Supplementary Material for "Less is More: A Small-Scale Learning Particle Swarm Optimization for Large-Scale Optimization"

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TABLE S.I
EXPERIMENTAL COMPARISON RESULTS OF SSLPSO WITH THE TOP ALGORITHMS OF THE CEC2010 AND CEC2012 COMPETITIONS

FUN	SSLPSO	MA-SW-Chains	MOS	jDElsgo	CCGS
	Mean±Std	Mean±Std	Mean±Std	Mean±Std	Mean±Std
f_1	**0.00E+00 ± 0.00E+00**	2.10E–14 ± 1.99E–14 (+)	**0.00E+00 ± 0.00E+00 (≈)**	8.86E-20 ± 4.51E-20 (+)	1.83E-22 ± 3.68E-22 (+)
f_2	5.43E+02 ± 3.05E+01	8.10E+02 ± 5.88E+01 (+)	1.97E+02 ± 1.59E+01 (-)	1.25E-01 ± 3.45E-01 (-)	**4.44E-02 ± 1.99E-01 (-)**
f_3	**4.53E-14 ± 3.61E-15**	7.28E–13 ± 3.40E–13 (+)	1.12E+00 ± 1.00E+00 (+)	3.81E-12 ± 5.02E-12 (+)	1.91E-01 ± 4.49E-01 (+)
f_4	4.01E+10 ± 1.10E+10	3.53E+11 ± 3.12E+10 (+)	**1.91E+10 ± 8.08E+09 (-)**	8.06E+10 ± 3.08E+10 (+)	1.79E+12 ± 7.62E+11 (+)
f_5	2.79E+08 ± 7.87E+06	1.68E+08 ± 1.04E+08 (-)	6.81E+08 ± 1.42E+08 (+)	9.72E+07 ± 1.44E+07 (-)	**1.97E+07 ± 4.69E+06 (-)**
f_6	**4.00E-09 ± 7.04E-15**	8.14E+04 ± 2.84E+05 (+)	1.99E+07 ± 5.67E+04 (+)	1.70E-08 ± 4.03E-08 (+)	2.88E+06 ± 4.87E+05 (+)
f_7	2.90E-15 ± 1.32E-14	1.03E+02 ± 8.70E+01 (+)	**0.00E+00 ± 0.00E+00 (-)**	1.31E-02 ± 6.82E-02 (+)	1.37E+02 ± 1.16E+02 (+)
f_8	**3.98E+02 ± 5.76E+02**	1.41E+07 ± 3.68E+07 (+)	1.12E+06 ± 1.79E+06 (+)	3.15E+06 ± 3.27E+06 (+)	2.81E+07 ± 3.14E+07 (+)
f_9	**6.17E+06 ± 5.91E+05**	1.41E+07 ± 1.15E+06 (+)	8.78E+06 ± 1.01E+06 (+)	3.11E+07 ± 5.00E+06 (+)	5.53E+07 ± 9.60E+06 (+)
f_{10}	**6.69E+02 ± 4.43E+01**	2.07E+03 ± 1.44E+02 (+)	7.86E+03 ± 2.43E+02 (+)	2.64E+03 ± 3.19E+02 (+)	4.74E+03 ± 2.45E+03 (+)
f_{11}	**1.18E-13 ± 2.95E-15**	3.80E+01 ± 7.35E+00 (+)	1.99E+02 ± 4.52E-01 (+)	2.20E+01 ± 1.53E+01 (+)	2.99E+01 ± 3.98E+00 (+)
f_{12}	5.45E+02 ± 3.11E+02	3.62E–06 ± 5.92E–07 (-)	**0.00E+00 ± 0.00E+00 (-)**	1.21E+04 ± 2.04E+03 (+)	5.35E+03 ± 4.39E+02 (+)
f_{13}	**1.39E+02 ± 4.72E+01**	1.25E+03 ± 5.72E+02 (+)	1.36E+03 ± 9.37E+02 (+)	7.11E+02 ± 1.37E+02 (+)	1.51E+03 ± 6.94E+02 (+)
f_{14}	1.90E+07 ± 1.14E+06	3.11E+07 ± 1.93E+06 (+)	**1.82E+07 ± 1.18E+06 (-)**	1.69E+08 ± 2.08E+07 (+)	1.35E+08 ± 9.05E+06 (+)
f_{15}	1.01E+04 ± 6.62E+01	2.74E+03 ± 1.22E+02 (-)	1.54E+04 ± 5.36E+02 (+)	5.84E+03 ± 4.48E+02 (-)	**1.74E+03 ± 8.94E+01 (-)**
f_{16}	**1.60E-13 ± 3.26E-15**	9.98E+01 ± 1.40E+01 (+)	3.97E+02 ± 2.10E-01 (+)	1.44E+02 ± 3.43E+01 (+)	3.11E+01 ± 5.22E+00 (+)
f_{17}	2.44E+04 ± 6.31E+03	1.24E+00 ± 1.25E–01 (-)	**4.66E-05 ± 6.24E–06 (-)**	1.02E+05 ± 1.26E+04 (+)	1.48E+04 ± 1.02E+03 (-)
f_{18}	**5.84E+02 ± 1.18E+02**	1.30E+03 ± 4.36E+02 (+)	3.91E+03 ± 2.18E+03 (+)	1.85E+03 ± 3.18E+02 (+)	3.13E+03 ± 1.01E+03 (+)
f_{19}	1.51E+07 ± 1.11E+06	2.85E+05 ± 1.78E+04 (-)	**3.41E+04 ± 2.63E+03 (-)**	2.74E+05 ± 2.12E+04 (-)	5.93E+05 ± 4.21E+04 (-)
f_{20}	8.43E+02 ± 6.31E+00	1.07E+03 ± 7.29E+01 (+)	**8.31E+02 ± 3.76E+02 (-)**	1.53E+03 ± 1.32E+02 (+)	1.31E+03 ± 2.14E+02 (+)
+(SSLPSO is significantly better)		15	11	16	15
-(SSLPSO is significantly worse)		5	8	4	5
≈		0	1	0	0

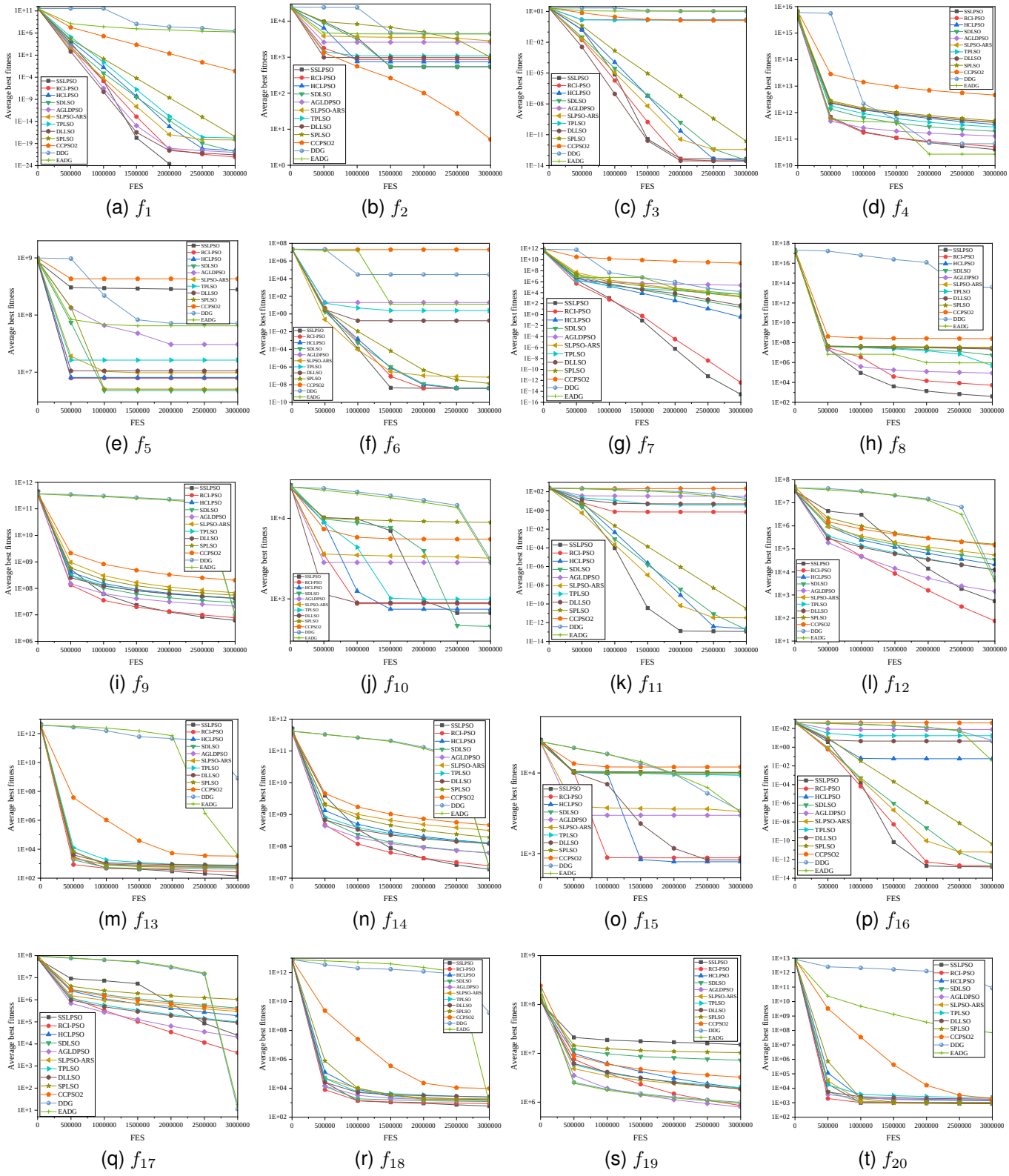
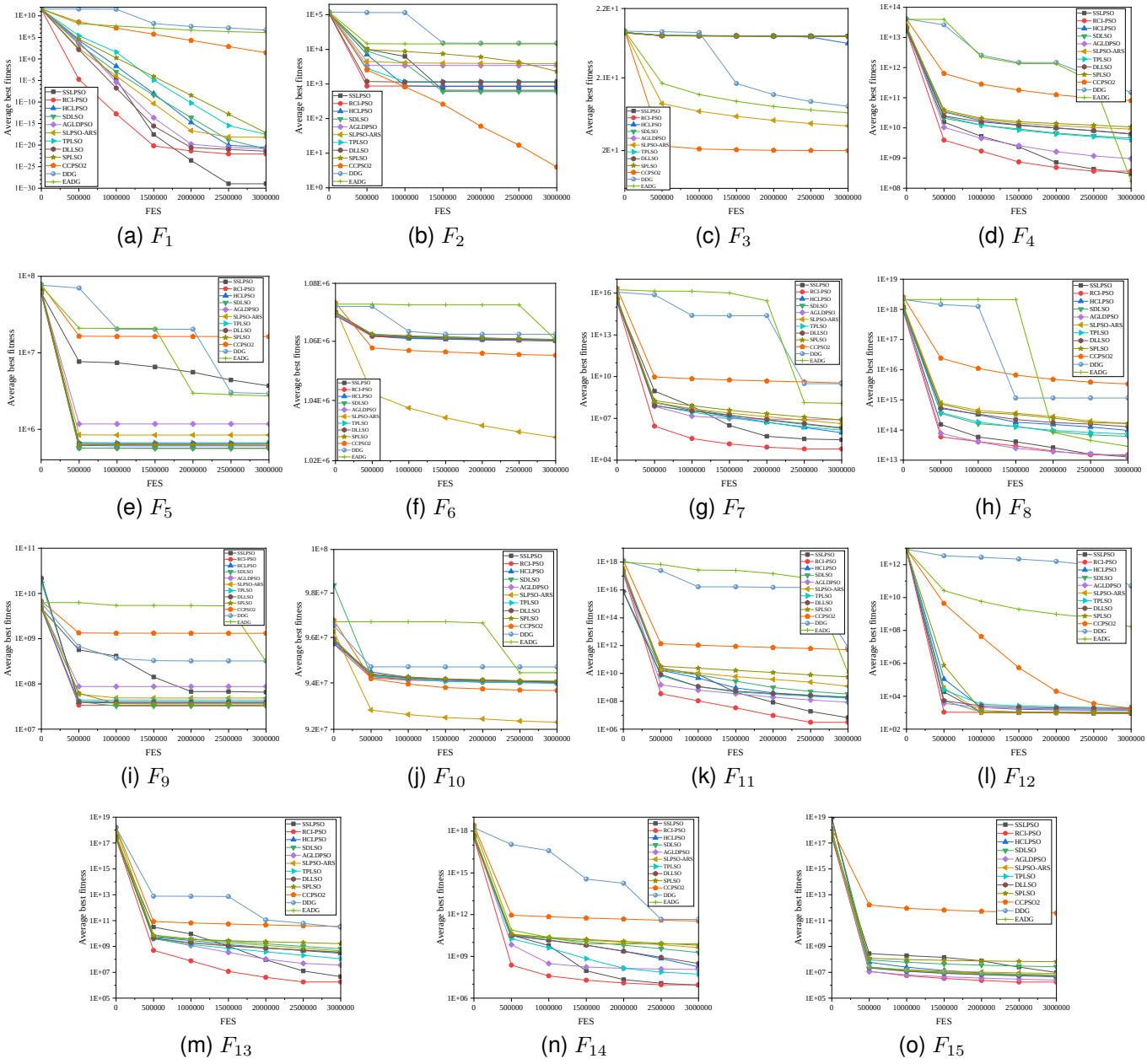


Fig. S.1. Comparison of the convergence behavior of BLPSO with other comparison algorithms on the 1000-dimensional CEC2010 benchmark functions.



(a) F_1 (b) F_2 (c) F_3 (d) F_4

(e) F_5 (f) F_6 (g) F_7 (h) F_8

(i) F_9 (j) F_{10} (k) F_{11} (l) F_{12}

(m) F_{13} (n) F_{14} (o) F_{15}

Fig. S.2. Comparison of the convergence behavior of BLPSO with other comparison algorithms on the 1000-dimensional CEC2013 benchmark functions.