

OLFWA: A Novel Fireworks Algorithm with New Explosion Operator and Two Stages Information Utilization

Mingjie Fan, Yupeng Zhou, Mingzhang Han, Xinchao Zhao, and Ying Tan

TABLE I: Comparison Results with State-of-the-Art FWA Variants on 50-D Test Functions

Fun.	OLFWA		FWASSP		ILoTFWA		MSCFWA		EDFWA	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.84E+00	1.52E+01	2.49E-06 −	3.60E-07	3.65E+01 +	6.44E+01	2.32E+03 +	4.05E+03	3.91E+02 +	6.95E+02
f_3	1.00E+02	4.14E-01	1.87E+05 +	2.08E+04	1.00E+02 −	1.11E-01	1.00E+02 ≈	2.94E-01	1.00E+02 −	3.12E-03
f_4	1.26E+02	2.18E+01	1.44E+02 ≈	3.99E+01	1.99E+02 +	3.92E+01	1.96E+02 +	3.82E+01	1.71E+02 +	4.06E+01
f_5	1.35E+02	8.75E+00	4.72E+02 +	1.50E+01	1.75E+02 +	1.43E+01	2.84E+02 +	2.28E+01	1.86E+02 +	1.26E+01
f_6	1.00E+02	6.25E-04	1.00E+02 +	7.64E-02	1.01E+02 +	1.13E+00	1.36E+02 +	5.92E+00	1.00E+02 +	2.80E-01
f_7	1.75E+02	5.98E+00	5.14E+02 +	1.51E+01	1.92E+02 +	1.05E+01	3.93E+02 +	4.11E+01	2.23E+02 +	9.40E+00
f_8	1.33E+02	7.35E+00	4.76E+02 +	1.56E+01	1.75E+02 +	1.54E+01	2.83E+02 +	2.18E+01	1.90E+02 +	1.29E+01
f_9	1.00E+02	6.55E-02	1.00E+02 −	2.90E-07	5.50E+02 +	7.38E+02	5.12E+03 +	1.41E+03	1.00E+02 ≈	6.72E-02
f_{10}	3.88E+03	4.91E+02	1.10E+04 +	3.55E+03	4.23E+03 +	5.43E+02	4.86E+03 +	5.44E+02	3.68E+03 −	3.81E+02
f_{11}	2.35E+02	3.18E+01	9.97E+03 +	7.16E+03	2.50E+02 +	3.51E+01	2.88E+02 +	4.45E+01	2.76E+02 +	4.21E+01
f_{12}	9.28E+05	3.85E+05	8.75E+09 +	3.08E+10	2.00E+06 +	1.04E+06	3.75E+07 +	1.86E+07	1.19E+06 +	5.46E+05
f_{13}	1.06E+04	2.07E+03	1.48E+10 +	2.10E+10	2.04E+04 +	5.54E+03	3.51E+04 +	1.22E+04	3.02E+04 +	1.03E+04
f_{14}	4.85E+03	3.12E+03	3.12E+06 +	2.61E+06	4.32E+03 ≈	3.31E+03	5.66E+03 ≈	4.96E+03	4.73E+03 ≈	5.14E+03
f_{15}	1.53E+03	4.32E+02	7.19E+09 +	4.01E+09	6.46E+03 +	3.06E+03	1.04E+04 +	3.41E+03	1.04E+04 +	3.79E+03
f_{16}	6.23E+02	1.70E+02	3.55E+03 +	8.06E+02	9.64E+02 +	2.12E+02	1.07E+03 +	1.87E+02	7.75E+02 +	1.53E+02
f_{17}	7.05E+02	1.34E+02	2.91E+03 +	4.25E+02	7.56E+02 ≈	1.70E+02	9.18E+02 +	1.31E+02	6.86E+02 ≈	1.06E+02
f_{18}	7.76E+04	1.96E+04	1.67E+07 +	1.40E+07	8.94E+04 ≈	3.50E+04	1.01E+05 +	4.21E+04	7.72E+04 ≈	2.30E+04
f_{19}	2.86E+03	1.78E+03	2.82E+09 +	1.78E+09	3.76E+04 +	2.80E+04	1.61E+05 +	1.88E+05	4.97E+04 +	2.12E+04
f_{20}	4.98E+02	1.23E+02	1.81E+03 +	1.68E+02	6.07E+02 +	1.30E+02	6.60E+02 +	1.18E+02	4.70E+02 ≈	8.88E+01
f_{21}	3.35E+02	6.53E+00	6.72E+02 +	1.44E+01	3.76E+02 +	1.28E+01	4.79E+02 +	2.53E+01	3.91E+02 +	1.27E+01
f_{22}	1.37E+03	1.93E+03	2.22E+03 +	4.34E+03	4.11E+03 +	1.67E+03	3.35E+03 +	2.65E+03	8.66E+02 ≈	1.49E+03
f_{23}	5.87E+02	1.29E+01	1.01E+03 +	3.69E+02	6.55E+02 +	3.28E+01	7.58E+02 +	3.99E+01	7.77E+02 +	4.35E+01
f_{24}	6.52E+02	1.09E+01	6.31E+02 −	3.68E+02	7.18E+02 +	3.03E+01	8.23E+02 +	3.53E+01	8.52E+02 +	5.77E+01
f_{25}	5.58E+02	2.01E+01	5.83E+02 +	2.38E+01	5.85E+02 +	2.79E+01	5.99E+02 +	2.68E+01	5.92E+02 +	3.03E+01
f_{26}	1.64E+03	2.74E+02	1.42E+03 −	1.28E+03	2.29E+03 +	3.83E+02	2.97E+03 +	1.24E+03	1.96E+03 +	1.13E+03
f_{27}	7.44E+02	3.51E+01	2.11E+03 +	5.93E+02	7.70E+02 +	5.34E+01	8.34E+02 +	5.34E+01	9.42E+02 +	6.39E+01
f_{28}	5.65E+02	1.29E+01	5.60E+02 −	3.86E+00	5.70E+02 ≈	1.84E+01	5.69E+02 +	1.27E+01	5.63E+02 ≈	6.36E+00
f_{29}	8.74E+02	1.23E+02	4.49E+03 +	1.62E+03	1.13E+03 +	2.12E+02	1.40E+03 +	1.97E+02	1.10E+03 +	1.26E+02
f_{30}	4.72E+06	8.06E+05	4.48E+09 +	2.42E+09	1.93E+07 +	2.52E+06	7.27E+07 +	1.47E+07	1.52E+07 +	3.06E+06
+/-/≈	-		23/5/1		24/1/4		27/0/2		20/2/7	

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TABLE II: Comparison Results with State-of-the-Art FWA Variants on 100-D Test Functions

Fun.	OLFWA		FWASSP		ILoTFWA		MSCFWA		EDFWA	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	1.19E+01	2.99E+01	4.81E+10 +	2.86E+11	4.61E+01 \approx	1.52E+02	5.47E+03 +	9.28E+03	3.72E+02 +	6.62E+02
f_3	1.17E+04	2.97E+03	4.70E+05 +	3.29E+04	2.31E+03 -	9.88E+02	1.20E+04 \approx	4.60E+03	1.10E+02 -	9.21E+00
f_4	2.83E+02	3.53E+01	3.04E+03 +	9.38E+03	3.26E+02 +	3.94E+01	3.53E+02 +	3.08E+01	2.97E+02 +	7.74E+01
f_5	1.80E+02	1.29E+01	9.92E+02 +	3.57E+01	3.08E+02 +	3.38E+01	6.54E+02 +	5.34E+01	3.71E+02 +	2.34E+01
f_6	1.00E+02	6.81E-04	1.00E+02 +	1.00E-01	1.01E+02 +	9.19E-01	1.56E+02 +	4.56E+00	1.03E+02 +	1.68E+00
f_7	2.64E+02	1.40E+01	2.99E+03 +	2.38E+03	3.07E+02 +	1.67E+01	1.03E+03 +	1.81E+02	4.25E+02 +	1.92E+01
f_8	1.81E+02	1.53E+01	1.03E+03 +	1.28E+02	3.09E+02 +	2.71E+01	6.57E+02 +	5.46E+01	3.90E+02 +	3.07E+01
f_9	1.00E+02	2.69E-02	2.71E+02 +	1.22E+03	3.03E+03 +	2.69E+03	1.84E+04 +	2.68E+03	1.52E+02 +	2.59E+02
f_{10}	8.31E+03	7.11E+02	2.59E+04 +	6.92E+03	8.97E+03 +	8.41E+02	1.12E+04 +	7.80E+02	8.82E+03 +	5.94E+02
f_{11}	1.09E+03	1.54E+02	1.69E+05 +	1.97E+04	1.01E+03 -	1.28E+02	1.21E+03 +	1.27E+02	1.24E+03 +	1.51E+02
f_{12}	1.83E+06	6.12E+05	1.75E+10 +	6.64E+10	5.61E+06 +	2.41E+06	2.37E+08 +	8.79E+07	2.73E+06 +	1.65E+06
f_{13}	1.54E+04	1.77E+03	5.43E+10 +	4.54E+10	1.83E+04 +	3.70E+03	2.75E+04 +	6.80E+03	2.64E+04 +	4.76E+03
f_{14}	7.71E+04	3.77E+04	1.83E+07 +	8.53E+06	6.30E+04 \approx	2.64E+04	8.50E+04 \approx	3.95E+04	4.36E+04 -	2.13E+04
f_{15}	4.32E+03	9.33E+02	3.01E+10 +	1.55E+10	1.17E+04 +	2.44E+03	2.01E+04 +	5.29E+03	1.96E+04 +	4.14E+03
f_{16}	1.69E+03	3.75E+02	1.07E+04 +	1.79E+03	2.36E+03 +	3.88E+02	2.97E+03 +	3.97E+02	2.11E+03 +	3.00E+02
f_{17}	1.67E+03	3.38E+02	1.16E+04 +	4.26E+03	1.83E+03 +	2.89E+02	2.22E+03 +	2.42E+02	1.71E+03 \approx	2.28E+02
f_{18}	1.70E+05	5.02E+04	2.98E+07 +	1.94E+07	1.64E+05 \approx	4.46E+04	1.89E+05 \approx	6.55E+04	1.48E+05 -	3.59E+04
f_{19}	7.84E+03	5.02E+03	3.20E+10 +	1.64E+10	1.31E+05 +	7.27E+04	8.87E+05 +	7.32E+05	1.25E+05 +	4.21E+04
f_{20}	1.73E+03	2.39E+02	4.93E+03 +	2.83E+02	1.81E+03 \approx	2.53E+02	2.00E+03 +	2.26E+02	1.63E+03 -	1.84E+02
f_{21}	4.24E+02	1.88E+01	1.44E+03 +	2.88E+02	5.59E+02 +	4.35E+01	9.02E+02 +	5.10E+01	7.07E+02 +	3.49E+01
f_{22}	9.88E+03	1.58E+03	2.06E+04 +	1.25E+04	1.13E+04 +	7.14E+02	1.31E+04 +	7.63E+02	9.94E+03 +	2.94E+03
f_{23}	7.92E+02	2.10E+01	2.19E+03 +	6.63E+02	1.11E+03 +	7.78E+01	1.42E+03 +	7.53E+01	1.58E+03 +	7.28E+01
f_{24}	1.14E+03	1.97E+01	2.68E+03 +	1.95E+03	1.38E+03 +	9.92E+01	1.78E+03 +	1.12E+02	2.10E+03 +	1.66E+02
f_{25}	7.54E+02	4.74E+01	4.60E+03 +	8.39E+03	8.26E+02 +	6.29E+01	8.53E+02 +	5.31E+01	8.74E+02 +	6.45E+01
f_{26}	4.29E+03	5.95E+02	1.12E+04 +	8.71E+03	5.89E+03 +	1.08E+03	1.09E+04 +	1.77E+03	6.88E+03 +	2.66E+03
f_{27}	8.09E+02	2.47E+01	3.58E+03 +	1.77E+03	9.37E+02 +	6.71E+01	1.03E+03 +	5.88E+01	1.21E+03 +	9.62E+01
f_{28}	6.67E+02	3.22E+01	5.48E+03 \approx	8.66E+03	6.75E+02 \approx	3.14E+01	6.95E+02 +	3.35E+01	7.06E+02 +	3.52E+01
f_{29}	2.62E+03	3.72E+02	1.59E+04 +	5.50E+03	3.24E+03 +	3.50E+02	3.98E+03 +	3.14E+02	3.11E+03 +	3.00E+02
f_{30}	6.12E+05	7.30E+04	5.35E+10 +	2.18E+10	2.79E+06 +	8.21E+05	5.26E+07 +	1.87E+07	1.00E+06 +	4.20E+05
+/-/ \approx	-		28/0/1		22/2/5		26/0/3		24/4/1	

TABLE III: Comparison Results with Other OD-based Algorithms on 50-D Test Functions

Fun.	OLFWA		OLPSO		OXDE		OCABC		OLBSO	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.84E+00	1.52E+01	4.09E+03 +	5.17E+03	1.80E+03 +	2.22E+03	2.47E+03 +	1.70E+03	2.02E+03 +	2.87E+03
f_3	1.00E+02	4.14E-01	4.23E+05 +	1.01E+05	9.50E+03 +	2.68E+03	2.31E+05 +	1.96E+04	1.30E+02 +	3.74E+01
f_4	1.26E+02	2.18E+01	2.32E+02 +	5.17E+01	1.81E+02 +	5.43E+01	1.42E+02 +	1.93E+01	2.37E+02 +	5.76E+01
f_5	1.35E+02	8.75E+00	1.73E+02 +	1.58E+01	1.43E+02 +	1.44E+01	2.95E+02 +	1.64E+01	4.06E+02 +	4.53E+01
f_6	1.00E+02	6.25E-04	1.00E+02 -	0.00E+00	1.00E+02 -	5.00E-08	1.00E+02 -	0.00E+00	1.09E+02 +	3.92E+00
f_7	1.75E+02	5.98E+00	2.15E+02 +	1.57E+01	2.12E+02 +	5.24E+01	3.11E+02 +	2.04E+01	4.70E+02 +	7.43E+01
f_8	1.33E+02	7.35E+00	5.10E+02 +	1.47E+01	4.94E+02 +	9.68E+00	5.08E+02 +	6.21E+00	5.00E+02 +	1.82E+01
f_9	1.00E+02	6.55E-02	1.06E+02 +	9.56E+00	1.00E+02 +	3.19E-01	6.22E+03 +	1.87E+03	1.24E+04 +	3.20E+03
f_{10}	3.88E+03	4.91E+02	4.54E+03 +	9.06E+02	9.04E+03 +	2.66E+03	4.40E+03 +	2.93E+02	6.90E+03 +	5.74E+02
f_{11}	2.35E+02	3.18E+01	1.91E+04 +	1.41E+04	1.44E+02 -	1.01E+01	1.59E+03 +	9.03E+02	3.07E+02 +	5.04E+01
f_{12}	9.28E+05	3.85E+05	2.51E+06 +	1.53E+06	3.27E+05 -	2.28E+05	3.80E+06 +	1.66E+06	1.19E+07 +	5.52E+06
f_{13}	1.06E+04	2.07E+03	5.65E+03 -	7.22E+03	2.68E+03 -	3.10E+03	5.79E+03 -	3.67E+03	6.21E+05 +	1.31E+05
f_{14}	4.85E+03	3.12E+03	1.19E+06 +	1.87E+06	6.34E+02 -	9.22E+02	8.49E+05 +	4.43E+05	2.76E+04 +	2.08E+04
f_{15}	1.53E+03	4.32E+02	8.04E+03 +	5.90E+03	5.17E+02 -	9.03E+02	1.33E+04 +	3.86E+03	1.27E+05 +	3.42E+04
f_{16}	6.23E+02	1.70E+02	1.50E+03 +	4.19E+02	9.09E+02 +	3.55E+02	1.31E+03 +	1.82E+02	2.07E+03 +	4.04E+02
f_{17}	7.05E+02	1.34E+02	1.02E+03 +	3.31E+02	7.02E+02 \approx	2.53E+02	9.89E+02 +	1.34E+02	1.78E+03 +	3.35E+02
f_{18}	7.76E+04	1.96E+04	2.22E+07 +	2.75E+07	3.65E+04 -	2.06E+04	1.42E+06 +	7.27E+05	2.58E+05 +	1.10E+05
f_{19}	2.86E+03	1.78E+03	1.64E+04 +	1.13E+04	2.00E+03 -	4.11E+03	1.52E+04 +	4.34E+03	1.44E+05 +	8.16E+04
f_{20}	4.98E+02	1.23E+02	9.73E+02 +	3.20E+02	4.45E+02 \approx	2.30E+02	8.15E+02 +	1.15E+02	1.19E+03 +	2.86E+02
f_{21}	3.35E+02	6.53E+00	3.79E+02 +	1.80E+01	3.47E+02 +	1.67E+01	4.95E+02 +	5.15E+01	7.05E+02 +	7.18E+01
f_{22}	1.37E+03	1.93E+03	4.92E+03 +	1.06E+03	8.76E+03 +	3.62E+03	4.37E+03 +	2.08E+03	7.73E+03 +	5.98E+02
f_{23}	5.87E+02	1.29E+01	6.20E+02 +	2.78E+01	5.71E+02 -	1.52E+01	7.49E+02 +	3.53E+01	1.07E+03 +	1.17E+02
f_{24}	6.52E+02	1.09E+01	6.95E+02 +	2.34E+01	6.61E+02 +	1.52E+01	1.11E+03 +	5.86E+01	1.04E+03 +	1.05E+02
f_{25}	5.58E+02	2.01E+01	6.40E+02 +	3.01E+01	6.37E+02 +	3.66E+01	6.07E+02 +	1.64E+01	5.59E+02 \approx	4.05E+01
f_{26}	1.64E+03	2.74E+02	2.17E+03 +	2.48E+02	1.64E+03 +	1.95E+02	1.04E+03 -	1.09E+03	7.80E+03 +	1.82E+03
f_{27}	7.44E+02	3.51E+01	8.01E+02 +	4.69E+01	6.54E+02 -	2.82E+01	7.40E+02 \approx	3.00E+01	1.59E+03 +	2.91E+02
f_{28}	5.65E+02	1.29E+01	6.04E+02 +	1.99E+01	6.00E+02 +	1.66E+01	5.81E+02 +	1.25E+01	5.89E+02 +	1.48E+01
f_{29}	8.74E+02	1.23E+02	9.33E+02 \approx	2.63E+02	4.80E+02 -	6.93E+01	1.16E+03 +	1.66E+02	2.81E+03 +	4.44E+02
f_{30}	4.72E+06	8.06E+05	1.14E+06 -	2.29E+05	7.23E+05 -	9.95E+04	7.49E+05 -	5.13E+04	1.41E+07 +	1.73E+06
+/-/ \approx	-		25/3/1		15/12/2		24/4/1		28/0/1	

TABLE IV: Comparison Results with Other OD-based Algorithms on 100-D Test Functions

Fun.	OLFWA		OLPSO		OXDE		OCABC		OLBSO	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	1.19E+01	2.99E+01	7.48E+03 +	9.06E+03	1.50E+03 +	3.23E+03	3.59E+03 +	2.50E+03	5.36E+07 +	5.86E+06
f_3	1.17E+04	2.97E+03	9.89E+05 +	5.22E+05	1.98E+05 +	2.13E+04	5.54E+05 +	3.26E+04	1.28E+04 +	1.53E+04
f_4	2.83E+02	3.53E+01	3.53E+02 +	3.98E+01	3.07E+02 +	1.90E+01	3.02E+02 +	2.18E+01	3.77E+02 +	6.55E+01
f_5	1.80E+02	1.29E+01	2.55E+02 +	2.89E+01	4.20E+02 +	1.97E+02	7.64E+02 +	4.78E+01	9.50E+02 +	7.83E+01
f_6	1.00E+02	6.81E-04	1.00E+02 -	0.00E+00	1.00E+02 -	0.00E+00	1.00E+02 -	0.00E+00	1.15E+02 +	3.91E+00
f_7	2.64E+02	1.40E+01	3.40E+02 +	2.83E+01	6.98E+02 +	1.62E+02	7.67E+02 +	3.88E+01	1.30E+03 +	1.26E+02
f_8	1.81E+02	1.53E+01	1.12E+03 +	3.05E+01	1.07E+03 +	1.65E+01	1.16E+03 +	1.39E+01	1.16E+03 +	2.80E+01
f_9	1.00E+02	2.69E-02	1.07E+02 +	9.69E+00	1.00E+02 +	1.70E-01	3.73E+04 +	4.49E+03	3.61E+04 +	5.76E+03
f_{10}	8.31E+03	7.11E+02	1.10E+04 +	1.29E+03	2.65E+04 +	1.29E+03	1.14E+04 +	6.92E+02	1.56E+04 +	1.04E+03
f_{11}	1.09E+03	1.54E+02	3.99E+05 +	8.53E+04	6.75E+02 -	4.09E+01	6.47E+04 +	1.45E+04	1.39E+03 +	1.58E+02
f_{12}	1.83E+06	6.12E+05	9.63E+06 +	5.43E+06	8.22E+05 -	4.28E+05	2.35E+07 +	5.84E+06	9.62E+07 +	2.20E+07
f_{13}	1.54E+04	1.77E+03	6.11E+03 -	6.61E+03	2.87E+03 -	2.59E+03	4.73E+03 -	1.67E+03	2.12E+06 +	2.66E+05
f_{14}	7.71E+04	3.77E+04	4.21E+06 +	4.70E+06	1.83E+04 -	1.96E+04	7.53E+06 +	2.43E+06	3.82E+05 +	1.43E+05
f_{15}	4.32E+03	9.33E+02	3.33E+03 -	3.93E+03	8.99E+02 -	6.39E+02	3.17E+03 -	1.55E+03	6.58E+05 +	1.17E+05
f_{16}	1.69E+03	3.75E+02	3.23E+03 +	6.94E+02	5.58E+03 +	1.46E+03	3.29E+03 +	2.59E+02	5.31E+03 +	6.71E+02
f_{17}	1.67E+03	3.38E+02	2.40E+03 +	6.33E+02	3.08E+03 +	1.15E+03	2.76E+03 +	2.83E+02	4.21E+03 +	6.45E+02
f_{18}	1.70E+05	5.02E+04	4.69E+07 +	4.07E+07	2.92E+05 +	1.48E+05	5.53E+06 +	1.32E+06	7.19E+05 +	2.42E+05
f_{19}	7.84E+03	5.02E+03	3.10E+03 -	4.97E+03	1.14E+03 -	1.25E+03	1.59E+04 +	7.53E+03	1.41E+06 +	6.31E+05
f_{20}	1.73E+03	2.39E+02	2.48E+03 +	6.46E+02	2.83E+03 +	1.07E+03	2.62E+03 +	2.74E+02	3.65E+03 +	4.52E+02
f_{21}	4.24E+02	1.88E+01	4.97E+02 +	2.67E+01	5.62E+02 +	1.86E+02	9.87E+02 +	3.97E+01	1.15E+03 +	1.76E+02
f_{22}	9.88E+03	1.58E+03	1.14E+04 +	1.57E+03	2.78E+04 +	1.41E+03	1.30E+04 +	5.87E+02	1.66E+04 +	9.17E+02
f_{23}	7.92E+02	2.10E+01	8.11E+02 +	3.51E+01	7.00E+02 -	3.28E+01	9.69E+02 +	2.40E+01	1.55E+03 +	1.89E+02
f_{24}	1.14E+03	1.97E+01	1.17E+03 +	4.41E+01	1.06E+03 -	5.21E+01	1.56E+03 +	3.81E+01	2.20E+03 +	2.66E+02
f_{25}	7.54E+02	4.74E+01	8.93E+02 +	4.87E+01	8.57E+02 +	3.69E+01	8.26E+02 +	3.52E+01	8.59E+02 +	6.60E+01
f_{26}	4.29E+03	5.95E+02	5.35E+03 +	3.99E+02	3.93E+03 -	3.85E+02	9.36E+03 +	1.81E+03	2.04E+04 +	3.83E+03
f_{27}	8.09E+02	2.47E+01	8.44E+02 +	4.29E+01	7.22E+02 -	1.78E+01	8.54E+02 +	2.34E+01	2.20E+03 +	3.87E+02
f_{28}	6.67E+02	3.22E+01	7.63E+02 +	5.16E+01	6.55E+02 -	3.35E+01	6.80E+02 +	1.27E+01	6.54E+02 \approx	2.64E+01
f_{29}	2.62E+03	3.72E+02	2.58E+03 \approx	4.02E+02	3.34E+03 +	1.02E+03	4.10E+03 +	2.50E+02	6.57E+03 +	8.17E+02
f_{30}	6.12E+05	7.30E+04	1.17E+04 -	6.07E+03	7.12E+03 -	2.72E+03	1.22E+04 -	3.22E+03	1.49E+07 +	4.66E+06
+/-/ \approx	-		23/5/1		16/13/0		25/4/0		28/0/1	

TABLE V: Comparison results with three flagship algorithms on 50-D test functions

Fun.	OLFWA		CMAES		SPSO2011		SHADE	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.84E+00	1.52E+01	0.00E+00 ⁻	0.00E+00	1.69E+03 ⁺	1.97E+03	2.89E+02 ⁺	9.01E+02
f_3	1.00E+02	4.14E-01	1.00E+02 ⁻	0.00E+00	2.12E+02 ⁺	8.05E+01	1.00E+02 ⁻	9.30E-07
f_4	1.26E+02	2.18E+01	1.43E+02 [≈]	4.65E+01	2.33E+02 ⁺	6.02E+01	1.48E+02 ⁺	3.65E+01
f_5	1.35E+02	8.75E+00	1.19E+03 ⁺	1.76E+02	2.17E+02 ⁺	2.28E+01	1.61E+02 ⁺	7.99E+00
f_6	1.00E+02	6.25E-04	1.97E+02 ⁺	9.71E+00	1.13E+02 ⁺	3.66E+00	1.01E+02 ⁺	5.38E-01
f_7	1.75E+02	5.98E+00	6.87E+03 ⁺	9.27E+02	2.61E+02 ⁺	2.03E+01	2.15E+02 ⁺	1.04E+01
f_8	1.33E+02	7.35E+00	4.99E+02 ⁺	1.46E+01	5.21E+02 ⁺	1.40E+01	1.66E+02 ⁺	9.75E+00
f_9	1.00E+02	6.55E-02	3.18E+04 ⁺	5.92E+03	7.00E+02 ⁺	4.05E+02	1.03E+02 ⁺	2.07E+00
f_{10}	3.88E+03	4.91E+02	8.37E+03 ⁺	9.46E+02	6.63E+03 ⁺	9.18E+02	5.39E+03 ⁺	4.28E+02
f_{11}	2.35E+02	3.18E+01	3.70E+02 ⁺	5.85E+01	2.53E+02 ⁺	3.28E+01	2.12E+02 ⁻	3.24E+01
f_{12}	9.28E+05	3.85E+05	2.67E+03 ⁻	5.78E+02	2.38E+06 ⁺	1.10E+06	5.75E+04 ⁻	6.56E+04
f_{13}	1.06E+04	2.07E+03	2.61E+03 ⁻	7.76E+02	5.84E+04 ⁺	3.24E+04	3.77E+03 ⁻	3.55E+03
f_{14}	4.85E+03	3.12E+03	4.23E+02 ⁻	7.58E+01	1.18E+04 ⁺	9.89E+03	4.82E+02 ⁻	1.18E+02
f_{15}	1.53E+03	4.32E+02	5.92E+02 ⁻	1.60E+02	2.05E+04 ⁺	1.56E+04	5.32E+02 ⁻	6.27E+02
f_{16}	6.23E+02	1.70E+02	1.09E+03 ⁺	3.74E+02	1.13E+03 ⁺	2.93E+02	9.55E+02 ⁺	2.24E+02
f_{17}	7.05E+02	1.34E+02	1.07E+03 ⁺	3.29E+02	1.12E+03 ⁺	2.17E+02	6.38E+02 ⁻	1.21E+02
f_{18}	7.76E+04	1.96E+04	4.51E+02 ⁻	1.22E+02	8.34E+04 [≈]	2.98E+04	2.13E+03 ⁻	1.90E+03
f_{19}	2.86E+03	1.78E+03	4.07E+02 ⁻	1.60E+02	7.30E+04 ⁺	2.39E+04	2.16E+02 ⁻	6.19E+01
f_{20}	4.98E+02	1.23E+02	2.48E+03 ⁺	5.12E+02	7.67E+02 ⁺	1.93E+02	5.56E+02 ⁺	1.29E+02
f_{21}	3.35E+02	6.53E+00	9.53E+02 ⁺	5.01E+02	4.02E+02 ⁺	1.88E+01	3.61E+02 ⁺	7.53E+00
f_{22}	1.37E+03	1.93E+03	8.91E+03 ⁺	1.15E+03	5.41E+03 ⁺	2.87E+03	5.48E+03 ⁺	1.49E+03
f_{23}	5.87E+02	1.29E+01	3.22E+03 ⁺	7.47E+02	6.55E+02 ⁺	3.09E+01	5.98E+02 ⁺	1.79E+01
f_{24}	6.52E+02	1.09E+01	7.42E+02 ⁺	1.84E+02	7.20E+02 ⁺	2.89E+01	6.78E+02 ⁺	1.17E+01
f_{25}	5.58E+02	2.01E+01	5.95E+02 ⁺	2.68E+01	6.66E+02 ⁺	3.24E+01	5.51E+02 [≈]	2.79E+01
f_{26}	1.64E+03	2.74E+02	1.75E+03 ⁺	6.98E+02	3.03E+03 ⁺	9.57E+02	2.11E+03 ⁺	1.53E+02
f_{27}	7.44E+02	3.51E+01	8.24E+02 ⁺	1.03E+03	9.58E+02 ⁺	7.62E+01	6.00E+02 ⁻	1.64E-04
f_{28}	5.65E+02	1.29E+01	5.70E+02 ⁺	2.04E+01	6.01E+02 ⁺	1.99E+01	6.00E+02 ⁺	1.67E-04
f_{29}	8.74E+02	1.23E+02	1.11E+03 ⁺	2.37E+02	1.59E+03 ⁺	2.78E+02	5.94E+02 ⁻	1.06E+02
f_{30}	4.72E+06	8.06E+05	7.69E+05 ⁻	1.88E+05	6.18E+06 ⁺	8.00E+05	1.07E+03 ⁻	9.29E+02
+/-/≈	-		19/9/1		28/0/1		16/12/1	

TABLE VI: Results obtained by the proposed algorithm with the proposed OD explosion (OLFWA) or the popular random explosion (OLFWA_{E1}, OLFWA_{E2}) using same number of explosion sparks as OLFWA and LotFWA on 30-D test functions

Fun.	OLFWA		OLFWA _{E1}		OLFWA _{E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.61E-01	1.30E+00	6.07E-01 \approx	1.29E+00	5.57E+00 $^+$	9.93E+00
f_3	1.00E+02	1.18E+00	1.00E+02 $^-$	0.00E+00	1.00E+02 $^-$	1.10E-07
f_4	1.01E+02	1.38E+00	1.07E+02 $^+$	1.73E+01	1.23E+02 $^+$	2.87E+01
f_5	1.18E+02	5.71E+00	1.30E+02 $^+$	7.50E+00	1.31E+02 $^+$	7.52E+00
f_6	1.00E+02	1.37E-03	1.02E+02 $^+$	1.90E+00	1.00E+02 $^+$	2.21E-01
f_7	1.42E+02	4.98E+00	1.47E+02 $^+$	4.93E+00	1.47E+02 $^+$	4.49E+00
f_8	1.17E+02	5.26E+00	1.26E+02 $^+$	7.43E+00	1.27E+02 $^+$	6.25E+00
f_9	1.00E+02	0.00E+00	1.06E+02 $^+$	1.22E+01	1.00E+02 $^+$	2.21E-01
f_{10}	2.15E+03	3.56E+02	2.39E+03 $^+$	2.83E+02	2.38E+03 $^+$	3.00E+02
f_{11}	1.55E+02	1.72E+01	1.53E+02 \approx	1.62E+01	1.62E+02 $^+$	1.85E+01
f_{12}	5.44E+04	3.07E+04	7.80E+04 \approx	5.65E+04	1.63E+05 $^+$	1.11E+05
f_{13}	8.25E+03	2.43E+03	9.08E+03 \approx	2.72E+03	1.22E+04 $^+$	3.27E+03
f_{14}	4.53E+02	1.94E+02	3.95E+02 \approx	9.27E+01	4.57E+02 \approx	2.04E+02
f_{15}	1.29E+03	4.19E+02	3.98E+03 $^+$	1.56E+03	4.98E+03 $^+$	1.66E+03
f_{16}	4.37E+02	1.50E+02	5.36E+02 $^+$	1.26E+02	5.73E+02 $^+$	1.50E+02
f_{17}	1.73E+02	3.21E+01	1.92E+02 $^+$	4.39E+01	2.02E+02 $^+$	4.28E+01
f_{18}	3.67E+04	1.75E+04	3.29E+04 \approx	1.40E+04	3.60E+04 \approx	1.57E+04
f_{19}	6.37E+02	6.57E+02	6.34E+03 $^+$	8.34E+03	1.15E+04 $^+$	1.13E+04
f_{20}	2.84E+02	5.77E+01	3.00E+02 \approx	5.58E+01	3.13E+02 $^+$	6.45E+01
f_{21}	3.14E+02	2.24E+01	3.25E+02 $^+$	2.65E+01	3.27E+02 $^+$	2.74E+01
f_{22}	2.00E+02	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00
f_{23}	4.72E+02	3.98E+01	4.81E+02 $^+$	7.19E+01	4.68E+02 $^-$	8.99E+01
f_{24}	5.44E+02	8.47E+00	5.59E+02 $^+$	1.37E+01	5.57E+02 $^+$	1.21E+01
f_{25}	4.85E+02	1.69E+00	4.86E+02 $^+$	1.67E+00	4.86E+02 $^+$	1.17E+00
f_{26}	4.34E+02	3.14E+02	3.49E+02 \approx	5.05E+01	3.79E+02 \approx	1.67E+02
f_{27}	6.12E+02	6.19E+00	6.27E+02 $^+$	1.27E+01	6.24E+02 $^+$	1.12E+01
f_{28}	4.02E+02	1.45E+01	4.02E+02 \approx	1.45E+01	4.03E+02 \approx	1.54E+01
f_{29}	6.97E+02	7.62E+01	7.22E+02 \approx	7.20E+01	7.17E+02 \approx	7.38E+01
f_{30}	6.57E+04	2.43E+04	1.37E+05 $^+$	1.05E+05	2.26E+05 $^+$	2.07E+05
+/-/ \approx	-		17/1/11		21/2/6	

TABLE VII: Results obtained by the proposed algorithm with the proposed OD explosion (OLFWA) or the popular random explosion (OLFWA_{E1}, OLFWA_{E2}) using same number of explosion sparks as OLFWA and LotFWA on 50-D test functions

Fun.	OLFWA		OLFWA _{E1}		OLFWA _{E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.84E+00	1.52E+01	4.27E+00 \approx	1.57E+01	2.25E+00\approx	6.81E+00
f_3	1.00E+02	4.14E-01	1.00E+02 $-$	2.55E-02	1.00E+02$-$	1.44E-02
f_4	1.26E+02	2.18E+01	1.56E+02 $+$	3.83E+01	1.58E+02 $+$	3.71E+01
f_5	1.35E+02	8.75E+00	1.60E+02 $+$	1.12E+01	1.60E+02 $+$	1.03E+01
f_6	1.00E+02	6.25E-04	1.00E+02 $+$	6.47E-01	1.01E+02 $+$	1.27E+00
f_7	1.75E+02	5.98E+00	1.83E+02 $+$	6.93E+00	1.83E+02 $+$	8.26E+00
f_8	1.33E+02	7.35E+00	1.62E+02 $+$	1.10E+01	1.58E+02 $+$	1.05E+01
f_9	1.00E+02	6.55E-02	2.84E+02 $+$	3.65E+02	4.05E+02 $+$	4.80E+02
f_{10}	3.88E+03	4.91E+02	4.09E+03 \approx	5.88E+02	4.15E+03 $+$	4.85E+02
f_{11}	2.35E+02	3.18E+01	2.31E+02 \approx	2.51E+01	2.30E+02\approx	3.03E+01
f_{12}	9.28E+05	3.85E+05	1.41E+06 $+$	6.87E+05	1.52E+06 $+$	7.51E+05
f_{13}	1.06E+04	2.07E+03	1.58E+04 $+$	3.90E+03	1.63E+04 $+$	3.31E+03
f_{14}	4.85E+03	3.12E+03	4.47E+03\approx	4.42E+03	4.85E+03 \approx	3.79E+03
f_{15}	1.53E+03	4.32E+02	4.85E+03 $+$	1.31E+03	4.31E+03 $+$	1.35E+03
f_{16}	6.23E+02	1.70E+02	8.11E+02 $+$	1.97E+02	8.00E+02 $+$	1.95E+02
f_{17}	7.05E+02	1.34E+02	7.63E+02 \approx	1.50E+02	7.41E+02 \approx	1.31E+02
f_{18}	7.76E+04	1.96E+04	6.87E+04$-$	2.59E+04	7.65E+04 \approx	3.11E+04
f_{19}	2.86E+03	1.78E+03	1.80E+04 $+$	1.02E+04	1.81E+04 $+$	1.28E+04
f_{20}	4.98E+02	1.23E+02	5.54E+02 $+$	1.23E+02	5.63E+02 $+$	1.14E+02
f_{21}	3.35E+02	6.53E+00	3.61E+02 $+$	1.06E+01	3.62E+02 $+$	9.43E+00
f_{22}	1.37E+03	1.93E+03	1.87E+03 \approx	2.17E+03	1.95E+03 \approx	2.21E+03
f_{23}	5.87E+02	1.29E+01	6.37E+02 $+$	2.18E+01	6.41E+02 $+$	2.52E+01
f_{24}	6.52E+02	1.09E+01	7.02E+02 $+$	3.07E+01	7.02E+02 $+$	3.07E+01
f_{25}	5.58E+02	2.01E+01	5.67E+02 \approx	2.78E+01	5.68E+02 \approx	3.19E+01
f_{26}	1.64E+03	2.74E+02	1.37E+03 \approx	9.10E+02	1.28E+03\approx	9.14E+02
f_{27}	7.44E+02	3.51E+01	7.83E+02 $+$	5.33E+01	7.85E+02 $+$	4.75E+01
f_{28}	5.65E+02	1.29E+01	5.63E+02 \approx	9.71E+00	5.61E+02\approx	1.03E+00
f_{29}	8.74E+02	1.23E+02	1.07E+03 $+$	1.54E+02	1.00E+03 $+$	1.33E+02
f_{30}	4.72E+06	8.06E+05	1.48E+07 $+$	2.60E+06	1.47E+07 $+$	2.45E+06
+/-/ \approx	-		18/2/9		19/1/9	

TABLE VIII: Results obtained by the proposed algorithm with the proposed OD explosion (OLFWA) or the popular random explosion (OLFWA_{E1}, OLFWA_{E2}) using same number of explosion sparks as OLFWA and LotFWA on 100-D test functions

Fun.	OLFWA		OLFWA _{E1}		OLFWA _{E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	1.19E+01	2.99E+01	1.26E+01 \approx	2.82E+01	8.48E-01 $^-$	2.84E+00
f_3	1.17E+04	2.97E+03	7.67E+03 $^-$	2.43E+03	1.51E+04 $^+$	3.69E+03
f_4	2.83E+02	3.53E+01	3.11E+02 $^+$	4.56E+01	2.83E+02 \approx	6.99E+01
f_5	1.80E+02	1.29E+01	2.36E+02 $^+$	2.09E+01	2.77E+02 $^+$	3.11E+01
f_6	1.00E+02	6.81E-04	1.00E+02 $^+$	1.28E-01	1.03E+02 $^+$	1.95E+00
f_7	2.64E+02	1.40E+01	2.75E+02 $^+$	1.53E+01	2.93E+02 $^+$	1.95E+01
f_8	1.81E+02	1.53E+01	2.44E+02 $^+$	3.09E+01	2.81E+02 $^+$	2.21E+01
f_9	1.00E+02	2.69E-02	1.00E+02 $^+$	4.32E-01	2.41E+03 $^+$	1.26E+03
f_{10}	8.31E+03	7.11E+02	8.98E+03 $^+$	8.83E+02	9.29E+03 $^+$	8.71E+02
f_{11}	1.09E+03	1.54E+02	1.05E+03 \approx	1.25E+02	9.83E+02 $^-$	9.70E+01
f_{12}	1.83E+06	6.12E+05	3.97E+06 $^+$	1.48E+06	2.09E+06 $^+$	7.15E+05
f_{13}	1.54E+04	1.77E+03	1.71E+04 $^+$	3.10E+03	1.54E+04 \approx	1.91E+03
f_{14}	7.71E+04	3.77E+04	7.48E+04 \approx	3.12E+04	4.55E+04 $^-$	1.98E+04
f_{15}	4.32E+03	9.33E+02	1.20E+04 $^+$	2.11E+03	9.64E+03 $^+$	1.96E+03
f_{16}	1.69E+03	3.75E+02	2.27E+03 $^+$	3.86E+02	2.18E+03 $^+$	3.86E+02
f_{17}	1.67E+03	3.38E+02	1.80E+03 \approx	2.98E+02	1.73E+03 \approx	3.31E+02
f_{18}	1.70E+05	5.02E+04	1.65E+05 \approx	4.37E+04	1.26E+05 $^-$	2.96E+04
f_{19}	7.84E+03	5.02E+03	1.35E+05 $^+$	7.51E+04	7.15E+04 $^+$	4.08E+04
f_{20}	1.73E+03	2.39E+02	1.86E+03 $^+$	2.77E+02	1.77E+03 \approx	2.69E+02
f_{21}	4.24E+02	1.88E+01	4.94E+02 $^+$	2.86E+01	5.40E+02 $^+$	4.43E+01
f_{22}	9.88E+03	1.58E+03	1.07E+04 $^+$	2.32E+03	1.06E+04 $^+$	3.11E+03
f_{23}	7.92E+02	2.10E+01	1.04E+03 $^+$	7.76E+01	1.03E+03 $^+$	5.95E+01
f_{24}	1.14E+03	1.97E+01	1.34E+03 $^+$	8.06E+01	1.36E+03 $^+$	8.22E+01
f_{25}	7.54E+02	4.74E+01	8.44E+02 $^+$	6.21E+01	7.82E+02 \approx	7.89E+01
f_{26}	4.29E+03	5.95E+02	5.54E+03 $^+$	8.58E+02	5.77E+03 $^+$	9.63E+02
f_{27}	8.09E+02	2.47E+01	9.67E+02 $^+$	7.34E+01	9.50E+02 $^+$	5.67E+01
f_{28}	6.67E+02	3.22E+01	6.79E+02 \approx	3.43E+01	6.68E+02 \approx	2.50E+01
f_{29}	2.62E+03	3.72E+02	3.18E+03 $^+$	3.20E+02	2.97E+03 $^+$	3.17E+02
f_{30}	6.12E+05	7.30E+04	2.37E+06 $^+$	6.69E+05	1.34E+06 $^+$	4.30E+05
+/-/ \approx	-		22/1/6		19/4/6	

TABLE IX: Results obtained by OLFWA and its 3 prediction variants on 30-D test functions. OLFWA_{Pr}, OLFWA_{Pf} and OLFWA_{P0} are the variants of OLFWA without the function-value-based prediction, rank-value-based prediction and both predictions, respectively

Fun.	OLFWA		OLFWA _{Pr}		OLFWA _{Pf}		OLFWA _{P0}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.61E-01	1.30E+00	9.50E-01 \approx	2.32E+00	6.37E-01 \approx	1.32E+00	8.64E-01 \approx	3.20E+00
f_3	1.00E+02	1.18E+00	1.00E+02 \approx	7.36E-01	1.00E+02 $-$	1.83E+00	1.00E+02 \approx	1.57E+00
f_4	1.01E+02	1.38E+00	1.03E+02 \approx	1.31E+01	1.01E+02 \approx	3.39E+00	1.01E+02 \approx	3.67E+00
f_5	1.18E+02	5.71E+00	1.19E+02 \approx	6.23E+00	1.18E+02 \approx	4.63E+00	1.25E+02 $+$	5.25E+00
f_6	1.00E+02	1.37E-03	1.00E+02 \approx	1.06E-03	1.00E+02 \approx	4.61E-04	1.00E+02 $+$	9.27E-02
f_7	1.42E+02	4.98E+00	1.43E+02 $+$	3.11E+00	1.44E+02 $+$	3.43E+00	1.46E+02 $+$	5.99E+00
f_8	1.17E+02	5.26E+00	1.19E+02 $+$	5.61E+00	1.17E+02 \approx	4.58E+00	1.24E+02 $+$	6.11E+00
f_9	1.00E+02	0.00E+00	1.00E+02 $+$	1.23E-01	1.00E+02 \approx	1.76E-02	1.00E+02 $+$	3.76E-01
f_{10}	2.15E+03	3.56E+02	2.17E+03 \approx	3.02E+02	2.17E+03 \approx	4.44E+02	2.42E+03 $+$	3.32E+02
f_{11}	1.55E+02	1.72E+01	1.52E+02 \approx	1.71E+01	1.52E+02 \approx	1.96E+01	1.53E+02 \approx	1.88E+01
f_{12}	5.44E+04	3.07E+04	5.81E+04 \approx	4.42E+04	5.85E+04 \approx	3.75E+04	7.70E+04 \approx	5.88E+04
f_{13}	8.25E+03	2.43E+03	1.06E+04 $+$	3.69E+03	9.02E+03 \approx	2.51E+03	9.59E+03 \approx	3.28E+03
f_{14}	4.53E+02	1.94E+02	4.68E+02 \approx	2.73E+02	4.29E+02 \approx	1.78E+02	4.37E+02 \approx	1.99E+02
f_{15}	1.29E+03	4.19E+02	2.46E+03 $+$	6.65E+02	1.48E+03 $+$	4.99E+02	3.34E+03 $+$	1.25E+03
f_{16}	4.37E+02	1.50E+02	4.85E+02 \approx	1.64E+02	5.09E+02 $+$	1.31E+02	5.75E+02 $+$	1.36E+02
f_{17}	1.73E+02	3.21E+01	1.79E+02 \approx	3.56E+01	1.73E+02 \approx	2.62E+01	1.98E+02 $+$	3.87E+01
f_{18}	3.67E+04	1.75E+04	3.65E+04 \approx	1.89E+04	3.65E+04 \approx	1.44E+04	3.18E+04 \approx	1.30E+04
f_{19}	6.37E+02	6.57E+02	1.23E+03 $+$	1.11E+03	7.47E+02 \approx	7.04E+02	3.88E+03 $+$	4.77E+03
f_{20}	2.84E+02	5.77E+01	2.61E+02 \approx	6.25E+01	2.70E+02 \approx	6.47E+01	3.10E+02 $+$	5.84E+01
f_{21}	3.14E+02	2.24E+01	3.13E+02 \approx	2.36E+01	3.14E+02 \approx	2.30E+01	3.20E+02 $+$	3.09E+01
f_{22}	2.00E+02	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00
f_{23}	4.72E+02	3.98E+01	4.64E+02 \approx	6.71E+01	4.68E+02 \approx	5.54E+01	4.30E+02 $-$	1.23E+02
f_{24}	5.44E+02	8.47E+00	5.40E+02 \approx	4.94E+01	5.51E+02 $+$	9.31E+00	5.47E+02 $+$	3.79E+01
f_{25}	4.85E+02	1.69E+00	4.85E+02 \approx	1.71E+00	4.85E+02 \approx	1.68E+00	4.86E+02 $+$	1.63E+00
f_{26}	4.34E+02	3.14E+02	3.55E+02 \approx	1.47E+02	4.76E+02 \approx	3.44E+02	3.37E+02 \approx	4.88E+01
f_{27}	6.12E+02	6.19E+00	6.12E+02 \approx	7.24E+00	6.13E+02 \approx	7.17E+00	6.28E+02 $+$	1.19E+01
f_{28}	4.02E+02	1.45E+01	4.02E+02 \approx	1.45E+01	4.02E+02 \approx	1.45E+01	4.00E+02 \approx	1.64E-03
f_{29}	6.97E+02	7.62E+01	7.07E+02 \approx	6.80E+01	6.90E+02 \approx	6.60E+01	7.31E+02 $+$	7.77E+01
f_{30}	6.57E+04	2.43E+04	7.73E+04 \approx	3.34E+04	6.46E+04 \approx	2.64E+04	1.10E+05 $+$	6.40E+04
+/-/ \approx	-		6/0/23		4/1/24		17/1/11	

TABLE X: Results obtained by OLFWA and its 3 prediction variants on 50-D test functions. OLFWA_{*P_r*}, OLFWA_{*P_f*} and OLFWA_{*P₀*} are the variants of OLFWA without the function-value-based prediction, rank-value-based prediction and both predictions, respectively

Fun.	OLFWA		OLFWA _{P_r}		OLFWA _{P_f}		OLFWA _{P₀}	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
<i>f</i> ₁	5.84E+00	1.52E+01	1.60E+00 ≈	3.60E+00	7.85E+00 ≈	4.13E+01	8.96E+00 ≈	2.54E+01
<i>f</i> ₃	1.00E+02	4.14E-01	1.00E+02 −	2.62E-01	1.00E+02 ≈	2.63E-01	1.00E+02 −	1.62E-01
<i>f</i> ₄	1.26E+02	2.18E+01	1.33E+02 ≈	2.73E+01	1.40E+02 +	2.81E+01	1.63E+02 +	4.06E+01
<i>f</i> ₅	1.35E+02	8.75E+00	1.35E+02 ≈	8.55E+00	1.34E+02 ≈	6.13E+00	1.45E+02 +	7.58E+00
<i>f</i> ₆	1.00E+02	6.25E-04	1.00E+02 ≈	5.23E-04	1.00E+02 −	1.71E-04	1.00E+02 +	3.83E-03
<i>f</i> ₇	1.75E+02	5.98E+00	1.78E+02 ≈	7.72E+00	1.77E+02 ≈	7.04E+00	1.79E+02 +	6.10E+00
<i>f</i> ₈	1.33E+02	7.35E+00	1.35E+02 ≈	7.81E+00	1.35E+02 ≈	8.84E+00	1.47E+02 +	8.93E+00
<i>f</i> ₉	1.00E+02	6.55E-02	1.00E+02 ≈	6.36E-02	1.00E+02 ≈	6.46E-02	1.00E+02 +	1.67E-01
<i>f</i> ₁₀	3.88E+03	4.91E+02	3.73E+03 ≈	4.45E+02	3.86E+03 ≈	4.23E+02	4.18E+03 +	4.98E+02
<i>f</i> ₁₁	2.35E+02	3.18E+01	2.29E+02 ≈	3.07E+01	2.33E+02 ≈	3.38E+01	2.47E+02 ≈	3.12E+01
<i>f</i> ₁₂	9.28E+05	3.85E+05	9.50E+05 ≈	4.58E+05	1.06E+06 ≈	5.48E+05	1.36E+06 +	6.60E+05
<i>f</i> ₁₃	1.06E+04	2.07E+03	1.71E+04 +	4.42E+03	1.11E+04 ≈	3.00E+03	1.58E+04 +	3.74E+03
<i>f</i> ₁₄	4.85E+03	3.12E+03	5.87E+03 ≈	6.12E+03	4.70E+03 ≈	4.43E+03	4.48E+03 ≈	3.50E+03
<i>f</i> ₁₅	1.53E+03	4.32E+02	4.43E+03 +	1.29E+03	1.37E+03 ≈	3.05E+02	4.59E+03 +	1.57E+03
<i>f</i> ₁₆	6.23E+02	1.70E+02	7.13E+02 +	1.81E+02	6.58E+02 ≈	1.91E+02	8.57E+02 +	1.77E+02
<i>f</i> ₁₇	7.05E+02	1.34E+02	7.37E+02 ≈	1.55E+02	7.15E+02 ≈	1.34E+02	7.71E+02 +	1.46E+02
<i>f</i> ₁₈	7.76E+04	1.96E+04	7.29E+04 −	3.43E+04	8.45E+04 ≈	2.94E+04	8.14E+04 ≈	3.89E+04
<i>f</i> ₁₉	2.86E+03	1.78E+03	1.26E+04 +	6.42E+03	3.16E+03 ≈	2.43E+03	1.58E+04 +	1.03E+04
<i>f</i> ₂₀	4.98E+02	1.23E+02	5.34E+02 ≈	1.31E+02	5.08E+02 ≈	1.06E+02	5.77E+02 +	1.07E+02
<i>f</i> ₂₁	3.35E+02	6.53E+00	3.40E+02 +	7.68E+00	3.35E+02 ≈	7.06E+00	3.50E+02 +	1.20E+01
<i>f</i> ₂₂	1.37E+03	1.93E+03	1.24E+03 ≈	1.82E+03	1.80E+03 ≈	2.03E+03	1.90E+03 ≈	2.24E+03
<i>f</i> ₂₃	5.87E+02	1.29E+01	5.83E+02 ≈	1.17E+01	5.89E+02 ≈	1.36E+01	6.29E+02 +	3.06E+01
<i>f</i> ₂₄	6.52E+02	1.09E+01	6.59E+02 +	1.40E+01	6.59E+02 +	9.24E+00	6.80E+02 +	1.89E+01
<i>f</i> ₂₅	5.58E+02	2.01E+01	5.57E+02 ≈	1.99E+01	5.61E+02 ≈	2.26E+01	5.66E+02 ≈	2.34E+01
<i>f</i> ₂₆	1.64E+03	2.74E+02	1.57E+03 ≈	4.05E+02	1.65E+03 ≈	3.86E+02	1.38E+03 ≈	7.98E+02
<i>f</i> ₂₇	7.44E+02	3.51E+01	7.44E+02 ≈	3.13E+01	7.61E+02 +	3.97E+01	7.82E+02 +	4.94E+01
<i>f</i> ₂₈	5.65E+02	1.29E+01	5.61E+02 ≈	3.05E+00	5.65E+02 +	1.16E+01	5.68E+02 +	1.66E+01
<i>f</i> ₂₉	8.74E+02	1.23E+02	9.21E+02 ≈	1.51E+02	9.06E+02 ≈	1.50E+02	1.06E+03 +	1.81E+02
<i>f</i> ₃₀	4.72E+06	8.06E+05	7.27E+06 +	1.28E+06	4.79E+06 ≈	8.47E+05	1.54E+07 +	3.00E+06
+/-/≈	-		7/2/20		4/1/24		21/1/7	

TABLE XI: Results obtained by OLFWA and its 3 prediction variants on 100-D test functions. OLFWA_{*P_r*}, OLFWA_{*P_f*} and OLFWA_{*P₀*} are the variants of OLFWA without the function-value-based prediction, rank-value-based prediction and both predictions, respectively

Fun.	OLFWA		OLFWA _{<i>P_r</i>}		OLFWA _{<i>P_f</i>}		OLFWA _{<i>P₀</i>}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
<i>f</i> ₁	1.19E+01	2.99E+01	7.31E+00 ≈	1.85E+01	5.08E+00 −	2.03E+01	2.77E+01 ≈	1.48E+02
<i>f</i> ₃	1.17E+04	2.97E+03	1.19E+04 ≈	4.00E+03	1.14E+04 ≈	3.21E+03	1.18E+04 ≈	3.32E+03
<i>f</i> ₄	2.83E+02	3.53E+01	2.84E+02 ≈	3.07E+01	2.90E+02 ≈	4.13E+01	3.11E+02 +	5.19E+01
<i>f</i> ₅	1.80E+02	1.29E+01	1.85E+02 ≈	1.52E+01	1.84E+02 ≈	1.31E+01	2.08E+02 +	1.49E+01
<i>f</i> ₆	1.00E+02	6.81E-04	1.00E+02 ≈	1.87E-03	1.00E+02 ≈	4.04E-04	1.00E+02 +	2.28E-03
<i>f</i> ₇	2.64E+02	1.40E+01	2.63E+02 ≈	1.47E+01	2.61E+02 ≈	1.31E+01	2.71E+02 +	1.45E+01
<i>f</i> ₈	1.81E+02	1.53E+01	1.88E+02 +	1.59E+01	1.82E+02 ≈	1.65E+01	2.14E+02 +	1.58E+01
<i>f</i> ₉	1.00E+02	2.69E-02	1.00E+02 ≈	6.55E-02	1.00E+02 ≈	1.08E-01	1.00E+02 ≈	1.38E-01
<i>f</i> ₁₀	8.31E+03	7.11E+02	8.53E+03 ≈	8.14E+02	8.55E+03 ≈	8.00E+02	8.93E+03 +	9.31E+02
<i>f</i> ₁₁	1.09E+03	1.54E+02	1.10E+03 ≈	1.37E+02	1.09E+03 ≈	1.31E+02	1.09E+03 ≈	1.30E+02
<i>f</i> ₁₂	1.83E+06	6.12E+05	1.95E+06 ≈	6.62E+05	1.90E+06 ≈	7.60E+05	3.62E+06 +	1.45E+06
<i>f</i> ₁₃	1.54E+04	1.77E+03	1.72E+04 +	2.40E+03	1.65E+04 +	2.59E+03	1.70E+04 +	2.47E+03
<i>f</i> ₁₄	7.71E+04	3.77E+04	8.78E+04 ≈	4.07E+04	8.39E+04 ≈	4.07E+04	8.25E+04 ≈	3.31E+04
<i>f</i> ₁₅	4.32E+03	9.33E+02	1.17E+04 +	2.61E+03	4.25E+03 ≈	8.31E+02	1.18E+04 +	2.50E+03
<i>f</i> ₁₆	1.69E+03	3.75E+02	1.84E+03 ≈	4.38E+02	1.74E+03 ≈	3.93E+02	2.08E+03 +	3.92E+02
<i>f</i> ₁₇	1.67E+03	3.38E+02	1.66E+03 ≈	2.61E+02	1.72E+03 ≈	2.37E+02	1.70E+03 ≈	2.83E+02
<i>f</i> ₁₈	1.70E+05	5.02E+04	1.78E+05 ≈	5.24E+04	1.75E+05 ≈	3.84E+04	1.71E+05 ≈	4.76E+04
<i>f</i> ₁₉	7.84E+03	5.02E+03	4.81E+04 +	2.12E+04	8.11E+03 ≈	6.16E+03	1.34E+05 +	6.97E+04
<i>f</i> ₂₀	1.73E+03	2.39E+02	1.74E+03 ≈	2.81E+02	1.72E+03 ≈	2.98E+02	1.88E+03 +	2.84E+02
<i>f</i> ₂₁	4.24E+02	1.88E+01	4.32E+02 ≈	2.16E+01	4.29E+02 ≈	2.12E+01	4.63E+02 +	1.85E+01
<i>f</i> ₂₂	9.88E+03	1.58E+03	9.94E+03 ≈	1.60E+03	1.01E+04 ≈	2.16E+03	1.06E+04 +	1.65E+03
<i>f</i> ₂₃	7.92E+02	2.10E+01	8.03E+02 +	2.00E+01	7.98E+02 ≈	2.09E+01	9.23E+02 +	4.55E+01
<i>f</i> ₂₄	1.14E+03	1.97E+01	1.15E+03 ≈	2.71E+01	1.15E+03 +	1.81E+01	1.24E+03 +	4.55E+01
<i>f</i> ₂₅	7.54E+02	4.74E+01	7.51E+02 ≈	5.15E+01	8.00E+02 +	7.06E+01	8.36E+02 +	6.64E+01
<i>f</i> ₂₆	4.29E+03	5.95E+02	4.50E+03 +	2.75E+02	4.49E+03 +	2.52E+02	4.91E+03 +	7.36E+02
<i>f</i> ₂₇	8.09E+02	2.47E+01	8.16E+02 ≈	2.62E+01	8.27E+02 +	2.75E+01	9.60E+02 +	5.82E+01
<i>f</i> ₂₈	6.67E+02	3.22E+01	6.66E+02 ≈	2.70E+01	7.04E+02 +	3.58E+01	7.03E+02 +	3.63E+01
<i>f</i> ₂₉	2.62E+03	3.72E+02	2.78E+03 +	3.32E+02	2.72E+03 ≈	3.40E+02	3.13E+03 +	3.37E+02
<i>f</i> ₃₀	6.12E+05	7.30E+04	6.20E+05 ≈	7.99E+04	6.01E+05 ≈	8.95E+04	2.38E+06 +	8.00E+05
+/-/≈	-		7/0/22		6/1/22		22/0/7	

TABLE XII: Results of guiding comparison experiments on 30-D test functions. Subscripts G0, G1, G2 indicate the corresponding variants use none, previous, previous+proposed guiding methods. And P0 indicates the corresponding variant do not use any prediction method

Fun.	OLFWA _{P0}		OLFWA _{P0G0}		OLFWA _{P0G1}		OLFWA _{P0G2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	8.64E-01	3.20E+00	1.10E+01 ⁺	3.94E+01	8.02E-01 \approx	1.66E+00	5.59E-01 \approx	1.54E+00
f_3	1.00E+02	1.57E+00	1.00E+02 \approx	1.73E+00	1.00E+02 \approx	4.86E-01	1.00E+02 \approx	1.78E+00
f_4	1.01E+02	3.67E+00	1.20E+02 ⁺	2.87E+01	1.11E+02 ⁺	2.54E+01	1.02E+02 \approx	3.79E+00
f_5	1.25E+02	5.25E+00	1.42E+02 ⁺	8.45E+00	1.27E+02 \approx	7.38E+00	1.22E+02 ⁻	6.19E+00
f_6	1.00E+02	9.27E-02	1.14E+02 ⁺	4.11E+00	1.00E+02 ⁺	1.21E-01	1.00E+02 ⁻	2.08E-03
f_7	1.46E+02	5.99E+00	1.59E+02 ⁺	6.93E+00	1.42E+02 ⁻	4.08E+00	1.41E+02 ⁻	2.97E+00
f_8	1.24E+02	6.11E+00	1.38E+02 ⁺	8.59E+00	1.26E+02 \approx	8.12E+00	1.20E+02 ⁻	6.31E+00
f_9	1.00E+02	3.76E-01	6.59E+02 ⁺	2.45E+02	1.01E+02 \approx	2.44E+00	1.00E+02 ⁻	0.00E+00
f_{10}	2.42E+03	3.32E+02	2.47E+03 \approx	3.38E+02	2.39E+03 \approx	3.95E+02	2.33E+03 \approx	3.71E+02
f_{11}	1.53E+02	1.88E+01	1.57E+02 \approx	1.83E+01	1.55E+02 \approx	1.70E+01	1.59E+02 ⁺	1.74E+01
f_{12}	7.70E+04	5.88E+04	1.84E+05 ⁺	1.36E+05	1.76E+05 ⁺	1.62E+05	9.38E+04 \approx	7.60E+04
f_{13}	9.59E+03	3.28E+03	1.03E+04 \approx	3.48E+03	1.06E+04 \approx	3.57E+03	9.88E+03 \approx	2.88E+03
f_{14}	4.37E+02	1.99E+02	4.70E+02 \approx	2.18E+02	4.27E+02 \approx	1.58E+02	4.95E+02 \approx	2.47E+02
f_{15}	3.34E+03	1.25E+03	3.04E+03 \approx	1.05E+03	3.09E+03 \approx	1.13E+03	3.74E+03 \approx	1.59E+03
f_{16}	5.75E+02	1.36E+02	6.06E+02 \approx	1.34E+02	5.68E+02 \approx	1.44E+02	5.65E+02 \approx	1.39E+02
f_{17}	1.98E+02	3.87E+01	2.12E+02 \approx	4.17E+01	2.09E+02 \approx	4.35E+01	1.97E+02 \approx	4.18E+01
f_{18}	3.18E+04	1.30E+04	3.68E+04 \approx	1.43E+04	4.07E+04 ⁺	1.52E+04	3.56E+04 \approx	1.39E+04
f_{19}	3.88E+03	4.77E+03	3.68E+03 \approx	3.99E+03	3.64E+03 \approx	3.41E+03	4.65E+03 \approx	4.33E+03
f_{20}	3.10E+02	5.84E+01	3.39E+02 ⁺	6.09E+01	3.18E+02 \approx	7.18E+01	3.20E+02 \approx	5.18E+01
f_{21}	3.20E+02	3.09E+01	3.16E+02 ⁻	5.02E+01	3.06E+02 \approx	4.75E+01	3.12E+02 ⁻	3.74E+01
f_{22}	2.00E+02	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00
f_{23}	4.30E+02	1.23E+02	4.31E+02 ⁺	1.31E+02	4.05E+02 \approx	1.40E+02	4.42E+02 \approx	1.10E+02
f_{24}	5.47E+02	3.79E+01	5.26E+02 ⁻	9.79E+01	5.36E+02 ⁻	8.65E+01	5.43E+02 \approx	5.16E+01
f_{25}	4.86E+02	1.63E+00	4.86E+02 ⁺	1.60E+00	4.86E+02 ⁺	1.47E+00	4.86E+02 ⁺	1.44E+00
f_{26}	3.37E+02	4.88E+01	3.25E+02 \approx	4.40E+01	3.41E+02 \approx	4.97E+01	3.35E+02 \approx	4.83E+01
f_{27}	6.28E+02	1.19E+01	6.32E+02 \approx	1.11E+01	6.32E+02 \approx	1.39E+01	6.29E+02 \approx	1.03E+01
f_{28}	4.00E+02	1.64E-03	4.08E+02 ⁺	2.74E+01	4.04E+02 \approx	2.03E+01	4.04E+02 \approx	2.02E+01
f_{29}	7.31E+02	7.77E+01	7.45E+02 \approx	7.70E+01	7.36E+02 \approx	7.86E+01	7.24E+02 \approx	7.80E+01
f_{30}	1.10E+05	6.40E+04	1.49E+05 \approx	1.13E+05	1.40E+05 \approx	1.39E+05	1.21E+05 \approx	6.86E+04
+/-/ \approx	-		12/2/15		5/2/22		2/6/21	

TABLE XIII: Results of guiding comparison experiments on 50-D test functions. Subscripts G0, G1, G2 indicate the corresponding variants use none, previous, previous+proposed guiding methods. And P0 indicates the corresponding variant do not use any prediction method

Fun.	OLFWA _{P0}		OLFWA _{P0G0}		OLFWA _{P0G1}		OLFWA _{P0G2}	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
f_1	8.96E+00	2.54E+01	5.07E+01 ⁺	1.33E+02	2.76E+00 ≈	6.46E+00	7.65E+00≈	2.08E+01
f_3	1.00E+02	1.62E-01	1.00E+02 ≈	2.02E-01	1.00E+02≈	3.59E-01	1.00E+02≈	4.46E-01
f_4	1.63E+02	4.06E+01	1.82E+02 ⁺	3.93E+01	1.74E+02≈	3.88E+01	1.74E+02≈	4.11E+01
f_5	1.45E+02	7.58E+00	2.03E+02 ⁺	1.98E+01	1.51E+02 ⁺	9.83E+00	1.37E+02 −	8.23E+00
f_6	1.00E+02	3.83E-03	1.21E+02 ⁺	4.69E+00	1.00E+02≈	6.00E-02	1.00E+02 ⁺	6.96E-03
f_7	1.79E+02	6.10E+00	2.45E+02 ⁺	2.17E+01	1.75E+02−	6.59E+00	1.72E+02 −	5.37E+00
f_8	1.47E+02	8.93E+00	2.03E+02 ⁺	1.89E+01	1.54E+02 ⁺	9.99E+00	1.39E+02 −	6.84E+00
f_9	1.00E+02	1.67E-01	3.40E+03 ⁺	9.88E+02	2.52E+02 ⁺	4.92E+02	1.00E+02 −	0.00E+00
f_{10}	4.18E+03	4.98E+02	4.85E+03 ⁺	4.97E+02	4.05E+03≈	5.21E+02	3.87E+03 −	5.23E+02
f_{11}	2.47E+02	3.12E+01	2.44E+02≈	2.98E+01	2.49E+02≈	3.06E+01	2.42E+02 ≈	2.98E+01
f_{12}	1.36E+06	6.60E+05	2.39E+06 ⁺	1.39E+06	1.76E+06≈	1.04E+06	1.57E+06≈	7.07E+05
f_{13}	1.58E+04	3.74E+03	1.66E+04≈	3.82E+03	1.50E+04 ≈	3.16E+03	1.58E+04≈	3.77E+03
f_{14}	4.48E+03	3.50E+03	4.95E+03≈	4.83E+03	5.03E+03≈	4.25E+03	5.18E+03≈	4.11E+03
f_{15}	4.59E+03	1.57E+03	4.49E+03 ≈	1.88E+03	4.77E+03≈	1.51E+03	4.63E+03≈	1.34E+03
f_{16}	8.57E+02	1.77E+02	9.04E+02≈	2.27E+02	8.56E+02≈	2.05E+02	7.63E+02 −	2.25E+02
f_{17}	7.71E+02	1.46E+02	7.90E+02≈	1.42E+02	7.46E+02 ≈	1.43E+02	7.81E+02≈	1.35E+02
f_{18}	8.14E+04	3.89E+04	7.11E+04 ≈	2.27E+04	8.10E+04≈	3.02E+04	7.98E+04≈	3.44E+04
f_{19}	1.58E+04	1.03E+04	1.80E+04≈	1.28E+04	1.68E+04≈	9.06E+03	1.56E+04 ≈	7.83E+03
f_{20}	5.77E+02	1.07E+02	6.31E+02 ⁺	1.31E+02	6.09E+02≈	1.26E+02	5.76E+02 ≈	1.42E+02
f_{21}	3.50E+02	1.20E+01	4.00E+02 ⁺	2.04E+01	3.56E+02 ⁺	1.01E+01	3.42E+02 −	7.87E+00
f_{22}	1.90E+03	2.24E+03	3.40E+03 ⁺	2.62E+03	2.87E+03 ⁺	2.21E+03	1.55E+03 ≈	2.05E+03
f_{23}	6.29E+02	3.06E+01	6.77E+02 ⁺	2.96E+01	6.42E+02 ⁺	2.38E+01	6.16E+02 ≈	6.31E+01
f_{24}	6.80E+02	1.89E+01	7.26E+02 ⁺	2.66E+01	6.99E+02 ⁺	1.67E+01	6.80E+02 ≈	2.24E+01
f_{25}	5.66E+02	2.34E+01	5.90E+02 ⁺	3.00E+01	5.96E+02 ⁺	3.13E+01	5.79E+02≈	3.34E+01
f_{26}	1.38E+03	7.98E+02	8.62E+02 −	9.42E+02	1.05E+03≈	8.35E+02	1.34E+03≈	7.60E+02
f_{27}	7.82E+02	4.94E+01	7.99E+02≈	4.65E+01	8.13E+02 ⁺	6.32E+01	7.94E+02≈	4.04E+01
f_{28}	5.68E+02	1.66E+01	5.67E+02≈	1.38E+01	5.66E+02 ≈	1.33E+01	5.71E+02≈	1.87E+01
f_{29}	1.06E+03	1.81E+02	1.17E+03 ⁺	1.99E+02	1.13E+03≈	2.07E+02	1.09E+03≈	2.04E+02
f_{30}	1.54E+07	3.00E+06	1.69E+07 ⁺	3.12E+06	1.71E+07 ⁺	3.11E+06	1.59E+07≈	2.98E+06
+/-/≈	-		17/1/11		10/1/18		1/7/21	

TABLE XIV: Results of guiding comparison experiments on 100-D test functions. Subscripts G0, G1, G2 indicate the corresponding variants use none, previous, previous+proposed guiding methods. And P0 indicates the corresponding variant do not use any prediction method

Fun.	OLFWA _{P0}		OLFWA _{P0G0}		OLFWA _{P0G1}		OLFWA _{P0G2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	2.77E+01	1.48E+02	2.12E+03 ⁺	4.05E+03	7.07E+00 ≈	1.96E+01	1.52E+01≈	4.08E+01
f_3	1.18E+04	3.32E+03	1.11E+04 ≈	3.24E+03	1.19E+04≈	3.49E+03	1.17E+04≈	3.49E+03
f_4	3.11E+02	5.19E+01	3.47E+02 ⁺	3.57E+01	3.20E+02≈	4.34E+01	3.06E+02 ≈	4.93E+01
f_5	2.08E+02	1.49E+01	4.63E+02 ⁺	4.30E+01	2.36E+02 ⁺	2.44E+01	1.85E+02 −	1.45E+01
f_6	1.00E+02	2.28E-03	1.35E+02 ⁺	4.23E+00	1.00E+02 ⁺	4.86E-02	1.00E+02 ⁺	2.38E-02
f_7	2.71E+02	1.45E+01	5.92E+02 ⁺	6.13E+01	2.59E+02 [−]	1.29E+01	2.52E+02 −	1.08E+01
f_8	2.14E+02	1.58E+01	4.65E+02 ⁺	4.75E+01	2.51E+02 ⁺	2.86E+01	1.95E+02 −	1.80E+01
f_9	1.00E+02	1.38E-01	1.36E+04 ⁺	2.43E+03	2.71E+02 ⁺	7.81E+02	1.00E+02 −	0.00E+00
f_{10}	8.93E+03	9.31E+02	1.13E+04 ⁺	8.70E+02	8.99E+03≈	1.04E+03	8.68E+03 ≈	8.16E+02
f_{11}	1.09E+03	1.30E+02	1.08E+03≈	1.29E+02	1.08E+03 ≈	1.45E+02	1.09E+03≈	1.02E+02
f_{12}	3.62E+06	1.45E+06	1.90E+07 ⁺	7.85E+06	7.24E+06 ⁺	2.63E+06	5.94E+06 ⁺	2.22E+06
f_{13}	1.70E+04	2.47E+03	2.03E+04 ⁺	3.96E+03	1.80E+04≈	3.57E+03	1.78E+04≈	2.34E+03
f_{14}	8.25E+04	3.31E+04	6.96E+04 −	2.70E+04	7.76E+04≈	3.57E+04	7.97E+04≈	3.72E+04
f_{15}	1.18E+04	2.50E+03	1.28E+04 ⁺	2.81E+03	1.21E+04≈	2.60E+03	1.11E+04 ≈	2.04E+03
f_{16}	2.08E+03	3.92E+02	2.75E+03 ⁺	3.79E+02	2.34E+03 ⁺	3.10E+02	2.13E+03≈	3.77E+02
f_{17}	1.70E+03	2.83E+02	2.09E+03 ⁺	3.48E+02	1.86E+03 ⁺	3.24E+02	1.80E+03≈	2.72E+02
f_{18}	1.71E+05	4.76E+04	1.70E+05≈	5.36E+04	1.81E+05≈	5.94E+04	1.69E+05 ≈	4.51E+04
f_{19}	1.34E+05	6.97E+04	1.54E+05≈	1.08E+05	1.64E+05≈	1.27E+05	1.77E+05 ⁺	1.00E+05
f_{20}	1.88E+03	2.84E+02	2.01E+03 ⁺	3.23E+02	1.93E+03≈	2.52E+02	1.86E+03 ≈	2.63E+02
f_{21}	4.63E+02	1.85E+01	7.17E+02 ⁺	5.35E+01	5.13E+02 ⁺	4.04E+01	4.43E+02 −	1.60E+01
f_{22}	1.06E+04	1.65E+03	1.31E+04 ⁺	8.26E+02	1.10E+04≈	9.08E+02	1.03E+04 ≈	2.25E+03
f_{23}	9.23E+02	4.55E+01	1.16E+03 ⁺	7.74E+01	1.04E+03 ⁺	6.90E+01	9.39E+02≈	6.55E+01
f_{24}	1.24E+03	4.55E+01	1.51E+03 ⁺	7.33E+01	1.34E+03 ⁺	9.67E+01	1.24E+03≈	5.28E+01
f_{25}	8.36E+02	6.64E+01	8.46E+02≈	6.92E+01	8.78E+02 ⁺	6.39E+01	8.97E+02 ⁺	6.09E+01
f_{26}	4.91E+03	7.36E+02	7.17E+03 ⁺	2.85E+03	5.00E+03 ⁺	1.27E+03	4.64E+03 −	7.31E+02
f_{27}	9.60E+02	5.82E+01	1.03E+03 ⁺	8.20E+01	9.97E+02 ⁺	7.04E+01	9.59E+02 ≈	6.17E+01
f_{28}	7.03E+02	3.63E+01	6.96E+02 ≈	3.39E+01	7.06E+02≈	3.60E+01	7.07E+02≈	4.04E+01
f_{29}	3.13E+03	3.37E+02	3.76E+03 ⁺	4.02E+02	3.33E+03 ⁺	3.58E+02	3.17E+03≈	3.61E+02
f_{30}	2.38E+06	8.00E+05	5.49E+06 ⁺	1.98E+06	3.82E+06 ⁺	1.10E+06	2.50E+06≈	6.01E+05
+/-/≈	-	-	22/1/6	-	15/1/13	-	4/6/19	-

TABLE XV: Results of guiding comparison experiments on 30-D test functions. Subscripts G0, G1, G2 indicate the corresponding variants use none, previous, previous+proposed guiding methods. The proposed prediction operator are employed in all methods

Fun.	OLFWA		OLFWA _{G0}		OLFWA _{G1}		OLFWA _{G2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.61E-01	1.30E+00	1.31E+00 \approx	4.43E+00	4.74E-01 \approx	1.56E+00	8.18E-01 \approx	2.24E+00
f_3	1.00E+02	1.18E+00	1.01E+02 \approx	1.36E+00	1.02E+02 \approx	6.12E+00	1.00E+02 \approx	8.43E-01
f_4	1.01E+02	1.38E+00	1.02E+02 \approx	9.93E+00	1.02E+02 $^+$	6.75E+00	1.01E+02 \approx	1.46E+00
f_5	1.18E+02	5.71E+00	1.21E+02 \approx	8.43E+00	1.18E+02 \approx	6.15E+00	1.18E+02 \approx	4.14E+00
f_6	1.00E+02	1.37E-03	1.00E+02 $^+$	5.71E-03	1.00E+02 $^-$	3.05E-04	1.00E+02 $^-$	7.95E-05
f_7	1.42E+02	4.98E+00	1.44E+02 $^+$	4.82E+00	1.42E+02 \approx	3.28E+00	1.40E+02 $^-$	3.11E+00
f_8	1.17E+02	5.26E+00	1.19E+02 \approx	5.42E+00	1.18E+02 \approx	5.67E+00	1.16E+02 \approx	5.58E+00
f_9	1.00E+02	0.00E+00	1.00E+02 $^+$	2.84E-01	1.00E+02 \approx	6.97E-02	1.00E+02 \approx	1.25E-02
f_{10}	2.15E+03	3.56E+02	2.16E+03 \approx	3.56E+02	2.23E+03 \approx	3.60E+02	2.15E+03 \approx	3.73E+02
f_{11}	1.55E+02	1.72E+01	1.59E+02 \approx	2.26E+01	1.55E+02 \approx	1.89E+01	1.53E+02 \approx	1.75E+01
f_{12}	5.44E+04	3.07E+04	4.51E+04 \approx	2.67E+04	7.12E+04 \approx	5.09E+04	6.21E+04 \approx	3.61E+04
f_{13}	8.25E+03	2.43E+03	7.55E+03 \approx	2.52E+03	8.06E+03 \approx	2.33E+03	8.02E+03 \approx	1.92E+03
f_{14}	4.53E+02	1.94E+02	5.48E+02 \approx	7.48E+02	5.03E+02 \approx	2.79E+02	5.12E+02 \approx	3.59E+02
f_{15}	1.29E+03	4.19E+02	1.20E+03 \approx	4.54E+02	1.33E+03 \approx	5.02E+02	1.51E+03 \approx	6.26E+02
f_{16}	4.37E+02	1.50E+02	4.99E+02 $^+$	1.10E+02	4.81E+02 \approx	1.26E+02	4.81E+02 \approx	1.45E+02
f_{17}	1.73E+02	3.21E+01	1.69E+02 \approx	2.06E+01	1.70E+02 \approx	2.39E+01	1.68E+02 \approx	1.61E+01
f_{18}	3.67E+04	1.75E+04	3.42E+04 \approx	1.47E+04	3.61E+04 \approx	1.50E+04	3.71E+04 \approx	1.35E+04
f_{19}	6.37E+02	6.57E+02	4.60E+02 \approx	2.59E+02	5.34E+02 \approx	3.27E+02	1.00E+03 $^+$	1.17E+03
f_{20}	2.84E+02	5.77E+01	2.74E+02 \approx	6.80E+01	2.88E+02 \approx	5.87E+01	2.65E+02 \approx	5.66E+01
f_{21}	3.14E+02	2.24E+01	3.15E+02 \approx	2.40E+01	3.15E+02 \approx	2.42E+01	3.19E+02 \approx	6.38E+00
f_{22}	2.00E+02	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00	2.00E+02 \approx	0.00E+00
f_{23}	4.72E+02	3.98E+01	4.44E+02 \approx	9.05E+01	4.68E+02 \approx	5.52E+01	4.73E+02 \approx	3.99E+01
f_{24}	5.44E+02	8.47E+00	5.48E+02 $^+$	8.69E+00	5.36E+02 \approx	4.91E+01	5.41E+02 \approx	3.52E+01
f_{25}	4.85E+02	1.69E+00	4.85E+02 \approx	1.62E+00	4.85E+02 \approx	1.64E+00	4.86E+02 $^+$	1.55E+00
f_{26}	4.34E+02	3.14E+02	4.36E+02 \approx	3.20E+02	4.23E+02 \approx	3.14E+02	3.50E+02 \approx	1.47E+02
f_{27}	6.12E+02	6.19E+00	6.11E+02 \approx	5.06E+00	6.12E+02 \approx	6.28E+00	6.11E+02 \approx	5.52E+00
f_{28}	4.02E+02	1.45E+01	4.02E+02 \approx	1.45E+01	4.04E+02 \approx	2.03E+01	4.00E+02 \approx	0.00E+00
f_{29}	6.97E+02	7.62E+01	7.04E+02 \approx	6.52E+01	6.97E+02 \approx	5.45E+01	6.89E+02 \approx	6.38E+01
f_{30}	6.57E+04	2.43E+04	7.51E+04 \approx	3.08E+04	7.13E+04 \approx	2.96E+04	6.57E+04 \approx	2.37E+04
$+/-/\approx$	-		5/0/24		1/1/27		2/2/25	

TABLE XVI: Results of guiding comparison experiments on 50-D test functions. Subscripts G0, G1, G2 indicate the corresponding variants use none, previous, previous+proposed guiding methods. The proposed prediction operator are employed in all methods

Fun.	OLFWA		OLFWA _{G0}		OLFWA _{G1}		OLFWA _{G2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.84E+00	1.52E+01	7.33E+00 \approx	3.57E+01	7.76E+00 \approx	1.59E+01	6.66E+00 \approx	1.77E+01
f_3	1.00E+02	4.14E-01	1.00E+02 \approx	7.81E-01	1.00E+02 \approx	3.99E-01	1.00E+02 \approx	4.51E-01
f_4	1.26E+02	2.18E+01	1.24E+02 \approx	2.18E+01	1.42E+02 $^+$	2.91E+01	1.35E+02 $^+$	2.50E+01
f_5	1.35E+02	8.75E+00	1.37E+02 \approx	6.88E+00	1.37E+02 \approx	1.03E+01	1.32E+02 $^-$	6.42E+00
f_6	1.00E+02	6.25E-04	1.00E+02 $^+$	3.92E-03	1.00E+02 $^-$	9.84E-04	1.00E+02 $^-$	2.76E-05
f_7	1.75E+02	5.98E+00	1.80E+02 $^+$	6.00E+00	1.73E+02 \approx	4.92E+00	1.71E+02 $^-$	5.54E+00
f_8	1.33E+02	7.35E+00	1.40E+02 $^+$	8.11E+00	1.34E+02 \approx	6.43E+00	1.32E+02 \approx	6.17E+00
f_9	1.00E+02	6.55E-02	1.00E+02 $^+$	2.97E-01	1.00E+02 \approx	0.00E+00	1.00E+02 \approx	0.00E+00
f_{10}	3.88E+03	4.91E+02	3.89E+03 \approx	5.79E+02	3.82E+03 \approx	4.76E+02	3.66E+03 $^-$	5.05E+02
f_{11}	2.35E+02	3.18E+01	2.33E+02 \approx	3.05E+01	2.31E+02 \approx	3.24E+01	2.36E+02 \approx	2.94E+01
f_{12}	9.28E+05	3.85E+05	1.04E+06 \approx	5.33E+05	1.24E+06 $^+$	6.11E+05	1.26E+06 $^+$	6.07E+05
f_{13}	1.06E+04	2.07E+03	1.09E+04 \approx	2.47E+03	1.24E+04 $^+$	2.59E+03	1.28E+04 $^+$	2.74E+03
f_{14}	4.85E+03	3.12E+03	5.30E+03 \approx	5.78E+03	5.08E+03 \approx	3.75E+03	5.42E+03 \approx	4.70E+03
f_{15}	1.53E+03	4.32E+02	1.44E+03 \approx	3.00E+02	1.90E+03 $^+$	5.29E+02	1.78E+03 $^+$	4.77E+02
f_{16}	6.23E+02	1.70E+02	7.37E+02 $^+$	1.72E+02	6.94E+02 \approx	1.69E+02	6.80E+02 \approx	1.71E+02
f_{17}	7.05E+02	1.34E+02	7.48E+02 \approx	1.50E+02	6.86E+02 \approx	1.35E+02	7.17E+02 \approx	1.29E+02
f_{18}	7.76E+04	1.96E+04	7.87E+04 \approx	2.97E+04	7.77E+04 \approx	2.70E+04	7.92E+04 \approx	2.93E+04
f_{19}	2.86E+03	1.78E+03	2.20E+03 $^-$	1.62E+03	4.14E+03 $^+$	2.51E+03	3.94E+03 $^+$	2.01E+03
f_{20}	4.98E+02	1.23E+02	5.12E+02 \approx	1.12E+02	5.42E+02 \approx	1.01E+02	5.45E+02 \approx	1.38E+02
f_{21}	3.35E+02	6.53E+00	3.40E+02 $^+$	7.44E+00	3.37E+02 \approx	7.46E+00	3.33E+02 \approx	5.70E+00
f_{22}	1.37E+03	1.93E+03	1.69E+03 \approx	2.06E+03	1.94E+03 \approx	2.04E+03	1.72E+03 \approx	2.09E+03
f_{23}	5.87E+02	1.29E+01	5.87E+02 \approx	1.15E+01	5.88E+02 \approx	9.60E+00	5.86E+02 \approx	1.32E+01
f_{24}	6.52E+02	1.09E+01	6.54E+02 \approx	1.13E+01	6.56E+02 \approx	1.37E+01	6.57E+02 $^+$	1.26E+01
f_{25}	5.58E+02	2.01E+01	5.60E+02 \approx	1.62E+01	5.65E+02 \approx	2.80E+01	5.63E+02 \approx	2.35E+01
f_{26}	1.64E+03	2.74E+02	1.57E+03 \approx	4.10E+02	1.62E+03 \approx	3.75E+02	1.65E+03 \approx	2.72E+02
f_{27}	7.44E+02	3.51E+01	7.49E+02 \approx	3.23E+01	7.64E+02 $^+$	3.96E+01	7.51E+02 \approx	3.89E+01
f_{28}	5.65E+02	1.29E+01	5.66E+02 $^+$	1.27E+01	5.68E+02 \approx	1.57E+01	5.64E+02 \approx	1.16E+01
f_{29}	8.74E+02	1.23E+02	8.50E+02 \approx	1.29E+02	8.84E+02 \approx	1.49E+02	9.41E+02 $^+$	1.36E+02
f_{30}	4.72E+06	8.06E+05	4.80E+06 \approx	8.22E+05	5.12E+06 $^+$	8.51E+05	5.11E+06 $^+$	7.82E+05
$+/-/\approx$	-		7/1/21		7/1/21		8/4/17	

TABLE XVII: Results of guiding comparison experiments on 100-D test functions. Subscripts G0, G1, G2 indicate the corresponding variants use none, previous, previous+proposed guiding methods. The proposed prediction operator are employed in all methods

Fun.	OLFWA		OLFWA _{G0}		OLFWA _{G1}		OLFWA _{G2}	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
f_1	1.19E+01	2.99E+01	7.54E+00 \approx	2.73E+01	7.09E+00 \approx	1.80E+01	3.29E+01 \approx	8.76E+01
f_3	1.17E+04	2.97E+03	1.15E+04 \approx	3.00E+03	1.15E+04 \approx	3.23E+03	1.17E+04 \approx	3.64E+03
f_4	2.83E+02	3.53E+01	2.92E+02 \approx	3.62E+01	2.91E+02 \approx	2.91E+01	2.81E+02 \approx	3.24E+01
f_5	1.80E+02	1.29E+01	1.99E+02 $^+$	1.69E+01	1.92E+02 $^+$	1.60E+01	1.74E+02 $^-$	1.48E+01
f_6	1.00E+02	6.81E-04	1.00E+02 $^+$	2.38E-03	1.00E+02 $^+$	7.37E-03	1.00E+02 \approx	1.79E-02
f_7	2.64E+02	1.40E+01	2.89E+02 $^+$	1.60E+01	2.58E+02 $^-$	1.42E+01	2.53E+02 $^-$	1.10E+01
f_8	1.81E+02	1.53E+01	1.95E+02 $^+$	1.43E+01	1.91E+02 $^+$	2.12E+01	1.78E+02 \approx	1.06E+01
f_9	1.00E+02	2.69E-02	1.00E+02 $^+$	1.98E-01	1.00E+02 $^-$	0.00E+00	1.00E+02 $^-$	0.00E+00
f_{10}	8.31E+03	7.11E+02	8.98E+03 $^+$	6.48E+02	8.46E+03 \approx	9.23E+02	8.35E+03 \approx	8.80E+02
f_{11}	1.09E+03	1.54E+02	1.07E+03 \approx	1.31E+02	1.10E+03 \approx	1.57E+02	1.08E+03 \approx	1.39E+02
f_{12}	1.83E+06	6.12E+05	1.94E+06 \approx	6.37E+05	6.41E+06 $^+$	2.49E+06	6.02E+06 $^+$	2.35E+06
f_{13}	1.54E+04	1.77E+03	1.49E+04 \approx	1.88E+03	1.70E+04 $^+$	2.41E+03	1.64E+04 $^+$	1.97E+03
f_{14}	7.71E+04	3.77E+04	8.95E+04 \approx	4.22E+04	9.06E+04 \approx	4.07E+04	8.40E+04 \approx	3.23E+04
f_{15}	4.32E+03	9.33E+02	4.00E+03 \approx	8.67E+02	6.56E+03 $^+$	1.26E+03	7.72E+03 $^+$	1.83E+03
f_{16}	1.69E+03	3.75E+02	1.96E+03 $^+$	3.46E+02	2.01E+03 $^+$	4.00E+02	1.80E+03 \approx	3.68E+02
f_{17}	1.67E+03	3.38E+02	1.74E+03 \approx	2.69E+02	1.79E+03 $^+$	2.91E+02	1.67E+03 \approx	2.97E+02
f_{18}	1.70E+05	5.02E+04	1.83E+05 \approx	4.74E+04	1.87E+05 \approx	5.18E+04	1.86E+05 \approx	5.05E+04
f_{19}	7.84E+03	5.02E+03	4.86E+03 $^-$	3.16E+03	1.84E+04 $^+$	1.11E+04	4.16E+04 $^+$	2.67E+04
f_{20}	1.73E+03	2.39E+02	1.80E+03 \approx	2.36E+02	1.84E+03 $^+$	3.31E+02	1.83E+03 \approx	2.36E+02
f_{21}	4.24E+02	1.88E+01	4.36E+02 $^+$	1.90E+01	4.24E+02 \approx	1.97E+01	4.24E+02 \approx	2.01E+01
f_{22}	9.88E+03	1.58E+03	1.03E+04 $^+$	2.25E+03	1.06E+04 $^+$	1.02E+03	9.28E+03 \approx	2.81E+03
f_{23}	7.92E+02	2.10E+01	7.75E+02 $^-$	1.77E+01	7.96E+02 \approx	2.01E+01	8.01E+02 $^+$	2.13E+01
f_{24}	1.14E+03	1.97E+01	1.14E+03 \approx	2.07E+01	1.14E+03 \approx	2.12E+01	1.14E+03 \approx	2.10E+01
f_{25}	7.54E+02	4.74E+01	7.45E+02 \approx	4.97E+01	7.74E+02 $^+$	4.70E+01	7.62E+02 \approx	5.14E+01
f_{26}	4.29E+03	5.95E+02	4.51E+03 $^+$	2.02E+02	4.38E+03 \approx	6.09E+02	4.36E+03 \approx	2.42E+02
f_{27}	8.09E+02	2.47E+01	8.13E+02 \approx	2.51E+01	8.11E+02 \approx	2.32E+01	8.12E+02 \approx	2.17E+01
f_{28}	6.67E+02	3.22E+01	6.84E+02 $^+$	3.00E+01	6.88E+02 $^+$	3.11E+01	6.67E+02 \approx	2.71E+01
f_{29}	2.62E+03	3.72E+02	2.75E+03 \approx	3.59E+02	2.96E+03 $^+$	3.82E+02	2.84E+03 $^+$	3.12E+02
f_{30}	6.12E+05	7.30E+04	6.03E+05 \approx	7.77E+04	7.79E+05 $^+$	1.31E+05	7.67E+05 $^+$	1.49E+05
+/-/ \approx	-		11/2/16		15/2/12		7/3/19	

TABLE XVIII: Results obtained by OLFWA and its 3 guiding variants on 30-D test functions

Fun.	OLFWA		OLFWA _{g1}		OLFWA _{g2}		OLFWA _{g1+g2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.61E-01	1.30E+00	2.94E+00 \approx	1.39E+01	8.41E-01 \approx	2.92E+00	4.74E-01\approx	1.56E+00
f_3	1.00E+02	1.18E+00	1.01E+02 \approx	1.53E+00	1.01E+02 \approx	4.05E+00	1.02E+02 \approx	6.12E+00
f_4	1.01E+02	1.38E+00	1.01E+02 \approx	1.46E+00	1.00E+02\approx	1.08E+00	1.02E+02 $^+$	6.75E+00
f_5	1.18E+02	5.71E+00	1.18E+02 \approx	4.75E+00	1.19E+02 \approx	4.65E+00	1.18E+02 \approx	6.15E+00
f_6	1.00E+02	1.37E-03	1.00E+02$^-$	8.18E-05	1.00E+02 $^+$	6.97E-03	1.00E+02 $^-$	3.05E-04
f_7	1.42E+02	4.98E+00	1.41E+02\approx	2.63E+00	1.44E+02 $^+$	4.21E+00	1.42E+02 \approx	3.28E+00
f_8	1.17E+02	5.26E+00	1.17E+02\approx	4.65E+00	1.18E+02 \approx	5.76E+00	1.18E+02 \approx	5.67E+00
f_9	1.00E+02	0.00E+00	1.00E+02\approx	0.00E+00	1.00E+02 $^+$	1.48E-01	1.00E+02 \approx	6.97E-02
f_{10}	2.15E+03	3.56E+02	2.14E+03\approx	4.51E+02	2.20E+03 \approx	3.10E+02	2.23E+03 \approx	3.60E+02
f_{11}	1.55E+02	1.72E+01	1.52E+02\approx	1.75E+01	1.53E+02 \approx	1.40E+01	1.55E+02 \approx	1.89E+01
f_{12}	5.44E+04	3.07E+04	6.45E+04 \approx	4.70E+04	5.54E+04 \approx	4.09E+04	7.12E+04 \approx	5.09E+04
f_{13}	8.25E+03	2.43E+03	8.54E+03 \approx	2.85E+03	7.98E+03\approx	2.16E+03	8.06E+03 \approx	2.33E+03
f_{14}	4.53E+02	1.94E+02	4.13E+02\approx	1.87E+02	4.61E+02 \approx	2.41E+02	5.03E+02 \approx	2.79E+02
f_{15}	1.29E+03	4.19E+02	1.49E+03 \approx	5.73E+02	1.33E+03 \approx	5.12E+02	1.33E+03 \approx	5.02E+02
f_{16}	4.37E+02	1.50E+02	4.94E+02 \approx	1.50E+02	4.94E+02 \approx	1.27E+02	4.81E+02 \approx	1.26E+02
f_{17}	1.73E+02	3.21E+01	1.75E+02 \approx	3.33E+01	1.77E+02 \approx	3.30E+01	1.70E+02\approx	2.39E+01
f_{18}	3.67E+04	1.75E+04	3.74E+04 \approx	1.56E+04	3.18E+04\approx	1.72E+04	3.61E+04 \approx	1.50E+04
f_{19}	6.37E+02	6.57E+02	6.45E+02 \approx	5.21E+02	5.44E+02 \approx	3.91E+02	5.34E+02\approx	3.27E+02
f_{20}	2.84E+02	5.77E+01	2.68E+02 \approx	6.26E+01	2.64E+02\approx	6.38E+01	2.88E+02 \approx	5.87E+01
f_{21}	3.14E+02	2.24E+01	3.12E+02\approx	2.55E+01	3.14E+02 \approx	2.39E+01	3.15E+02 \approx	2.42E+01
f_{22}	2.00E+02	0.00E+00	2.00E+02\approx	0.00E+00	2.00E+02\approx	0.00E+00	2.00E+02\approx	0.00E+00
f_{23}	4.72E+02	3.98E+01	4.54E+02 \approx	7.48E+01	4.38E+02$^-$	9.62E+01	4.68E+02 \approx	5.52E+01
f_{24}	5.44E+02	8.47E+00	5.41E+02 \approx	3.49E+01	5.42E+02 \approx	3.53E+01	5.36E+02\approx	4.91E+01
f_{25}	4.85E+02	1.69E+00	4.86E+02 $^+$	1.63E+00	4.85E+02 \approx	1.65E+00	4.85E+02\approx	1.64E+00
f_{26}	4.34E+02	3.14E+02	4.35E+02 \approx	3.17E+02	4.33E+02 \approx	3.31E+02	4.23E+02\approx	3.14E+02
f_{27}	6.12E+02	6.19E+00	6.11E+02\approx	6.55E+00	6.13E+02 \approx	5.09E+00	6.12E+02 \approx	6.28E+00
f_{28}	4.02E+02	1.45E+01	4.02E+02 \approx	1.45E+01	4.02E+02 \approx	1.45E+01	4.04E+02 \approx	2.03E+01
f_{29}	6.97E+02	7.62E+01	6.91E+02 \approx	6.68E+01	6.85E+02\approx	6.11E+01	6.97E+02 \approx	5.45E+01
f_{30}	6.57E+04	2.43E+04	7.09E+04 \approx	2.92E+04	5.89E+04\approx	2.59E+04	7.13E+04 \approx	2.96E+04
$+/-/\approx$	-		1/1/27		3/1/25		1/1/27	

TABLE XIX: Results obtained by OLFWA and its 3 guiding variants on 50-D test functions

Fun.	OLFWA		OLFWA _{g1}		OLFWA _{g2}		OLFWA _{g1+g2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.84E+00	1.52E+01	5.15E+00 \approx	1.69E+01	1.26E+00 \approx	3.04E+00	7.76E+00 \approx	1.59E+01
f_3	1.00E+02	4.14E-01	1.00E+02 \approx	2.11E-01	1.00E+02 \approx	6.94E-01	1.00E+02 \approx	3.99E-01
f_4	1.26E+02	2.18E+01	1.26E+02 \approx	2.13E+01	1.27E+02 \approx	2.13E+01	1.42E+02 $^+$	2.91E+01
f_5	1.35E+02	8.75E+00	1.33E+02 \approx	7.74E+00	1.36E+02 \approx	7.96E+00	1.37E+02 \approx	1.03E+01
f_6	1.00E+02	6.25E-04	1.00E+02 $^-$	3.32E-05	1.00E+02 $^+$	2.51E-03	1.00E+02 $^-$	9.84E-04
f_7	1.75E+02	5.98E+00	1.72E+02 $^-$	6.34E+00	1.81E+02 $^+$	7.28E+00	1.73E+02 \approx	4.92E+00
f_8	1.33E+02	7.35E+00	1.33E+02 \approx	5.62E+00	1.37E+02 $^+$	7.86E+00	1.34E+02 \approx	6.43E+00
f_9	1.00E+02	6.55E-02	1.00E+02 \approx	0.00E+00	1.00E+02 $^+$	1.36E-01	1.00E+02 \approx	0.00E+00
f_{10}	3.88E+03	4.91E+02	3.67E+03 $^-$	4.69E+02	3.89E+03 \approx	4.36E+02	3.82E+03 \approx	4.76E+02
f_{11}	2.35E+02	3.18E+01	2.33E+02 \approx	2.74E+01	2.27E+02 \approx	3.27E+01	2.31E+02 \approx	3.24E+01
f_{12}	9.28E+05	3.85E+05	1.13E+06 \approx	4.82E+05	1.23E+06 $^+$	5.77E+05	1.24E+06 $^+$	6.11E+05
f_{13}	1.06E+04	2.07E+03	1.17E+04 $^+$	2.28E+03	1.12E+04 \approx	2.02E+03	1.24E+04 $^+$	2.59E+03
f_{14}	4.85E+03	3.12E+03	6.12E+03 \approx	5.41E+03	5.91E+03 \approx	4.86E+03	5.08E+03 \approx	3.75E+03
f_{15}	1.53E+03	4.32E+02	1.63E+03 \approx	4.44E+02	1.51E+03 \approx	4.90E+02	1.90E+03 $^+$	5.29E+02
f_{16}	6.23E+02	1.70E+02	6.15E+02 \approx	1.90E+02	6.37E+02 \approx	1.92E+02	6.94E+02 \approx	1.69E+02
f_{17}	7.05E+02	1.34E+02	7.35E+02 \approx	1.20E+02	7.05E+02 \approx	1.60E+02	6.86E+02 \approx	1.35E+02
f_{18}	7.76E+04	1.96E+04	8.23E+04 \approx	2.79E+04	8.26E+04 \approx	2.81E+04	7.77E+04 \approx	2.70E+04
f_{19}	2.86E+03	1.78E+03	3.62E+03 \approx	2.59E+03	3.29E+03 \approx	2.49E+03	4.14E+03 $^+$	2.51E+03
f_{20}	4.98E+02	1.23E+02	5.45E+02 $^+$	1.07E+02	5.14E+02 \approx	1.33E+02	5.42E+02 \approx	1.01E+02
f_{21}	3.35E+02	6.53E+00	3.35E+02 \approx	6.49E+00	3.38E+02 $^+$	7.97E+00	3.37E+02 \approx	7.46E+00
f_{22}	1.37E+03	1.93E+03	1.87E+03 \approx	2.12E+03	8.44E+02 \approx	1.47E+03	1.94E+03 \approx	2.04E+03
f_{23}	5.87E+02	1.29E+01	5.85E+02 \approx	1.29E+01	5.86E+02 \approx	1.54E+01	5.88E+02 \approx	9.60E+00
f_{24}	6.52E+02	1.09E+01	6.56E+02 \approx	1.02E+01	6.59E+02 $^+$	1.10E+01	6.56E+02 \approx	1.37E+01
f_{25}	5.58E+02	2.01E+01	5.64E+02 \approx	2.02E+01	5.60E+02 \approx	1.77E+01	5.65E+02 \approx	2.80E+01
f_{26}	1.64E+03	2.74E+02	1.63E+03 \approx	3.32E+02	1.51E+03 \approx	4.55E+02	1.62E+03 \approx	3.75E+02
f_{27}	7.44E+02	3.51E+01	7.57E+02 \approx	2.65E+01	7.55E+02 \approx	3.97E+01	7.64E+02 $^+$	3.96E+01
f_{28}	5.65E+02	1.29E+01	5.63E+02 \approx	9.69E+00	5.62E+02 \approx	3.17E+00	5.68E+02 \approx	1.57E+01
f_{29}	8.74E+02	1.23E+02	8.95E+02 \approx	1.60E+02	9.01E+02 \approx	1.42E+02	8.84E+02 \approx	1.49E+02
f_{30}	4.72E+06	8.06E+05	4.92E+06 \approx	7.70E+05	4.81E+06 \approx	7.06E+05	5.12E+06 $^+$	8.51E+05
$+/-/\approx$	-		2/3/24		7/0/22		7/1/21	

TABLE XX: Results obtained by OLFWA and its 3 guiding variants on 100-D test functions

Fun.	OLFWA		OLFWA _{g1}		OLFWA _{g2}		OLFWA _{g1+g2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	1.19E+01	2.99E+01	7.71E+00 \approx	2.02E+01	2.11E+00 \approx	4.14E+00	7.09E+00 \approx	1.80E+01
f_3	1.17E+04	2.97E+03	1.18E+04 \approx	4.34E+03	1.14E+04 \approx	3.39E+03	1.15E+04 \approx	3.23E+03
f_4	2.83E+02	3.53E+01	2.82E+02 \approx	2.78E+01	2.86E+02 \approx	2.60E+01	2.91E+02 \approx	2.91E+01
f_5	1.80E+02	1.29E+01	1.87E+02 $^+$	1.55E+01	2.00E+02 $^+$	1.42E+01	1.92E+02 $^+$	1.60E+01
f_6	1.00E+02	6.81E-04	1.00E+02 $^+$	2.54E-03	1.00E+02 $^+$	2.02E-03	1.00E+02 $^+$	7.37E-03
f_7	2.64E+02	1.40E+01	2.60E+02 \approx	1.35E+01	2.86E+02 $^+$	1.80E+01	2.58E+02 $^-$	1.42E+01
f_8	1.81E+02	1.53E+01	1.87E+02 $^+$	1.46E+01	1.96E+02 $^+$	1.78E+01	1.91E+02 $^+$	2.12E+01
f_9	1.00E+02	2.69E-02	1.00E+02 $^-$	0.00E+00	1.00E+02 \approx	1.24E-01	1.00E+02 $^-$	0.00E+00
f_{10}	8.31E+03	7.11E+02	8.37E+03 \approx	7.79E+02	8.58E+03 $^+$	6.78E+02	8.46E+03 \approx	9.23E+02
f_{11}	1.09E+03	1.54E+02	1.11E+03 \approx	1.51E+02	1.07E+03 \approx	1.33E+02	1.10E+03 \approx	1.57E+02
f_{12}	1.83E+06	6.12E+05	3.44E+06 $^+$	1.40E+06	2.34E+06 $^+$	1.03E+06	6.41E+06 $^+$	2.49E+06
f_{13}	1.54E+04	1.77E+03	1.62E+04 \approx	2.47E+03	1.55E+04 \approx	2.37E+03	1.70E+04 $^+$	2.41E+03
f_{14}	7.71E+04	3.77E+04	7.32E+04 \approx	3.62E+04	8.29E+04 \approx	4.16E+04	9.06E+04 \approx	4.07E+04
f_{15}	4.32E+03	9.33E+02	5.42E+03 $^+$	1.11E+03	4.66E+03 \approx	1.11E+03	6.56E+03 $^+$	1.26E+03
f_{16}	1.69E+03	3.75E+02	1.82E+03 \approx	3.88E+02	1.86E+03 $^+$	4.10E+02	2.01E+03 $^+$	4.00E+02
f_{17}	1.67E+03	3.38E+02	1.81E+03 $^+$	2.45E+02	1.75E+03 \approx	2.58E+02	1.79E+03 $^+$	2.91E+02
f_{18}	1.70E+05	5.02E+04	1.86E+05 \approx	5.01E+04	1.81E+05 \approx	5.97E+04	1.87E+05 \approx	5.18E+04
f_{19}	7.84E+03	5.02E+03	1.19E+04 $^+$	7.20E+03	8.85E+03 \approx	7.40E+03	1.84E+04 $^+$	1.11E+04
f_{20}	1.73E+03	2.39E+02	1.73E+03 \approx	2.58E+02	1.70E+03 \approx	2.96E+02	1.84E+03 $^+$	3.31E+02
f_{21}	4.24E+02	1.88E+01	4.23E+02 \approx	2.02E+01	4.35E+02 $^+$	1.94E+01	4.24E+02 \approx	1.97E+01
f_{22}	9.88E+03	1.58E+03	9.86E+03 \approx	2.19E+03	1.03E+04 $^+$	2.21E+03	1.06E+04 $^+$	1.02E+03
f_{23}	7.92E+02	2.10E+01	7.92E+02 \approx	1.79E+01	7.87E+02 \approx	1.93E+01	7.96E+02 \approx	2.01E+01
f_{24}	1.14E+03	1.97E+01	1.15E+03 \approx	2.88E+01	1.14E+03 \approx	1.67E+01	1.14E+03 \approx	2.12E+01
f_{25}	7.54E+02	4.74E+01	7.74E+02 \approx	5.43E+01	7.44E+02 \approx	4.93E+01	7.74E+02 $^+$	4.70E+01
f_{26}	4.29E+03	5.95E+02	4.47E+03 $^+$	2.12E+02	4.49E+03 $^+$	2.32E+02	4.38E+03 \approx	6.09E+02
f_{27}	8.09E+02	2.47E+01	8.21E+02 $^+$	2.56E+01	8.18E+02 \approx	2.83E+01	8.11E+02 \approx	2.32E+01
f_{28}	6.67E+02	3.22E+01	6.73E+02 \approx	3.42E+01	6.64E+02 \approx	2.92E+01	6.88E+02 $^+$	3.11E+01
f_{29}	2.62E+03	3.72E+02	2.79E+03 $^+$	2.95E+02	2.67E+03 \approx	3.77E+02	2.96E+03 $^+$	3.82E+02
f_{30}	6.12E+05	7.30E+04	6.47E+05 $^+$	9.46E+04	6.05E+05 \approx	8.93E+04	7.79E+05 $^+$	1.31E+05
$+/-/\approx$	-		11/1/17		10/0/19		15/2/12	

TABLE XXI: Detailed results of the interaction analysis experiments about OD explosion's influence on information utilization without using any predictions and guiding on 30-D test functions

Fun.	OLFWA _{P0G0}		OLFWA _{P0G0E1}		OLFWA _{P0G0E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	1.10E+01	3.94E+01	6.91E+00 ≈	1.78E+01	4.07E+01 ⁺	1.08E+02
f_3	1.00E+02	1.73E+00	1.00E+02 −	0.00E+00	1.00E+02 [−]	4.00E-08
f_4	1.20E+02	2.87E+01	1.21E+02≈	3.10E+01	1.39E+02 ⁺	3.41E+01
f_5	1.42E+02	8.45E+00	1.42E+02 ≈	9.71E+00	1.45E+02≈	1.02E+01
f_6	1.14E+02	4.11E+00	1.13E+02≈	4.74E+00	1.11E+02 −	3.83E+00
f_7	1.59E+02	6.93E+00	1.62E+02≈	8.83E+00	1.68E+02 ⁺	1.07E+01
f_8	1.38E+02	8.59E+00	1.36E+02≈	7.48E+00	1.36E+02 ≈	8.74E+00
f_9	6.59E+02	2.45E+02	4.89E+02 −	1.83E+02	5.17E+02 [−]	2.38E+02
f_{10}	2.47E+03	3.38E+02	2.44E+03 ≈	3.18E+02	2.59E+03 ⁺	3.41E+02
f_{11}	1.57E+02	1.83E+01	1.57E+02≈	1.80E+01	1.59E+02≈	1.97E+01
f_{12}	1.84E+05	1.36E+05	1.55E+05 ≈	1.21E+05	2.26E+05≈	2.19E+05
f_{13}	1.03E+04	3.48E+03	9.00E+03 −	3.07E+03	1.26E+04 ⁺	4.69E+03
f_{14}	4.70E+02	2.18E+02	4.02E+02 −	2.06E+02	4.45E+02≈	2.02E+02
f_{15}	3.04E+03	1.05E+03	3.99E+03 ⁺	1.37E+03	5.59E+03 ⁺	2.15E+03
f_{16}	6.06E+02	1.34E+02	5.54E+02 ≈	1.44E+02	5.95E+02≈	1.41E+02
f_{17}	2.12E+02	4.17E+01	2.10E+02≈	4.71E+01	2.09E+02 ≈	4.57E+01
f_{18}	3.68E+04	1.43E+04	3.58E+04 ≈	1.31E+04	3.80E+04≈	1.72E+04
f_{19}	3.68E+03	3.99E+03	4.86E+03≈	4.97E+03	1.10E+04 ⁺	1.16E+04
f_{20}	3.39E+02	6.09E+01	3.27E+02 ≈	6.06E+01	3.33E+02≈	6.08E+01
f_{21}	3.16E+02	5.02E+01	3.12E+02 ≈	5.25E+01	3.31E+02≈	3.61E+01
f_{22}	2.00E+02	0.00E+00	2.00E+02 ≈	0.00E+00	2.00E+02 ≈	0.00E+00
f_{23}	4.31E+02	1.31E+02	4.48E+02≈	1.16E+02	4.66E+02≈	9.89E+01
f_{24}	5.26E+02	9.79E+01	5.48E+02≈	6.30E+01	5.57E+02≈	3.89E+01
f_{25}	4.86E+02	1.60E+00	4.86E+02≈	1.46E+00	4.86E+02≈	1.18E+00
f_{26}	3.25E+02	4.40E+01	3.37E+02≈	4.88E+01	3.51E+02 ⁺	8.23E+01
f_{27}	6.32E+02	1.11E+01	6.25E+02 −	1.14E+01	6.28E+02≈	1.27E+01
f_{28}	4.08E+02	2.74E+01	4.04E+02≈	1.83E+01	4.04E+02 −	1.63E+01
f_{29}	7.45E+02	7.70E+01	7.35E+02 ≈	7.69E+01	7.40E+02≈	7.06E+01
f_{30}	1.49E+05	1.13E+05	1.48E+05 ≈	1.21E+05	1.81E+05≈	1.49E+05
+/-/≈	-		1/5/23		8/4/17	

TABLE XXII: Detailed results of the interaction analysis experiments about OD explosion's influence on information utilization without using any predictions and guiding on 50-D test functions

Fun.	OLFWA _{P0G0}		OLFWA _{P0G0E1}		OLFWA _{P0G0E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	5.07E+01	1.33E+02	1.24E+02 \approx	3.80E+02	2.40E+02 \approx	7.87E+02
f_3	1.00E+02	2.02E-01	1.00E+02 \sim	2.20E-02	1.00E+02 \sim	3.86E-02
f_4	1.82E+02	3.93E+01	1.85E+02 \approx	3.40E+01	1.79E+02 \approx	3.75E+01
f_5	2.03E+02	1.98E+01	1.98E+02 \approx	1.53E+01	2.00E+02 \approx	1.95E+01
f_6	1.21E+02	4.69E+00	1.21E+02 \approx	3.68E+00	1.20E+02 \approx	4.16E+00
f_7	2.45E+02	2.17E+01	2.43E+02 \approx	2.13E+01	2.43E+02 \approx	1.64E+01
f_8	2.03E+02	1.89E+01	2.05E+02 \approx	1.90E+01	2.01E+02 \approx	2.20E+01
f_9	3.40E+03	9.88E+02	3.04E+03 \approx	9.29E+02	2.90E+03 \sim	8.44E+02
f_{10}	4.85E+03	4.97E+02	4.87E+03 \approx	4.31E+02	4.64E+03 \sim	5.06E+02
f_{11}	2.44E+02	2.98E+01	2.35E+02 \approx	2.12E+01	2.45E+02 \approx	3.18E+01
f_{12}	2.39E+06	1.39E+06	2.05E+06 \approx	1.06E+06	2.29E+06 \approx	9.57E+05
f_{13}	1.66E+04	3.82E+03	1.75E+04 \approx	4.13E+03	1.69E+04 \approx	4.39E+03
f_{14}	4.95E+03	4.83E+03	4.88E+03 \approx	4.39E+03	4.00E+03 \approx	4.50E+03
f_{15}	4.49E+03	1.88E+03	4.88E+03 \approx	1.66E+03	4.39E+03 \approx	1.53E+03
f_{16}	9.04E+02	2.27E+02	8.48E+02 \approx	2.28E+02	8.67E+02 \approx	1.87E+02
f_{17}	7.90E+02	1.42E+02	7.98E+02 \approx	1.47E+02	8.19E+02 \approx	1.34E+02
f_{18}	7.11E+04	2.27E+04	6.63E+04 \approx	2.11E+04	7.18E+04 \approx	2.32E+04
f_{19}	1.80E+04	1.28E+04	2.08E+04 \approx	1.38E+04	2.04E+04 \approx	1.13E+04
f_{20}	6.31E+02	1.31E+02	5.74E+02 \sim	1.23E+02	5.78E+02 \sim	1.18E+02
f_{21}	4.00E+02	2.04E+01	3.95E+02 \approx	2.28E+01	3.91E+02 \sim	1.76E+01
f_{22}	3.40E+03	2.62E+03	2.58E+03 \approx	2.47E+03	2.80E+03 \approx	2.40E+03
f_{23}	6.77E+02	2.96E+01	6.58E+02 \sim	2.54E+01	6.66E+02 \sim	2.93E+01
f_{24}	7.26E+02	2.66E+01	7.16E+02 \approx	3.15E+01	7.16E+02 \approx	2.17E+01
f_{25}	5.90E+02	3.00E+01	5.86E+02 \approx	3.05E+01	5.78E+02 \sim	2.94E+01
f_{26}	8.62E+02	9.42E+02	1.02E+03 \approx	1.02E+03	8.75E+02 \approx	8.96E+02
f_{27}	7.99E+02	4.65E+01	7.71E+02 \sim	5.40E+01	7.81E+02 \approx	4.90E+01
f_{28}	5.67E+02	1.38E+01	5.63E+02 \sim	7.68E+00	5.67E+02 \approx	1.58E+01
f_{29}	1.17E+03	1.99E+02	1.14E+03 \approx	1.83E+02	1.11E+03 \approx	2.10E+02
f_{30}	1.69E+07	3.12E+06	1.58E+07 \approx	2.48E+06	1.62E+07 \approx	3.12E+06
$+/-/\approx$	-		0/5/24		0/7/22	

TABLE XXIII: Detailed results of the interaction analysis experiments about OD explosion's influence on information utilization without using any predictions and guiding on 100-D test functions

Fun.	OLFWA _{P0G0}		OLFWA _{P0G0E1}		OLFWA _{P0G0E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	2.12E+03	4.05E+03	3.80E+03 \approx	6.05E+03	3.10E+02 ⁻	5.36E+02
f_3	1.11E+04	3.24E+03	7.90E+03 ⁻	2.21E+03	1.47E+04 ⁺	3.67E+03
f_4	3.47E+02	3.57E+01	3.44E+02 \approx	3.42E+01	3.32E+02 \approx	4.65E+01
f_5	4.63E+02	4.30E+01	4.42E+02 ⁻	4.86E+01	4.21E+02 ⁻	4.77E+01
f_6	1.35E+02	4.23E+00	1.34E+02 \approx	4.55E+00	1.33E+02 ⁻	4.72E+00
f_7	5.92E+02	6.13E+01	5.83E+02 \approx	6.60E+01	5.03E+02 ⁻	4.15E+01
f_8	4.65E+02	4.75E+01	4.51E+02 \approx	5.14E+01	4.21E+02 ⁻	4.28E+01
f_9	1.36E+04	2.43E+03	1.23E+04 ⁻	2.26E+03	1.13E+04 ⁻	2.10E+03
f_{10}	1.13E+04	8.70E+02	1.13E+04 \approx	7.71E+02	1.10E+04 ⁻	8.24E+02
f_{11}	1.08E+03	1.29E+02	1.06E+03 \approx	1.26E+02	1.04E+03 \approx	1.12E+02
f_{12}	1.90E+07	7.85E+06	1.55E+07 ⁻	6.02E+06	1.00E+07 ⁻	5.16E+06
f_{13}	2.03E+04	3.96E+03	1.94E+04 \approx	3.26E+03	1.66E+04 ⁻	2.68E+03
f_{14}	6.96E+04	2.70E+04	7.65E+04 \approx	3.64E+04	5.03E+04 ⁻	2.01E+04
f_{15}	1.28E+04	2.81E+03	1.29E+04 \approx	2.91E+03	1.09E+04 ⁻	2.35E+03
f_{16}	2.75E+03	3.79E+02	2.75E+03 \approx	3.95E+02	2.56E+03 ⁻	4.98E+02
f_{17}	2.09E+03	3.48E+02	1.99E+03 \approx	3.31E+02	1.95E+03 ⁻	2.80E+02
f_{18}	1.70E+05	5.36E+04	1.63E+05 \approx	4.56E+04	1.35E+05 ⁻	3.68E+04
f_{19}	1.54E+05	1.08E+05	1.79E+05 \approx	1.19E+05	9.83E+04 ⁻	5.21E+04
f_{20}	2.01E+03	3.23E+02	1.89E+03 \approx	2.89E+02	1.82E+03 ⁻	2.59E+02
f_{21}	7.17E+02	5.35E+01	6.91E+02 ⁻	6.44E+01	6.51E+02 ⁻	3.69E+01
f_{22}	1.31E+04	8.26E+02	1.26E+04 \approx	1.99E+03	1.26E+04 \approx	1.90E+03
f_{23}	1.16E+03	7.74E+01	1.14E+03 \approx	8.23E+01	1.10E+03 ⁻	6.33E+01
f_{24}	1.51E+03	7.33E+01	1.48E+03 ⁻	7.97E+01	1.41E+03 ⁻	7.73E+01
f_{25}	8.46E+02	6.92E+01	8.37E+02 \approx	5.62E+01	7.98E+02 ⁻	6.76E+01
f_{26}	7.17E+03	2.85E+03	6.95E+03 ⁻	2.20E+03	6.35E+03 ⁻	2.67E+03
f_{27}	1.03E+03	8.20E+01	9.86E+02 ⁻	7.56E+01	9.65E+02 ⁻	6.98E+01
f_{28}	6.96E+02	3.39E+01	6.89E+02 \approx	3.10E+01	6.74E+02 ⁻	2.95E+01
f_{29}	3.76E+03	4.02E+02	3.51E+03 ⁻	3.38E+02	3.46E+03 ⁻	4.33E+02
f_{30}	5.49E+06	1.98E+06	4.50E+06 ⁻	1.67E+06	2.56E+06 ⁻	7.38E+05
$+/-/\approx$	-		0/10/19		1/25/3	

TABLE XXIV: Detailed results of the interaction analysis experiments about OD explosion's influence on information utilization without using any predictions on 30-D test functions

Fun.	OLFWA _{P0}		OLFWA _{P0E1}		OLFWA _{P0E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	8.64E-01	3.20E+00	6.07E-01 ≈	1.29E+00	5.57E+00 ⁺	9.93E+00
f_3	1.00E+02	1.57E+00	1.00E+02 ≈	0.00E+00	1.00E+02 [−]	1.10E-07
f_4	1.01E+02	3.67E+00	1.07E+02 ⁺	1.73E+01	1.23E+02 ⁺	2.87E+01
f_5	1.25E+02	5.25E+00	1.30E+02 ⁺	7.50E+00	1.31E+02 ⁺	7.52E+00
f_6	1.00E+02	9.27E-02	1.02E+02 ⁺	1.90E+00	1.00E+02 ⁺	2.21E-01
f_7	1.46E+02	5.99E+00	1.47E+02≈	4.93E+00	1.47E+02≈	4.49E+00
f_8	1.24E+02	6.11E+00	1.26E+02 ⁺	7.43E+00	1.27E+02 ⁺	6.25E+00
f_9	1.00E+02	3.76E-01	1.06E+02 ⁺	1.22E+01	1.00E+02 ≈	2.21E-01
f_{10}	2.42E+03	3.32E+02	2.39E+03≈	2.83E+02	2.38E+03 ≈	3.00E+02
f_{11}	1.53E+02	1.88E+01	1.53E+02≈	1.62E+01	1.62E+02 ⁺	1.85E+01
f_{12}	7.70E+04	5.88E+04	7.80E+04≈	5.65E+04	1.63E+05 ⁺	1.11E+05
f_{13}	9.59E+03	3.28E+03	9.08E+03 ≈	2.72E+03	1.22E+04 ⁺	3.27E+03
f_{14}	4.37E+02	1.99E+02	3.95E+02 ≈	9.27E+01	4.57E+02≈	2.04E+02
f_{15}	3.34E+03	1.25E+03	3.98E+03 ⁺	1.56E+03	4.98E+03 ⁺	1.66E+03
f_{16}	5.75E+02	1.36E+02	5.36E+02 ≈	1.26E+02	5.73E+02≈	1.50E+02
f_{17}	1.98E+02	3.87E+01	1.92E+02 ≈	4.39E+01	2.02E+02≈	4.28E+01
f_{18}	3.18E+04	1.30E+04	3.29E+04≈	1.40E+04	3.60E+04≈	1.57E+04
f_{19}	3.88E+03	4.77E+03	6.34E+03≈	8.34E+03	1.15E+04 ⁺	1.13E+04
f_{20}	3.10E+02	5.84E+01	3.00E+02 ≈	5.58E+01	3.13E+02≈	6.45E+01
f_{21}	3.20E+02	3.09E+01	3.25E+02≈	2.65E+01	3.27E+02 ⁺	2.74E+01
f_{22}	2.00E+02	0.00E+00	2.00E+02 ≈	0.00E+00	2.00E+02 ≈	0.00E+00
f_{23}	4.30E+02	1.23E+02	4.81E+02 ⁺	7.19E+01	4.68E+02 ⁺	8.99E+01
f_{24}	5.47E+02	3.79E+01	5.59E+02 ⁺	1.37E+01	5.57E+02 ⁺	1.21E+01
f_{25}	4.86E+02	1.63E+00	4.86E+02 ≈	1.67E+00	4.86E+02 ⁺	1.17E+00
f_{26}	3.37E+02	4.88E+01	3.49E+02≈	5.05E+01	3.79E+02 ⁺	1.67E+02
f_{27}	6.28E+02	1.19E+01	6.27E+02≈	1.27E+01	6.24E+02 ≈	1.12E+01
f_{28}	4.00E+02	1.64E-03	4.02E+02≈	1.45E+01	4.03E+02≈	1.54E+01
f_{29}	7.31E+02	7.77E+01	7.22E+02≈	7.20E+01	7.17E+02 ≈	7.38E+01
f_{30}	1.10E+05	6.40E+04	1.37E+05≈	1.05E+05	2.26E+05 ⁺	2.07E+05
$+/-/\approx$	-		8/1/20		16/1/12	

TABLE XXV: Detailed results of the interaction analysis experiments about OD explosion's influence on information utilization without using any predictions on 50-D test functions

Fun.	OLFWA _{P0}		OLFWA _{P0E1}		OLFWA _{P0E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	8.96E+00	2.54E+01	4.27E+00 \approx	1.57E+01	2.25E+00 $^-$	6.81E+00
f_3	1.00E+02	1.62E-01	1.00E+02 $^-$	2.55E-02	1.00E+02 $^-$	1.44E-02
f_4	1.63E+02	4.06E+01	1.56E+02 \approx	3.83E+01	1.58E+02 \approx	3.71E+01
f_5	1.45E+02	7.58E+00	1.60E+02 $^+$	1.12E+01	1.60E+02 $^+$	1.03E+01
f_6	1.00E+02	3.83E-03	1.00E+02 $^+$	6.47E-01	1.01E+02 $^+$	1.27E+00
f_7	1.79E+02	6.10E+00	1.83E+02 $^+$	6.93E+00	1.83E+02 \approx	8.26E+00
f_8	1.47E+02	8.93E+00	1.62E+02 $^+$	1.10E+01	1.58E+02 $^+$	1.05E+01
f_9	1.00E+02	1.67E-01	2.84E+02 $^+$	3.65E+02	4.05E+02 $^+$	4.80E+02
f_{10}	4.18E+03	4.98E+02	4.09E+03 \approx	5.88E+02	4.15E+03 \approx	4.85E+02
f_{11}	2.47E+02	3.12E+01	2.31E+02 $^-$	2.51E+01	2.30E+02 $^-$	3.03E+01
f_{12}	1.36E+06	6.60E+05	1.41E+06 \approx	6.87E+05	1.52E+06 \approx	7.51E+05
f_{13}	1.58E+04	3.74E+03	1.58E+04 \approx	3.90E+03	1.63E+04 \approx	3.31E+03
f_{14}	4.48E+03	3.50E+03	4.47E+03 \approx	4.42E+03	4.85E+03 \approx	3.79E+03
f_{15}	4.59E+03	1.57E+03	4.85E+03 \approx	1.31E+03	4.31E+03 \approx	1.35E+03
f_{16}	8.57E+02	1.77E+02	8.11E+02 \approx	1.97E+02	8.00E+02 \approx	1.95E+02
f_{17}	7.71E+02	1.46E+02	7.63E+02 \approx	1.50E+02	7.41E+02 \approx	1.31E+02
f_{18}	8.14E+04	3.89E+04	6.87E+04 \approx	2.59E+04	7.65E+04 \approx	3.11E+04
f_{19}	1.58E+04	1.03E+04	1.80E+04 \approx	1.02E+04	1.81E+04 \approx	1.28E+04
f_{20}	5.77E+02	1.07E+02	5.54E+02 \approx	1.23E+02	5.63E+02 \approx	1.14E+02
f_{21}	3.50E+02	1.20E+01	3.61E+02 $^+$	1.06E+01	3.62E+02 $^+$	9.43E+00
f_{22}	1.90E+03	2.24E+03	1.87E+03 \approx	2.17E+03	1.95E+03 \approx	2.21E+03
f_{23}	6.29E+02	3.06E+01	6.37E+02 \approx	2.18E+01	6.41E+02 $^+$	2.52E+01
f_{24}	6.80E+02	1.89E+01	7.02E+02 $^+$	3.07E+01	7.02E+02 $^+$	3.07E+01
f_{25}	5.66E+02	2.34E+01	5.67E+02 \approx	2.78E+01	5.68E+02 \approx	3.19E+01
f_{26}	1.38E+03	7.98E+02	1.37E+03 \approx	9.10E+02	1.28E+03 \approx	9.14E+02
f_{27}	7.82E+02	4.94E+01	7.83E+02 \approx	5.33E+01	7.85E+02 \approx	4.75E+01
f_{28}	5.68E+02	1.66E+01	5.63E+02 $^-$	9.71E+00	5.61E+02 $^-$	1.03E+00
f_{29}	1.06E+03	1.81E+02	1.07E+03 \approx	1.54E+02	1.00E+03 \approx	1.33E+02
f_{30}	1.54E+07	3.00E+06	1.48E+07 \approx	2.60E+06	1.47E+07 \approx	2.45E+06
$+/-/\approx$	-		7/3/19		7/4/18	

TABLE XXVI: Detailed results of the interaction analysis experiments about OD explosion's influence on information utilization without using any predictions on 100-D test functions

Fun.	OLFWA _{P0}		OLFWA _{P0E1}		OLFWA _{P0E2}	
	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>	<i>Mean</i>	<i>Std</i>
f_1	2.77E+01	1.48E+02	1.26E+01 \approx	2.82E+01	8.48E-01 $^-$	2.84E+00
f_3	1.18E+04	3.32E+03	7.67E+03 $^-$	2.43E+03	1.51E+04 $^+$	3.69E+03
f_4	3.11E+02	5.19E+01	3.11E+02 \approx	4.56E+01	2.83E+02 \approx	6.99E+01
f_5	2.08E+02	1.49E+01	2.36E+02 $^+$	2.09E+01	2.77E+02 $^+$	3.11E+01
f_6	1.00E+02	2.28E-03	1.00E+02 $^+$	1.28E-01	1.03E+02 $^+$	1.95E+00
f_7	2.71E+02	1.45E+01	2.75E+02 \approx	1.53E+01	2.93E+02 $^+$	1.95E+01
f_8	2.14E+02	1.58E+01	2.44E+02 $^+$	3.09E+01	2.81E+02 $^+$	2.21E+01
f_9	1.00E+02	1.38E-01	1.00E+02 $^+$	4.32E-01	2.41E+03 $^+$	1.26E+03
f_{10}	8.93E+03	9.31E+02	8.98E+03 \approx	8.83E+02	9.29E+03 $^+$	8.71E+02
f_{11}	1.09E+03	1.30E+02	1.05E+03 \approx	1.25E+02	9.83E+02 $^-$	9.70E+01
f_{12}	3.62E+06	1.45E+06	3.97E+06 \approx	1.48E+06	2.09E+06 $^-$	7.15E+05
f_{13}	1.70E+04	2.47E+03	1.71E+04 \approx	3.10E+03	1.54E+04 $^-$	1.91E+03
f_{14}	8.25E+04	3.31E+04	7.48E+04 \approx	3.12E+04	4.55E+04 $^-$	1.98E+04
f_{15}	1.18E+04	2.50E+03	1.20E+04 \approx	2.11E+03	9.64E+03 $^-$	1.96E+03
f_{16}	2.08E+03	3.92E+02	2.27E+03 $^+$	3.86E+02	2.18E+03 \approx	3.86E+02
f_{17}	1.70E+03	2.83E+02	1.80E+03 \approx	2.98E+02	1.73E+03 \approx	3.31E+02
f_{18}	1.71E+05	4.76E+04	1.65E+05 \approx	4.37E+04	1.26E+05 $^-$	2.96E+04
f_{19}	1.34E+05	6.97E+04	1.35E+05 \approx	7.51E+04	7.15E+04 $^-$	4.08E+04
f_{20}	1.88E+03	2.84E+02	1.86E+03 \approx	2.77E+02	1.77E+03 \approx	2.69E+02
f_{21}	4.63E+02	1.85E+01	4.94E+02 $^+$	2.86E+01	5.40E+02 $^+$	4.43E+01
f_{22}	1.06E+04	1.65E+03	1.07E+04 \approx	2.32E+03	1.06E+04 $^-$	3.11E+03
f_{23}	9.23E+02	4.55E+01	1.04E+03 $^+$	7.76E+01	1.03E+03 $^+$	5.95E+01
f_{24}	1.24E+03	4.55E+01	1.34E+03 $^+$	8.06E+01	1.36E+03 $^+$	8.22E+01
f_{25}	8.36E+02	6.64E+01	8.44E+02 \approx	6.21E+01	7.82E+02 $^-$	7.89E+01
f_{26}	4.91E+03	7.36E+02	5.54E+03 $^+$	8.58E+02	5.77E+03 $^+$	9.63E+02
f_{27}	9.60E+02	5.82E+01	9.67E+02 \approx	7.34E+01	9.50E+02 \approx	5.67E+01
f_{28}	7.03E+02	3.63E+01	6.79E+02 $^-$	3.43E+01	6.68E+02 $^-$	2.50E+01
f_{29}	3.13E+03	3.37E+02	3.18E+03 \approx	3.20E+02	2.97E+03 $^-$	3.17E+02
f_{30}	2.38E+06	8.00E+05	2.37E+06 \approx	6.69E+05	1.34E+06 $^-$	4.30E+05
$+/-/\approx$	-		9/2/18		11/13/5	

TABLE XXVII: 30-D result of the interaction analysis experiments about OL predictions' influence on guiding operator. Subscript g' indicates the corresponding variant abandons inputing OL prediction sparks on the proposed guiding operator.

Fun.	OLFWA				OLFWA _{g'}				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	5.61E-01	1.19E-04	7.54E+00	1.30E+00	1.77E+00	2.72E-06	4.75E+01	6.92E+00	\approx
f_3	1.00E+02	1.00E+02	1.07E+02	1.18E+00	1.03E+02	1.00E+02	2.14E+02	1.60E+01	\approx
f_4	1.01E+02	1.00E+02	1.04E+02	1.38E+00	1.01E+02	1.00E+02	1.04E+02	1.55E+00	\approx
f_5	1.18E+02	1.09E+02	1.36E+02	5.71E+00	1.17E+02	1.07E+02	1.30E+02	4.80E+00	\approx
f_6	1.00E+02	1.00E+02	1.00E+02	1.37E-03	1.00E+02	1.00E+02	1.00E+02	8.81E-05	-
f_7	1.42E+02	1.37E+02	1.71E+02	4.98E+00	1.42E+02	1.35E+02	1.62E+02	4.61E+00	\approx
f_8	1.17E+02	1.09E+02	1.38E+02	5.26E+00	1.16E+02	1.10E+02	1.30E+02	4.49E+00	\approx
f_9	1.00E+02	1.00E+02	1.00E+02	0.00E+00	1.00E+02	1.00E+02	1.00E+02	0.00E+00	\approx
f_{10}	2.15E+03	1.40E+03	3.04E+03	3.56E+02	2.14E+03	1.45E+03	2.89E+03	2.81E+02	\approx
f_{11}	1.55E+02	1.23E+02	1.96E+02	1.72E+01	1.52E+02	1.26E+02	1.97E+02	1.88E+01	\approx
f_{12}	5.44E+04	1.08E+04	1.45E+05	3.07E+04	4.89E+04	5.74E+03	1.67E+05	3.56E+04	\approx
f_{13}	8.25E+03	3.20E+03	1.53E+04	2.43E+03	7.76E+03	3.90E+03	1.36E+04	2.19E+03	\approx
f_{14}	4.53E+02	2.84E+02	1.09E+03	1.94E+02	5.56E+02	2.98E+02	4.43E+03	6.07E+02	\approx
f_{15}	1.29E+03	5.08E+02	2.93E+03	4.19E+02	1.35E+03	7.54E+02	2.07E+03	3.88E+02	\approx
f_{16}	4.37E+02	1.41E+02	7.09E+02	1.50E+02	4.44E+02	1.15E+02	8.01E+02	1.46E+02	\approx
f_{17}	1.73E+02	1.37E+02	2.74E+02	3.21E+01	1.75E+02	1.31E+02	2.84E+02	3.23E+01	\approx
f_{18}	3.67E+04	8.80E+03	1.10E+05	1.75E+04	3.93E+04	1.66E+04	8.50E+04	1.46E+04	\approx
f_{19}	6.37E+02	2.08E+02	3.46E+03	6.57E+02	6.46E+02	2.45E+02	2.16E+03	4.95E+02	\approx
f_{20}	2.84E+02	1.76E+02	4.19E+02	5.77E+01	2.74E+02	1.84E+02	4.08E+02	5.08E+01	\approx
f_{21}	3.14E+02	2.00E+02	3.28E+02	2.24E+01	3.14E+02	2.00E+02	3.34E+02	2.38E+01	\approx
f_{22}	2.00E+02	2.00E+02	2.00E+02	0.00E+00	2.00E+02	2.00E+02	2.00E+02	0.00E+00	\approx
f_{23}	4.72E+02	2.00E+02	4.98E+02	3.98E+01	4.50E+02	2.00E+02	4.97E+02	8.35E+01	\approx
f_{24}	5.44E+02	5.27E+02	5.65E+02	8.47E+00	5.47E+02	5.30E+02	5.79E+02	8.74E+00	+
f_{25}	4.85E+02	4.83E+02	4.87E+02	1.69E+00	4.85E+02	4.83E+02	4.87E+02	1.69E+00	\approx
f_{26}	4.34E+02	3.00E+02	1.44E+03	3.14E+02	4.26E+02	3.00E+02	1.50E+03	3.02E+02	\approx
f_{27}	6.12E+02	5.90E+02	6.26E+02	6.19E+00	6.11E+02	5.89E+02	6.25E+02	6.69E+00	\approx
f_{28}	4.02E+02	4.00E+02	5.03E+02	1.45E+01	4.04E+02	4.00E+02	5.03E+02	2.02E+01	\approx
f_{29}	6.97E+02	5.73E+02	8.50E+02	7.62E+01	6.92E+02	5.98E+02	8.38E+02	5.82E+01	\approx
f_{30}	6.57E+04	2.79E+04	1.18E+05	2.43E+04	6.40E+04	2.60E+04	1.30E+05	2.38E+04	\approx
S/I/D	1/1/27				1/1/27				

TABLE XXVIII: 50-D result of the interaction analysis experiments about OL predictions' influence on guiding operator. Subscript g' indicates the corresponding variant abandons inputing OL prediction sparks on the proposed guiding operator.

Fun.	OLFWA				OLFWA _{g'}				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	5.84E+00	3.44E-06	6.83E+01	1.52E+01	3.97E+00	2.04E-06	1.00E+02	1.51E+01	\approx
f_3	1.00E+02	1.00E+02	1.03E+02	4.14E-01	1.00E+02	1.00E+02	1.02E+02	3.36E-01	\approx
f_4	1.26E+02	1.00E+02	1.99E+02	2.18E+01	1.34E+02	1.00E+02	2.00E+02	2.70E+01	\approx
f_5	1.35E+02	1.19E+02	1.62E+02	8.75E+00	1.34E+02	1.18E+02	1.53E+02	6.90E+00	\approx
f_6	1.00E+02	1.00E+02	1.00E+02	6.25E-04	1.00E+02	1.00E+02	1.00E+02	1.23E-04	-
f_7	1.75E+02	1.65E+02	2.00E+02	5.98E+00	1.75E+02	1.64E+02	1.88E+02	4.98E+00	\approx
f_8	1.33E+02	1.21E+02	1.54E+02	7.35E+00	1.36E+02	1.23E+02	1.51E+02	7.25E+00	\approx
f_9	1.00E+02	1.00E+02	1.00E+02	6.55E-02	1.00E+02	1.00E+02	1.00E+02	1.25E-02	\approx
f_{10}	3.88E+03	2.49E+03	4.89E+03	4.91E+02	3.66E+03	2.41E+03	4.74E+03	4.81E+02	-
f_{11}	2.35E+02	1.78E+02	3.04E+02	3.18E+01	2.33E+02	1.82E+02	3.04E+02	2.85E+01	\approx
f_{12}	9.28E+05	2.11E+05	1.93E+06	3.85E+05	1.03E+06	2.29E+05	2.84E+06	5.44E+05	\approx
f_{13}	1.06E+04	7.49E+03	1.94E+04	2.07E+03	1.16E+04	6.80E+03	1.52E+04	2.11E+03	+
f_{14}	4.85E+03	6.01E+02	1.41E+04	3.12E+03	5.21E+03	7.82E+02	2.68E+04	5.13E+03	\approx
f_{15}	1.53E+03	8.64E+02	2.57E+03	4.32E+02	1.72E+03	9.60E+02	2.90E+03	5.25E+02	\approx
f_{16}	6.23E+02	2.30E+02	1.14E+03	1.70E+02	6.62E+02	2.44E+02	1.09E+03	1.95E+02	\approx
f_{17}	7.05E+02	3.83E+02	9.53E+02	1.34E+02	6.99E+02	3.87E+02	9.66E+02	1.44E+02	\approx
f_{18}	7.76E+04	4.50E+04	1.28E+05	1.96E+04	8.23E+04	2.55E+04	2.72E+05	3.92E+04	\approx
f_{19}	2.86E+03	3.88E+02	7.31E+03	1.78E+03	3.53E+03	3.50E+02	9.67E+03	2.22E+03	\approx
f_{20}	4.98E+02	2.74E+02	8.59E+02	1.23E+02	5.24E+02	2.73E+02	7.73E+02	1.14E+02	\approx
f_{21}	3.35E+02	3.21E+02	3.53E+02	6.53E+00	3.37E+02	3.22E+02	3.51E+02	5.86E+00	\approx
f_{22}	1.37E+03	2.00E+02	5.02E+03	1.93E+03	1.76E+03	2.00E+02	5.30E+03	2.15E+03	\approx
f_{23}	5.87E+02	5.53E+02	6.15E+02	1.29E+01	5.86E+02	5.64E+02	6.07E+02	1.06E+01	\approx
f_{24}	6.52E+02	6.33E+02	6.72E+02	1.09E+01	6.53E+02	6.35E+02	6.82E+02	1.13E+01	\approx
f_{25}	5.58E+02	5.28E+02	6.15E+02	2.01E+01	5.58E+02	5.28E+02	5.83E+02	1.49E+01	\approx
f_{26}	1.64E+03	4.00E+02	1.94E+03	2.74E+02	1.39E+03	4.00E+02	1.93E+03	5.64E+02	\approx
f_{27}	7.44E+02	6.60E+02	8.22E+02	3.51E+01	7.52E+02	6.83E+02	8.14E+02	3.16E+01	\approx
f_{28}	5.65E+02	5.59E+02	6.08E+02	1.29E+01	5.63E+02	5.59E+02	6.10E+02	9.95E+00	\approx
f_{29}	8.74E+02	6.49E+02	1.27E+03	1.23E+02	9.27E+02	6.58E+02	1.17E+03	1.27E+02	+
f_{30}	4.72E+06	2.98E+06	7.01E+06	8.06E+05	4.87E+06	3.54E+06	6.30E+06	7.17E+05	\approx
S/I/D	2/2/25				2/2/25				

TABLE XXIX: 100-D result of the interaction analysis experiments about OL predictions' influence on guiding operator. Subscript g' indicates the corresponding variant abandons inputing OL prediction sparks on the proposed guiding operator.

Fun.	OLFWA				OLFWA _{g'}				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	1.19E+01	1.80E-04	1.49E+02	2.99E+01	1.02E+01	2.06E-04	2.46E+02	3.71E+01	-
f_3	1.17E+04	6.19E+03	2.03E+04	2.97E+03	1.31E+04	6.26E+03	2.20E+04	3.62E+03	+
f_4	2.83E+02	1.71E+02	3.50E+02	3.53E+01	2.91E+02	1.81E+02	3.47E+02	3.23E+01	\approx
f_5	1.80E+02	1.53E+02	2.13E+02	1.29E+01	1.92E+02	1.59E+02	2.19E+02	1.53E+01	+
f_6	1.00E+02	1.00E+02	1.00E+02	6.81E-04	1.00E+02	1.00E+02	1.00E+02	4.59E-04	+
f_7	2.64E+02	2.38E+02	3.07E+02	1.40E+01	2.66E+02	2.40E+02	2.90E+02	1.25E+01	\approx
f_8	1.81E+02	1.63E+02	2.27E+02	1.53E+01	1.94E+02	1.68E+02	2.29E+02	1.40E+01	+
f_9	1.00E+02	1.00E+02	1.00E+02	2.69E-02	1.00E+02	1.00E+02	1.00E+02	9.27E-02	\approx
f_{10}	8.31E+03	7.08E+03	9.98E+03	7.11E+02	8.77E+03	6.28E+03	1.02E+04	8.10E+02	+
f_{11}	1.09E+03	7.56E+02	1.54E+03	1.54E+02	1.10E+03	8.45E+02	1.43E+03	1.38E+02	\approx
f_{12}	1.83E+06	8.18E+05	3.76E+06	6.12E+05	2.57E+06	1.14E+06	5.54E+06	7.78E+05	+
f_{13}	1.54E+04	1.11E+04	1.96E+04	1.77E+03	1.58E+04	1.03E+04	2.19E+04	2.36E+03	\approx
f_{14}	7.71E+04	2.29E+04	1.81E+05	3.77E+04	8.99E+04	7.70E+03	2.03E+05	4.16E+04	\approx
f_{15}	4.32E+03	2.16E+03	6.57E+03	9.33E+02	4.92E+03	3.07E+03	7.11E+03	9.73E+02	+
f_{16}	1.69E+03	7.31E+02	2.29E+03	3.75E+02	1.79E+03	1.02E+03	2.69E+03	3.75E+02	\approx
f_{17}	1.67E+03	8.13E+02	2.26E+03	3.38E+02	1.71E+03	9.69E+02	2.26E+03	2.92E+02	\approx
f_{18}	1.70E+05	6.97E+04	2.76E+05	5.02E+04	1.84E+05	1.16E+05	2.80E+05	4.16E+04	\approx
f_{19}	7.84E+03	1.48E+03	2.86E+04	5.02E+03	1.13E+04	1.14E+03	4.46E+04	8.91E+03	\approx
f_{20}	1.73E+03	1.21E+03	2.24E+03	2.39E+02	1.83E+03	1.30E+03	2.61E+03	2.79E+02	\approx
f_{21}	4.24E+02	3.91E+02	4.75E+02	1.88E+01	4.24E+02	3.98E+02	4.60E+02	1.53E+01	\approx
f_{22}	9.88E+03	2.00E+02	1.12E+04	1.58E+03	1.02E+04	2.00E+02	1.24E+04	1.70E+03	\approx
f_{23}	7.92E+02	7.50E+02	8.37E+02	2.10E+01	7.92E+02	7.57E+02	8.42E+02	2.01E+01	\approx
f_{24}	1.14E+03	1.10E+03	1.19E+03	1.97E+01	1.13E+03	1.10E+03	1.18E+03	1.93E+01	\approx
f_{25}	7.54E+02	6.57E+02	8.47E+02	4.74E+01	7.40E+02	6.52E+02	8.41E+02	4.93E+01	\approx
f_{26}	4.29E+03	4.00E+02	4.73E+03	5.95E+02	4.34E+03	4.00E+02	4.88E+03	5.92E+02	\approx
f_{27}	8.09E+02	7.65E+02	8.70E+02	2.47E+01	8.10E+02	7.46E+02	8.52E+02	2.54E+01	\approx
f_{28}	6.67E+02	6.05E+02	7.36E+02	3.22E+01	6.68E+02	6.33E+02	7.24E+02	2.42E+01	\approx
f_{29}	2.62E+03	1.90E+03	3.32E+03	3.72E+02	2.75E+03	1.95E+03	3.53E+03	3.71E+02	\approx
f_{30}	6.12E+05	4.50E+05	7.68E+05	7.30E+04	6.02E+05	2.44E+05	7.64E+05	1.01E+05	\approx
S/I/D	7/1/21				1/7/21				

TABLE XXX: Results obtained by OLPSO with and without the proposed prediction and guiding methods on 30-D test functions

Fun.	OLPSO _{PPG}				OLPSO				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	3.41E+03	3.77E+00	1.79E+04	4.58E+03	4.29E+03	1.61E-01	1.91E+04	4.85E+03	≈
f_3	7.53E+03	9.75E+02	2.79E+04	6.05E+03	2.05E+05	1.21E+05	3.24E+05	4.62E+04	+
f_4	1.87E+02	1.00E+02	2.31E+02	3.28E+01	1.88E+02	1.00E+02	2.20E+02	3.30E+01	≈
f_5	1.45E+02	1.23E+02	1.83E+02	1.24E+01	1.44E+02	1.22E+02	1.73E+02	1.23E+01	≈
f_6	1.00E+02	1.00E+02	1.00E+02	0.00E+00	1.00E+02	1.00E+02	1.00E+02	1.50E-07	≈
f_7	1.72E+02	1.51E+02	2.17E+02	1.19E+01	1.71E+02	1.47E+02	2.07E+02	1.34E+01	≈
f_8	2.87E+02	2.67E+02	3.06E+02	9.07E+00	2.91E+02	2.69E+02	3.18E+02	9.43E+00	+
f_9	1.02E+02	1.00E+02	1.23E+02	4.02E+00	1.04E+02	1.00E+02	1.70E+02	1.12E+01	≈
f_{10}	2.75E+03	1.25E+03	4.10E+03	5.95E+02	2.76E+03	1.26E+03	3.89E+03	5.61E+02	≈
f_{11}	1.54E+02	1.11E+02	2.29E+02	3.15E+01	2.32E+03	1.35E+02	1.90E+04	3.94E+03	+
f_{12}	8.20E+04	7.31E+03	2.62E+05	5.28E+04	4.85E+05	1.65E+04	1.51E+06	4.05E+05	+
f_{13}	1.66E+04	1.31E+02	6.18E+04	1.69E+04	1.41E+04	1.36E+02	6.10E+04	1.53E+04	≈
f_{14}	9.94E+03	4.01E+02	3.06E+04	7.52E+03	3.08E+05	5.59E+03	1.73E+06	3.54E+05	+
f_{15}	1.10E+04	1.21E+02	4.14E+04	1.04E+04	7.70E+03	1.22E+02	2.59E+04	7.67E+03	≈
f_{16}	8.55E+02	2.50E+02	1.34E+03	2.54E+02	8.19E+02	2.94E+02	1.41E+03	2.77E+02	≈
f_{17}	3.32E+02	1.41E+02	8.42E+02	1.53E+02	3.77E+02	1.40E+02	7.65E+02	1.67E+02	≈
f_{18}	1.36E+05	1.13E+04	5.88E+05	1.26E+05	8.08E+06	4.38E+05	7.66E+07	1.19E+07	+
f_{19}	9.31E+03	1.11E+02	5.33E+04	1.36E+04	7.89E+03	1.37E+02	4.75E+04	1.06E+04	≈
f_{20}	4.21E+02	1.38E+02	7.55E+02	1.45E+02	4.20E+02	1.25E+02	1.03E+03	1.74E+02	≈
f_{21}	3.48E+02	3.21E+02	3.81E+02	1.34E+01	3.49E+02	3.30E+02	3.77E+02	1.25E+01	≈
f_{22}	1.64E+03	2.00E+02	4.16E+03	1.49E+03	1.69E+03	2.00E+02	4.02E+03	1.44E+03	≈
f_{23}	5.00E+02	4.76E+02	5.47E+02	1.60E+01	5.01E+02	4.74E+02	5.34E+02	1.22E+01	≈
f_{24}	5.74E+02	5.51E+02	6.20E+02	1.49E+01	5.77E+02	5.49E+02	6.35E+02	1.71E+01	≈
f_{25}	4.88E+02	4.83E+02	5.24E+02	5.47E+00	4.89E+02	4.83E+02	5.24E+02	6.24E+00	+
f_{26}	1.68E+03	3.00E+02	2.33E+03	3.40E+02	1.70E+03	1.33E+03	2.02E+03	1.54E+02	≈
f_{27}	6.20E+02	6.07E+02	6.46E+02	9.04E+00	6.21E+02	5.95E+02	6.43E+02	9.74E+00	≈
f_{28}	4.68E+02	4.00E+02	5.62E+02	5.70E+01	4.81E+02	4.00E+02	5.83E+02	5.81E+01	≈
f_{29}	8.27E+02	5.60E+02	1.22E+03	1.54E+02	8.32E+02	5.22E+02	1.29E+03	1.79E+02	≈
f_{30}	6.61E+03	2.99E+03	1.33E+04	2.82E+03	8.23E+03	2.56E+03	5.72E+04	7.58E+03	≈
S/I/D	7/0/22				0/7/22				

TABLE XXXI: Results obtained by OLPSO with and without the proposed prediction and guiding methods on 50-D test functions

Fun.	OLPSO _{PPG}				OLPSO				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	4.08E+03	2.66E-06	2.23E+04	5.00E+03	4.09E+03	1.69E+01	2.45E+04	5.17E+03	≈
f_3	9.00E+04	5.66E+04	1.40E+05	2.27E+04	4.23E+05	2.31E+05	6.93E+05	1.01E+05	+
f_4	2.33E+02	1.29E+02	3.19E+02	4.97E+01	2.32E+02	1.29E+02	3.31E+02	5.17E+01	≈
f_5	1.76E+02	1.45E+02	2.14E+02	1.70E+01	1.73E+02	1.39E+02	2.03E+02	1.58E+01	≈
f_6	1.00E+02	1.00E+02	1.00E+02	0.00E+00	1.00E+02	1.00E+02	1.00E+02	0.00E+00	≈
f_7	2.18E+02	1.80E+02	2.66E+02	1.81E+01	2.15E+02	1.92E+02	2.64E+02	1.57E+01	≈
f_8	5.07E+02	4.88E+02	5.31E+02	1.13E+01	5.10E+02	4.77E+02	5.41E+02	1.47E+01	≈
f_9	1.04E+02	1.00E+02	1.18E+02	3.93E+00	1.06E+02	1.00E+02	1.64E+02	9.56E+00	≈
f_{10}	4.28E+03	2.64E+03	6.49E+03	8.40E+02	4.54E+03	2.48E+03	6.23E+03	9.06E+02	≈
f_{11}	2.23E+02	1.57E+02	3.18E+02	3.97E+01	1.91E+04	7.07E+02	4.74E+04	1.41E+04	+
f_{12}	1.21E+06	1.64E+05	3.88E+06	9.36E+05	2.51E+06	4.64E+05	5.95E+06	1.53E+06	+
f_{13}	5.47E+03	1.67E+02	3.49E+04	6.87E+03	5.65E+03	1.58E+02	3.68E+04	7.22E+03	≈
f_{14}	6.52E+04	7.09E+03	2.02E+05	4.52E+04	1.19E+06	6.46E+04	1.15E+07	1.87E+06	+
f_{15}	6.70E+03	1.50E+02	1.81E+04	5.81E+03	8.04E+03	1.48E+02	1.81E+04	5.90E+03	≈
f_{16}	1.38E+03	6.81E+02	2.27E+03	4.31E+02	1.50E+03	7.62E+02	2.65E+03	4.19E+02	≈
f_{17}	9.57E+02	3.31E+02	1.83E+03	3.04E+02	1.02E+03	3.59E+02	1.97E+03	3.31E+02	≈
f_{18}	6.60E+05	9.72E+04	2.21E+06	5.22E+05	2.22E+07	9.15E+05	1.41E+08	2.75E+07	+
f_{19}	1.44E+04	1.43E+02	3.56E+04	9.78E+03	1.64E+04	5.04E+02	4.16E+04	1.13E+04	≈
f_{20}	8.73E+02	1.46E+02	1.63E+03	3.16E+02	9.73E+02	2.43E+02	1.78E+03	3.20E+02	≈
f_{21}	3.80E+02	3.47E+02	4.27E+02	1.79E+01	3.79E+02	3.42E+02	4.48E+02	1.80E+01	≈
f_{22}	4.96E+03	3.18E+03	6.33E+03	7.27E+02	4.92E+03	2.00E+02	6.93E+03	1.06E+03	≈
f_{23}	6.22E+02	5.72E+02	6.79E+02	2.47E+01	6.20E+02	5.68E+02	6.89E+02	2.78E+01	≈
f_{24}	6.89E+02	6.56E+02	7.33E+02	1.96E+01	6.95E+02	6.39E+02	7.49E+02	2.34E+01	≈
f_{25}	6.48E+02	5.81E+02	6.93E+02	3.06E+01	6.40E+02	5.62E+02	6.99E+02	3.01E+01	≈
f_{26}	2.21E+03	1.73E+03	2.67E+03	2.09E+02	2.17E+03	1.68E+03	2.74E+03	2.48E+02	≈
f_{27}	7.78E+02	6.76E+02	9.60E+02	5.43E+01	8.01E+02	7.09E+02	9.15E+02	4.69E+01	+
f_{28}	6.07E+02	5.59E+02	6.63E+02	2.07E+01	6.04E+02	5.59E+02	6.35E+02	1.99E+01	≈
f_{29}	8.78E+02	4.60E+02	1.56E+03	2.62E+02	9.33E+02	4.96E+02	1.77E+03	2.63E+02	≈
f_{30}	1.12E+06	7.47E+05	1.99E+06	3.12E+05	1.14E+06	7.37E+05	1.71E+06	2.29E+05	≈
S/I/D	6/0/23				0/6/23				

TABLE XXXII: Results obtained by OLPSO with and without the proposed prediction and guiding methods on 100-D test functions

Fun.	OLPSO _{PPG}				OLPSO				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	7.71E+03	4.77E-01	4.21E+04	1.02E+04	7.48E+03	1.12E+02	4.11E+04	9.06E+03	≈
f_3	4.28E+05	2.97E+05	5.79E+05	7.27E+04	9.89E+05	6.50E+05	4.53E+06	5.22E+05	+
f_4	3.51E+02	2.93E+02	4.51E+02	3.63E+01	3.53E+02	2.48E+02	4.87E+02	3.98E+01	≈
f_5	2.51E+02	2.12E+02	3.20E+02	2.50E+01	2.55E+02	2.01E+02	3.29E+02	2.89E+01	≈
f_6	1.00E+02	1.00E+02	1.00E+02	0.00E+00	1.00E+02	1.00E+02	1.00E+02	0.00E+00	≈
f_7	3.38E+02	2.86E+02	4.25E+02	2.94E+01	3.40E+02	2.97E+02	4.21E+02	2.83E+01	≈
f_8	1.12E+03	1.07E+03	1.18E+03	2.11E+01	1.12E+03	1.07E+03	1.21E+03	3.05E+01	≈
f_9	1.13E+02	1.01E+02	1.87E+02	1.62E+01	1.07E+02	1.00E+02	1.64E+02	9.69E+00	-
f_{10}	1.09E+04	7.71E+03	1.38E+04	1.34E+03	1.10E+04	8.45E+03	1.35E+04	1.29E+03	≈
f_{11}	4.87E+03	1.89E+03	1.91E+04	3.23E+03	3.99E+05	1.99E+05	6.10E+05	8.53E+04	+
f_{12}	4.74E+06	1.81E+06	1.22E+07	2.01E+06	9.63E+06	3.30E+06	3.08E+07	5.43E+06	+
f_{13}	6.48E+03	2.02E+02	2.11E+04	6.19E+03	6.11E+03	2.25E+02	2.62E+04	6.61E+03	≈
f_{14}	8.27E+05	2.05E+05	2.19E+06	4.78E+05	4.21E+06	5.55E+05	2.31E+07	4.70E+06	+
f_{15}	2.27E+03	1.61E+02	1.24E+04	2.47E+03	3.33E+03	1.47E+02	1.97E+04	3.93E+03	≈
f_{16}	2.77E+03	1.78E+03	4.47E+03	5.79E+02	3.23E+03	1.65E+03	4.55E+03	6.94E+02	+
f_{17}	2.38E+03	1.29E+03	3.62E+03	5.82E+02	2.40E+03	8.43E+02	3.87E+03	6.33E+02	≈
f_{18}	1.67E+06	4.03E+05	4.15E+06	8.85E+05	4.69E+07	3.26E+06	1.66E+08	4.07E+07	+
f_{19}	3.22E+03	1.60E+02	2.06E+04	4.53E+03	3.10E+03	1.88E+02	3.00E+04	4.97E+03	≈
f_{20}	2.27E+03	1.07E+03	3.82E+03	4.88E+02	2.48E+03	9.99E+02	4.67E+03	6.46E+02	≈
f_{21}	4.99E+02	4.38E+02	5.74E+02	3.37E+01	4.97E+02	4.32E+02	5.55E+02	2.67E+01	≈
f_{22}	1.14E+04	7.86E+03	1.52E+04	1.52E+03	1.14E+04	8.00E+03	1.47E+04	1.57E+03	≈
f_{23}	8.11E+02	7.21E+02	9.08E+02	3.63E+01	8.11E+02	7.50E+02	9.06E+02	3.51E+01	≈
f_{24}	1.17E+03	1.11E+03	1.25E+03	2.89E+01	1.17E+03	1.08E+03	1.29E+03	4.41E+01	≈
f_{25}	9.05E+02	7.82E+02	1.01E+03	5.59E+01	8.93E+02	7.88E+02	9.90E+02	4.87E+01	≈
f_{26}	5.30E+03	4.49E+03	6.27E+03	4.43E+02	5.35E+03	4.27E+03	6.30E+03	3.99E+02	≈
f_{27}	8.22E+02	7.56E+02	9.08E+02	3.17E+01	8.44E+02	7.72E+02	9.30E+02	4.29E+01	+
f_{28}	7.40E+02	6.34E+02	8.35E+02	5.43E+01	7.63E+02	6.33E+02	8.42E+02	5.16E+01	+
f_{29}	2.59E+03	1.69E+03	3.93E+03	6.13E+02	2.58E+03	1.42E+03	3.45E+03	4.02E+02	≈
f_{30}	9.48E+03	3.98E+03	1.88E+04	4.39E+03	1.17E+04	3.92E+03	3.62E+04	6.07E+03	+
S/I/D	9/1/19				1/9/19				

TABLE XXXIII: Results obtained by OXDE with and without the proposed prediction and guiding methods on 30-D test functions

Fun.	OXDE _{PPG}				OXDE				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	3.50E+03	4.46E+00	1.56E+04	3.63E+03	4.23E+03	2.33E+00	2.74E+04	5.36E+03	≈
f_3	1.00E+02	1.00E+02	1.03E+02	3.54E-01	1.01E+02	1.00E+02	1.29E+02	4.03E+00	≈
f_4	1.58E+02	1.00E+02	1.88E+02	3.04E+01	1.87E+02	1.04E+02	2.17E+02	2.64E+01	+
f_5	1.27E+02	1.14E+02	1.51E+02	8.95E+00	1.28E+02	1.11E+02	1.53E+02	8.82E+00	≈
f_6	1.00E+02	1.00E+02	1.00E+02	2.01E-06	1.00E+02	1.00E+02	1.00E+02	1.60E-07	≈
f_7	1.55E+02	1.42E+02	1.81E+02	7.90E+00	1.54E+02	1.40E+02	1.69E+02	7.56E+00	≈
f_8	2.86E+02	2.64E+02	3.00E+02	7.70E+00	2.84E+02	2.66E+02	3.03E+02	7.06E+00	≈
f_9	1.00E+02	1.00E+02	1.02E+02	4.23E-01	1.00E+02	1.00E+02	1.03E+02	6.19E-01	+
f_{10}	2.51E+03	9.77E+02	4.36E+03	6.74E+02	2.49E+03	1.07E+03	3.57E+03	6.80E+02	≈
f_{11}	1.42E+02	1.04E+02	2.08E+02	3.09E+01	1.36E+02	1.10E+02	1.88E+02	2.48E+01	≈
f_{12}	4.06E+04	1.16E+04	1.23E+05	2.51E+04	5.40E+04	6.42E+03	5.58E+05	7.78E+04	≈
f_{13}	9.57E+03	1.23E+02	4.44E+04	1.22E+04	1.15E+04	1.70E+02	5.39E+04	1.24E+04	≈
f_{14}	1.71E+02	1.21E+02	4.96E+02	7.40E+01	2.01E+02	1.27E+02	2.36E+03	3.11E+02	≈
f_{15}	6.21E+02	1.11E+02	8.84E+03	1.42E+03	9.37E+02	1.13E+02	7.32E+03	1.58E+03	+
f_{16}	4.92E+02	1.05E+02	9.53E+02	2.50E+02	5.14E+02	1.01E+02	1.22E+03	2.80E+02	≈
f_{17}	1.70E+02	1.22E+02	3.81E+02	5.44E+01	1.69E+02	1.10E+02	3.68E+02	5.57E+01	≈
f_{18}	2.45E+04	2.18E+03	8.20E+04	1.72E+04	2.15E+04	1.84E+03	6.70E+04	1.57E+04	≈
f_{19}	7.45E+02	1.09E+02	2.11E+04	2.97E+03	1.16E+03	1.06E+02	2.16E+04	3.39E+03	≈
f_{20}	2.06E+02	1.08E+02	3.78E+02	8.02E+01	1.94E+02	1.06E+02	4.76E+02	8.81E+01	≈
f_{21}	3.28E+02	3.15E+02	3.54E+02	8.11E+00	3.31E+02	3.16E+02	3.61E+02	9.33E+00	≈
f_{22}	3.98E+02	2.00E+02	3.29E+03	6.98E+02	3.74E+02	2.00E+02	3.93E+03	7.36E+02	≈
f_{23}	4.79E+02	4.62E+02	5.11E+02	9.01E+00	4.84E+02	4.65E+02	5.11E+02	1.09E+01	+
f_{24}	5.54E+02	5.37E+02	5.74E+02	8.60E+00	5.56E+02	5.36E+02	5.98E+02	1.22E+01	≈
f_{25}	4.87E+02	4.83E+02	4.91E+02	1.19E+00	4.89E+02	4.87E+02	5.12E+02	4.54E+00	+
f_{26}	1.36E+03	1.08E+03	1.62E+03	1.15E+02	1.39E+03	1.04E+03	1.70E+03	1.38E+02	≈
f_{27}	6.11E+02	5.98E+02	6.26E+02	4.98E+00	6.11E+02	5.93E+02	6.33E+02	7.57E+00	≈
f_{28}	4.44E+02	4.00E+02	5.67E+02	6.45E+01	5.01E+02	4.00E+02	5.62E+02	4.25E+01	+
f_{29}	5.73E+02	4.27E+02	8.28E+02	6.61E+01	5.85E+02	4.62E+02	9.28E+02	8.23E+01	≈
f_{30}	3.64E+03	2.21E+03	9.16E+03	1.47E+03	4.24E+03	2.13E+03	9.51E+03	2.06E+03	≈
S/I/D	6/0/23				0/6/23				

TABLE XXXIV: Results obtained by OXDE with and without the proposed prediction and guiding methods on 50-D test functions

Fun.	OXDE _{PPG}				OXDE				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	3.38E+03	2.00E-01	1.85E+04	4.46E+03	1.80E+03	9.23E-03	9.04E+03	2.22E+03	≈
f_3	9.55E+03	3.16E+03	1.57E+04	2.74E+03	9.50E+03	4.07E+03	1.58E+04	2.68E+03	≈
f_4	1.86E+02	1.29E+02	3.18E+02	5.33E+01	1.81E+02	1.29E+02	3.13E+02	5.43E+01	≈
f_5	1.39E+02	1.17E+02	2.53E+02	2.00E+01	1.43E+02	1.17E+02	1.83E+02	1.44E+01	≈
f_6	1.00E+02	1.00E+02	1.00E+02	0.00E+00	1.00E+02	1.00E+02	1.00E+02	5.00E-08	≈
f_7	1.96E+02	1.69E+02	3.43E+02	3.06E+01	2.12E+02	1.69E+02	3.75E+02	5.24E+01	≈
f_8	4.93E+02	4.77E+02	5.26E+02	9.59E+00	4.94E+02	4.77E+02	5.16E+02	9.68E+00	≈
f_9	1.00E+02	1.00E+02	1.01E+02	1.51E-01	1.00E+02	1.00E+02	1.02E+02	3.19E-01	≈
f_{10}	8.00E+03	2.75E+03	1.25E+04	2.77E+03	9.04E+03	2.33E+03	1.20E+04	2.66E+03	+
f_{11}	1.44E+02	1.11E+02	2.13E+02	1.54E+01	1.44E+02	1.30E+02	1.88E+02	1.01E+01	≈
f_{12}	3.31E+05	7.47E+04	1.57E+06	2.65E+05	3.27E+05	1.95E+04	1.11E+06	2.28E+05	≈
f_{13}	2.52E+03	2.02E+02	1.08E+04	2.49E+03	2.68E+03	1.37E+02	1.44E+04	3.10E+03	≈
f_{14}	7.49E+02	1.39E+02	1.41E+04	1.98E+03	6.34E+02	1.45E+02	4.80E+03	9.22E+02	≈
f_{15}	5.69E+02	1.26E+02	2.58E+03	6.84E+02	5.17E+02	1.26E+02	6.14E+03	9.03E+02	≈
f_{16}	8.78E+02	2.40E+02	1.57E+03	3.33E+02	9.09E+02	2.40E+02	1.80E+03	3.55E+02	≈
f_{17}	6.43E+02	1.92E+02	1.24E+03	2.59E+02	7.02E+02	2.36E+02	1.54E+03	2.53E+02	≈
f_{18}	4.24E+04	8.28E+03	1.16E+05	2.68E+04	3.65E+04	2.53E+03	8.29E+04	2.06E+04	≈
f_{19}	1.78E+03	1.15E+02	1.47E+04	3.35E+03	2.00E+03	1.19E+02	2.06E+04	4.11E+03	≈
f_{20}	4.69E+02	1.30E+02	8.81E+02	1.99E+02	4.45E+02	1.27E+02	9.79E+02	2.30E+02	≈
f_{21}	3.46E+02	3.22E+02	4.31E+02	1.71E+01	3.47E+02	3.19E+02	3.91E+02	1.67E+01	≈
f_{22}	6.80E+03	2.00E+02	1.19E+04	4.56E+03	8.76E+03	2.00E+02	1.27E+04	3.62E+03	+
f_{23}	5.63E+02	5.39E+02	6.12E+02	1.43E+01	5.71E+02	5.47E+02	6.22E+02	1.52E+01	+
f_{24}	6.49E+02	6.25E+02	6.85E+02	1.56E+01	6.61E+02	6.30E+02	7.04E+02	1.52E+01	+
f_{25}	6.38E+02	5.61E+02	6.83E+02	3.02E+01	6.37E+02	5.80E+02	6.81E+02	3.66E+01	≈
f_{26}	1.54E+03	1.26E+03	2.01E+03	1.45E+02	1.64E+03	1.35E+03	2.30E+03	1.95E+02	+
f_{27}	6.67E+02	6.24E+02	7.52E+02	3.07E+01	6.54E+02	6.18E+02	7.48E+02	2.82E+01	-
f_{28}	6.00E+02	5.59E+02	6.15E+02	1.54E+01	6.00E+02	5.59E+02	6.15E+02	1.66E+01	-
f_{29}	4.79E+02	4.05E+02	7.45E+02	6.82E+01	4.80E+02	4.09E+02	7.52E+02	6.93E+01	≈
f_{30}	7.27E+05	5.87E+05	1.02E+06	1.10E+05	7.23E+05	5.87E+05	9.86E+05	9.95E+04	≈
S/I/D	5/2/22				2/5/22				

TABLE XXXV: Results obtained by OXDE with and without the proposed prediction and guiding methods on 100-D test functions

Fun.	OXDE _{PPG}				OXDE				ST
	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	<i>Mean</i>	<i>Min</i>	<i>Max</i>	<i>Std</i>	
f_1	1.25E+03	2.15E+00	9.30E+03	2.17E+03	1.50E+03	5.43E-01	1.99E+04	3.23E+03	≈
f_3	1.88E+05	1.41E+05	2.40E+05	2.19E+04	1.98E+05	1.42E+05	2.46E+05	2.13E+04	+
f_4	3.13E+02	2.81E+02	3.79E+02	2.03E+01	3.07E+02	2.52E+02	3.66E+02	1.90E+01	≈
f_5	3.09E+02	1.46E+02	6.94E+02	1.72E+02	4.20E+02	1.62E+02	7.57E+02	1.97E+02	+
f_6	1.00E+02	1.00E+02	1.00E+02	0.00E+00	1.00E+02	1.00E+02	1.00E+02	0.00E+00	≈
f_7	6.71E+02	2.64E+02	9.03E+02	1.70E+02	6.98E+02	2.84E+02	8.94E+02	1.62E+02	≈
f_8	1.08E+03	1.05E+03	1.11E+03	1.46E+01	1.07E+03	1.04E+03	1.12E+03	1.65E+01	-
f_9	1.00E+02	1.00E+02	1.01E+02	1.73E-01	1.00E+02	1.00E+02	1.01E+02	1.70E-01	≈
f_{10}	2.66E+04	2.41E+04	2.98E+04	1.26E+03	2.65E+04	2.38E+04	2.89E+04	1.29E+03	≈
f_{11}	6.78E+02	5.84E+02	7.76E+02	4.58E+01	6.75E+02	5.61E+02	7.78E+02	4.09E+01	≈
f_{12}	5.90E+05	2.10E+05	1.18E+06	2.36E+05	8.22E+05	2.63E+05	1.85E+06	4.28E+05	+
f_{13}	3.27E+03	2.80E+02	1.25E+04	3.01E+03	2.87E+03	4.10E+02	9.98E+03	2.59E+03	≈
f_{14}	2.07E+04	2.36E+03	9.28E+04	1.86E+04	1.83E+04	1.32E+03	9.32E+04	1.96E+04	≈
f_{15}	1.07E+03	3.11E+02	6.21E+03	8.95E+02	8.99E+02	2.07E+02	3.32E+03	6.39E+02	≈
f_{16}	5.47E+03	1.70E+03	7.07E+03	1.43E+03	5.58E+03	1.19E+03	6.93E+03	1.46E+03	≈
f_{17}	2.96E+03	1.11E+03	4.50E+03	1.01E+03	3.08E+03	1.29E+03	4.59E+03	1.15E+03	≈
f_{18}	2.70E+05	1.13E+05	1.21E+06	1.71E+05	2.92E+05	1.21E+05	8.60E+05	1.48E+05	≈
f_{19}	7.62E+02	1.56E+02	2.63E+03	6.15E+02	1.14E+03	2.55E+02	6.26E+03	1.25E+03	≈
f_{20}	3.13E+03	1.15E+03	4.65E+03	1.21E+03	2.83E+03	1.28E+03	4.77E+03	1.07E+03	≈
f_{21}	4.91E+02	3.75E+02	8.57E+02	1.43E+02	5.62E+02	3.96E+02	9.48E+02	1.86E+02	+
f_{22}	2.76E+04	2.44E+04	3.04E+04	1.19E+03	2.78E+04	2.49E+04	3.07E+04	1.41E+03	≈
f_{23}	7.05E+02	6.46E+02	7.88E+02	3.76E+01	7.00E+02	6.39E+02	7.83E+02	3.28E+01	≈
f_{24}	1.03E+03	1.01E+03	1.07E+03	1.32E+01	1.06E+03	1.02E+03	1.33E+03	5.21E+01	+
f_{25}	8.48E+02	7.60E+02	9.46E+02	4.11E+01	8.57E+02	7.38E+02	9.24E+02	3.69E+01	≈
f_{26}	3.65E+03	3.41E+03	4.07E+03	1.68E+02	3.93E+03	3.40E+03	5.06E+03	3.85E+02	+
f_{27}	7.17E+02	6.64E+02	7.64E+02	2.07E+01	7.22E+02	6.84E+02	7.70E+02	1.78E+01	≈
f_{28}	6.51E+02	6.21E+02	7.13E+02	2.03E+01	6.55E+02	5.81E+02	7.20E+02	3.35E+01	≈
f_{29}	2.60E+03	1.01E+03	4.49E+03	8.56E+02	3.34E+03	1.20E+03	4.91E+03	1.02E+03	+
f_{30}	6.96E+03	2.69E+03	1.55E+04	3.07E+03	7.12E+03	3.26E+03	1.30E+04	2.72E+03	≈
S/I/D	7/1/21				1/7/21				