Supplementary Materials

Table S1. MIGD results (Mean and Standard Deviation) for FDA and dMOP functions.

		Reference: **[16]**						CSA	**DB-CSA (without Dynamic Process)**	**DB-CSA-II (with Dynamic Process)**
DMOPs	(τ_t, n_t)	MMTL-MOEA/D	KF-MOEA/D	PPS-MOEA/D	SVR-MOEA/D	Tr-MOEA/D	RI-MOEA/D			
FDA1	(5, 10)	0.1214$_{(1.07E-1)}$ -	0.4670$_{(3.38E-1)}$ -	0.2485$_{(1.40E-1)}$ -	0.3745$_{(3.12E-1)}$ -	0.3381$_{(2.14E-1)}$ -	0.3166$_{(3.58E-1)}$ -	2.76e-05$_{(2.8e-06)}$-	**1.39e-07$_{(2.8e-08)}$** +	6.37e-07$_{(2.2e-07)}$
	(10, 10)	0.1199$_{(7.93E-2)}$ -	0.2659$_{(1.23E-1)}$ -	0.2141$_{(1.22E-1)}$ -	0.2332$_{(1.66E-1)}$ -	0.3592$_{(3.41E-1)}$ -	0.2733$_{(1.83E-1)}$ -	2.56e-05$_{(3.7e-06)}$-	**1.46e-07$_{(2.3e-08)}$** +	6.35e-07$_{(2.0e-07)}$
	(20, 10)	0.0658$_{(3.64E-2)}$ -	0.1635$_{(9.12E-2)}$ -	0.1018$_{(1.25E-1)}$ -	0.2168$_{(2.03E-1)}$ -	0.1778$_{(2.47E-1)}$ -	0.1959$_{(2.36E-1)}$ -	2.09e-05$_{(2.6e-06)}$-	**8.07e-08$_{(8.5e-09)}$** +	3.39e-07$_{(9.8e-08)}$
FDA2	(5, 10)	0.0740$_{(3.53E-2)}$ -	0.1695$_{(6.51E-2)}$ -	0.1023$_{(1.09E-1)}$ -	0.2062$_{(1.66E-1)}$ -	0.1241$_{(4.72E-2)}$ -	0.2127$_{(1.49E-1)}$-	3.79e-05$_{(2.1e-06)}$-	4.73e-06$_{(8.0e-07)}$-	**3.33e-06$_{(8.8e-07)}$**
	(10, 10)	0.0842$_{(3.34E-2)}$ -	0.1906$_{(7.00E-2)}$ -	0.1200$_{(2.00E-1)}$ -	0.1965$_{(1.31E-1)}$ -	0.1243$_{(4.27E-2)}$ -	0.2528$_{(1.34E-1)}$ -	3.92e-05$_{(1.8e-06)}$-	5.08e-06$_{(9.8e-07)}$-	**4.19e-06$_{(1.0e-06)}$**
	(20, 10)	0.0662$_{(3.63E-2)}$ -	0.1335$_{(4.02E-2)}$ -	0.0719$_{(9.86E-2)}$ -	0.1810$_{(1.88E-1)}$ -	0.0785$_{(3.37E-2)}$ -	0.1678$_{(1.44E-1)}$ -	2.97e-05$_{(1.5e-06)}$-	3.56e-06$_{(4.6e-07)}$-	**3.06e-06$_{(8.5e-07)}$**
FDA3	(5, 10)	0.1428$_{(1.11E-1)}$ -	0.2685$_{(2.66E-1)}$ -	0.3142$_{(2.14E-1)}$ -	0.2250$_{(1.81E-1)}$ -	0.2925$_{(2.44E-1)}$ -	0.3493$_{(4.27E-1)}$ -	2.73e-03$_{(2.1e-04)}$-	3.96e-04$_{(2.8e-05)}$-	**2.63e-04$_{(7.3e-05)}$**
	(10, 10)	0.0914$_{(9.77E-2)}$ -	0.1429$_{(7.49E-2)}$ -	0.2072$_{(1.38E-1)}$ -	0.1994$_{(1.93E-1)}$ -	0.252$_{(2.75E-1)}$ -	0.2530$_{(3.05E-1)}$ -	3.61e-03$_{(3.6e-04)}$-	6.75e-04$_{(8.0e-05)}$-	**4.69e-04$_{(1.6e-04)}$**
	(20, 10)	0.0749$_{(5.08E-2)}$ -	0.1349$_{(1.02E-1)}$ -	0.2286$_{(1.76E-1)}$ -	0.1409$_{(1.94E-1)}$ -	0.1442$_{(8.24E-2)}$ -	0.1361$_{(7.58E-2)}$ -	2.61e-03$_{(2.3e-04)}$-	4.15e-04$_{(4.3e-05)}$-	**2.30e-04$_{(8.6e-05)}$**
FDA4	(5, 10)	0.1523$_{(9.67E-2)}$ -	0.1578$_{(7.21E-2)}$ -	0.2114$_{(1.48E-1)}$ -	0.1866$_{(7.83E-2)}$ -	0.2335$_{(1.21E-1)}$ -	0.1702$_{(4.11E-2)}$ -	1.43e-05$_{(1.1e-06)}$-	**6.94e-07$_{(8.2e-08)}$** +	1.60e-06$_{(2.1e-07)}$
	(10, 10)	0.1594$_{(5.77E-2)}$ -	0.1311$_{(4.03E-2)}$ -	0.1848$_{(1.75E-1)}$ -	0.1709$_{(5.15E-2)}$ -	0.2180$_{(1.05E-1)}$ -	0.1787$_{(8.33E-2)}$ -	1.43e-05$_{(1.8e-06)}$-	**8.14e-07$_{(1.6e-07)}$** +	1.43e-06$_{(1.7e-07)}$
	(20, 10)	0.1336$_{(3.89E-2)}$ -	0.125$_{(4.06E-2)}$ -	0.1765$_{(2.02E-1)}$ -	0.1234$_{(2.36E-2)}$ -	0.1998$_{(9.90E-2)}$ -	0.1253$_{(2.66E-2)}$ -	1.18e-05$_{(1.2e-06)}$-	**5.95e-07$_{(8.0e-08)}$** +	9.48e-07$_{(1.2e-07)}$
FDA5	(5, 10)	0.2081$_{(6.47E-2)}$ -	0.2683$_{(8.65E-2)}$ -	0.2036$_{(7.28E-2)}$ -	0.2120$_{(1.05E-1)}$ -	0.1737$_{(4.19E-2)}$ -	0.2184$_{(1.01E-1)}$ -	7.37e-05$_{(3.6e-06)}$-	4.51e-05$_{(1.4e-06)}$-	**3.78e-06$_{(4.7e-07)}$**
	(10, 10)	0.1892$_{(5.19E-2)}$ -	0.2369$_{(7.79E-2)}$ -	0.2305$_{(1.04E-1)}$ -	0.1862$_{(9.43E-2)}$ -	0.1752$_{(4.89E-2)}$ -	0.2140$_{(1.01E-1)}$ -	7.52e-05$_{(5.5e-06)}$-	4.72e-05$_{(1.8e-06)}$-	**3.90e-06$_{(6.9e-07)}$**
	(20, 10)	0.1642$_{(6.06E-2)}$ -	0.1818$_{(5.76E-2)}$ -	0.1895$_{(8.11E-2)}$ -	0.1729$_{(9.00E-2)}$ -	0.1879$_{(4.56E-2)}$ -	0.1968$_{(7.64E-2)}$ -	5.67e-05$_{(3.1e-06)}$-	3.50e-05$_{(1.3e-06)}$-	**2.20e-06$_{(3.2e-07)}$**
dMOP1	(5, 10)	0.0589$_{(3.82E-2)}$ -	0.1857$_{(9.13E-2)}$ -	0.1269$_{(2.37E-1)}$ -	0.2237$_{(8.15E-2)}$ -	0.2345$_{(6.53E-2)}$ -	0.2421$_{(1.33E-1)}$ -	2.07e-04$_{(3.8e-05)}$-	1.10e-05$_{(5.4e-09)}$-	**7.28e-07$_{(1.3e-07)}$**
	(10, 10)	0.0543$_{(5.52E-2)}$ -	0.1565$_{(7.39E-2)}$ -	0.0965$_{(2.18E-1)}$ -	0.3266$_{(1.99E-1)}$ -	0.2507$_{(8.15E-2)}$ -	0.2734$_{(1.46E-1)}$ -	1.90e-04$_{(4.0e-05)}$-	1.09e-05$_{(6.5e-09)}$-	**5.95e-07$_{(9.0e-08)}$**
	(20, 10)	0.0252$_{(9.00E-3)}$ -	0.1145$_{(5.03E-2)}$ -	0.0690$_{(1.95E-1)}$ -	0.1938$_{(1.25E-1)}$ -	0.1204$_{(9.13E-2)}$ -	0.1606$_{(1.63E-1)}$ -	1.26e-04$_{(2.6e-05)}$-	8.27e-06$_{(6.1e-09)}$-	**3.66e-07$_{(6.0e-08)}$**
dMOP2	(5, 10)	0.0494$_{(1.59E-2)}$ -	0.2258$_{(1.31E-1)}$ -	0.1265$_{(1.34E-1)}$ -	0.1302$_{(8.99E-2)}$ -	0.1311$_{(6.02E-2)}$ -	0.1505$_{(1.58E-1)}$ -	1.87e-04$_{(4.4e-05)}$-	3.35e-06$_{(5.2e-08)}$-	**1.99e-06$_{(7.5e-07)}$**
	(10, 10)	0.0717$_{(4.20E-2)}$ -	0.1646$_{(8.01E-2)}$ -	0.1102$_{(1.00E-1)}$ -	0.1142$_{(8.98E-2)}$ -	0.1157$_{(6.03E-2)}$ -	0.1586$_{(1.33E-1)}$ -	1.78e-04$_{(4.8e-05)}$-	3.14e-06$_{(3.3e-08)}$-	**2.38e-06$_{(8.0e-07)}$**
	(20, 10)	0.0261$_{(8.53E-3)}$ -	0.120$_{(8.70E-2)}$ -	0.0771$_{(1.12E-1)}$ -	0.0541$_{(4.82E-2)}$ -	0.0795$_{(4.89E-2)}$ -	0.0609$_{(4.64E-2)}$ -	1.28e-04$_{(3.0e-05)}$-	2.62e-06$_{(2.0e-08)}$-	**9.89e-07$_{(2.7e-07)}$**
dMOP3	(5, 10)	0.0593$_{(3.10E-2)}$ -	0.1132$_{(8.72E-2)}$ -	0.1136$_{(8.84E-2)}$ -	0.0987$_{(7.16E-2)}$ -	0.1203$_{(4.29E-2)}$ -	0.0729$_{(3.87E-2)}$ -	7.68e-03$_{(3.1e-04)}$-	8.42e-03$_{(3.3e-04)}$-	**2.55e-03$_{(5.8e-04)}$**
	(10, 10)	0.0683$_{(4.26E-2)}$ -	0.1431$_{(5.58E-2)}$ -	0.0736$_{(6.38E-2)}$ -	0.0897$_{(4.56E-2)}$ -	0.1057$_{(5.18E-2)}$ -	0.0850$_{(5.68E-2)}$ -	2.39e-03$_{(4.9e-06)}$-	2.38e-03$_{(6.7e-09)}$-	**7.66e-05$_{(1.5e-05)}$**
	(20, 10)	0.0260$_{(5.56E-3)}$ -	0.0730$_{(4.91E-2)}$ -	0.0563$_{(6.87E-2)}$ -	0.0510$_{(3.52E-2)}$ -	0.0575$_{(3.22E-2)}$ -	0.0401$_{(2.57E-2)}$ -	2.61e-02$_{(5.9e-04)}$-	2.78e-02$_{(3.3e-04)}$-	**5.84e-04$_{(3.1e-04)}$**
+/-/ ≈			**0/24/0**	**0/24/0**	**0/24/0**	**0/24/0**	**0/24/0**	**0/24/0**	**6/18/0**	

The symbols "+", "≈" and "−" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA with dynamic process.**

Table S2. IGD results (Mean and Standard Deviation) for FDA and dMOP functions.

DMOPs		Reference: **[12]**					CSA	**DB-CSA (without Dynamic Process)**	**DB-CSA-II (with Dynamic Process)**
	(τ_t, n_t)	DNSGA-II	dCOEA	PPS	MOEA/D	SGEA			
FDA1	(5, 10)	6.40E-1$_{(9.8E-2)}$ -	6.36E-2$_{(1.1E-2)}$ -	2.08E-1$_{(8.4E-2)}$ -	3.56E-1$_{(4.9E-2)}$ -	3.41E-2$_{(8.0E-3)}$ -	2.48e-02$_{(2.5e-03)}$ -	**1.25e-04$_{(2.5e-05)}$** +	5.73e-04$_{(2.0e-04)}$
	(10, 10)	5.82E-2$_{(3.8E-3)}$ -	4.13E-2$_{(6.5E-3)}$ -	4.27E-2$_{(1.9E-2)}$ -	1.21E-1$_{(1.1E-2)}$ -	1.48E-2$_{(2.0E-3)}$ -	2.30e-02$_{(3.4e-03)}$ -	**1.31e-04$_{(2.1e-05)}$** +	5.71e-04$_{(1.8e-04)}$
	(20, 10)	4.14E-2$_{(4.2E-3)}$ -	2.39E-2$_{(2.2E-3)}$ -	1.62E-2$_{(7.9E-3)}$ -	4.04E-2$_{(2.2E-3)}$ -	7.55E-3$_{(1.4E-3)}$ -	1.88e-02$_{(2.3e-03)}$ -	**7.26e-05$_{(7.6e-06)}$** +	3.05e-04$_{(8.9e-05)}$
FDA2	(5, 10)	2.85E-2$_{(2.4E-3)}$ -	7.28E-2$_{(3.8E-2)}$ -	8.13E-2$_{(3.0E-2)}$ -	8.40E-2$_{(1.3E-2)}$ -	1.50E-2$_{(1.6E-3)}$ -	3.41e-02$_{(1.9e-03)}$ -	4.25e-03$_{(7.2e-04)}$ -	**2.99e-03$_{(7.9e-04)}$**
	(10, 10)	1.68E-3$_{(9.0E-4)}$ -	4.73E-2$_{(3.3E-2)}$ -	6.35E-2$_{(1.0E-2)}$ -	3.38E-2$_{(8.8E-3)}$ -	9.11E-3$_{(6.3E-4)}$ -	3.53e-02$_{(1.6e-03)}$ -	4.57e-03$_{(8.8e-04)}$ -	**3.77e-03$_{(9.1e-04)}$**
	(20, 10)	6.51E-3$_{(5.3E-4)}$ -	3.24E-2$_{(4.6E-2)}$ -	6.27E-2$_{(9.1E-3)}$ -	1.64E-2$_{(4.9E-3)}$ -	6.32E-3$_{(4.1E-4)}$ -	2.68e-02$_{(1.4e-03)}$ -	3.20e-03$_{(4.2e-04)}$ -	**2.75e-03$_{(7.6e-04)}$**
FDA3	(5, 10)	2.63E-1$_{(6.0E-2)}$ -	2.63E-1$_{(3.5E-2)}$ -	4.43E-1$_{(1.1E-1)}$ -	2.47E-1$_{(2.3E-2)}$ -	6.25E-2$_{(3.8E-2)}$ -	2.45e+00$_{(1.9e-01)}$ -	3.56e-01$_{(2.5e-02)}$ -	**2.36e-01$_{(6.6e-02)}$**
	(10, 10)	1.08E-1$_{(3.3E-2)}$ -	1.95E-1$_{(3.2E-2)}$ -	2.19E-1$_{(1.8E-2)}$ -	1.30E-1$_{(2.5E-2)}$ -	4.03E-2$_{(2.9E-2)}$ -	3.25e+00$_{(3.2e-01)}$ -	6.07e-01$_{(7.2e-02)}$ -	**4.22e-01$_{(1.5e-01)}$**
	(20, 10)	9.03E-2$_{(2.8E-3)}$ -	1.26E-1$_{(3.1E-2)}$ -	1.92E-1$_{(2.4E-2)}$ -	5.45E-2$_{(8.3E-3)}$ -	3.52E-2$_{(2.9E-2)}$ -	2.35e+00$_{(2.1e-01)}$ -	3.74e-01$_{(3.9e-02)}$ -	**2.07e-01$_{(7.7e-02)}$**
FDA4	(5, 10)	1.49E+0$_{(1.2E-1)}$ -	1.62E-1$_{(6.1E-3)}$ -	3.07E-1$_{(1.9E-2)}$ -	1.36E+0$_{(1.6E-1)}$ -	4.60E-1$_{(6.6E-2)}$ -	1.29e-02$_{(9.9e-04)}$ -	**6.25e-04$_{(7.3e-05)}$** +	1.44e-03$_{(1.9e-04)}$
	(10, 10)	7.63E-1$_{(4.4E-2)}$ -	1.24E-1$_{(4.5E-3)}$ -	2.11E-1$_{(2.0E-2)}$ -	5.77E-1$_{(5.4E-2)}$ -	1.83E-1$_{(6.6E-3)}$ -	1.29e-02$_{(1.6e-03)}$ -	**7.33e-04$_{(1.4e-04)}$** +	1.29e-03$_{(1.5e-04)}$
	(20, 10)	2.62E-1$_{(1.6E-2)}$ -	1.03E-1$_{(1.7E-3)}$ -	1.79E-1$_{(3.0E-3)}$ -	2.22E-1$_{(1.3E-2)}$ -	1.26E-1$_{(1.5E-3)}$ -	1.06e-02$_{(1.1e-03)}$ -	**5.36e-04$_{(7.2e-05)}$** +	8.54e-04$_{(1.1e-04)}$
FDA5	(5, 10)	1.76E+0$_{(1.0E-1)}$ -	4.33E-1$_{(4.6E-2)}$ -	6.55E-1$_{(3.1E-2)}$ -	1.57E+0$_{(1.3E-1)}$ -	5.23E-1$_{(3.3E-2)}$ -	6.64e-02$_{(3.2e-03)}$ -	4.06e-02$_{(1.2e-03)}$ -	**3.40e-03$_{(4.3e-04)}$**
	(10, 10)	1.02E+0$_{(5.4E-2)}$ -	3.62E-1$_{(4.0E-2)}$ -	4.80E-1$_{(3.5E-2)}$ -	8.19E-1$_{(6.0E-2)}$ -	3.62E-1$_{(8.5E-3)}$ -	6.77e-02$_{(5.0e-03)}$ -	4.25e-02$_{(1.6e-03)}$ -	**3.51e-03$_{(6.2e-04)}$**
	(20, 10)	4.88E-1$_{(1.2E-2)}$ -	3.10E-1$_{(2.7E-2)}$ -	3.71E-1$_{(1.2E-2)}$ -	4.07E-1$_{(1.4E-2)}$ -	3.09E-1$_{(2.2E-3)}$ -	5.10e-02$_{(2.8e-03)}$ -	3.15e-02$_{(1.2e-03)}$ -	**1.98e-03$_{(2.9e-04)}$**
dMOP1	(5, 10)	1.31E-1$_{(1.1E-2)}$ -	6.95E-2$_{(1.4E-2)}$ -	4.15E-1$_{(7.4E-1)}$ -	1.36E-2$_{(9.0E-3)}$ -	1.12E-2$_{(8.1E-3)}$ -	1.87e-01$_{(3.4e-02)}$ -	9.89e-03$_{(4.8e-06)}$ -	**6.55e-04$_{(1.2e-04)}$**
	(10, 10)	8.83E-3$_{(5.0E-3)}$ -	3.93E-2$_{(6.2E-3)}$ -	5.09E-2$_{(9.3E-2)}$ -	9.39E-3$_{(4.3E-3)}$ -	8.24E-3$_{(5.3E-3)}$ -	1.71e-01$_{(3.6e-02)}$ -	9.78e-03$_{(5.8e-06)}$ -	**5.35e-04$_{(8.1e-05)}$**
	(20, 10)	7.39E-3$_{(3.2E-3)}$ -	1.88E-2$_{(2.3E-3)}$ -	4.39E-2$_{(8.4E-2)}$ -	7.17E-3$_{(2.7E-3)}$ -	6.54E-3$_{(3.0E-3)}$ -	1.13e-01$_{(2.3e-02)}$ -	7.44e-03$_{(5.5e-06)}$ -	**3.30e-04$_{(5.4e-05)}$**
dMOP2	(5, 10)	6.87E-1$_{(7.5E-2)}$ -	1.20E-1$_{(2.0E-2)}$ -	1.56E-1$_{(1.8E-2)}$ -	4.91E-1$_{(4.1E-2)}$ -	3.02E-2$_{(3.4E-3)}$ -	1.69e-01$_{(3.9e-02)}$ -	3.01e-03$_{(4.6e-05)}$ -	**1.79e-03$_{(6.7e-04)}$**
	(10, 10)	1.18E-1$_{(9.4E-3)}$ -	7.32E-2$_{(8.9E-3)}$ -	4.28E-1$_{(1.7E-2)}$ -	1.88E-1$_{(1.9E-2)}$ -	1.21E-2$_{(5.7E-4)}$ -	1.61e-01$_{(4.3e-02)}$ -	2.82e-03$_{(3.0e-05)}$ -	**2.15e-03$_{(7.2e-04)}$**
	(20, 10)	1.57E-1$_{(6.70E-4)}$ -	3.46E-2$_{(4.3E-3)}$ -	2.02E-2$_{(2.5E-3)}$ -	5.63E-2$_{(3.9E-3)}$ -	6.32E-3$_{(1.8E-4)}$ -	1.15e-01$_{(2.7e-02)}$ -	2.36e-03$_{(1.8e-05)}$ -	**8.91e-04$_{(2.4e-04)}$**
dMOP3	(5, 10)	5.62E-1$_{(3.9E-2)}$ -	4.95E-2$_{(4.8E-3)}$ -	1.76E-1$_{(8.0E-2)}$ -	3.42E-1$_{(1.9E-2)}$ -	1.81E-1$_{(9.6E-2)}$ -	6.91e+00$_{(2.8e-01)}$ -	7.58e+00$_{(3.0e-01)}$ -	**2.30e+00$_{(5.2e-01)}$**
	(10, 10)	2.00E-1$_{(1.5E-2)}$ -	2.95E-2$_{(2.4E-3)}$ -	1.13E-1$_{(1.2E-2)}$ -	1.68E-1$_{(1.0E-2)}$ -	1.32E-1$_{(1.3E-2)}$ -	2.15e+00$_{(4.4e-03)}$ -	2.14e+00$_{(6.0e-06)}$ -	**6.89e-02$_{(1.3e-02)}$**
	(20, 10)	1.07E-1$_{(8.5E-3)}$ -	1.63E-2$_{(1.7E-3)}$ -	8.99E-2$_{(6.7E-3)}$ -	6.27E-2$_{(4.4E-3)}$ -	8.15E-2$_{(1.3E-2)}$ -	2.35e+01$_{(5.3e-01)}$ -	2.50e+01$_{(2.9e-01)}$ -	**5.26e-01$_{(2.8e-01)}$**
+/-/ ≈		**0/24/0**	**0/24/0**	**0/24/0**	**0/24/0**	**0/24/0**	**0/24/0**	**6/18/0**	

The symbols "+", "≈" and "–" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA.**

Table S3. HVD results (Mean and Standard Deviation) for FDA and dMOP functions

		Reference: **[12]**					CSA	**DB-CSA (without Dynamic Process)**	**DB-CSA-II (with Dynamic Process)**
Prob.	(τ_t, n_t)	DNSGA-II	dCOEA	PPS	MOEA/D	SGEA			
FDA1	(5, 10)	8.70E-1$_{(7.5E-2)}$ -	1.25E-1$_{(2.4E-2)}$ -	3.87E-1$_{(1.0E-1)}$ -	7.70E-1$_{(9.4E-2)}$ -	8.14E-2$_{(2.0E-2)}$ -	1.73e+00$_{(3.2e-01)}$-	**7.23e-03$_{(1.6e-03)}$** +	2.22e-02$_{(1.5e-02)}$
	(10, 10)	1.36E-1$_{(1.7E-2)}$ -	8.52E-2$_{(2.0E-2)}$ -	2.97E-1$_{(1.6E-2)}$ -	2.88E-1$_{(2.9E-2)}$ -	3.81E-2$_{(1.4E-2)}$ -	1.65e+00$_{(3.1e-01)}$-	**7.65e-03$_{(1.4e-03)}$** +	1.96e-02$_{(1.3e-02)}$
	(20, 10)	3.55E-2$_{(1.3E-2)}$ -	5.46E-2$_{(1.6E-2)}$ -	2.84E-1$_{(1.5E-2)}$ -	1.34E-1$_{(9.2E-3)}$ -	2.02E-2$_{(1.2E-2)}$ -	1.59e+00$_{(2.8e-01)}$-	**4.82e-03$_{(5.1e-04)}$** +	1.40e-02$_{(5.8e-03)}$
FDA2	(5, 10)	4.71E-2$_{(1.4E-2)}$ +	1.85E-1$_{(6.4E-2)}$ +	3.21E-1$_{(6.7E-2)}$ +	1.30E-1$_{(2.5E-2)}$ +	**2.54E-2$_{(1.3E-2)}$** +	1.34e+02$_{(2.1e+01)}$-	1.09e+01$_{(8.1e+00)}$ -	7.96e-01$_{(1.1e+00)}$
	(10, 10)	2.05E-2$_{(1.4E-2)}$ +	1.24E-1$_{(4.6E-2)}$ +	2.66E-1$_{(1.4E-2)}$ +	6.29E-2$_{(1.8E-2)}$ +	**1.67E-2$_{(1.4E-2)}$** +	1.37e+02$_{(2.4e+01)}$-	1.21e+01$_{(9.9e+00)}$ -	4.33e+00$_{(1.2e+01)}$
	(20, 10)	1.33E-2$_{(1.4E-2)}$ +	8.64E-2$_{(7.0E-2)}$ +	2.55E-1$_{(9.4E-3)}$ ±	3.24E-2$_{(1.4E-2)}$ +	**1.23E-2$_{(1.4E-2)}$** +	1.27e+02$_{(1.9e+01)}$-	1.38e+01$_{(1.1e+01)}$ -	1.60e+00$_{(3.9e+00)}$
FDA3	(5, 10)	1.54E+0$_{(1.6E-1)}$ -	1.45E+0$_{(8.5E-2)}$ -	1.75E+0$_{(1.8E-1)}$ -	1.66E+0$_{(7.8E-2)}$ -	9.80E-1$_{(1.0E-1)}$ -	2.04e+00$_{(2.0e+00)}$ -	**3.85e-01$_{(9.1e-02)}$** +	4.89e-01$_{(2.3e-01)}$
	(10, 10)	1.09E+0$_{(9.9E-2)}$ -	1.32E+0$_{(7.7E-2)}$ -	1.16E+0$_{(4.6E-2)}$ -	1.12E+0$_{(9.3E-2)}$ -	9.24E-1$_{(8.2E-2)}$ -	3.32e+00$_{(1.8e+00)}$ -	**4.30e-01$_{(1.4e-01)}$** +	6.24e-01$_{(2.9e-01)}$
	(20, 10)	1.04E+0$_{(7.9E-2)}$ -	1.15E+0$_{(6.6E-2)}$ -	1.03E+0$_{(7.4E-2)}$ -	9.47E-1$_{(2.2E-2)}$ -	9.11E-1$_{(8.1E-2)}$ -	2.57e+00$_{(1.7e+00)}$ -	**3.21e-01$_{(8.0e-02)}$** +	4.19e-01$_{(2.1e-01)}$
FDA4	(5, 10)	2.05E+0$_{(2.0E-1)}$ -	3.80E-1$_{(2.6E-2)}$ -	7.77E-1$_{(6.8E-2)}$ -	3.97E+0$_{(1.6E+0)}$ -	1.03E+0$_{(1.3E-1)}$ -	3.50e+00$_{(5.1e-01)}$ -	1.75e-01$_{(3.0e-02)}$ -	**7.92e-02$_{(2.8e-02)}$**
	(10, 10)	1.58E+0$_{(6.6E-2)}$ -	2.70E-1$_{(3.5E-2)}$ -	4.34E-1$_{(7.2E-2)}$ -	1.24E+0$_{(1.3E-1)}$ -	2.74E-1$_{(2.4E-2)}$ -	3.64e+00$_{(7.0e-01)}$ -	1.89e-01$_{(5.4e-02)}$ -	**3.67e-02$_{(2.9e-02)}$**
	(20, 10)	5.48E-1$_{(5.7E-2)}$ -	1.80E-1$_{(2.4E-2)}$ +	3.34E-1$_{(8.3E-3)}$ -	4.34E-1$_{(5.0E-2)}$ -	1.44E-1$_{(2.0E-2)}$ -	3.06e+00$_{(4.3e-01)}$ -	1.50e-01$_{(4.0e-02)}$ -	**6.82e-02$_{(4.8e-02)}$**
FDA5	(5, 10)	6.75E+0$_{(1.9E-1)}$ -	2.76E+0$_{(2.8E-1)}$ -	3.88E+0$_{(3.1E-1)}$ -	7.08E+0$_{(1.0E+0)}$ -	2.70E+0$_{(2.2E-1)}$ -	1.11e+00$_{(1.9e+00)}$ -	4.42e-01$_{(1.5e-08)}$ -	**2.56e-01$_{(1.4e-01)}$**
	(10, 10)	5.41E+0$_{(1.6E-1)}$ -	2.37E+0$_{(2.7E-1)}$ -	2.19E+0$_{(3.9E-1)}$ -	4.80E+0$_{(2.6E-1)}$ -	1.88E+0$_{(9.3E-2)}$ -	1.72e+00$_{(3.3e+00)}$ -	3.74e-01$_{(1.2e-08)}$ -	**1.87e-01$_{(1.4e-01)}$**
	(20, 10)	2.64E+0$_{(1.1E-1)}$ -	2.02E+0$_{(1.8E-1)}$ -	1.04E+0$_{(1.1E-1)}$ -	2.15E+0$_{(1.0E-1)}$ -	1.78E+0$_{(7.1E-2)}$ -	1.71e+00$_{(3.5e+00)}$ -	4.24e-01$_{(1.8e-08)}$ -	**2.48e-01$_{(1.3e-01)}$**
dMOP1	(5, 10)	3.93E-2$_{(3.81E-2)}$ -	1.73E-1$_{(3.3E-2)}$ -	2.86E-1$_{(3.6E-1)}$ -	4.64E-2$_{(3.6E-2)}$ -	3.75E-2$_{(2.5E-2)}$ -	2.84e+00$_{(1.6e+00)}$ -	3.25e-01$_{(8.4e-04)}$ -	4.14e-03$_{(3.1e-03)}$
	(10, 10)	2.28E-2$_{(2.0E-2)}$ -	1.12E-1$_{(2.0E-2)}$ -	9.27E-2$_{(1.3E-1)}$ -	2.57E-2$_{(1.5E-2)}$ -	**1.90E-2$_{(1.4E-2)}$** +	2.96e+00$_{(1.4e+00)}$ -	3.21e-01$_{(1.3e-03)}$ -	1.99e-02$_{(1.1e-02)}$
	(20, 10)	1.71E-2$_{(1.4E-2)}$ -	5.65E-2$_{(8.1E-3)}$ -	6.02E-2$_{(8.1E-2)}$ -	**1.59E-2$_{(7.9E-3)}$** +	1.80E-2$_{(1.3E-2)}$ -	2.44e+00$_{(1.7e+00)}$ -	3.28e-01$_{(7.7e-04)}$ -	1.92e-02$_{(1.1e-02)}$
dMOP2	(5, 10)	8.06E-1$_{(1.1E-1)}$ -	3.03E-1$_{(4.9E-2)}$ -	3.95E-1$_{(3.9E-2)}$ -	9.04E-1$_{(7.3E-2)}$ -	8.71E-2$_{(1.9E-2)}$ -	2.58e+00$_{(1.6e+00)}$ -	1.03e-01$_{(1.9e-03)}$ -	**6.22e-02$_{(4.2e-02)}$**
	(10, 10)	2.90E-1$_{(2.5E-2)}$ -	2.07E-1$_{(2.4E-2)}$ -	1.17E-1$_{(4.3E-2)}$ -	4.46E-1$_{(4.2E-2)}$ -	**3.59E-2$_{(1.1E-2)}$** +	2.66e+00$_{(1.6e+00)}$ -	9.92e-02$_{(1.8e-03)}$ -	5.10e-02$_{(4.4e-02)}$
	(20, 10)	4.50E-2$_{(1.2E-2)}$ -	1.09E-1$_{(1.5E-2)}$ -	5.65E-2$_{(6.2E-3)}$ -	1.98E-1$_{(1.4E-2)}$ -	**1.85E-2$_{(1.1E-2)}$** +	2.04e+00$_{(1.6e+00)}$ -	1.00e-01$_{(9.7e-04)}$ -	1.90e-02$_{(1.5e-02)}$
dMOP3	(5, 10)	9.51E-1$_{(3.4E-2)}$ +	**1.05E-1$_{(1.6E-2)}$** +	4.22E-1$_{(1.5E-2)}$ +	7.61E-1$_{(5.3E-2)}$ +	4.07E-1$_{(2.4E-2)}$ +	1.59e+01$_{(5.6e-01)}$ +	1.62e+01$_{(3.1e-01)}$ +	1.84e+01$_{(3.4e+00)}$
	(10, 10)	4.74E-1$_{(2.8E-2)}$ -	**6.57E-2$_{(1.3E-2)}$** +	2.79E-1$_{(2.7E-2)}$ -	4.54E-1$_{(2.8E-2)}$ -	3.18E-1$_{(2.9E-2)}$ -	2.98e+00$_{(4.7e-01)}$ -	2.36e+00$_{(4.8e-01)}$ -	**1.68e-01$_{(9.9e-02)}$**
	(20, 10)	2.76E-1$_{(2.5E-2)}$ -	**3.63E-2$_{(1.3E-2)}$** +	2.21E-1$_{(1.5E-2)}$ -	2.87E-1$_{(2.0E-2)}$ -	2.15E-1$_{(3.0E-2)}$ -	3.07e+00$_{(5.9e-01)}$ -	2.38e+00$_{(3.9e-01)}$ -	**1.31e-01$_{(9.4e-02)}$**
+/-/ ≈		**4/20/0**	**7/17/1**	**4/20/0**	**5/19/0**	**6/18/0**	**1/23/0**	**7/17/0**	

The symbols "+", "≈" and "−" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA.**

Table S4. IGD results (Mean and Standard Deviation) for UDF and F(ZJZ) functions with ($\tau_t = n_t$=10).

	Reference: **[12]**					CSA	DB-CSA (without Dynamic Process)	**DB-CSA-II (with Dynamic Process)**
Prob.	DNSGA-II	dCOEA	PPS	MOEA/D	SGEA			
UDF1	1.07E-1(2.4E-2) -	2.91E-1(2.3E-2) -	2.67E-1(2.2E-2) -	1.70E-1(5.1E-2) -	1.24E-1(3.3E-2) -	2.22e-02(1.1e-07) -	2.22e-02(2.1e-07) -	**6.57e-05(5.1e-06)**
UDF2	1.12E-1(1.0E-2) -	1.83E-1(2.0E-2) -	2.54E-2(5.0E-3) -	1.16E-1(9.5E-3) -	8.95E-2(1.3E-2) -	2.23e-02(8.8e-08) -	2.23e-02(9.9e-08) -	**6.74e-05(3.9e-06)**
UDF3	6.06E-1(3.3E-6) -	6.51E-1(7.7E-2) -	4.55E+0(1.1E+0) -	6.06E-1(6.3E-5) -	6.06E-1(7.4E-6) -	**3.62e-05(2.2e-06) +**	3.73e-05(2.3e-06) -	3.68e-05(2.1e-06)
UDF4	1.70E-1(4.7E-2) -	2.87E-1(2.8E-2) -	1.85E-1(8.2E-3) -	3.19E-1(1.3E-1) -	1.68E-1(4.4E-2) -	9.60e-05(1.2e-06) -	9.70e-05(1.2e-06) -	**3.07e-05(2.0e-06)**
UDF5	1.18E-1(1.2E-2) -	2.05E-1(3.5E-2) -	2.89E-2(1.3E-2) -	1.61E-1(1.4E-2) -	1.00E-1(1.1E-2) -	9.82e-05(1.1e-06) -	9.94e-05(1.6e-06) -	**3.20e-05(2.2e-06)**
UDF6	4.57E-1(8.7E-2) -	8.04E-1(1.0E-1) -	1.34E+0(7.1E-2) -	5.31E-1(1.6E-1) -	6.68E-1(2.0E-1) -	4.83e+00(5.4e-05) -	4.83e+00(3.4e-04) -	**1.48e-03(9.1e-04)**
UDF7	5.24E-1(2.2E-2) -	8.40E-1(6.4E-2) -	6.68E-1(4.4E-2) -	5.08E-1(1.4E-1) -	5.08E-1(4.2E-2) -	4.93e-01(2.5e-03) -	4.85e-01(2.1e-08) -	**1.80e-03(1.1e-04)**
F5	7.82E-1(3.9E-2) -	8.01E-1(2.2E-1) -	2.69E-1(4.3E-2) -	6.88E-1(4.1E-2) -	4.41E-1(4.5E-2) -	9.11e-02(1.5e-02) -	1.12e-01(1.3e-02) -	**4.16e-02(9.5e-03)**
F6	3.02E-1(2.1E-2) -	6.57E-1(1.3E-1) -	2.60E-1(6.5E-2) -	3.44E-1(5.6E-2) -	2.90E-1(1.3E-2) -	6.03e+00(1.6e+00) -	4.41e+00(3.5e+00) -	**2.36e-01(1.9e-01)**
F7	4.19E-1(6.9E-3) -	1.56E+0(6.0E-1) -	2.63E-1(7.1E-2) -	4.18E-1(6.0E-2) -	4.47E-1(1.0E-2) -	5.60e-02(2.7e-03) -	5.64e-02(1.7e-03) -	**1.94e-02(6.6e-03)**
F8	4.86E-1(1.3E-2) -	4.00E-1(6.7E-2) -	4.56E-1(3.1E-2) -	5.49E-1(2.3E-2) -	2.51E-1(1.4E-1) -	6.55e-03(8.8e-04) -	4.48e-03(4.1e-04) -	**1.05e-03(3.9e-05)**
F9	4.74E-1(2.1E-2) -	8.87E-1(3.3E-1) -	**3**.59E-1(4.4E-2) -	4.29E-1(2.4E-2) -	3.65E-1(3.4E-2) -	6.12e-02(7.4e-03) -	7.02e-02(7.6e-03) -	**2.85e-02(1.1e-02)**
F10	1.05E+0(1.5E-1) -	5.76E-1(8.1E-2) +	**3.79E-1(8.7E-2) +**	6.39E-1(8.6E-2) -	3.80E-1(1.3E-2) +	1.29e+00(2.4e-01) -	1.03e+00(1.7e-01) -	5.82e-01(9.9e-02)
+/-/ ≈	**0/13/0**	**1/12/0**	**1/12/0**	**0/13/0**	**1/12/0**	**1/12/0**	**0/13/0**	

The symbols "+", "≈" and "–" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA**

Table S5. HVD results (Mean and Standard Deviation) for UDF and F(ZJZ) functions with ($\tau_t = n_t$=10).

	Reference: **[12]**					CSA	**DB-CSA (without Dynamic Process)**	**DB-CSA-II (with Dynamic Process)**
Prob.	DNSGA-II	dCOEA	PPS	MOEA/D	SGEA			
UDF1	5.14E-1(3.2E-2) -	7.47E-1(3.8E-2)-	7.97E-1(5.2E-2)-	6.12E-1(9.4E-2) -	5.18E-1(5.0E-2) -	2.98e+00(6.2e-03) -	2.98e+00(4.4e-03) -	**4.57e-03(3.2e-04)**
UDF2	5.51E-1(2.4E-2) -	6.13E-1(2.8E-2) -	4.32E-1(1.9E-2) -	5.42E-1(1.7E-2) -	5.10E-1(2.5E-2) -	2.98e+00(5.3e-03) -	2.98e+00(3.6e-03) -	**4.67e-03(2.3e-04)**
UDF3	1.22E+0(1.9E-3) -	1.23E+0(7.0E-2) -	1.73E+0(3.1E-4) -	1.22E+0(2.4E-3) -	1.22E+0(2.4E-3) -	**4.69e-03(2.5e-04) +**	4.81e-03(2.5e-04) -	4.76e-03(2.4e-04)
UDF4	3.47E-1(8.3E-2) -	5.06E-1(3.7E-2) -	3.77E-1(2.1E-2) -	6.41E-1(1.9E-1) -	3.32E-1(7.1E-2) -	2.49e-02(4.7e-04) -	2.45e-02(3.4e-04) -	**4.67e-04(3.1e-04)**
UDF5	2.78E-1(2.5E-2) -	3.98E-1(3.3E-2) -	2.70E-1(1.5E-2) -	3.65E-1(2.7E-2) -	2.72E-1(1.8E-2) -	2.47e-02(3.8e-04) -	2.42e-02(5.7e-04) -	**4.60e-04(2.9e-04)**
UDF6	9.34E-1(1.5E-1) -	1.26E+0(7.2E-2) -	1.83E+0(1.0E-2) -	1.21E+0(1.4E-1) -	9.77E-1(2.0E-1) -	3.92e+02(3.6e+00) -	3.95e+02(2.1e+00) -	**8.73e-03(2.5e-03)**
UDF7	2.40E+0(7.4E-2) -	**1.91E+0(1.7E-1) +**	2.06E+0(5.4E-2) -	2.32E+0(2.4E-1) -	2.06E+0(1.2E-1) -	5.39e+00(7.9e-01) -	4.55e+00(1.2e-01) -	**2.31e+00(1.4e+00)**
F5	1.25E+0(2.5E-2) +	1.10E+0(1.6E-1) +	**4.01E-1(9.9E-2) +**	1.19E+0(2.9E-2) +	7.16E-1(8.2E-2) +	3.52e+01(2.3e+01) -	6.17e+01(1.2e+01) -	3.00e+01(2.0e+01)
F6	4.76E-1(3.7E-2) +	9.22E-1(1.0E-1) +	4.92E-1(1.5E-1) +	5.75E-1(7.5E-2) +	**3.60E-1(2.5E-2) +**	3.80e+02(1.7e+02) -	1.74e+02(1.4e+02) -	5.01e+01(3.2e+01)
F7	6.49E-1(1.0E-2) +	1.22E+0(1.5E-1) +	**4.49E-1(1.4E-1) +**	6.50E-1(2.8E-2) +	6.05E-1(1.5E-2) +	7.65e+01(1.7e+01) +	7.41e+01(1.8e+00) +	1.12e+02(4.9e+01)
F8	1.06E+0(4.6E-2) -	8.85E-1(1.2E-1) -	1.34E+0(1.0E-1) -	1.06E+0(6.6E-2) -	4.57E-1(3.2E-2) -	4.89e-01(8.7e-02) -	2.53e-01(1.5e-01) -	**5.70e-02(1.0e-02)**
F9	8.87E-1(3.4E-2) +	1.07E+0(1.9E-1) +	6.88E-1(7.7E-2) +	8.58E-1(4.6E-2) +	**5.76E-1(7.0E-2) +**	5.97e+01(2.2e+01) -	8.57e+01(2.1e+01) -	2.70e+01(1.8e+01)
F10	1.22E+0(5.0E-2) +	8.58E-1(8.8E-2) +	**5.38E-1(1.2E-1) +**	1.05E+0(5.9E-2) +	5.77E-1(2.3E-2) +	6.15e+01(4.1e+01) +	1.39e+01(1.8e+01) +	9.95e+01(2.9e+01)
+/-/ ≈	**5/8/0**	**6/7/0**	**5/8/0**	**5/8/0**	**5/8/0**	**3/10/0**	**2/11/0**	

The symbols "+", "≈" and "–" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA**

Table S6. IGD results (Mean and Standard Deviation) of the 13 MOEAs [56] compared to DB-CSA on the 2, 3 and 7 objectives WFG problems.

MOEAs	M	WFG1	WFG2	WFG3	WFG4	WFG5	WFG6	WFG7	WFG8	WFG9	+/-/ ≈
MSOPS-II	2	2.11E-1$_{(9.19E-2)}$ -	2.68E-2$_{(3.18E-3)}$-	1.68E-2$_{(9.57E-3)}$ -	1.80E-2$_{(1.16E-3)}$-	6.61E-2$_{(4.58E-4)}$-	7.66E-2$_{(2.14E-2)}$-	1.91E-2$_{(1.42E-3)}$-	1.13E-1$_{(2.64E-3)}$-	4.76E-2$_{(7.28E-2)}$-	
	3	3.86E-1$_{(7.13E-2)}$ -	2.73E-1$_{(3.40E-2)}$-	9.79E-2$_{(244E-2)}$ -	2.60E-1$_{(9.62E-3)}$-	2.80E-1$_{(9.31E-3)}$-	3.20E-1$_{(1.71E-2)}$-	2.71E-1$_{(1.35E-2)}$ -	3.91E-1$_{(1.25E-2)}$-	2.56E-1$_{(3.01E-2)}$-	**0/27/0**
	7	1.17E+0$_{(9.67E-2)}$ -	3.14E+0$_{(7.86E-1)}$-	1.85E-1$_{(4.01E-2)}$ -	2.78E+0$_{(3.14E-2)}$-	2.92E+0$_{(8.1E-2)}$-	2.92E+0$_{(5.6E-2)}$-	2.92E+0$_{(6.22E-2)}$ -	2.99E+0$_{(4.0E-2)}$-	2.75E+0$_{(3.9E-2)}$-	
MOEA/D	2	5.28E-1$_{(5.95E-2)}$ -	1.09E-1$_{(6.86E-2)}$ -	2.68E-2$_{(4.89E-3)}$-	3.60E-2$_{(4.78E-3)}$-	7.23E-2$_{(1.45E-3)}$-	9.55E-2$_{(2.32E-2)}$-	3.35E-2$_{(3.34E-3)}$-	1.27E-1$_{(5.63E-3)}$-	7.41E-2$_{(5.48E-2)}$-	
	3	6.52E-1$_{(9.52E-2)}$ -	1.02E+0$_{(3.31E-2)}$-	2.05E-1$_{(5.78E-2)}$ -	2.63E-1$_{(5.94E-3)}$ -	2.51E-1$_{(3.69E-3)}$-	2.99E-1$_{(8.25E-3)}$-	3.73E-1$_{(4.54E-2)}$ -	3.25E-1$_{(1.10E-2)}$-	3.03E-1$_{(3.76E-2)}$-	**0/27/0**
	7	2.12E+0$_{(2.52E-1)}$ -	1.06E+1$_{(1.18E-1)}$-	3.05E+0$_{(1.7E-1)}$ -	6.00E+0$_{(1.65E-1)}$-	5.73E+0$_{(1.3E-1)}$-	6.18E+0$_{(1.4E-1)}$-	6.10E+0$_{(1.34E-1)}$ -	5.37E+0$_{(1.5E-1)}$-	5.57E+0$_{(4.4E-1)}$-	
HypE	2	7.27E-1$_{(1.53E-1)}$ -	**1.08E-2$_{(2.8E-4)}$ +**	1.12E-2$_{(3.48E-4)}$ -	1.78E-2$_{(1.24E-3)}$-	6.69E-2$_{(1.48E-3)}$-	8.11E-2$_{(2.09E-2)}$-	1.79E-2$_{(8.14E-4)}$-	1.11E-1$_{(3.79E-3)}$-	2.07E-2$_{(1.00E-3)}$-	
	3	1.33E+0$_{(1.22E-1)}$ -	2.71E-1$_{(4.30E-2)}$ -	3.72E-2$_{(3.53E-3)}$-	3.33E-1$_{(1.48E-2)}$ -	3.62E-1$_{(1.19E-2)}$-	3.72E-1$_{(2.28E-2)}$-	3.83E-1$_{(1.44E-2)}$ -	3.72E-1$_{(1.41E-2)}$-	3.62E-1$_{(1.31E-2)}$-	**1/26/0**
	7	2.53E+0$_{(1.31E-1)}$ -	3.89E+0$_{(6.24E-1)}$-	9.29E-2$_{(9.16E-3)}$ -	4.43E+0$_{(5.97E-1)}$-	2.91E+0$_{(7.70E-2)}$	2.95E+0$_{(1.3E-1)}$-	3.21E+0$_{(2.53E-1)}$ -	3.39E+0$_{(1.9E-1)}$-	2.89E+0$_{(2.0E-1)}$-	
PICEA-g	2	2.04E-1$_{(3.63E-2)}$ -	2.59E-2$_{(4.83E-2)}$ -	1.81E-2$_{(1.67E-3)}$-	1.85E-2$_{(1.97E-3)}$-	6.59E-2$_{(2.22E-3)}$-	9.55E-2$_{(1.99E-2)}$-	1.60E-2$_{(9.18E-4)}$-	1.20E-1$_{(4.01E-3)}$-	4.25E-2$_{(5.09E-2)}$-	
	3	9.78E-1$_{(1.07E-1)}$ -	1.54E-1$_{(9.67E-3)}$ -	1.25E-1$_{(1.04E-2)}$ -	2.23E-1$_{(3.05E-3)}$ -	2.28E-1$_{(3.29E-3)}$-	2.63E-1$_{(2.14E-2)}$-	2.18E-1$_{(3.58E-3)}$ -	3.09E-1$_{(4.52E-3)}$-	2.21E-1$_{(1.10E-2)}$-	**0/27/0**
	7	2.46E+0$_{(5.1E-2)}$ -	2.04E+0$_{(3.88E-1)}$-	8.76E-1$_{(8.43E-2)}$ -	2.52E+0$_{(1.51E-1)}$-	2.46E+0$_{(1.9E-2)}$-	2.50E+0$_{(1.7E-2)}$-	2.47E+0$_{(1.69E-2)}$ -	2.70E+0$_{(1.3E-1)}$-	2.54E+0$_{(4.7E-2)}$-	
SPEA2/SDE	2	1.93E-1$_{(4.81E-2)}$ -	1.25E-2$_{(7.4E-4)}$ +	1.37E-2$_{(3.66E-4)}$-	3.18E-2$_{(5.11E-3)}$-	7.82E-2$_{(4.69E-3)}$-	9.44E-2$_{(1.88E-2)}$-	3.54E-2$_{(5.56E-3)}$-	1.18E-1$_{(3.46E-3)}$-	3.55E-2$_{(5.90E-3)}$-	
	3	2.94E-1$_{(5.17E-2)}$ -	2.47E-1$_{(5.53E-2)}$ -	6.64E-2$_{(5.31E-3)}$ -	3.28E-1$_{(1.37E-2)}$ -	3.34E-1$_{(1.60E-2)}$-	3.55E-1$_{(1.97E-2)}$-	3.27E-1$_{(1.41E-2)}$ -	3.61E-1$_{(1.11E-2)}$-	3.12E-1$_{(1.39E-2)}$-	**1/26/0**
	7	1.13E+0$_{(9.70E-2)}$ -	6.15E+0$_{(1.3E+0)}$-	1.25E+0$_{(4.5E-1)}$ -	2.76E+0$_{(3.53E-2)}$-	2.75E+0$_{(4.2E-2)}$-	2.87E+0$_{(4.9E-2)}$-	2.79E+0$_{(4.18E-2)}$ -	2.83E+0$_{(3.6E-2)}$-	2.67E+0$_{(3.1E-2)}$-	
GrEA	2	1.92E-1$_{(9.01E-2)}$ -	3.14E-2$_{(2.06E-3)}$ -	2.38E-2$_{(3.33E-4)}$ -	2.60E-2$_{(1.42E-3)}$-	7.41E-2$_{(2.13E-3)}$-	8.08E-2$_{(2.56E-2)}$-	2.98E-2$_{(1.90E-3)}$-	1.12E-1$_{(9.73E-4)}$-	3.03E-2$_{(2.65E-3)}$-	
	3	3.04E-1$_{(4.41E-2)}$ -	2.61E-1$_{(2.64E-2)}$-	9.10E-2$_{(8.78E-3)}$ -	2.41E-1$_{(2.99E-3)}$ -	2.61E-1$_{(4.44E-3)}$-	2.72E-1$_{(9.51E-3)}$-	2.55E-1$_{(9.13E-3)}$ -	3.02E-1$_{(8.89E-3)}$-	2.39E-1$_{(5.39E-3)}$-	**0/27/0**
	7	1.31E+0$_{(1.90E-1)}$ -	3.00E+0$_{(6.88E-1)}$-	8.82E-1$_{(1.37E-1)}$ -	2.47E+0$_{(1.66E-2)}$-	2.47E+0$_{(2.1E-2)}$-	2.52E+0$_{(2.3E-2)}$-	2.51E+0$_{(1.22E-2)}$ -	2.59E+0$_{(2.5E-2)}$-	2.43E+0$_{(1.5E-2)}$-	
NSGA-III	2	2.70E-1$_{(5.03E-2)}$ -	1.52E-2$_{(6.3E-4)}$ +	1.35E-2$_{(8.46E-4)}$-	1.39E-2$_{(1.13E-3)}$-	6.44E-2$_{(1.01E-3)}$-	8.64E-2$_{(2.42E-2)}$-	1.27E-2$_{(2.4E-4)}$ +	1.13E-1$_{(1.70E-3)}$-	2.30E-2$_{(1.97E-3)}$-	
	3	5.55E-1$_{(7.70E-2)}$ -	1.82E-1$_{(5.38E-3)}$-	1.19E-1$_{(8.98E-3)}$ -	2.22E-1$_{(9.79E-4)}$ -	2.13E-1$_{(4.39E-4)}$-	2.51E-1$_{(1.27E-2)}$-	2.22E-1$_{(4.19E-4)}$ -	2.95E-1$_{(5.07E-3)}$-	2.35E-1($_{3.10E-2)}$-	**2/25/0**
	7	1.58E+0$_{(1.43E-1)}$ -	3.35E+0$_{(2.2E+0)}$-	1.21E+0$_{(2.9E-1)}$ -	2.66E+0$_{(4.57E-2)}$-	2.60E+0$_{(7.9E-3)}$-	2.66E+0$_{(1.9E-2)}$-	2.66E+0$_{(9.73E-3)}$ -	2.68E+0$_{(1.67E-1)}$-	2.54E+0$_{(1.9E-2)}$-	
KnEA	2	2.88E-1$_{(1.39E-1)}$ -	9.19E-1$_{(2.70E-1)}$ -	1.79E-2$_{(8.33E-4)}$-	2.52E-2$_{(4.50E-3)}$-	7.86E-2$_{(9.41E-3)}$-	3.09E-1$_{(6.94E-2)}$-	1.41E-1$_{(5.41E-2)}$-	5.02E-1$_{(7.25E-2)}$ -	3.74E-2$_{(4.19E-2)}$ -	
	3	3.79E-1$_{(5.38E-2)}$ -	2.36E-1$_{(4.36E-2)}$-	1.36E-1$_{(5.76E-2)}$ -	2.54E-1$_{(1.04E-2)}$ -	2.68E-1$_{(1.54E-2)}$-	3.02E-1$_{(1.45E-2)}$-	2.52E-1$_{(1.36E-2)}$ -	3.38E-1$_{(1.29E-2)}$-	2.29E-1$_{(5.63E-3)}$-	**0/27/0**
	7	1.29E+0$_{(1.32E-1)}$ -	2.16E+0$_{(3.84E-1)}$-	1.56E+0$_{(5.8E-1)}$ -	2.83E+0$_{(3.81E-2)}$-	2.85E+0$_{(3.7E-2)}$-	3.04E+0$_{(8.7E-2)}$-	2.90E+0$_{(5.22E-2)}$ -	2.87E+0$_{(7.35E-2)}$-	2.66E+0$_{(4.7E-2)}$-	
RVEA	2	5.81E-1$_{(4.75E-2)}$ -	7.72E-2$_{(1.07E-2)}$ -	5.79E-2$_{(1.04E-2)}$-	9.44E-2$_{(1.59E-2)}$-	1.01E-1$_{(1.40E-2)}$-	1.69E-1$_{(2.42E-2)}$-	6.65E-2$_{(1.26E-2)}$ -	2.06E-1$_{(1.51E-2)}$ -	6.04E-2$_{(5.71E-3)}$-	
	3	6.54E-1$_{(6.52E-2)}$ -	2.17E-1$_{(2.05E-2)}$-	2.30E-1$_{(1.96E-2)}$ -	2.43E-1$_{(5.85E-3)}$ -	2.37E-1$_{(2.78E-3)}$-	2.72E-1$_{(1.72E-2)}$-	2.39E-1$_{(5.28E-3)}$ -	3.28E-1$_{(1.62E-2)}$-	2.36E-1$_{(6.77E-3)}$-	**0/27/0**
	7	1.37E+0$_{(1.27E-1)}$ -	5.39E+0$_{(1.1E+0)}$-	1.93E+0$_{(5.3E-1)}$ -	2.63E+0$_{(1.09E-2)}$-	2.62E+0$_{(8.8E-3)}$-	2.64E+0$_{(3.4E-2)}$-	2.65E+0$_{(1.85E-2)}$ -	2.68E+0$_{(4.91E-2)}$-	2.57E+0$_{(3.1E-2)}$-	
Two-Arch2	2	2.57E-1$_{(9.01E-2)}$ -	1.29E-2$_{(1.9E-3)}$ +	1.47E-2$_{(1.46E-3)}$-	1.62E-2$_{(8.82E-4)}$-	6.59E-2$_{(2.36E-3)}$-	7.38E-2$_{(2.00E-2)}$-	1.62E-2$_{(2.69E-4)}$ -	1.18E-1$_{(8.79E-3)}$ -	2.02E-2$_{(2.34E-3)}$-	
	3	4.58E-1$_{(1.14E-1)}$ -	1.53E-1$_{(3.41E-3)}$-	8.74E-2$_{(6.22E-3)}$ -	2.27E-1$_{(5.49E-3)}$ -	2.37E-1$_{(3.98E-3)}$-	2.53E-1$_{(1.38E-2)}$-	2.25E-1$_{(4.51E-3)}$ -	3.11E-1$_{(5.61E-3)}$-	2.22E-1$_{(3.75E-3)}$-	**1/26/0**
	7	1.62E+0$_{(1.57E-1)}$ -	2.02E+0$_{(4.16E-1)}$-	9.56E-1$_{(1.15E-1)}$ -	2.59E+0$_{(2.16E-2)}$-	2.54E+0$_{(2.4E-2)}$-	2.61E+0$_{(3.2E-2)}$-	2.56E+0$_{(2.17E-2)}$-	2.87E+0$_{(3.88E-2)}$-	2.58E+0$_{(3.7E-2)}$-	
$\boldsymbol{\theta}$-DEA	2	2.70E-1$_{(8.29E-2)}$ -	3.02E-2$_{(4.77E-2)}$ -	1.29E-2$_{(5.23E-4)}$-	1.40E-2$_{(1.21E-3)}$-	6.52E-2$_{(2.14E-3)}$-	8.09E-2$_{(1.42E-2)}$-	**1.27E-2$_{(1.9E-4)}$ +**	1.15E-1$_{(3.42E-3)}$ -	2.18E-2$_{(2.34E-3)}$-	
	3	4.75E-1$_{(6.57E-2)}$ -	2.10E-1$_{(2.24E-2)}$-	1.34E-1$_{(1.84E-2)}$ -	2.22E-1$_{(5.44E-4)}$ -	2.30E-1$_{(8.14E-4)}$-	2.46E-1$_{(1.13E-2)}$-	2.22E-1$_{(4.77E-4)}$ -	2.93E-1$_{(4.59E-3)}$-	2.32E-1$_{(3.04E-2)}$-	**1/26/0**
	7	1.29E+0$_{(2.93E-1)}$-	3.60E+0$_{(1.7E+0)}$-	1.22E+0$_{(2.0E-1)}$ -	2.65E+0$_{(1.08E-2)}$-	2.61E+0$_{(7.9E-3)}$-	2.65E+0$_{(1.6E-2)}$-	2.66E+0$_{(1.14E-2)}$ -	2.61E+0$_{(1.21E-2)}$-	2.54E+0$_{(7.8E-3)}$-	
MOEA/DD	2	3.11E-1$_{(3.60E-2)}$ -	2.48E-2$_{(1.68E-3)}$ -	1.58E-2$_{(1.21E-3)}$-	1.43E-2$_{(4.79E-4)}$-	6.71E-2$_{(2.75E-3)}$-	8.35E-2$_{(1.87E-2)}$-	1.39E-2$_{(3.5E-4)}$ +	1.10E-1$_{(1.98E-3)}$ -	2.21E-2$_{(2.23E-3)}$-	
	3	1.02E+0$_{(1.49E-1)}$-	4.85E-1$_{(1.11E-1)}$-	2.61E-1$_{(1.01E-1)}$ -	2.41E-1$_{(9.34E-4)}$ -	2.46E-1$_{(1.68E-3)}$-	2.61E-1$_{(1.29E-2)}$-	2.44E-1$_{(1.85E-3)}$ -	3.05E-1$_{(3.66E-3)}$-	2.39E-1$_{(1.92E-3)}$-	**1/26/0**
	7	1.86E+0$_{(1.17E-1)}$ -	8.91E+0$_{(2.73E-1)}$-	1.78E+0$_{(1.4E-1)}$ -	2.93E+0$_{(7.84E-2)}$-	3.05E+0$_{(1.1E-1)}$-	2.98E+0$_{(9.4E-2)}$-	2.93E+0$_{(1.13E-1)}$ -	2.83E+0$_{(2.01E-2)}$-	3.11E+0$_{(1.2E-1)}$-	
AnD	2	2.84E-1$_{(2.60E-2)}$ -	3.03E-2$_{(3.96E-3)}$ -	1.90E-2$_{(1.64E-3)}$-	1.98E-2$_{(2.00E-3)}$-	6.69E-2$_{(1.91E-3)}$-	8.42E-2$_{(1.87E-2)}$-	1.97E-2$_{(1.68E-3)}$ -	1.18E-1$_{(2.65E-3)}$ -	2.89E-2$_{(3.46E-3)}$-	
	3	4.79E-1$_{(4.94E-2)}$ -	2.49E-1$_{(2.26E-2)}$-	1.54E-1$_{(1.87E-2)}$ -	2.28E-1$_{(6.08E-3)}$ -	2.38E-1$_{(4.09E-3)}$-	2.55E-1$_{(1.69E-2)}$-	2.29E-1$_{(4.27E-3)}$ -	3.28E-1$_{(9.38E-3)}$-	2.26E-1$_{(9.73E-3)}$-	**0/27/0**
	7	1.26E+0$_{(1.07E-1)}$-	3.29E+0$_{(1.0E+0)}$-	1.15E+0$_{(1.7E-1)}$ -	2.57E+0$_{(2.35E-2)}$-	2.56E+0$_{(1.9E-2)}$-	2.63E+0$_{(3.3E-2)}$-	2.63E+0$_{(3.41E-2)}$ -	2.63E+0$_{(2.59E-2)}$-	2.48E+0$_{(2.4E-2)}$-	
CSA	2	3.09e-03$_{(5.0e-04)}$-	3.44e-02$_{(6.8e-03)}$-	1.19e-02$_{(1.4e-03)}$-	9.28e-03$_{(1.5e-03)}$-	9.43e-04$_{(2.2e-04)}$-	2.60e-03$_{(4.4e-04)}$-	1.13e-02$_{(1.3e-03)}$-	4.76e-03$_{(9.2e-04)}$-	1.49e-03$_{(1.1e-04)}$-	**0/27/0**
	3	6.59e-04$_{(5.9e-05)}$-	1.58e-02$_{(1.9e-03)}$-	5.80e-03$_{(2.9e-04)}$-	4.50e-03$_{(2.3e-04)}$-	9.41e-05$_{(4.8e-06)}$-	1.22e-03$_{(8.8e-05)}$-	6.13e-03$_{(4.2e-04)}$-	1.34e-03$_{(8.8e-05)}$-	3.28e-04$_{(1.6e-05)}$-	**0/27/0**
	7	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	**0/27/0**
DB-CSA	2	**7.47E-4$_{(4.10E-5)}$**	1.92E-2$_{(1.80E-3)}$	**1.10E-2$_{(1.20E-3)}$**	**1.01E-2$_{(8.10E-4)}$**	**2.46E-4$_{(3.50E-5)}$**	**2.50E-4$_{(4.30E-5)}$**	1.46E-2$_{(2.20E-3)}$	**1.56E-2$_{(2.40E-3)}$**	**3.85E-4$_{(5.10E-5)}$**	
	3	**3.13E-4$_{(3.40E-5)}$**	**7.68E-3$_{(3.70E-4)}$**	**2.37E-4$_{(7.10E-6)}$**	**5.08E-3$_{(2.70E-4)}$**	**1.38E-4$_{(2.30E-6)}$**	**1.53E-4$_{(4.40E-6)}$**	**6.61E-3$_{(4.40E-4)}$**	**6.26E-3$_{(2.80E-4)}$**	**5.51E-4$_{(3.10E-5)}$**	
	7	**2.42E-4$_{(1.60E-5)}$**	**3.70E-4$_{(1.70E-5)}$**	**5.87E-5$_{(7.50E-7)}$**	**1.08E-3$_{(2.00E-5)}$**	**1.65E-4$_{(5.00E-6)}$**	**6.97E-4$_{(6.40E-5)}$**	**2.20E-3$_{(6.90E-5)}$**	**1.91E-3$_{(4.40E-5)}$**	**7.93E-4$_{(3.70E-5)}$**	

The symbols "+", "≈" and "–" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA.**

Table S7. IGD results (Mean and Standard Deviation) of the 13 MOEAs [56] compared to DB-CSA on the 2, 3 and 7 objectives MaF problems.

Prob.	M	MaF1	MaF 2	MaF 3	MaF 4	MaF5	MaF6	MaF7	+/-/ ≈
MSOPS-II	2	5.68E-3$_{(2.82E-4)}$ -	3.03E-3$_{(1.52E-4)}$ -	1.83E+0$_{(2.4E+0)}$ -	2.92E-1$_{(3.55E-1)}$ -	5.49E-1$_{(9.11E-1)}$ -	7.55E-2$_{(5.84E-2)}$ -	7.76E-2$_{(1.52E-1)}$ -	**0/21/0**
	3	5.40E-2$_{(5.31E-3)}$ -	3.72E-2$_{(1.18E-3)}$ -	5.48E+0$_{(7.03E+0)}$ -	2.14E+0$_{(1.5E+0)}$ -	7.77E-1$_{(6.97E-1)}$ -	2.70E-2$_{(5.22E-2)}$ -	1.40E-1$_{(1.21E-2)}$ -	
	7	2.39E-1$_{(1.83E-2)}$ -	1.70E-1$_{(4.50E-3)}$ -	2.39E+1$_{(5.1E+1)}$ -	1.56E+2$_{(1.3E+2)}$ -	2.08E+1$_{(8.71E+0)}$ -	1.45E-2$_{(2.29E-3)}$ -	9.27E-1$_{(2.52E-1)}$ -	
MOEA/D	2	3.57E-3$_{(1.21E-7)}$ -	2.58E-3$_{(1.54E-4)}$ -	6.66E-1$_{(1.32E+0)}$ -	7.41E-1$_{(6.20E-1)}$ -	1.46E-1$_{(5.15E-1)}$ -	4.14E-3$_{(1.52E-4)}$ -	7.03E-2$_{(1.53E-1)}$ -	**0/21/0**
	3	7.05E-2$_{(1.70E-5)}$ -	4.14E-2$_{(1.20E-3)}$ -	9.03E-1$_{(1.18E+0)}$ -	2.27E+0$_{(1.1E+0)}$ -	1.58E+0$_{(1.22E+0)}$ -	9.94E-2$_{(1.48E-1)}$ -	1.54E-1$_{(1.74E-3)}$ -	
	7	4.77E-1$_{(3.74E-2)}$ -	2.09E-1$_{(2.95E-3)}$ -	4.64E-1$_{(4.54E-1)}$ -	7.24E+1$_{(5.3E+0)}$ -	4.47E+1$_{(2.70E+0)}$ -	4.14E-1$_{(2.02E-1)}$ -	1.36E+0$_{(1.75E-1)}$ -	
HypE	2	3.68E-3$_{(1.28E-5)}$ -	2.06E-3$_{(1.27E-5)}$ -	1.66E+0$_{(2.7E+0)}$ -	2.12E-1$_{(3.69E-1)}$ -	6.28E-1$_{(8.89E-1)}$ -	9.56E-3$_{(3.88E-3)}$ -	3.26E-1$_{(2.01E-1)}$ -	**0/21/0**
	3	8.51E-2$_{(5.82E-3)}$ -	4.56E-2$_{(1.71E-3)}$ -	3.71E+0$_{(5.4E+0)}$ -	2.68E+0$_{(2.5E+0)}$ -	1.64E+0$_{(1.09E+0)}$ -	1.96E-1$_{(2.54E-2)}$ -	8.22E-1$_{(5.03E-3)}$ -	
	7	2.99E-1$_{(6.63E-3)}$ -	4.29E-1$_{(2.29E-2)}$ -	1.09E+5$_{(1.6E+5)}$ -	7.59E+1$_{(5.9E+1)}$ -	1.97E+1$_{(3.79E+0)}$ -	2.01E-1$_{(3.26E-2)}$ -	3.28E+0$_{(2.32E-1)}$ -	
PICEA-g	2	3.82E-3$_{(3.90E-5)}$ -	2.21E-3$_{(3.00E-5)}$ -	2.18E+2$_{(1.4E+2)}$ -	9.79E-1$_{(1.05E+0)}$ -	1.46E-1$_{(5.15E-1)}$ -	4.57E-3$_{(3.10E-4)}$ -	3.47E+2$_{(1.14E-1)}$ -	**0/21/0**
	3	4.16E-2$_{(4.72E-4)}$ -	3.04E-2$_{(7.07E-4)}$ -	2.63E+1$_{(1.8E+1)}$ -	6.26E+0$_{(5.5E+0)}$ -	7.78E-1$_{(6.90E-1)}$ -	4.58E-3$_{(3.02E-4)}$ -	3.77E-1$_{(2.65E-1)}$ -	
	7	2.16E-1$_{(3.34E-3)}$ -	2.16E-1$_{(4.08E-2)}$ -	1.31E+9$_{(1.3E+9)}$ -	2.95E+2$_{(3.4E+2)}$ -	1.07E+1$_{(3.50E+0)}$ -	4.38E+3$_{(1.77E-4)}$ -	3.03E+0$_{(8.23E-1)}$ -	
SPEA2/SDE	2	3.99E-3$_{(6.27E-5)}$ -	2.38E-3$_{(6.38E-5)}$ -	7.44E-1$_{(1.20E+0)}$ -	3.47E-1$_{(4.34E-1)}$ -	1.63E-1$_{(5.10E-1)}$ -	1.08E-2$_{(1.32E-3)}$ -	5.22E-3$_{(2.02E-4)}$ -	**0/21/0**
	3	4.20E-2$_{(6.20E-4)}$ -	3.09E-2$_{(7.86E-4)}$ -	5.51E-1$_{(9.40E-1)}$ -	1.89E+0$_{(1.9E+0)}$ -	6.60E-1$_{(6.28E-1)}$ -	9.57E-3$_{(1.19E-3)}$ -	5.86E-2$_{(2.56E-3)}$ -	
	7	2.05E-1$_{(2.51E-3)}$ -	1.60E-1$_{(7.08E-3)}$ -	2.09E+0$_{(5.6E+0)}$ -	2.44E+1$_{(1.4E+1)}$ -	1.09E+1$_{(2.47E+0)}$ -	1.03E-2$_{(1.33E-3)}$ -	5.40E-1$_{(9.29E-3)}$ -	
GrEA	2	7.83E-3$_{(6.05E-5)}$ -	3.99E-3$_{(8.78E-5)}$ -	1.07E+0$_{(2.1E+0)}$ -	7.02E-1$_{(6.75E-1)}$ -	3.20E-2$_{(1.18E-3)}$ -	9.85E-3$_{(6.53E-4)}$ -	2.98E-2$_{(7.39E-3)}$ -	**0/21/0**
	3	4.03E-2$_{(9.01E-4)}$ -	3.13E-2$_{(6.19E-4)}$ -	2.37E+0$_{(3.1E+0)}$ -	3.02E+0$_{(3.2E+0)}$ -	5.39E-1$_{(5.10E-1)}$ -	2.09E-2$_{(5.31E-4)}$ -	8.29E-2$_{(4.07E-3)}$ -	
	7	2.21E-1$_{(4.66E-3)}$ -	1.66E-1$_{(3.06E-3)}$ -	2.79E+5$_{(6.6E+5)}$ -	6.41E+1$_{(6.7E+1)}$ -	8.60E+0$_{(2.44E-1)}$ -	8.24E-2$_{(1.54E-1)}$ -	7.13E-1$_{(7.15E-2)}$ -	
NSGA-III	2	3.57E-3$_{(2.33E-6)}$ -	2.05E-3$_{(7.13E-5)}$ -	3.12E+0$_{(7.7E+0)}$ -	7.50E-1$_{(9.42E-1)}$ -	1.45E-1$_{(5.15E-1)}$ -	4.02E-3$_{(3.97E-5)}$ -	6.85E-3$_{(1.74E-4)}$ -	**0/21/0**
	3	6.16E-2$_{(1.91E-3)}$ -	3.67E-2$_{(8.54E-4)}$ -	4.09E+0$_{(3.5E+0)}$ -	4.64E+0$_{(3.3E+0)}$ -	4.95E-1$_{(6.22E-1)}$ -	1.49E-2$_{(1.56E-3)}$ -	7.67E-2$_{(2.96E-3)}$ -	
	7	2.56E-1$_{(1.70E-2)}$ -	1.96E-1$_{(1.60E-2)}$ -	4.46E+2$_{(5.9E+2)}$ -	1.30E+2$_{(1.4E+2)}$ -	1.21E+1$_{(9.47E-1)}$ -	2.08E-1$_{(2.67E-1)}$ -	7.25E-1$_{(3.74E-2)}$ -	
KnEA	2	5.06E-3$_{(2.14E-4)}$ -	2.15E-2$_{(7.69E-3)}$ -	9.27E-1$_{(1.16E+0)}$ -	4.63E-1$_{(3.83E-1)}$ -	5.71E-1$_{(8.97E-1)}$ -	1.48E-1$_{(1.80E-2)}$ -	3.40E-2$_{(1.48E-2)}$ -	**0/21/0**
	3	4.84E-2$_{(7.05E-3)}$ -	3.42E-2$_{(1.66E-3)}$ -	2.33E+0$_{(5.1E+0)}$ -	1.54E+0$_{(1.6E+0)}$ -	3.11E-1$_{(9.91E-3)}$ -	4.74E-2$_{(3.94E-2)}$ -	6.81E-2$_{(6.14E-3)}$ -	
	7	2.05E-1$_{(5.09E-3)}$ -	1.63E-1$_{(7.03E-3)}$ -	6.37E+6$_{(1.7E+7)}$ -	3.03E+2$_{(2.7E+2)}$ -	1.29E+1$_{(5.11E-1)}$ -	4.50E-1$_{(1.62E+0)}$ -	5.07E-1$_{(1.38E-2)}$ -	
RVEA	2	3.60E-3$_{(3.29E-5)}$ -	2.76E-3$_{(1.61E-4)}$ -	1.98E+2$_{(2.8E+2)}$ -	2.33E+0$_{(1.8E+0)}$ -	1.37E-2$_{(1.25E-3)}$ -	7.55E-3$_{(8.55E-4)}$ -	2.91E-2$_{(4.64E-3)}$ -	**0/21/0**
	3	8.23E-2$_{(2.56E-4)}$ -	4.22E-2$_{(1.36E-3)}$ -	8.04E+2$_{(1.3E+3)}$ -	7.71E+0$_{(5.8E+0)}$ -	2.60E-1$_{(9.96E-4)}$ -	5.11E-2$_{(2.43E-2)}$ -	1.08E-1$_{(2.83E-3)}$ -	
	7	4.99E-1$_{(7.00E-2)}$ -	4.58E-1$_{(1.47E-1)}$ -	5.75E+1$_{(5.0E+1)}$ -	4.09E+1$_{(1.9E+1)}$ -	1.51E+1$_{(3.26E+0)}$ -	1.31E-1$_{(2.53E-2)}$ -	1.24E+0$_{(2.41E-1)}$ -	
Two-Arch2	2	4.00E-3$_{(3.10E-6)}$ -	2.24E-3$_{(2.06E-5)}$ -	2.09E+1$_{(2.4E+1)}$ -	2.10E+0$_{(2.6E+0)}$ -	1.61E+0$_{(8.25E-1)}$ -	5.18E-3$_{(1.66E-4)}$ -	6.33E-2$_{(1.54E-1)}$ -	**0/21/0**
	3	4.15E-2$_{(4.28E-4)}$ -	2.91E-2$_{(4.68E-4)}$ -	1.25E+1$_{(1.3E+1)}$ -	5.49E+0$_{(3.6E+0)}$ -	2.54E-1$_{(6.40E-3)}$ -	5.84E-3$_{(2.83E-4)}$ -	9.69E-2$_{(1.03E-1)}$ -	
	7	2.07E-1$_{(4.22E-3)}$ -	1.62E-1$_{(3.64E-3)}$ -	2.09E+5$_{(7.0E+5)}$ -	1.50E+2$_{(1.3E+2)}$ -	8.95E+0$_{(2.39E-1)}$ -	7.65E-3$_{(7.45E-4)}$ -	5.56E-1$_{(3.59E-2)}$ -	
$\boldsymbol{\theta}$-DEA	2	3.57E-3$_{(4.88E-7)}$ -	2.01E-3$_{(7.51E-6)}$ -	1.09E+1$_{(3.2E+1)}$ -	2.12E-1$_{(3.12E-1)}$ -	4.11E-1$_{(8.26E-1)}$ -	4.01E-3$_{(6.45E-5)}$ -	5.11E-3$_{(7.25E-5)}$ -	**0/21/0**
	3	8.04E-2$_{(9.64E-4)}$ -	3.65E-2$_{(4.26E-4)}$ -	3.81E+0$_{(4.8E+0)}$ -	1.79E+0$_{(2.7E+0)}$ -	6.66E-1$_{(7.11E-1)}$ -	3.34E-2$_{(2.28E-3)}$ -	1.10E-1$_{(6.96E-2)}$ -	
	7	2.63E-1$_{(5.71E-3)}$ -	2.03E-1$_{(1.32E-2)}$ -	2.09E+1$_{(1.8E+1)}$ -	4.99E+1$_{(4.0E+1)}$ -	1.18E+1$_{(5.89E-1)}$ -	1.46E-1$_{(5.93E-2)}$ -	7.14E-1$_{(7.91E-2)}$ -	
MOEA/DD	2	3.57E-3$_{(9.24E-8)}$ -	4.44E-3$_{(1.38E-4)}$ -	4.14E+1$_{(3.7E+1)}$ -	2.18E+0$_{(1.8E+0)}$ -	1.31E-2$_{(1.20E-6)}$ -	4.06E-3$_{(4.73E-5)}$ -	2.01E-2$_{(1.15E-3)}$ -	**0/21/0**
	3	7.82E-2$_{(1.97E-3)}$ -	5.58E-2$_{(2.08E-3)}$ -	2.66E+1$_{(2.7E+1)}$ -	2.01E+0$_{(2.4E+0)}$ -	2.97E-1$_{(1.89E-4)}$ -	3.05E-2$_{(1.45E-3)}$ -	5.06E-1$_{(2.54E-1)}$ -	
	7	3.34E-1$_{(3.01E-2)}$ -	2.28E-1$_{(2.34E-2)}$ -	2.04E+2$_{(1.6E+2)}$ -	4.56E+1$_{(1.0E+1)}$ -	3.94E+1$_{(2.30E+0)}$ -	1.29E-1$_{(1.10E-2)}$ -	2.09E+0$_{(5.77E-1)}$ -	
AnD	2	4.18E-3$_{(2.25E-4)}$ -	2.52E-3$_{(9.47E-5)}$ -	1.24E+4$_{(1.9E+4)}$ -	2.95E+0$_{(1.5E+0)}$ -	1.59E-2$_{(1.23E-3)}$ -	2.23E-3$_{(7.01E-4)}$ -	9.38E-3$_{(8.54E-4)}$ -	**0/21/0**
	3	4.38E-2$_{(6.16E-4)}$ -	3.03E-2$_{(4.94E-4)}$ -	7.97E+3$_{(9.7E+3)}$ -	8.69E+0$_{(5.1E+0)}$ -	2.63E-1$_{(5.32E-3)}$ -	6.26E-2$_{(1.53E-2)}$ -	8.54E-2$_{(3.08E-3)}$ -	
	7	2.17E-1$_{(1.24E-3)}$ -	1.57E-1$_{(5.08E-3)}$ -	7.43E+3$_{(1.4E+4)}$ -	9.23E+1$_{(8.0E+1)}$ -	9.57E+0$_{(4.03E-1)}$ -	3.12E-1$_{(6.39E-2)}$ -	5.66E-1$_{(2.63E-2)}$ -	
CSA	2/3/7	NaN	NaN	NaN	NaN	NaN	NaN	NaN	**0/21/0**
DB-CSA	2	**4.86E-4$_{(2.40E-5)}$**	**6.16E-5$_{(2.5E-7)}$**	**2.88E-4$_{(5.60E-6)}$**	**2.16E-4$_{(6.20E-7)}$**	**3.89E-4$_{(2.80E-5)}$**	**3.17E-5$_{(1.20E-7)}$**	**7.13E-4$_{(5.30E-6)}$**	
	3	**1.72E-2$_{(1.60E-3)}$**	**6.16E-5$_{(2.60E-7)}$**	**2.96E-4$_{(3.40E-6)}$**	**2.12E-4$_{(6.30E-7)}$**	**3.72E-4$_{(3.30E-5)}$**	**3.16E-5$_{(1.10E-7)}$**	**7.14E-4$_{(5.70E-6)}$**	
	7	**2.10E-2$_{(1.50E-3)}$**	**6.17E-5$_{(2.30E-7)}$**	**2.77E-4$_{(3.90E-6)}$**	**2.15E-4$_{(7.90E-7)}$**	**3.84E-4$_{(3.10E-5)}$**	**3.26E-5$_{(1.30E-7)}$**	**7.13E-4$_{(4.90E-6)}$**	

The symbols "+", "≈" and "−" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA.**

Table S8. IGD results (Mean and Standard Deviation) of the 8 MOEAs on the WFG test suite.

			Reference : [55]								
Prob.	M	D	PMEA-MA	PMEA*-MA	SPEA2/SDE	NSGA-II+SDR	MaOEA/IGD	VaEA	SPEAR	CSA	**DB-CSA**
WFG1	3	12	6.38E-1$_{(6.61E-2)}$-	3.42E-1$_{(4.42E-2)}$ -	2.37E-1$_{(2.90E-2)}$ -	2.79E-1$_{(4.02E-2)}$ -	2.04E+0$_{(3.9E-1)}$ -	2.34E-1$_{(2.91E-2)}$ -	2.63E-1$_{(4.78E-2)}$ -	2.41e-03$_{(2.8e-04)}$-	**4.24E-3$_{(1.6E-3)}$**
	5	14	9.24E-1$_{(1.33E-1)}$-	6.07E-1$_{(5.13E-2)}$ -	4.31E-1$_{(2.50E-2)}$ -	6.49E-1$_{(5.68E-2)}$ -	3.52E+0$_{(1.56E+0)}$-	7.12E-1$_{(7.52E-2)}$ -	4.56E-1$_{(7.98E-2)}$ -	NaN	**1.98E-3$_{(7.3E-4)}$**
	8	17	1.55E+0$_{(9.4E-2)}$ -	1.31E+0$_{(9.67E-2)}$ -	1.04E+0$_{(3.85E-2)}$-	1.52E+0$_{(1.44E-1)}$ -	5.57E+0$_{(2.43E+0)}$-	1.55E+0$_{(1.44E-1)}$ -	1.45E+0$_{(1.14E-1)}$-	NaN	**1.82E-3$_{(6.5E-4)}$**
	10	19	1.65E+0$_{(1.0E-1)}$-	1.48E+0$_{(7.64E-2)}$-	1.09E+0$_{(2.59E-2)}$-	1.71E+0$_{(1.20E-1)}$-	9.49E+0$_{(3.40E+0)}$-	1.93E+0$_{(2.13E-1)}$ -	1.49E+0$_{(9.24E-2)}$ -	NaN	**1.53E-3$_{(3.6E-4)}$**
	15	24	2.07E+0$_{(9.8E-2)}$-	2.44E+0$_{(1.56E-1)}$-	1.97E+0$_{(8.29E-2)}$-	2.48E+0$_{(4.01E-2)}$-	4.35E+0$_{(2.52E+0)}$-	2.73E+0$_{(2.19E-1)}$ -	2.47E+0$_{(1.57E-1)}$-	NaN	**1.47E-3$_{(2.3E-4)}$**
WFG2	3	12	1.70E-1$_{(4.62E-3)}$-	1.68E-1$_{(3.82E-3)}$ -	2.18E-1$_{(1.10E-2)}$ -	2.03E-1$_{(1.45E-2)}$ -	1.32E+0$_{(3.25E-1)}$-	1.72E-1$_{(4.75E-3)}$ -	1.71E-1$_{(2.95E-3)}$ -	1.39e-02$_{(2.0e-03)}$-	**7.22E-3$_{(7.3E-4)}$**
	5	14	8.66E-1$_{(1.28E-1)}$-	4.01E-1$_{(7.17E-3)}$ -	4.98E-1$_{(2.14E-2)}$ -	4.95E-1$_{(5.28E-2)}$ -	1.16E+0$_{(2.65E-1)}$-	3.91E-1$_{(4.48E-3)}$ -	3.94E-1$_{(2.38E-3)}$ -	NaN	**3.82E-3$_{(2.9E-4)}$**
	8	17	1.85E+0$_{(1.0E-1)}$-	1.07E+0$_{(3.55E-2)}$-	1.08E+0$_{(3.65E-2)}$-	1.47E+0$_{(1.67E-1)}$-	2.12E+0$_{(3.91E-1)}$-	9.35E-1$_{(1.27E-2)}$ -	9.65E-1$_{(1.84E-2)}$ -	NaN	**4.27E-3$_{(6.8E-4)}$**
	10	19	1.94E+0$_{(3.1E-2)}$ -	1.18E+0$_{(3.62E-2)}$-	1.14E+0$_{(3.81E-2)}$-	1.62E+0$_{(1.38E-1)}$-	2.28E+0$_{(5.57E-1)}$-	1.01E+0$_{(1.17E-2)}$ -	1.08E+0$_{(1.08E-2)}$-	NaN	**2.75E-3$_{(5.5E-4)}$**
	15	24	2.52E+0$_{(4.0E-2)}$-	1.89E+0$_{(4.72E-2)}$-	1.88E+0$_{(5.98E-2)}$-	2.42E+0$_{(4.94E-2)}$-	3.15E+0$_{(1.38E+0)}$-	1.76E+0$_{(4.39E-2)}$ -	1.87E+0$_{(7.38E-2)}$-	NaN	**5.06E-3$_{(1.1E-3)}$**
WFG3	3	12	1.16E-1$_{(1.29E-2)}$-	1.12E-1$_{(8.45E-3)}$ -	7.16E-2$_{(6.18E-3)}$ -	1.15E-1$_{(6.24E-2)}$ -	3.19E+0$_{(3.23E-2)}$-	1.36E-1$_{(1.22E-2)}$ -	1.46E-1$_{(1.27E-2)}$ -	5.17e-03$_{(4.0e-04)}$-	**1.28E-3$_{(6.8E-5)}$**
	5	14	5.02E-1$_{(4.61E-2)}$-	5.09E-1$_{(6.16E-2)}$ -	4.86E-1$_{(1.56E-1)}$ -	3.59E-1$_{(3.76E-2)}$ -	4.73E+0$_{(1.83E+0)}$-	5.38E-1$_{(4.57E-2)}$ -	4.65E-1$_{(5.11E-2)}$ -	NaN	**7.90E-4$_{(5.1E-5)}$**
	8	17	1.49E+0$_{(1.6E-1)}$-	1.45E+0$_{(1.74E-1)}$-	1.44E+0$_{(5.51E-1)}$-	1.13E+0$_{(8.43E-1)}$-	6.08E+0$_{(3.76E+0)}$-	1.50E+0$_{(1.53E-1)}$ -	1.78E+0$_{(2.00E-1)}$-	NaN	**6.10E-4$_{(5.8E-5)}$**
	10	19	1.97E+0$_{(1.8E-1)}$-	2.00E+0$_{(2.34E-1)}$-	1.66E+0$_{(7.33E-1)}$-	1.63E+0$_{(6.21E-1)}$-	4.76E+0$_{(4.49E+0)}$-	1.79E+0$_{(2.11E-1)}$ -	1.94E+0$_{(1.63E-1)}$-	NaN	**4.81E-4$_{(5.7E-5)}$**
	15	24	3.77E+0$_{(4.3E-1)}$-	3.51E+0$_{(5.24E-1)}$-	7.13E+0$_{(2.08E+0)}$-	4.53E+0$_{(1.35E+0)}$-	7.55E+0$_{(4.55E+0)}$-	3.82E+0$_{(4.41E-1)}$ -	4.39E+0$_{(5.34E-1)}$-	NaN	**9.57E-4$_{(1.0E-4)}$**
WFG4	3	12	2.24E-1$_{(4.05E-3)}$-	2.29E-1$_{(4.17E-3)}$ -	3.36E-1$_{(1.97E-2)}$ -	2.55E-1$_{(8.55E-3)}$ -	3.82E+0$_{(5.07E-1)}$-	2.31E-1$_{(4.01E-3)}$ -	2.27E-1$_{(3.06E-3)}$ -	4.96e-03$_{(3.8e-04)}$-	**5.28E-3$_{(3.9E-4)}$**
	5	14	9.35E-1$_{(6.44E-3)}$-	9.54E-1$_{(6.05E-3)}$ -	1.39E+0$_{(1.42E-2)}$-	9.89E-1$_{(7.86E-3)}$ -	6.39E+0$_{(1.17E+0)}$-	9.47E-1$_{(5.63E-3)}$ -	9.75E-1$_{(3.62E-3)}$ -	NaN	**2.23E-3$_{(6.9E-5)}$**
	8	17	2.92E+0$_{(2.2E-2)}$-	3.06E+0$_{(2.38E-2)}$-	3.24E+0$_{(3.89E-2)}$-	3.21E+0$_{(3.16E-2)}$-	9.55E+0$_{(1.25E+0)}$-	3.00E+0$_{(3.17E-2)}$ -	2.98E+0$_{(1.05E-2)}$-	NaN	**2.19E-3$_{(7.4E-5)}$**
	10	19	3.97E+0$_{(2.5E-2)}$-	4.19E+0$_{(3.08E-2)}$-	4.44E+0$_{(5.25E-2)}$-	4.38E+0$_{(3.72E-2)}$-	1.13E+1$_{(2.11E+0)}$-	4.03E+0$_{(2.45E-2)}$ -	4.56E+0$_{(1.08E-2)}$-	NaN	**1.45E-3$_{(3.9E-5)}$**
	15	24	8.27E+0$_{(9.1E-2)}$-	8.81E+0$_{(9.68E-2)}$-	9.98E+0$_{(7.35E-1)}$-	9.39E+0$_{(5.28E-1)}$-	1.69E+1$_{(9.10E+0)}$-	8.26E+0$_{(7.86E-2)}$ -	9.41E+0$_{(3.17E-2)}$-	NaN	**2.01E-3$_{(4.6E-5)}$**
WFG5	3	12	2.33E-1$_{(3.46E-3)}$-	2.40E-1$_{(3.60E-3)}$ -	3.44E-1$_{(1.57E-2)}$ -	2.60E-1$_{(5.91E-3)}$ -	2.16E+0$_{(1.30E+0)}$-	2.39E-1$_{(2.59E-3)}$ -	2.37E-1$_{(3.25E-3)}$ -	2.66e-04$_{(1.5e-05)}$-	**7.94E-4$_{(7.0E-5)}$**
	5	14	9.29E-1$_{(6.58E-3)}$-	9.57E-1$_{(6.75E-3)}$ -	1.15E+0$_{(1.60E-2)}$-	9.87E-1$_{(1.35E-2)}$ -	2.11E+0$_{(1.38E+0)}$-	9.42E-1$_{(6.17E-3)}$ -	9.66E-1$_{(3.79E-3)}$ -	NaN	**1.06E-3$_{(2.9E-5)}$**
	8	17	2.94E+0$_{(2.2E-2)}$-	3.13E+0$_{(3.12E-2)}$-	3.24E+0$_{(4.37E-2)}$-	3.25E+0$_{(3.30E-2)}$-	7.09E+0$_{(4.97E+0)}$-	3.04E+0$_{(3.93E-2)}$ -	2.95E+0$_{(8.36E-3)}$-	NaN	**1.64E-3$_{(3.2E-5)}$**
	10	19	3.91E+0$_{(2.6E-2)}$-	4.23E+0$_{(4.61E-2)}$-	4.43E+0$_{(3.62E-2)}$-	4.42E+0$_{(5.99E-2)}$-	9.18E+0$_{(6.57E+0)}$-	4.00E+0$_{(2.50E-2)}$ -	4.54E+0$_{(8.28E-3)}$-	NaN	**1.57E-3$_{(1.3E-5)}$**
	15	24	8.04E+0$_{(8.9E-2)}$-	8.87E+0$_{(4.42E-2)}$-	1.13E+1$_{(5.60E-1)}$-	9.39E+0$_{(2.86E-1)}$-	1.85E+1$_{(1.11E+1)}$-	7.98E+0$_{(6.16E-2)}$ -	9.27E+0$_{(2.42E-2)}$-	NaN	**1.99E-3$_{(3.1E-5)}$**
WFG6	3	12	2.47E-1$_{(1.22E-2)}$-	2.54E-1$_{(1.23E-2)}$ -	3.53E-1$_{(1.47E-2)}$ -	2.69E-1$_{(1.04E-2)}$ -	2.33E+0$_{(1.21E+0)}$-	2.56E-1$_{(1.03E-2)}$ -	2.46E-1$_{(8.54E-3)}$ -	1.92e-03$_{(1.2e-04)}$-	**1.21E-3$_{(2.8E-4)}$**
	5	14	9.44E-1$_{(7.53E-3)}$-	9.77E-1$_{(8.15E-3)}$ -	1.19E+0$_{(1.81E-2)}$-	9.99E-1$_{(1.13E-2)}$ -	1.05E+0$_{(1.49E-2)}$-	5.5E+0$_{(1.21E+0)}$ -	9.69E-1$_{(3.67E-3)}$ -	NaN	**1.92E-3$_{(2.0E-4)}$**
	8	17	3.02E+0$_{(3.4E-2)}$-	3.22E+0$_{(3.37E-2)}$-	3.34E+0$_{(5.37E-2)}$-	3.34E+0$_{(3.90E-2)}$-	9.22E+0$_{(4.16E+0)}$-	3.12E+0$_{(4.26E-2)}$ -	2.99E+0$_{(1.80E-2)}$-	NaN	**3.33E-3$_{(2.6E-4)}$**
	10	19	3.98E+0$_{(3.1E-2)}$-	4.35E+0$_{(4.86E-2)}$-	4.56E+0$_{(4.35E-2)}$-	4.53E+0$_{(7.34E-2)}$-	9.16E+0$_{(5.32E+0)}$-	4.09E+0$_{(3.27E-2)}$ -	4.58E+0$_{(1.07E-2)}$-	NaN	**2.82E-3$_{(1.1E-4)}$**
	15	24	7.96E+0$_{(9.1E-2)}$-	8.97E+0$_{(5.20E-2)}$-	1.05E+1$_{(7.98E-1)}$-	1.03E+1$_{(1.27E+0)}$-	2.07E+1$_{(8.74E+0)}$-	7.92E+0$_{(7.55E-2)}$ -	9.44E+0$_{(9.96E-2)}$-	NaN	**3.83E-3$_{(1.5E-4)}$**
WFG7	3	12	2.24E-1$_{(2.77E-3)}$-	2.29E-1$_{(4.00E-3)}$ -	3.43E-1$_{(1.46E-2)}$ -	2.50E-1$_{(4.85E-3)}$ -	2.57E+0$_{(1.18E+0)}$-	2.33E-1$_{(3.94E-3)}$ -	2.28E-1$_{(3.63E-3)}$ -	6.41e-03$_{(4.4e-04)}$-	**6.40E-3$_{(3.8E-4)}$**
	5	14	9.37E-1$_{(7.57E-3)}$-	9.66E-1$_{(6.15E-3)}$ -	1.17E+0$_{(2.05E-2)}$-	9.93E-1$_{(1.13E-2)}$ -	3.89E+0$_{(1.66E+0)}$-	9.51E-1$_{(7.33E-3)}$ -	9.71E-1$_{(2.05E-3)}$ -	NaN	**3.42E-3$_{(1.2E-4)}$**
	8	17	2.94E+0$_{(2.4E-2)}$-	3.14E+0$_{(3.66E-2)}$-	3.18E+0$_{(3.76E-2)}$-	3.29E+0$_{(4.93E-2)}$-	8.39E+0$_{(3.76E+0)}$-	3.07E+0$_{(4.85E-2)}$ -	2.98E+0$_{(1.01E-2)}$-	NaN	**3.82E-3$_{(1.1E-4)}$**
	10	19	3.93E+0$_{(2.7E-2)}$-	4.23E+0$_{(3.26E-2)}$-	4.40E+0$_{(4.95E-2)}$-	4.43E+0$_{(6.35E-2)}$-	7.61E+0$_{(3.31E+0)}$-	4.01E+3$_{(2.21E-2)}$ -	4.55E+0$_{(2.81E-2)}$-	NaN	**2.72E-3$_{(1.0E-4)}$**
	15	24	8.14E+0$_{(1.1E-1)}$-	8.68E+0$_{(6.56E-2)}$-	9.23E+0$_{(4.17E-1)}$-	1.11E+1$_{(1.24E+0)}$-	1.85E+1$_{(8.66E+0)}$-	8.08E+0$_{(7.35E-2)}$ -	9.36E+0$_{(4.33E-2)}$-	NaN	**4.08E-3$_{(1.7E-4)}$**
WFG8	3	12	2.76E-1$_{(3.48E-3)}$-	2.95E-1$_{(4.12E-3)}$ -	3.76E-1$_{(1.08E-2)}$ -	3.31E-1$_{(7.75E-3)}$ -	3.65E+0$_{(4.00E-1)}$-	3.06E-1$_{(5.90E-3)}$ -	2.74E-1$_{(2.41E-3)}$ -	2.42e-03$_{(1.6e-04)}$-	**6.92E-3$_{(3.1E-4)}$**
	5	14	9.68E-1$_{(4.84E-3)}$-	1.02E+0$_{(6.57E-3)}$-	1.16E+0$_{(1.61E-2)}$-	1.05E+0$_{(1.31E-2)}$-	4.57E+0$_{(9.65E-1)}$-	1.07E+0$_{(1.28E-2)}$ -	9.89E-1$_{(3.03E-3)}$ -	NaN	**2.89E-3$_{(9.3E-5)}$**
	8	17	3.06E+0$_{(4.9E-2)}$-	3.23E+0$_{(4.12E-2)}$-	3.39E+0$_{(3.62E-2)}$-	3.32E+0$_{(4.09E-2)}$-	9.09E+0$_{(2.85E+0)}$-	3.28E+0$_{(3.03E-2)}$ -	3.09E+0$_{(3.27E-2)}$-	NaN	**3.71E-3$_{(9.1E-5)}$**
	10	19	3.99E+0$_{(6.9E-2)}$-	4.39E+0$_{(5.12E-2)}$-	4.55E+0$_{(3.82E-2)}$-	4.52E+0$_{(5.66E-2)}$-	1.31E+1$_{(2.37E+0)}$-	4.32E+0$_{(5.20E-2)}$ -	4.65E+0$_{(1.97E-2)}$-	NaN	**2.70E-3$_{(7.3E-5)}$**
	15	24	8.52E+0$_{(1.4E-1)}$-	8.71E+0$_{(7.50E-2)}$-	9.04E+0$_{(1.26E-1)}$-	9.83E+0$_{(9.41E-1)}$-	2.46E+1$_{(2.95E+0)}$-	8.59E+0$_{(1.57E-1)}$ -	9.39E+0$_{(5.40E-2)}$-	NaN	**3.92E-3$_{(1.7E-4)}$**
WFG9	3	12	2.18E-1$_{(2.70E-3)}$-	2.25E-1$_{(3.27E-3)}$ -	3.27E-1$_{(1.94E-2)}$ -	2.51E-1$_{(7.00E-3)}$ -	2.07E+0$_{(7.20E-1)}$-	2.33E-1$_{(2.35E-2)}$ -	2.24E-1$_{(1.50E-3)}$ -	1.23e-03$_{(7.8e-05)}$-	**2.11E-3$_{(2.5E-4)}$**
	5	14	9.14E-1$_{(5.30E-3)}$-	9.27E-1$_{(5.68E-3)}$ -	1.09E+0$_{(1.82E-2)}$-	9.77E-1$_{(1.12E-2)}$ -	3.71E+0$_{(1.60E+0)}$-	9.30E-1$_{(6.40E-3)}$ -	9.44E-1$_{(2.86E-3)}$ -	NaN	**2.55E-3$_{(8.6E-5)}$**
	8	17	2.95E+0$_{(1.7E-2)}$-	3.03E+0$_{(3.18E-2)}$-	3.22E+0$_{(3.34E-2)}$-	3.18E+0$_{(4.37E-2)}$-	4.77E+0$_{(2.08E+0)}$-	3.02E+0$_{(2.65E-2)}$ -	2.94E+0$_{(8.74E-3)}$-	NaN	**3.56E-3$_{(1.1E-4)}$**
	10	19	3.94E+0$_{(3.2E-2)}$-	4.09E+0$_{(3.35E-2)}$-	4.64E+0$_{(2.54E-1)}$-	4.43E+0$_{(1.05E-1)}$-	4.38E+0$_{(4.74E-2)}$-	3.98E+0$_{(2.75E-2)}$ -	4.52E+0$_{(1.56E-2)}$-	NaN	**2.96E-3$_{(5.7E-5)}$**
	15	24	7.92E+0$_{(1.4E-1)}$-	8.47E+0$_{(1.07E-1)}$-	8.88E+0$_{(3.66E-1)}$-	8.89E+0$_{(4.25E-1)}$-	9.02E+0$_{(7.35E-1)}$-	7.79E+0$_{(7.89E-2)}$ -	9.12E+0$_{(2.73E-2)}$-	NaN	**4.24E-3$_{(8.1E-5)}$**
+/-/ ≈			**0/45/0**	**0/45/0**	**0/45/0**	**0/45/0**	**0/45/0**	**0/45/0**	**0/45/0**	**0/45/0**	

The symbols "+", "≈" and "–" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA.**

Table S9. IGD results (Mean and Standard Deviation) of the 8 MOEAs on the DTLZ test suite.

			Reference : [55]								
Prob.	M	D	PMEA-MA	PMEA*-MA	SPEA2/SDE	NSGA-II+SDR	MaOEA/IGD	VaEA	SPEAR	CSA	**DB-CSA**
DTLZ1	3	7	2.58E-2$_{(1.71E-3)}$-	2.20E-2$_{(3.79E-4)}$ -	2.16E-2$_{(3.45E-4)}$ -	3.43E-2$_{(8.40E-3)}$ -	7.48E-1$_{(4.05E-1)}$ -	3.62E-2$_{(2.38E-2)}$ -	2.58E-2$_{(1.59E-2)}$ -	5.74e-02$_{(8.4e-04)}$	**1.19E-2$_{(1.4E-3)}$**
	5	9	5.29E-2$_{(9.08E-4)}$ -	5.29E-2$_{(4.77E-4)}$ -	5.00E-2$_{(2.76E-4)}$ -	7.38E-2$_{(9.06E-3)}$ -	3.33E-1$_{(2.69E-1)}$ -	1.06E-1$_{(3.24E-2)}$ -	8.07E-2$_{(2.33E-2)}$ -	NaN	**1.47E-2$_{(1.3E-3)}$**
	8	12	1.15E-1$_{(2.57E-3)}$ -	1.04E-1$_{(1.19E-3)}$ -	9.61E-2$_{(5.25E-4)}$ -	1.61E-1$_{(1.18E-2)}$ -	4.78E-1$_{(4.28E-1)}$ -	1.99E-1$_{(2.25E-2)}$ -	1.26E-1$_{(1.48E-2)}$ -	NaN	**1.52e-2$_{(2.8e-3)}$**
	10	14	1.15E-1$_{(1.31E-3)}$ -	1.08E-1$_{(1.50E-3)}$ -	1.01E-1$_{(5.01E-4)}$ -	1.68E-1$_{(1.29E-2)}$ -	1.40E-1$_{(1.02E-1)}$ -	1.92E-1$_{(1.83E-2)}$ -	1.52E-1$_{(2.87E-2)}$ -	NaN	**2.20e-2$_{(3.3e-3)}$**
	15	19	1.39E-1$_{(1.41E-3)}$ -	2.62E-1$_{(6.19E-2)}$ -	1.34E-1$_{(1.17E-3)}$ -	2.00E-1$_{(2.76E-2)}$ -	6.09E-1$_{(9.50E-1)}$ -	2.48E-1$_{(8.41E-2)}$ -	3.11E-1$_{(1.53E-1)}$ -	NaN	**2.80e-2$_{(4.6e-3)}$**
DTLZ 2	3	12	5.59E-2$_{(5.74E-4)}$ -	5.72E-2$_{(5.53E-4)}$ -	7.92E-2$_{(2.61E-3)}$ -	4.70E-1$_{(1.99E-2)}$ -	1.81E-1$_{(4.98E-2)}$ -	5.78E-2$_{(6.49E-4)}$ -	5.77E-2$_{(1.81E-3)}$ -	1.48e-02$_{(6.4e-05)}$	**9.52E-3$_{(1.8E-3)}$**
	5	14	1.63E-1$_{(1.00E-3)}$ -	1.66E-1$_{(6.93E-4)}$ -	1.90E-1$_{(1.68E-3)}$ -	1.65E-1$_{(3.04E-5)}$ -	1.69E-1$_{(6.53E-4)}$ -	1.68E-1$_{(9.78E-4)}$ -	1.69E-1$_{(1.18E-3)}$ -	NaN	**4.54E-3$_{(2.0E-4)}$**
	8	17	3.51E-1$_{(2.36E-3)}$ -	3.56E-1$_{(2.03E-3)}$ -	3.60E-1$_{(1.68E-3)}$ -	4.18E-1$_{(8.53E-2)}$ -	3.44E-1$_{(2.07E-2)}$ -	3.66E-1$_{(2.34E-3)}$ -	3.25E-1$_{(2.07E-3)}$ -	NaN	**3.98e-3$_{(1.8e-4)}$**
	10	19	3.98E-1$_{(2.08E-3)}$ -	4.15E-1$_{(1.90E-3)}$ -	4.23E-1$_{(2.19E-3)}$ -	4.35E-1$_{(6.45E-3)}$ -	4.33E-1$_{(3.30E-3)}$ -	4.28E-1$_{(4.66E-3)}$ -	4.31E-1$_{(2.60E-3)}$ -	NaN	**2.32e-3$_{(7.3e-5)}$**
	15	24	5.77E-1$_{(7.07E-3)}$ -	6.12E-1$_{(2.09E-3)}$ -	6.03E-1$_{(2.70E-3)}$ -	6.71E-1$_{(6.17E-2)}$ -	7.83E-1$_{(7.52E-2)}$ -	6.29E-1$_{(2.09E-2)}$ -	6.63E-1$_{(1.10E-2)}$ -	NaN	**2.52e-3$_{(4.7e-5)}$**
DTLZ 3	3	12	5.73E-2$_{(1.05E-3)}$ -	6.41E-2$_{(2.73E-2)}$ -	7.84E-2$_{(3.16E-3)}$ -	4.42E-1$_{(3.39E-2)}$ -	1.64E+1$_{(7.51E+0)}$-	5.92E-2$_{(6.55E-3)}$ -	2.14E-1$_{(7.45E-2)}$ -	8.14e-02$_{(8.9e-04)}$	**1.41E-2$_{(1.4E-3)}$**
	5	14	1.66E-1$_{(1.91E-3)}$ -	2.45E-1$_{(9.39E-2)}$ -	1.89E-1$_{(1.65E-3)}$ -	1.82E-1$_{(3.49E-3)}$ -	1.15E+1$_{(3.85E+0)}$-	3.35E-1$_{(7.89E-2)}$ -	5.06E-1$_{(1.78E-1)}$ -	NaN	**4.52E-3$_{(2.0E-4)}$**
	8	17	3.56E-1$_{(4.14E-3)}$ -	4.84E-1$_{(5.03E-2)}$ -	3.69E-1$_{(1.44E-2)}$ -	4.55E-1$_{(1.19E-1)}$ -	1.03E+1$_{(6.52E+0)}$-	2.25E+0$_{(1.44E+0)}$-	6.42E+0$_{(3.37E+0)}$-	NaN	**1.89e-3$_{(4.5e-5)}$**
	10	19	4.00E-1$_{(2.94E-3)}$ -	6.09E-1$_{(3.87E-2)}$ -	4.27E-1$_{(5.62E-3)}$ -	4.37E-1$_{(5.48E-3)}$ -	4.98E+0$_{(3.15E+0)}$-	3.99E+0$_{(2.30E+0)}$-	1.31E+1$_{(8.98E+0)}$-	NaN	**1.17e-3$_{(2.0e-5)}$**
	15	24	5.81E-1$_{(6.33E-3)}$ -	1.42E+0$_{(8.27E-1)}$ -	6.22E-1$_{(8.34E-3)}$ -	8.01E-1$_{(8.22E-2)}$ -	6.46E+0$_{(6.28E+0)}$-	9.22E+0$_{(5.83E+0)}$-	4.91E+1$_{(1.91E+1)}$-	NaN	**8.90e-4$_{(2.2e-5)}$**
DTLZ 4	3	12	5.61E-2$_{(6.58E-4)}$ -	5.73E-2$_{(6.68E-4)}$ -	2.45E-1$_{(2.74E-1)}$ -	5.17E-1$_{(9.85E-2)}$ -	3.64E-1$_{(1.80E-1)}$ -	5.78E-2$_{(7.26E-4)}$ -	5.78E-2$_{(1.33E-3)}$ -	5.31e-02$_{(5.8e-04)}$	**5.07E-2$_{(1.1E-2)}$**
	5	14	1.64E-1$_{(1.04E-3)}$ -	1.66E-1$_{(5.25E-4)}$ -	1.98E-1$_{(4.08E-2)}$ -	6.45E-1$_{(8.57E-2)}$ -	2.61E-1$_{(1.43E-1)}$ -	1.70E-1$_{(1.24E-3)}$ -	1.69E-1$_{(1.19E-3)}$ -	NaN	**7.12E-3$_{(8.5E-4)}$**
	8	17	3.52E-1$_{(1.46E-3)}$ -	3.53E-1$_{(1.20E-3)}$ -	3.63E-1$_{(1.62E-2)}$ -	7.72E-1$_{(9.05E-2)}$ -	3.79E-1$_{(5.66E-2)}$ -	3.69E-1$_{(4.46E-3)}$ -	3.46E-1$_{(3.71E-3)}$ -	NaN	**7.13e-3$_{(4.8e-4)}$**
	10	19	3.99E-1$_{(1.08E-3)}$ -	4.11E-1$_{(1.29E-3)}$ -	4.17E-1$_{(1.30E-3)}$ -	7.65E-1$_{(8.29E-2)}$ -	4.49E-1$_{(2.43E-2)}$ -	4.39E-1$_{(8.96E-3)}$ -	4.62E-1$_{(4.10E-3)}$ -	NaN	**2.57e-3$_{(1.3e-4)}$**
	15	24	5.72E-1$_{(2.01E-3)}$ -	6.05E-1$_{(3.25E-3)}$ -	6.03E-1$_{(1.06E-2)}$ -	8.19E-1$_{(2.38E-2)}$ -	6.57E-1$_{(2.57E-2)}$ -	6.21E-1$_{(1.23E-2)}$ -	6.59E-1$_{(9.19E-3)}$ -	NaN	**6.77e-4$_{(2.9e-5)}$**
DTLZ 5	3	12	**4.89E-3$_{(1.28E-4)}$ +**	5.03E-3$_{(9.89E-5)}$ +	1.09E-2$_{(1.27E-3)}$ -	3.13E-2$_{(5.2E-3)}$ +	5.12E-1$_{(2.12E-1)}$ -	5.44E-3$_{(2.21E-4)}$ +	2.99E-2$_{(3.46E-3)}$ -	9.46e-02$_{(1.3e-05)}$	8.54E-3$_{(6.6E-4)}$
	5	14	9.02E-2$_{(1.69E-2)}$ -	9.72E-2$_{(1.98E-2)}$ -	6.08E-2$_{(1.09E-2)}$ -	6.25E-2$_{(1.39E-2)}$ -	3.77E-1$_{(1.54E-1)}$ -	1.13E-1$_{(2.67E-2)}$ -	2.02E-1$_{(4.24E-2)}$ -	NaN	**3.21E-4$_{(1.6E-5)}$**
	8	17	1.75E-1$_{(2.36E-2)}$ -	2.71E-1$_{(4.95E-2)}$ -	1.21E-1$_{(2.18E-2)}$ -	1.23E-1$_{(2.09E-2)}$ -	5.57E-1$_{(1.89E-1)}$ -	3.13E-1$_{(7.07E-2)}$ -	4.43E-1$_{(8.34E-2)}$ -	NaN	**2.49e-4$_{(6.7e-6)}$**
	10	19	2.04E-1$_{(3.23E-2)}$ -	3.36E-1$_{(5.81E-2)}$ -	1.48E-1$_{(3.15E-2)}$ -	1.63E-1$_{(3.13E-2)}$ -	4.91E-1$_{(1.94E-1)}$ -	3.97E-1$_{(9.26E-2)}$ -	6.75E-1$_{(1.55E-1)}$ -	NaN	**1.79e-4$_{(2.6e-6)}$**
	15	24	3.53E-1$_{(7.07E-2)}$ -	4.97E-1$_{(9.04E-2)}$ -	1.64E-1$_{(3.22E-2)}$ -	1.02E-1$_{(2.00E-2)}$ -	6.58E-1$_{(1.69E-1)}$ -	5.29E-1$_{(1.15E-1)}$ -	9.39E-1$_{(2.96E-1)}$ -	NaN	**2.71e-4$_{(2.9e-6)}$**
DTLZ 6	3	12	4.84E-3$_{(1.09E-4)}$ -	4.92E-3$_{(1.04E-4)}$ -	1.07E-2$_{(1.25E-3)}$ -	5.98E-2$_{(1.52E-2)}$ -	6.45E-1$_{(1.18E-1)}$ -	5.08E-3$_{(1.50E-4)}$ -	3.91E-2$_{(8.74E-3)}$ -	1.80e-03$_{(6.2e-05)}$	**2.82E-4$_{(5.9E-5)}$**
	5	14	1.47E-1$_{(4.03E-2)}$ -	1.49E-1$_{(4.74E-2)}$ -	7.14E-2$_{(1.18E-2)}$ -	9.32E-2$_{(1.99E-2)}$ -	6.19E-1$_{(8.32E-2)}$ -	2.65E-1$_{(4.63E-2)}$ -	2.95E-1$_{(9.84E-2)}$ -	NaN	**3.08E-4$_{(3.7E-5)}$**
	8	17	2.77E-1$_{(7.58E-2)}$ -	4.07E-1$_{(1.47E-1)}$ -	2.14E-1$_{(4.37E-2)}$ -	2.27E-1$_{(5.24E-2)}$ -	8.40E-1$_{(4.31E-1)}$ -	1.16E+0$_{(6.51E-1)}$ -	8.82E-1$_{(2.01E-1)}$ -	NaN	**6.02e-4$_{(6.1e-5)}$**
	10	19	3.07E-1$_{(7.55E-2)}$ -	4.69E-1$_{(1.37E-1)}$ -	2.09E-1$_{(3.64E-2)}$ -	2.52E-1$_{(7.25E-2)}$ -	6.65E-1$_{(1.18E-1)}$ -	1.43E+0$_{(5.42E-1)}$ -	1.12E+0$_{(1.84E-1)}$ -	NaN	**5.50e-4$_{(3.0e-5)}$**
	15	24	4.86E-1$_{(1.51E-1)}$ -	5.85E-1$_{(2.00E-1)}$ -	3.38E-1$_{(2.59E-2)}$ -	1.24E-1$_{(2.70E-2)}$ -	7.07E-1$_{(7.32E-2)}$ -	5.71E-1$_{(3.50E-1)}$ -	9.02E+0$_{(6.38E-1)}$ -	NaN	**9.69e-4$_{(7.6e-5)}$**
DTLZ 7	3	22	5.98E-2$_{(1.48E-3)}$ -	6.95E-2$_{(5.27E-2)}$ -	8.24E-2$_{(7.77E-2)}$ -	9.15E-2$_{(6.18E-3)}$ -	8.03E-1$_{(4.39E-1)}$ -	7.42E-2$_{(5.20E-2)}$ -	9.53E-2$_{(1.96E-3)}$ -	1.01e-02$_{(1.3e-03)}$	**1.40E-3$_{(2.9E-4)}$**
	5	24	2.71E-1$_{(1.19E-2)}$ -	2.51E-1$_{(5.56E-3)}$ -	2.71E-1$_{(2.65E-2)}$ -	3.15E-1$_{(2.61E-2)}$ -	6.64E-1$_{(4.04E-2)}$ -	2.74E-1$_{(5.88E-3)}$ -	3.56E-1$_{(5.13E-3)}$ -	NaN	**1.53E-3$_{(1.2E-4)}$**
	8	27	9.87E-1$_{(1.00E-1)}$ -	1.06E+0$_{(1.77E-1)}$ -	7.42E-1$_{(2.00E-2)}$ -	9.76E-1$_{(1.22E-1)}$ -	1.23E+0$_{(3.81E-2)}$ -	7.32E-1$_{(1.98E-2)}$ -	1.24E+0$_{(5.22E-2)}$ -	NaN	**2.17e-3$_{(9.9e-5)}$**
	10	29	1.20E+0$_{(1.38E-1)}$ -	1.22E+0$_{(1.88E-1)}$ -	8.79E-1$_{(5.94E-2)}$ -	1.57E+0$_{(2.8E-1)}$ -	1.47E+0$_{(4.08E-2)}$ -	1.07E+0$_{(2.98E-2)}$ -	2.16E+0$_{(5.17E-2)}$ -	NaN	**1.97e-3$_{(6.1e-5)}$**
	15	34	3.51E+0$_{(3.90E-1)}$ -	6.95E+0$_{(2.03E+0)}$-	1.55E+0$_{(3.47E-2)}$ -	4.66E+0$_{(6.6E-1)}$ -	2.65E+0$_{(1.43E-1)}$ -	2.74E+0$_{(2.72E-1)}$ -	8.97E+0$_{(6.69E-2)}$ -	NaN	**2.99e-3$_{(7.2e-5)}$**
+/-/ ≈			**1/34/0**	**1/34/0**	**0/35/0**	**1/34/0**	**0/35/0**	**1/34/0**	**0/35/0**	**0/35/0**	

The symbols "+", "≈" and "−" denote that the performance of the compared algorithm is statistically better than, equivalent to, and worse than **DB-CSA**