4.45E+02	4.12E+01	+	4.31E+02	3.88E+00	+	4.32E+02	5.65E+00	+	4.27E+02	4.89E+00
F24	5.10E+02	4.33E+00	+	5.06E+02	3.46E+00	=	5.10E+02	3.47E+00	+	5.07E+02	3.27E+00
F25	4.94E+02	2.08E+01	+	4.81E+02	2.89E+00	=	4.84E+02	1.03E+01	+	4.81E+02	2.81E+00
F26	1.20E+03	3.78E+02	+	1.08E+03	5.40E+01	=	1.14E+03	4.50E+01	+	1.09E+03	4.91E+01
F27	5.31E+02	1.43E+01	+	5.25E+02	1.35E+01	+	5.30E+02	2.17E+01	+	5.17E+02	1.27E+01
F28	4.89E+02	2.35E+01	+	4.58E+02	6.74E+00	-	4.70E+02	2.12E+01	+	4.58E+02	1.73E-01
F29	4.22E+02	1.24E+02	+	3.55E+02	1.12E+01	=	3.85E+02	1.66E+01	+	3.59E+02	1.05E+01
F30	6.32E+05	5.30E+04	=	6.34E+05	4.54E+04	=	6.42E+05	6.98E+04	=	6.31E+05	5.25E+04
W	**23**			**14**			**19**				
T	**4**			**11**			**9**				
L	**2**			**4**			**1**				

Table S4
Comparison of ESA with other multi-strategy methods on the real-world problems

	Sa			EPS			SaM		
	mean	std	sig	mean	std	sig	mean	std	sig
Parameter Estimation for Frequency Modulated (FM) Sound Waves	1.74E+00	4.11E+00	=	**5.98E-01**	**2.42E+00**	=	1.42E+00	3.60E+00	=
Lennard-Jones Potential Problem	-2.76E+01	4.56E-01	+	-2.76E+01	4.66E-01	+	-2.77E+01	3.96E-01	+
Tersoff Potential for model Si (B)	-3.68E+01	2.41E-01	=	-3.68E+01	2.11E-01	=	-3.68E+01	1.78E-01	=
Tersoff Potential for model Si (C)	-2.92E+01	2.16E-04	+	-2.92E+01	2.52E-04	+	-2.92E+01	1.96E-04	+
Circular Antenna Array Design Problem	-2.16E+01	1.04E-01	=	-2.16E+01	8.00E-02	=	-2.16E+01	9.69E-02	=
ELD Problems: DED instance 1	4.67E+04	3.89E+02	+	4.67E+04	3.56E+02	+	4.64E+04	3.31E+02	+
ELD Instance 4	1.23E+05	4.90E+02	+	1.23E+05	4.09E+02	+	1.23E+05	4.95E+02	+
Hydrothermal Scheduling Instance 1	9.25E+05	5.91E+02	+	9.25E+05	5.99E+02	+	9.25E+05	6.51E+02	+
+	**5**			**5**			**5**		
=	3			3			3		
−	0			0			0		

CSM			UM			SCSS			ESA	
mean	std	sig	mean	std	sig	mean	std	sig	mean	std
1.66E+01	4.52E+00	+	6.35E-01	2.57E+00	+	1.26E+00	3.48E+00	=	**5.98E-01**	**2.42E+00**
-2.79E+01	**4.97E-01**	=	-2.74E+01	5.44E-01	+	-2.77E+01	4.32E-01	=	**-2.79E+01**	**4.22E-01**
-3.66E+01	4.16E-01	=	**-3.68E+01**	**3.40E-01**	=	-3.68E+01	2.08E-01	-	**-3.68E+01**	**2.57E-01**
-2.92E+01	4.44E-04	-	-2.92E+01	4.84E-04	+	**-2.92E+01**	**6.89E-05**	-	-2.92E+01	6.11E-05
-2.15E+01	9.77E-02	+	**-2.17E+01**	**9.86E-02**	=	-2.16E+01	8.77E-02	+	**-2.17E+01**	**8.94E-02**
4.76E+04	3.92E+02	+	4.71E+04	4.03E+02	+	4.66E+04	3.40E+02	+	**4.61E+04**	**3.75E+02**
1.24E+05	4.75E+02	+	**1.22E+05**	**2.57E+02**	=	1.23E+05	3.96E+02	+	**1.22E+05**	**3.03E+02**
9.26E+05	6.28E+02	+	9.25E+05	5.14E+02	+	9.25E+05	6.92E+02	+	**9.25E+05**	**5.41E+02**
5			**5**			**4**				
2			3			2				
1			0			2				

Table S5 Comparison of ESA with single mutation strategy on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	30-D								50-D							
	SHADE-rand/1			SHADE-current-to-pbest/1			ESA-SHADE		SHADE-rand/1			SHADE-current-to-pbest/1			ESA-SHADE	
	mean	std	sig	mean	std	sig	mean	std	mean	std	sig	mean	std	sig	mean	std
F1	0.00E+00	0.00E+00	=	1.11E-14	5.90E-15	+	0.00E+00	0.00E+00	3.78E+03	3.60E+03	+	4.65E-14	1.75E-14	+	0.00E+00	0.00E+00
F3	3.39E+04	5.10E+04	+	7.58E-14	3.53E-14	+	2.00E+03	1.43E+04	9.35E+04	1.13E+05	+	3.43E-13	1.12E-13	-	7.51E-05	4.84E-04
F4	5.77E+01	7.70E+00	+	5.58E+01	1.42E+01	-	5.87E+01	7.78E-01	8.32E+01	5.50E+01	+	5.67E+01	4.49E+01	=	6.24E+01	4.30E+01
F5	3.75E+01	8.62E+00	+	1.47E+01	3.07E+00	=	1.83E+01	1.01E+01	7.41E+01	1.12E+01	+	3.25E+01	5.49E+00	+	2.69E+01	5.17E+00
F6	3.55E-07	8.05E-07	=	2.59E-05	2.85E-05	+	3.49E-07	5.83E-07	6.99E-06	1.37E-05	=	8.16E-04	9.69E-04	+	7.34E-06	1.07E-05
F7	6.78E+01	8.60E+00	+	4.43E+01	2.63E+00	=	4.53E+01	6.25E+00	1.23E+02	1.52E+01	+	8.18E+01	4.98E+00	+	7.75E+01	7.14E+00
F8	3.68E+01	6.88E+00	+	1.62E+01	2.95E+00	=	1.85E+01	6.35E+00	7.59E+01	1.34E+01	+	3.16E+01	4.83E+00	+	2.69E+01	4.48E+00
F9	1.42E-02	6.64E-02	=	2.65E-02	7.31E-02	+	1.23E-02	3.59E-02	5.33E-01	6.11E-01	+	9.36E-01	6.54E-01	+	3.33E-01	4.51E-01
F10	2.36E+03	2.32E+02	+	1.69E+03	2.52E+02	=	1.78E+03	2.46E+02	4.42E+03	2.42E+02	+	3.34E+03	3.29E+02	=	3.41E+03	3.20E+02
F11	2.75E+01	2.34E+01	=	2.91E+01	2.39E+01	=	2.85E+01	2.43E+01	7.94E+01	2.20E+01	=	1.34E+02	3.67E+01	+	7.72E+01	2.15E+01
F12	8.08E+03	8.28E+03	+	1.28E+03	3.99E+02	-	3.72E+03	3.88E+03	6.49E+04	3.68E+04	+	5.42E+03	3.88E+03	-	2.40E+04	1.64E+04
F13	3.17E+01	1.26E+01	=	3.74E+01	2.19E+01	+	2.93E+01	1.09E+01	1.48E+03	1.97E+03	+	2.84E+02	2.14E+02	+	1.31E+02	7.51E+01
F14	2.86E+01	1.04E+01	+	2.98E+01	5.50E+00	+	2.57E+01	8.00E+00	7.35E+01	1.73E+01	=	2.13E+02	6.49E+01	+	7.26E+01	2.25E+01
F15	1.40E+01	8.57E+00	+	2.27E+01	1.60E+01	+	1.07E+01	4.70E+00	1.11E+02	5.30E+01	+	3.09E+02	1.38E+02	+	8.49E+01	4.21E+01
F16	5.38E+02	1.64E+02	+	2.56E+02	1.29E+02	=	3.00E+02	1.42E+02	1.08E+03	1.92E+02	+	7.58E+02	1.70E+02	=	7.78E+02	2.31E+02
F17	9.59E+01	2.80E+01	+	4.78E+01	1.24E+01	-	5.16E+01	1.20E+01	8.02E+02	1.33E+02	+	5.19E+02	1.45E+02	=	4.88E+02	1.11E+02
F18	3.28E+03	2.32E+04	=	7.84E+01	4.73E+01	+	3.12E+01	1.29E+01	2.97E+04	2.05E+05	+	2.00E+02	1.31E+02	=	1.81E+02	1.74E+02
F19	1.05E+01	4.51E+00	=	1.29E+01	7.34E+00	+	9.02E+00	2.76E+00	5.07E+01	2.49E+01	=	1.48E+02	5.02E+01	+	5.62E+01	2.07E+01
F20	1.31E+02	5.36E+01	+	7.09E+01	5.01E+01	=	7.38E+01	4.73E+01	6.08E+02	1.39E+02	+	3.22E+02	1.26E+02	=	3.56E+02	1.22E+02
F21	2.40E+02	8.69E+00	+	2.17E+02	3.24E+00	=	2.19E+02	7.34E+00	2.77E+02	1.37E+01	+	2.35E+02	5.69E+00	+	2.30E+02	6.26E+00
F22	1.00E+02	2.14E-13	=	1.00E+02	1.68E-13	=	1.00E+02	2.14E-13	3.64E+03	2.23E+03	+	3.18E+03	1.57E+03	=	3.57E+03	1.30E+03
F23	3.87E+02	7.92E+00	+	3.64E+02	5.56E+00	=	3.65E+02	7.55E+00	4.93E+02	1.65E+01	+	4.59E+02	9.24E+00	+	4.52E+02	1.49E+01
F24	4.59E+02	1.11E+01	+	4.35E+02	4.38E+00	=	4.36E+02	8.82E+00	5.73E+02	1.66E+01	+	5.31E+02	6.80E+00	+	5.24E+02	8.81E+00
F25	3.87E+02	1.62E-01	+	3.87E+02	2.39E-01	=	3.87E+02	9.48E-02	4.92E+02	2.88E+01	=	5.11E+02	3.96E+01	=	4.92E+02	2.65E+01
F26	1.36E+03	1.17E+02	+	1.08E+03	4.94E+01	=	1.13E+03	1.32E+02	1.84E+03	1.61E+02	+	1.43E+03	9.89E+01	+	1.38E+03	1.25E+02
F27	5.06E+02	6.40E+00	+	5.05E+02	5.37E+00	+	5.01E+02	6.93E+00	5.67E+02	2.94E+01	+	5.44E+02	2.15E+01	+	5.35E+02	2.00E+01
F28	3.54E+02	5.96E+01	+	3.46E+02	6.11E+01	=	3.27E+02	4.87E+01	4.67E+02	1.85E+01	+	4.90E+02	2.29E+01	+	4.65E+02	1.58E+01
F29	4.83E+02	7.11E+01	=	4.61E+02	2.37E+01	=	4.80E+02	5.96E+01	5.82E+02	1.71E+02	+	4.56E+02	8.32E+01	=	4.79E+02	1.52E+02
F30	2.11E+03	9.31E+01	+	2.09E+03	1.27E+02	=	2.07E+03	1.17E+02	6.17E+05	4.37E+04	=	6.94E+05	8.59E+04	+	6.28E+05	4.67E+04
W	**20**			**10**					**23**			**18**				
T	**9**			**16**					**6**			**9**				
L	**0**			**3**					**0**			**2**				

Table S5 Comparison of ESA with single mutation strategy on 30-D, 50-D and 100-D CEC2017 benchmark set over 51 independent runs

	100-D							
	SHADE-rand/1			SHADE-current-to-pbest/1			ESA-SHADE	
	mean	std	sig	mean	std	sig	mean	std
F1	5.83E+03	6.44E+03	+	3.26E-10	7.32E-10	+	0.00E+00	0.00E+00
F3	3.01E+05	2.77E+05	+	3.37E-06	2.02E-05	-	1.14E+03	7.60E+03
F4	2.14E+02	1.52E+01	+	1.41E+02	6.61E+01	-	1.94E+02	1.72E+01
F5	1.67E+02	3.60E+01	+	1.01E+02	1.34E+01	+	6.45E+01	8.97E+00
F6	5.05E-05	5.30E-05	=	7.84E-02	5.02E-02	+	5.68E-05	4.07E-05
F7	2.55E+02	3.29E+01	+	2.07E+02	1.25E+01	+	1.68E+02	2.03E+01
F8	1.74E+02	3.98E+01	+	9.93E+01	1.18E+01	+	6.22E+01	7.76E+00
F9	4.88E+00	3.58E+00	=	2.68E+01	1.99E+01	+	4.29E+00	3.46E+00
F10	1.15E+04	5.02E+02	+	9.36E+03	4.43E+02	=	9.42E+03	5.35E+02
F11	1.75E+04	2.55E+04	+	1.05E+03	2.04E+02	+	3.53E+02	1.33E+02
F12	4.10E+05	1.77E+05	+	2.08E+04	1.23E+04	-	7.74E+04	3.65E+04
F13	2.53E+03	2.23E+03	+	6.80E+02	9.00E+02	-	1.37E+03	1.97E+03
F14	9.15E+03	8.33E+03	+	6.11E+02	2.59E+02	=	6.75E+02	5.99E+02
F15	7.98E+02	7.25E+02	+	3.64E+02	8.54E+01	+	3.47E+02	3.65E+02
F16	3.14E+03	2.57E+02	+	2.35E+03	3.09E+02	=	2.39E+03	3.04E+02
F17	2.44E+03	3.46E+02	+	1.88E+03	2.47E+02	+	1.71E+03	2.67E+02
F18	5.72E+05	1.81E+06	+	1.57E+03	1.16E+03	-	1.39E+04	1.08E+04
F19	1.43E+03	1.79E+03	+	2.92E+02	2.02E+02	+	4.70E+02	1.84E+03
F20	2.32E+03	2.40E+02	+	1.64E+03	2.51E+02	=	1.75E+03	2.08E+02
F21	3.96E+02	4.39E+01	+	3.27E+02	1.20E+01	+	2.92E+02	9.15E+00
F22	1.27E+04	4.43E+02	+	1.06E+04	5.58E+02	=	1.07E+04	5.85E+02
F23	6.50E+02	2.43E+01	+	6.13E+02	1.50E+01	+	5.87E+02	1.13E+01
F24	1.03E+03	3.48E+01	+	9.92E+02	2.41E+01	+	9.44E+02	1.15E+01
F25	7.69E+02	5.38E+01	+	7.40E+02	5.89E+01	=	7.25E+02	3.79E+01
F26	4.76E+03	3.42E+02	+	4.17E+03	2.16E+02	+	3.65E+03	1.21E+02
F27	7.35E+02	3.54E+01	+	6.72E+02	2.64E+01	=	6.71E+02	2.66E+01
F28	5.58E+02	2.82E+01	+	5.16E+02	3.86E+01	-	5.36E+02	3.02E+01
F29	2.41E+03	3.68E+02	+	2.12E+03	3.06E+02	+	1.87E+03	3.45E+02
F30	4.53E+03	1.32E+03	+	2.69E+03	3.28E+02	=	2.60E+03	2.44E+02
W	**27**			**15**				
T	**2**			**8**				
L	**0**			**6**				