Supplementary Document of "Progressive Preference Learning: Proof-of-Principle Results in MOEA/D"*

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1 Parametric Settings

This section provides the settings of the number of weight vectors, the number of function evaluations (FEs) and population sizes for different test problems used in our experiments. Specifically, the number of reference points and population size settings are given in Table 1 as suggested in [1]. The setting of the number of FEs is given in Table 2.

Table 1: Number of weight vectors and population size.

m	♯ of reference points	I-MOEA/D-PLVF
3	91	91
5	210	210
8	156	156
10	275	275

Table 2: Number of FEs for DTLZ test problems.

Test instance	$m = 3$	$m = 5$	$m = 8$	$m = 10$
DTLZ1	400	600	750	1,000
DTLZ2	250	350	500	750
DTLZ3	1,000	1,000	1,000	1,500
DTLZ4	600	1,000	1,250	2,000

Each cell only gives the number of generations. The corresponding number of FEs is each tuple times the corresponding population size of I-MOEA/D-PLVF as shown in Table 1.

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2 Settings of the DM's Preference Information

In this section, we provide the DM's preference information in terms of the utopia weights $\mathbf{w}^*$ and their corresponding Pareto-optimal optimal solution (also known as the DM's 'golden' point) in Table 3 to Table 6.

Table 3: Settings of the utopia weights $\mathbf{w}^*$ that prefers the middle of the PF.

	objective index									
m	1	2	3	4	5	6	7	8	9	10
3	0.4	0.3	0.3	\	\	\	\	\	\	\
5	0.2	0.18	0.24	0.18	0.2	\	\	\	\	\
8	0.13	0.13	0.12	0.13	0.14	0.12	0.11	0.11	\	\
10	0.11	0.12	0.11	0.08	0.1	0.09	0.1	0.09	0.11	0.09

Table 4: Settings of the corresponding DM's 'golden' point with respect to the $\mathbf{w}^*$ that prefers the middle of the PF.

		objective index									
m	problem	1	2	3	4	5	6	7	8	9	10
3	DTLZ1	0.200	0.150	0.150	\	\	\	\	\	\	\
	DTLZ2-4	0.686	0.514	0.514	\	\	\	\	\	\	\
5	DTLZ1	0.100	0.090	0.120	0.090	0.100	\	\	\	\	\
	DTLZ2-4	0.445	0.400	0.533	0.400	0.445	\	\	\	\	\
8	DTLZ1	0.065	0.065	0.060	0.065	0.070	0.060	0.055	0.055	\	\
	DTLZ2-4	0.370	0.370	0.342	0.370	0.399	0.342	0.313	0.313	\	\
10	DTLZ1	0.055	0.060	0.055	0.040	0.050	0.045	0.050	0.045	0.055	0.045
	DTLZ2-4	0.345	0.377	0.345	0.251	0.314	0.283	0.314	0.283	0.345	0.283

Table 5: Settings of the utopia weights $\mathbf{w}^*$ that prefers one side of the PF.

		objective index									
m	problem	1	2	3	4	5	6	7	8	9	10
3	DTLZ1	0.2	0.2	0.6	\	\	\	\	\	\	\
	DTLZ2-4	0.2	0.6	0.2	\	\	\	\	\	\	\
5	DTLZ1	0.1	0.09	0.08	0.08	0.65	\	\	\	\	\
	DTLZ2-4	0.08	0.65	0.1	0.09	0.08	\	\	\	\	\
8	DTLZ1	0.5	0.07	0.08	0.07	0.07	0.06	0.08	0.07	\	\
	DTLZ2-4	0.07	0.06	0.08	0.07	0.5	0.07	0.08	0.07	\	\
10	DTLZ1	0.05	0.06	0.05	0.06	0.06	0.5	0.05	0.06	0.05	0.06
	DTLZ2-4	0.06	0.06	0.5	0.05	0.06	0.05	0.06	0.05	0.06	0.05

Table 6: Settings of the corresponding DM's 'golden' point with respect to the $\mathbf{w}^*$ that prefers one side of the PF.

		objective index									
m	problem	1	2	3	4	5	6	7	8	9	10
3	DTLZ1	0.100	0.100	0.300	\	\	\	\	\	\	\
	DTLZ2-4	0.302	0.905	0.302	\	\	\	\	\	\	\
5	DTLZ1	0.050	0.045	0.040	0.040	0.325	\	\	\	\	\
	DTLZ2-4	0.119	0.965	0.149	0.134	0.119	\	\	\	\	\
8	DTLZ1	0.250	0.035	0.040	0.035	0.035	0.030	0.040	0.035	\	\
	DTLZ2-4	0.131	0.112	0.150	0.131	0.935	0.131	0.150	0.131	\	\
10	DTLZ1	0.025	0.030	0.025	0.030	0.030	0.250	0.025	0.030	0.025	0.030
	DTLZ2-4	0.114	0.114	0.948	0.095	0.114	0.095	0.114	0.095	0.114	0.095

3 Plots of the Population Distribution

In this section, as shown in Fig. 1 to Fig. 8, we show the plots of the population (with respect to the best approximation error) obtained by different algorithms on DTLZ1 to DTLZ4 test problems. In particular, we show the results for different preference specifications, i.e., preference on the middle of the PF or on one side of the PF, in different plots.

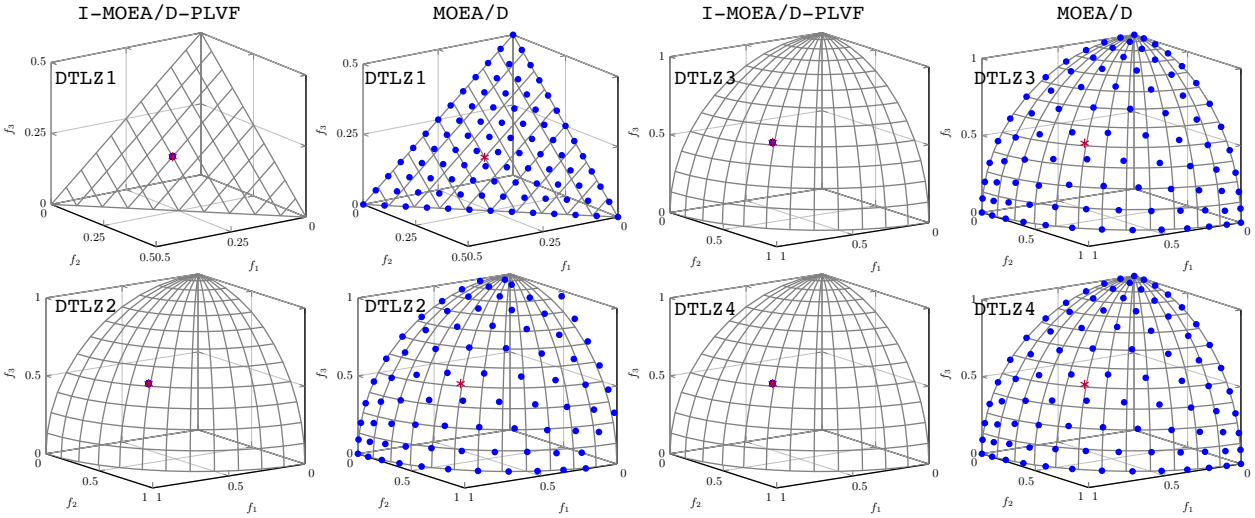

Figure 1: Solutions obtained on 3-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers the middle region of the PF, is represented as the red asterisk.

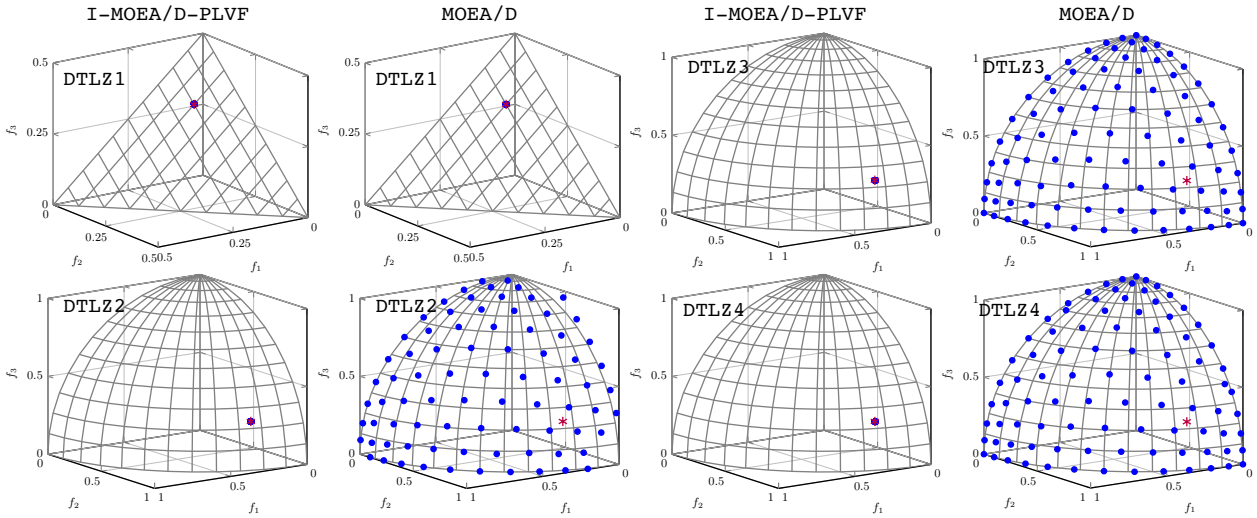

Figure 2: Solutions obtained on 3-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers one side of the PF, is represented as the red asterisk.

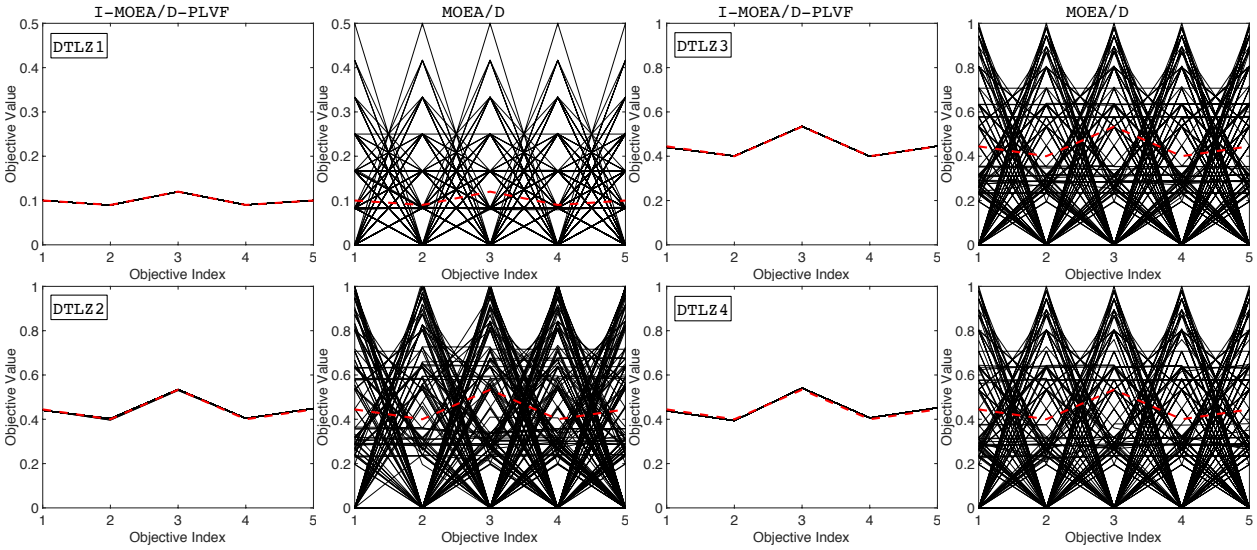

Figure 3: Solutions obtained on 5-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers the middle region of the PF, is represented as the red dotted line.

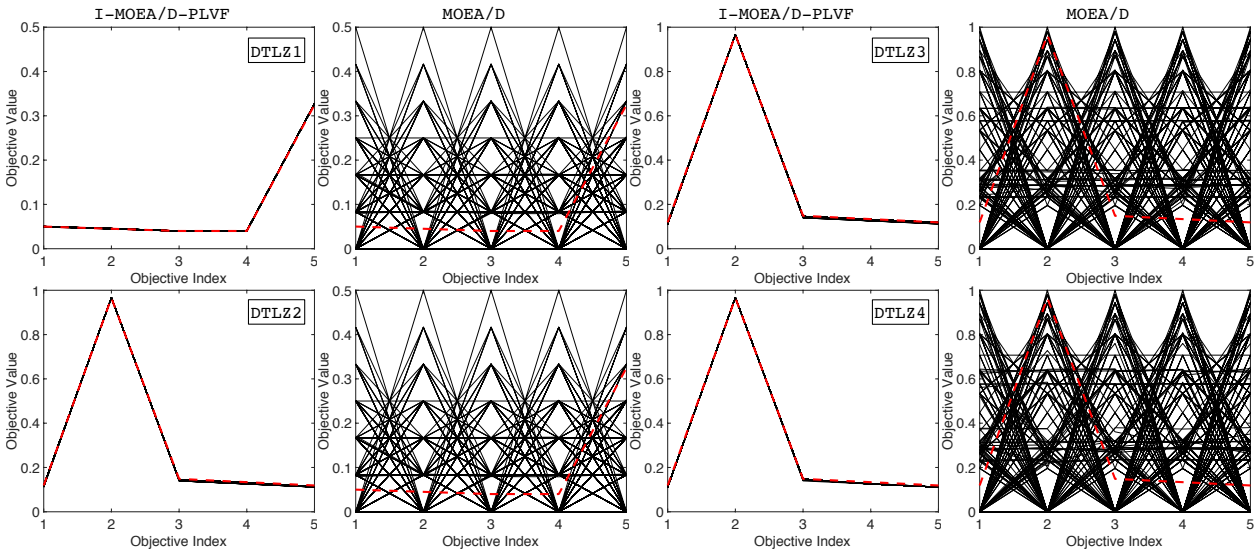

Figure 4: Solutions obtained on 5-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers one side of the PF, is represented as the red dotted line.

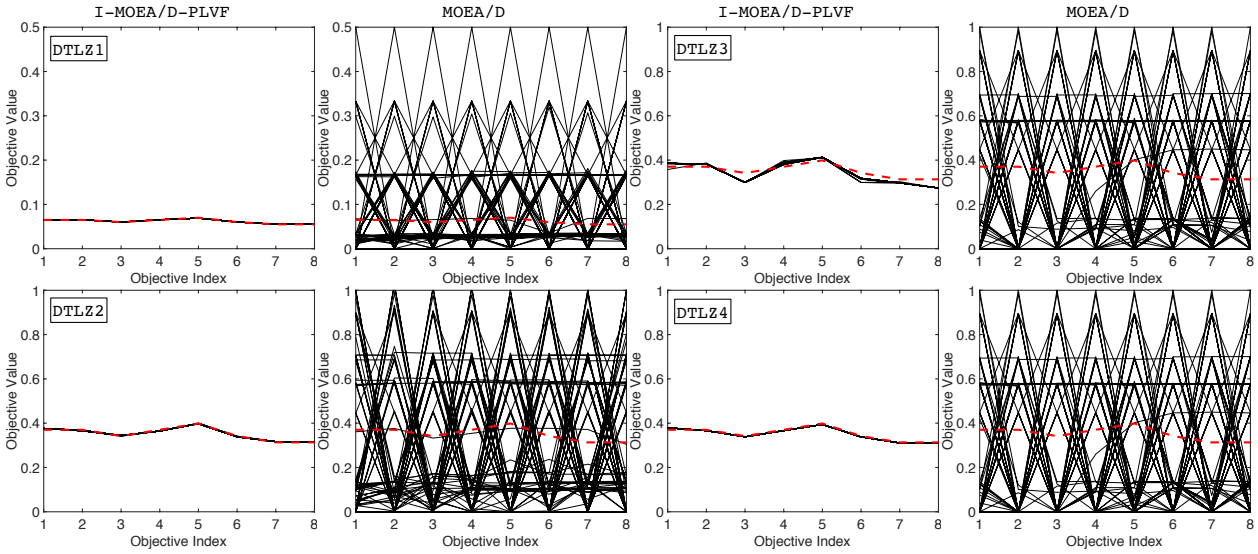

Figure 5: Solutions obtained on 8-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers the middle region of the PF, is represented as the red dotted line.

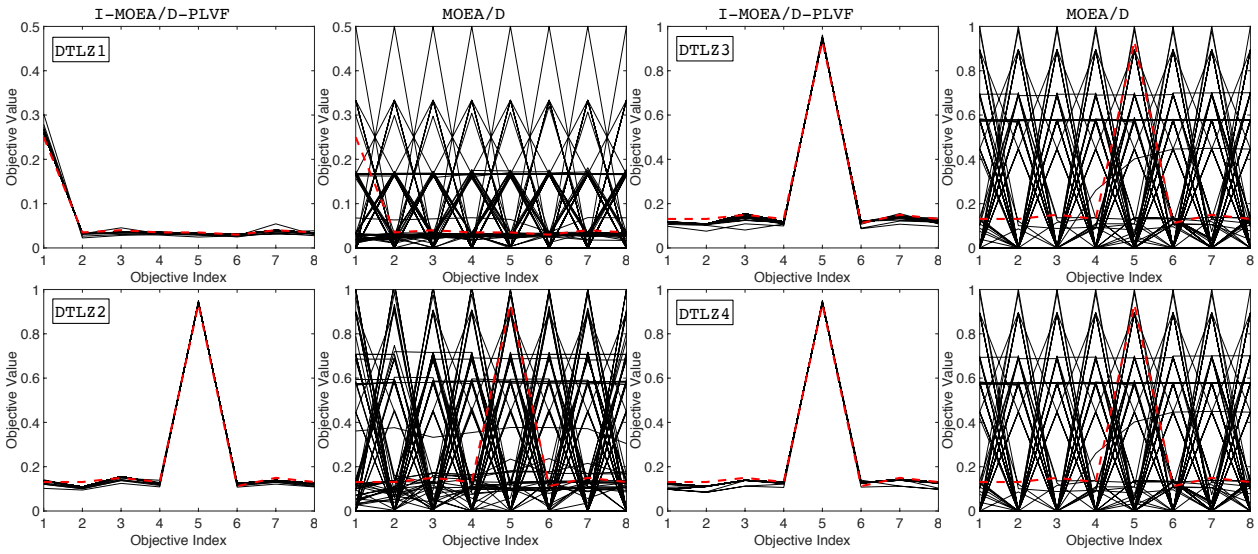

Figure 6: Solutions obtained on 8-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers one side of the PF, is represented as the red dotted line.

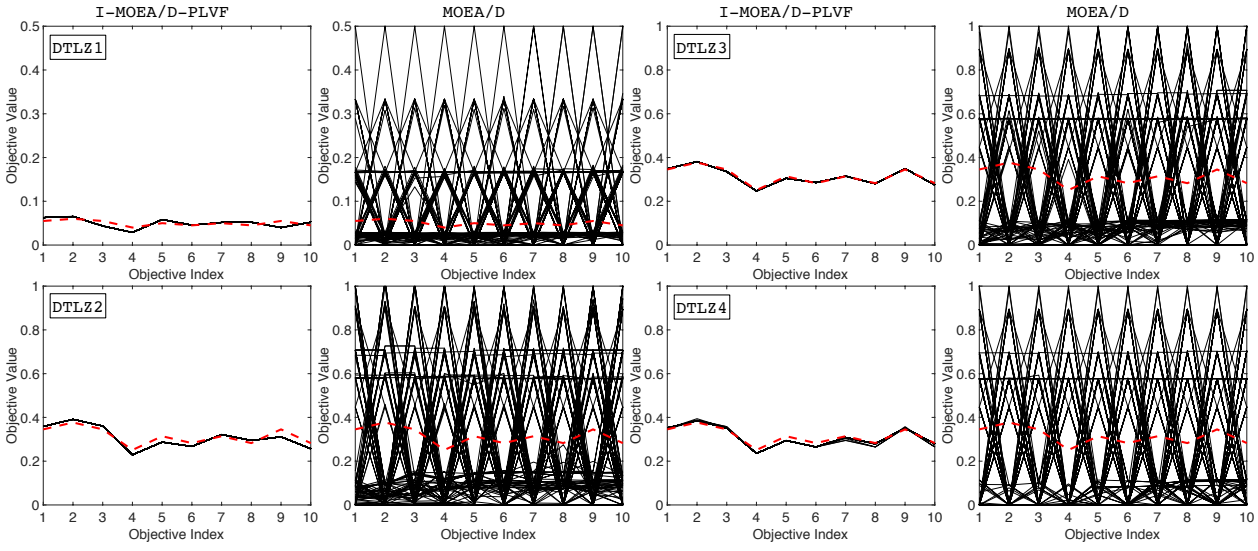

Figure 7: Solutions obtained on 10-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers the middle region of the PF, is represented as the red dotted line.

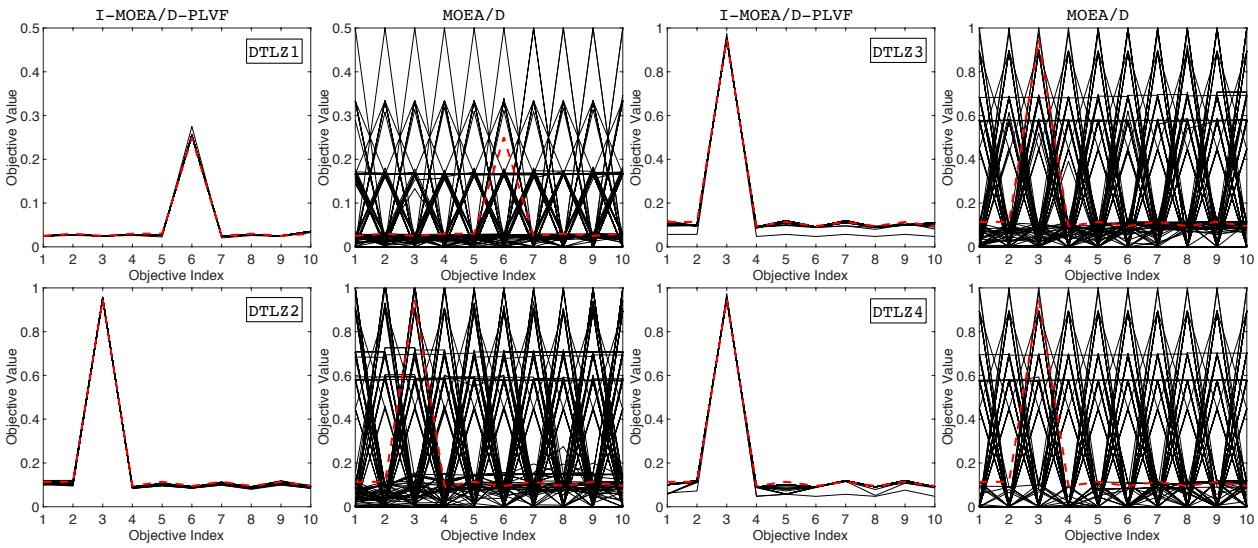

Figure 8: Solutions obtained on 10-objective DTLZ1 to DTLZ4 test problems. The DM's 'golden' point, which prefers one side of the PF, is represented as the red dotted line.

References

[1] K. Li, K. Deb, Q. Zhang, and S. Kwong, "An evolutionary many-objective optimization algorithm based on dominance and decomposition," *IEEE Trans. Evolutionary Computation*, vol. 19, no. 5, pp. 694–716, 2015.