

Supplementary Files for “Particle-Status-Oriented Knowledge Transfer for Multiobjective Multitask Optimization”

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S-I. PERFORMANCE METRIC

The IGD+ for a non-dominated solution set \mathcal{S} in M -dimensional objective space is calculated as

$$\text{IGD+}(\mathcal{S}, \mathcal{Z}) = \frac{1}{|\mathcal{Z}|} \sum_{j=1}^{|\mathcal{Z}|} \min_{s_i \in \mathcal{A}} d(s_i, z_j), \quad (1)$$

where \mathcal{Z} in IGD+ is the set of optimal reference points, and $d(s, z)$ is calculated as

$$d(s, z) = \sqrt{\sum_{k=1}^M (\max\{s^k - z^k, 0\})^2}. \quad (2)$$

The smaller the value of IGD+ the better performance.

The HV of \mathcal{S} is calculated as

$$\text{HV}(\mathcal{S}, \mathcal{Z}) = \text{VOL}(\bigcup [s^1, z^1] \times \dots \times [s^M, z^M]), \quad (3)$$

where VOL indicates the Lebesgue measure, and \mathcal{Z} in HV is the best non-dominated solution set of all algorithms after 30 runs. The bigger the value of HV means the better performance.

S-II. REAL-WORLD APPLICATION PROBLEMS

A. Case 1: Optimal Power Flow

TABLE S-I
COMBINATION OF OBJECTIVE FUNCTIONS OF DIFFERENT CASES OF MULTIOBJECTIVE OPTIMAL POWER FLOW PROBLEMS.

	Generation cost	Emission	Power loss	Voltage deviation
Case 1	✓	✓		
Case 2	✓	✓	✓	
Case 3	✓	✓		✓
Case 4	✓	✓	✓	✓

The objective functions and constraints of OPF [1], [2] can be described as

$$\begin{aligned}
 \text{Minimize : } & f_1(\mathbf{x}) = \sum_{i=1}^{ng} a_i + b_i P_{G_i} + c_i P_{G_i}^2, \\
 & f_2(\mathbf{x}) = \sum_{i=1}^{ng} \alpha_i + \beta_i P_{G_i} + \gamma_i P_{G_i}^2 + \varrho e^{(\phi_i P_{G_i})}, \\
 & f_3(\mathbf{x}) = \sum_{i=1}^{nn} \sum_{j \neq i}^{nn} G_{ij} (V_i^2 + V_j^2 - \\
 & \quad 2V_i V_j \cos(\delta_i - \delta_j)), \\
 & f_4(\mathbf{x}) = \sum_{i=1}^{nl} |V_{L_i} - 1.0|, \\
 \text{subject to : } & P_{G_i}^{\min} \leq P_{G_i} \leq P_{G_i}^{\max}, \quad i = 1, \dots, ng, \\
 & Q_{G_i}^{\min} \leq Q_{G_i} \leq Q_{G_i}^{\max}, \quad i = 1, \dots, ng, \\
 & V_{G_i}^{\min} \leq V_{G_i} \leq V_{G_i}^{\max}, \quad i = 1, \dots, ng, \\
 & Q_{C_i}^{\min} \leq V_{C_i} \leq V_{C_i}^{\max}, \quad i = 1, \dots, nc, \\
 & T_i^{\min} \leq T_i \leq T_i^{\max}, \quad i = 1, \dots, nt, \\
 & V_{L_i}^{\min} \leq V_{L_i} \leq V_{L_i}^{\max}, \quad i = 1, \dots, nl, \\
 & S_{l_i}^{\min} \leq V_{l_i} \leq V_{l_i}^{\max}, \quad i = 1, \dots, nn,
 \end{aligned} \quad (4)$$

where $\mathbf{x} = (P_{G_2}, \dots, P_{G_{ng}}, V_{G_1}, \dots, V_{G_{ng}}, Q_{C_1}, \dots, Q_{C_{nc}}, T_1, \dots, T_{nt})$. Different bus systems constitute different OPF problems according to the above objectives and constraints. Here we use two different bus systems, IEEE-30 and IEEE-57, to form two-task MOMTOPs. IEEE-30 is a relatively easy bus system with 24-dimensional decision variables. IEEE-57 is a more complex bus system with 33-dimensional decision variables. Based on this task combination, a total of four cases are constructed according to different objective combinations as in Table S-I.

B. Case 2: Synchronous Optimal Pulse-width Modulation

TABLE S-II
SYNCHRONOUS OPTIMAL PULSE-WIDTH MODULATION WITH DIFFERENT LEVEL INVERTERS.

Level	D	n	m	\mathbf{s}
3	25	1	0.32	[-1,1,-1,1,-1,1,-1,1]
5	25	2	0.32	[1,-1,1,1,-1,1,-1,1,-1]
7	25	3	0.36	[1,-1,1,1,1,-1,-1,1,-1]
9	30	4	0.32	[1,1,1,1,-1,1,-1,-1,1,-1]
11	30	5	0.3333	[1,-1,1,1,1,-1,-1,-1,1,1]
13	30	6	0.32	[1,1,1,-1,1,-1,1,1,1,1,1]

A SOPM problem [3], [4] can be defined as a bi-objective constrained optimization problem as

$$\begin{aligned}
 \text{Minimize : } \quad f_1(\mathbf{x}) &= \frac{\sqrt{\sum_k (k^{-4})(\sum_{i=1}^D s_i \cos(kx_i))^2}}{n \sqrt{\sum_k k^{-4}}}, \\
 f_2(\mathbf{x}) &= (nm - \sum_{i=1}^D s_i \cos(x_i))^2, \\
 \text{subject to : } \quad x_{i+1} - x_i - 10^{-5} &> 0, \quad i = 1, 2, \dots, N-1, \\
 0 < x_i < \frac{\pi}{2}, \quad i &= 1, 2, \dots, N,
 \end{aligned} \tag{5}$$

where $\mathbf{x} = (x_1, x_2, \dots, x_D)$ and $k = 5, 7, 11, 13, \dots, 97$. Six SOPM problems with different levels used in [5] are chosen as optimization tasks and their detailed parameters are shown in Table S-II. The combinations of levels 3, 5, and 7 become the first three-task MOMTOP of SOPM. The combinations of levels 9, 11, and 13 become the second MOMTOP. The tasks in each MOMTOP of SOPM have the same variable dimension, the same variable structure constraints, and different objective functions.

C. Case 3: Sensor Coverage Problem

A bi-objective SCP [6], [7] can be described as

$$\begin{aligned}
 \text{Minimize : } \quad f_1(\mathbf{x}) &= 1 - \frac{\mathbf{A} \bigcup_{i=1}^S \pi r_i^2(x_i, y_i)}{\mathbf{A}}, \\
 f_2(\mathbf{x}) &= \sum_{i=1}^S (1 + 10 \cdot r_i^2), \\
 \text{subject to : } \quad -1 < x_i < 1, \\
 -1 < y_i < 1, \\
 0.1 < r_i < 0.25,
 \end{aligned} \tag{6}$$

where $\mathbf{x} = (x_1, y_1, r_1, \dots, x_S, y_S, r_S)$. Since the number of sensors is uncertain, the length of the variables is also uncertain, for each possible variable length is an optimization task. The final result required for multiobjective SCP is the non-dominated solution set after merging all task solution sets. As the set of solutions for different tasks may be in conflict, this type of problem is also called the competitive MOMTOP.

TABLE S-III
SENSOR COVERAGE PROBLEMS.

Problem	T	D	Sensor number
SCP(28-32)	5	[84,87,...,96]	[28,29,...,32]
SCP(25-34)	10	[75,78,...,102]	[25,26,...,34]

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S-III. DETAILED RESULTS

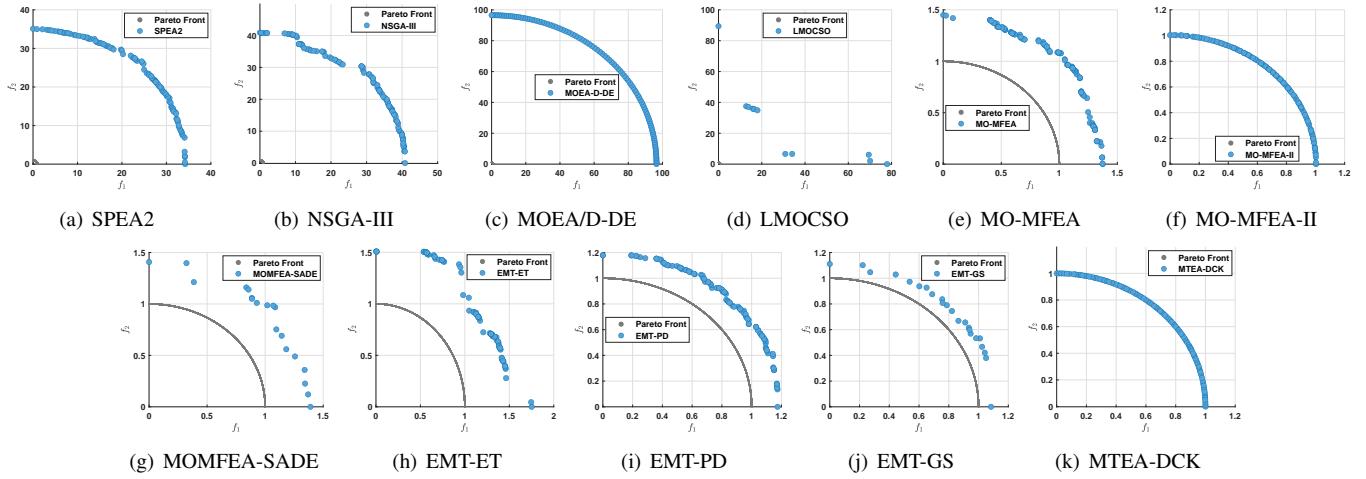


Fig. S-1. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B17-P3-T1.

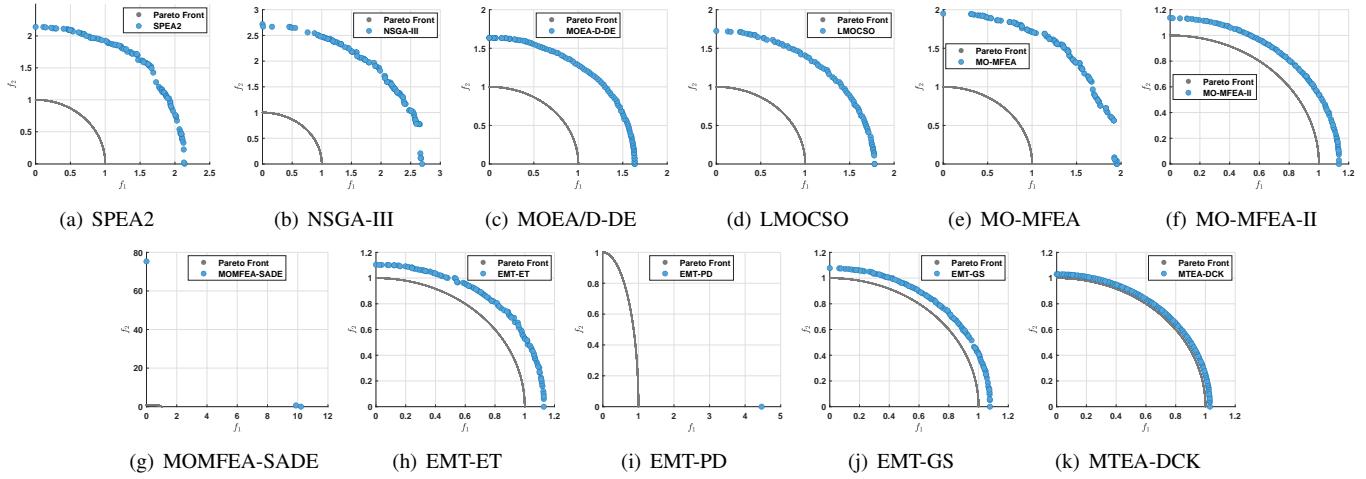


Fig. S-2. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B17-P5-T1.

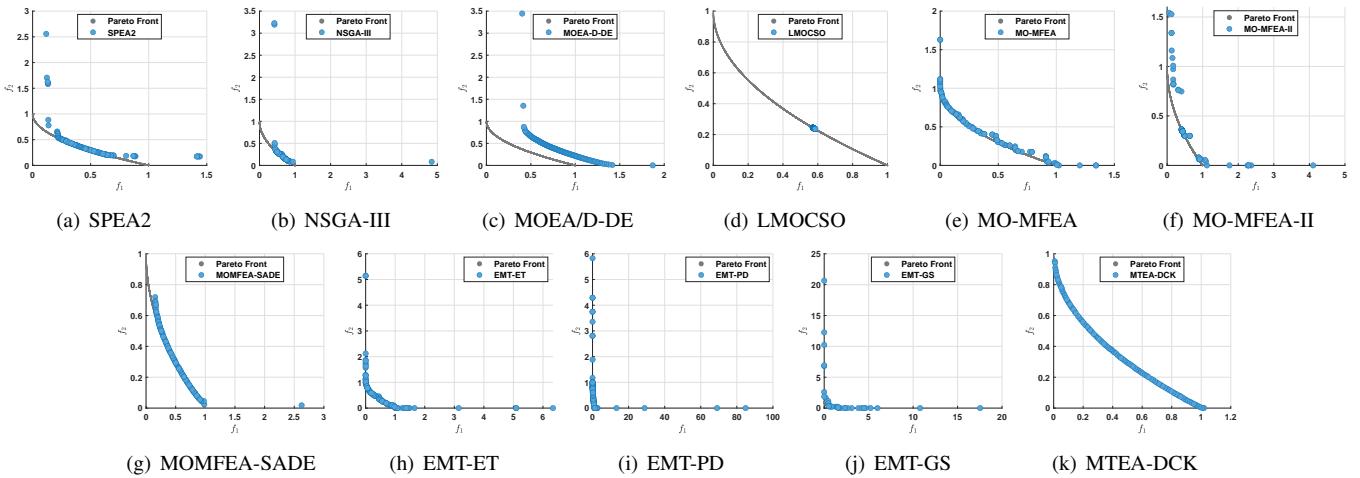


Fig. S-3. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B19-P2-T2.

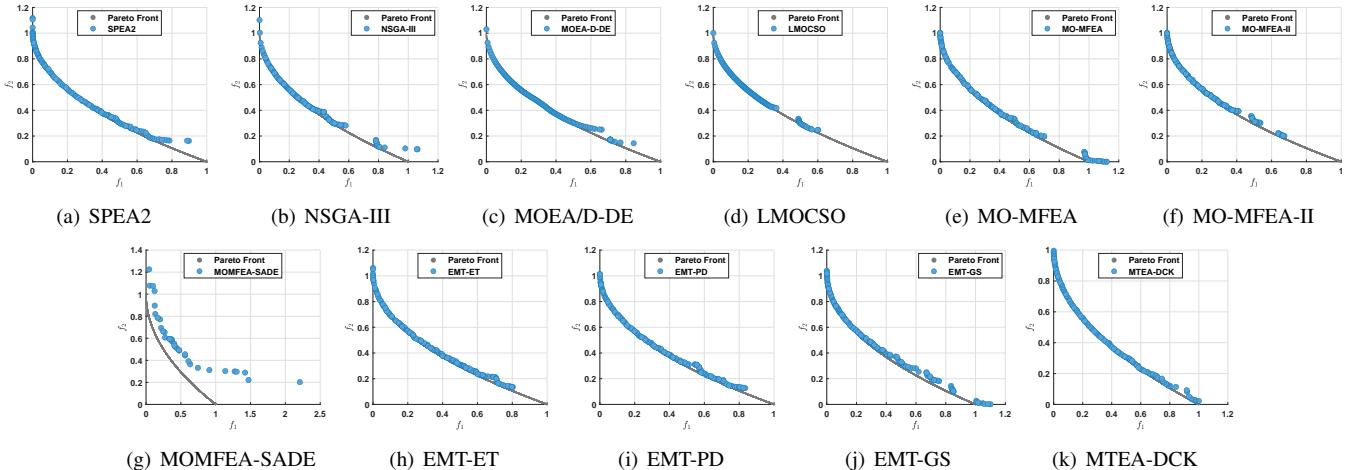


Fig. S-4. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B19-P5-T1.

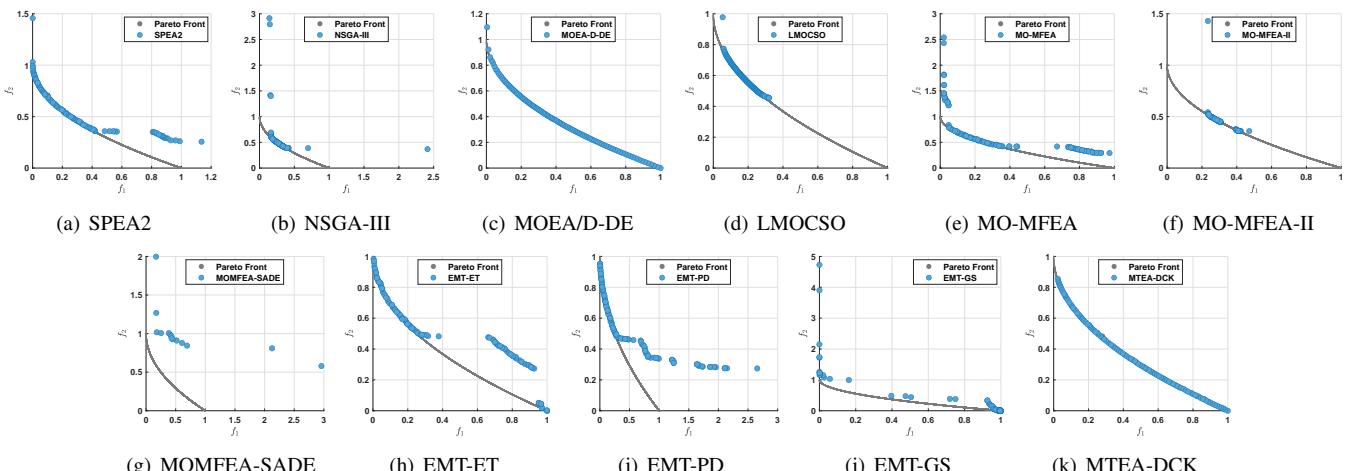


Fig. S-5. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B19-P10-T1.

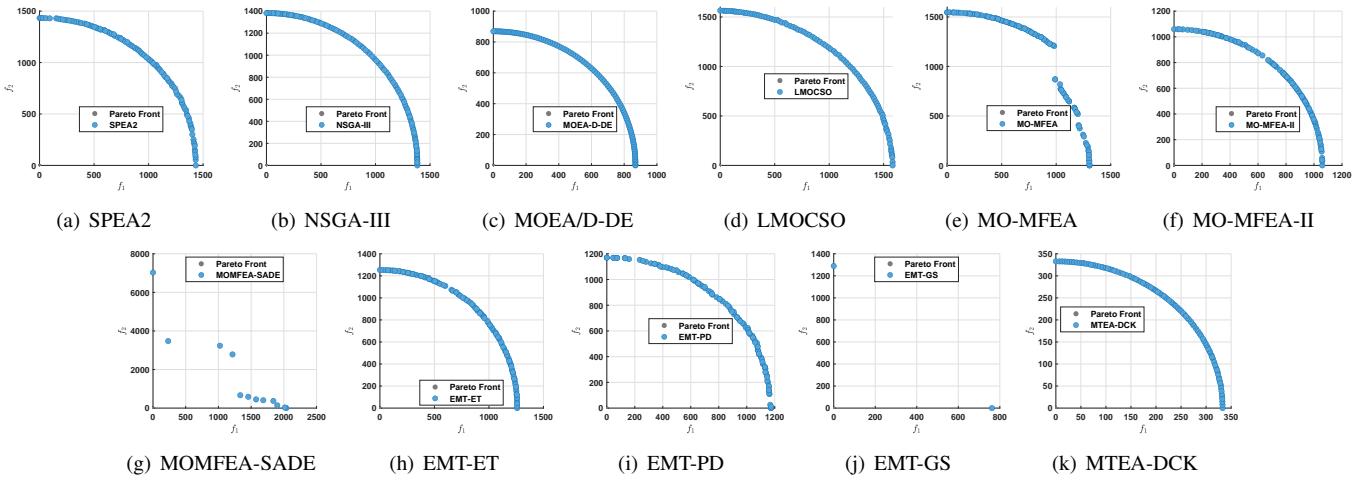


Fig. S-6. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B21-P3-T1.

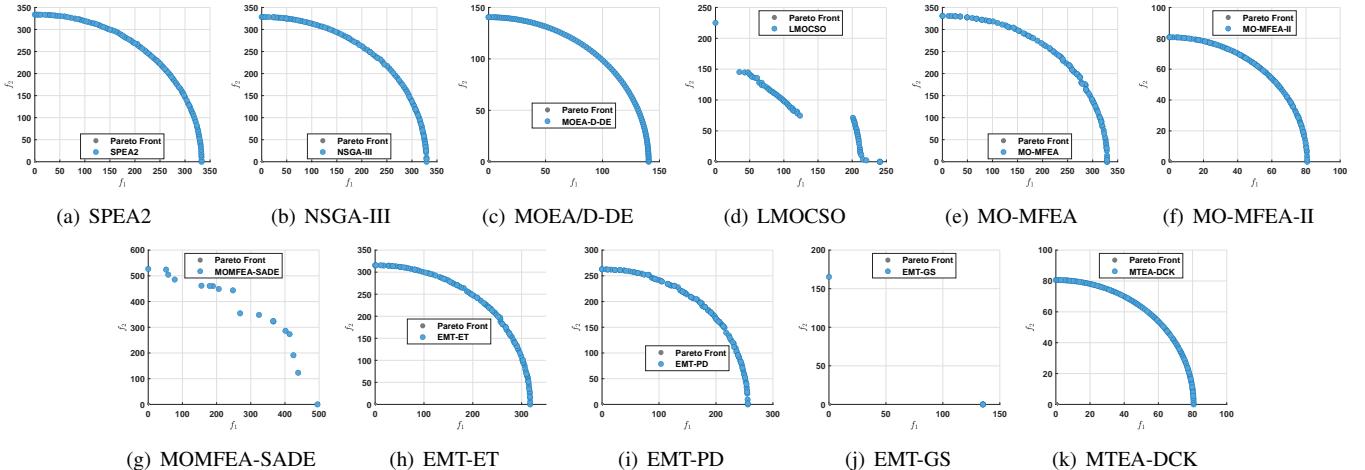


Fig. S-7. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B21-P6-T1.

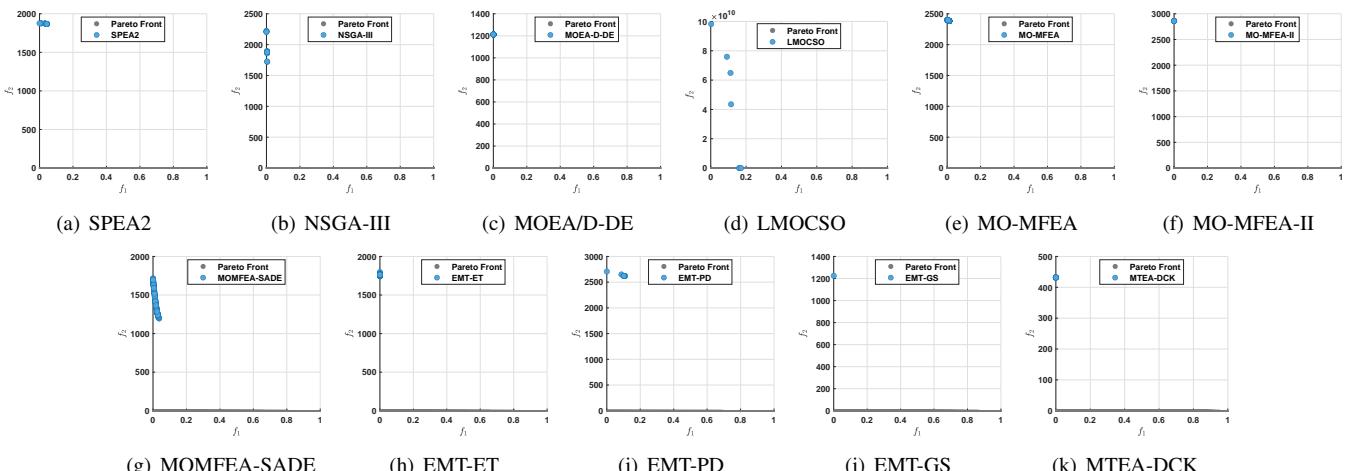


Fig. S-8. Final non-dominated solutions (the median result of 30 runs) of each algorithm on B21-P9-T2.

TABLE S-IV

AVERAGE IGD+ VALUES FOR COMPARISON ON THREE MULTIOBJECTIVE MULTITASK BENCHMARK SUITES.

	SPEA2	NSGA-III	MOEA/D-DE	LMOCSO	MO-MFEA	MO-MFEA-II	MOMFMEA-SADE	EMT-ET	EMT-PD	EMT-GS	MTEA-DCK
B17-P1-T1	1.0957e+00 (2.59e-01)	3.5732e+00 (7.42e-01)	5.5442e+00 (7.48e-00)	8.7274e-02 (2.46e-02)	2.7526e-01 (5.27e-02)	5.5982e-03 (1.31e-03)	1.4444e+00 (5.48e+00)	3.1842e-01 (7.11e-02)	1.3624e-01 (3.37e-02)	1.9735e-03 (5.31e-05)	1.0989e-03 (4.50e-05)
B17-P1-T2	6.1786e-01 (1.09e-01)	1.4925e-00 (1.76e-01)	1.1752e-00 (1.01e-01)	6.3421e-01 (1.60e-01)	5.3924e-01 (5.33e-02)	4.9185e-02 (8.23e-03)	3.8459e-01 (1.16e-01)	5.7120e-01 (7.15e-02)	3.8762e-01 (5.28e-02)	2.9936e-03 (2.04e-04)	3.4199e-03 (3.78e-04)
B17-P2-T1	6.1279e-02 (9.76e-03)	2.9446e-02 (1.31e-02)	2.0094e-01 (1.65e-01)	1.3126e-01 (1.48e-01)	8.4006e-03 (6.63e-03)	5.7786e-03 (5.31e-03)	2.9545e-03 (1.46e-04)	1.1366e-02 (1.39e-02)	7.4195e-03 (6.23e-03)	2.5700e-03 (3.37e-05)	2.4896e-03 (7.63e-05)
B17-P2-T2	7.0600e-01 (5.36e-01)	7.0222e-01 (7.49e-01)	1.9216e-03 (2.11e-05) +	2.4478e-01 (2.50e-01)	1.3330e-02 (6.73e-03)	8.5059e-02 (3.68e-01)	3.6659e-03 (1.51e-04)	1.5623e-02 (9.98e-03)	1.2014e-02 (7.63e-03)	1.9646e-04 (5.86e-05)	2.0619e-03 (8.42e-05)
B17-P3-T1	3.3187e+01 (3.69e+00)	3.7976e+01 (4.44e+00)	9.2284e+01 (3.03e+01)	3.1552e+01 (9.89e+00)	4.9846e-01 (2.99e-01)	5.2437e-01 (8.78e-04)	3.4384e-01 (2.84e-02)	7.9738e-01 (6.45e-01)	4.6517e+00 (1.14e+01)	8.7162e+00 (1.39e+01)	1.9475e-03 (5.43e-05)
B17-P3-T2	3.4101e+02 (2.20e-02)	5.9402e-02 (1.24e-01)	1.7753e-02 (7.13e-03)	6.3455e-03 (4.15e-04)	1.0724e-02 (2.53e-03)	3.8843e-02 (2.28e-04)	1.1188e-02 (4.04e-04)	1.3870e-02 (5.85e-03)	6.6918e-02 (1.88e-01)	3.0363e-03 (1.06e-04) +	3.4022e-03 (1.99e-04)
B17-P4-T1	3.8527e-01 (2.40e-01)	2.9349e-02 (2.52e-01)	1.2630e-01 (1.51e-01)	3.2386e-02 (2.52e-03)	1.2051e-01 (1.51e-01)	1.0762e-02 (2.52e-03)	5.5636e-02 (1.83e-03)	1.0762e-01 (1.51e-01)	5.5636e-01 (1.83e-03)	8.6150e-01 (1.83e-03)	3.1650e-01 (3.61e-04)
B17-P4-T2	4.1275e+01 (1.16e+01)	8.5272e+01 (2.60e+01)	2.8289e+03 (6.81e+01)	3.1316e+03 (1.52e+01)	2.7470e+03 (1.52e+01)	4.6567e+00 (6.84e+00)	5.0795e-02 (8.55e-03) +	2.7470e+01 (2.05e+01)	5.2215e+01 (2.05e+01)	7.7165e+01 (2.05e+01)	4.1049e-01 (4.06e-01)
B17-P5-T1	1.1226e+00 (2.53e-01)	1.7184e+00 (3.18e-01)	1.7277e+01 (2.48e-01)	7.1387e+01 (1.12e-01)	9.7155e+01 (1.67e-01)	1.2055e+01 (3.10e-02)	9.9499e+00 (2.37e-01)	1.2024e+01 (3.85e-02)	4.4897e+01 (5.70e-01)	8.3487e+01 (4.92e-02)	3.3161e-02 (1.24e-02) +
B17-P5-T2	1.4837e+03 (4.17e+02)	1.3663e+03 (3.64e+02)	7.8157e+02 (1.92e+02)	2.2763e+03 (7.38e+02)	1.1579e+03 (1.38e+02)	4.0888e+02 (1.29e+02)	2.5005e+02 (8.74e+01)	1.3465e-02 (1.45e-02) +	4.9993e+02 (5.84e-02)	1.0327e+02 (1.31e+02)	2.0725e+02 (8.10e+01)
B17-P6-T1	5.9458e-02 (1.38e-02)	1.1553e+01 (1.81e-02)	4.2946e-02 (4.28e-02)	2.9374e-02 (1.35e-02)	7.9349e-02 (1.35e-02)	5.5335e-03 (3.37e-03)	8.2380e-02 (2.71e-01)	8.2150e-02 (1.86e-02)	1.0884e-01 (2.31e-01)	2.7966e-03 (2.57e-03) +	5.1482e-03 (5.75e-03)
B17-P6-T2	2.0783e+01 (1.00e-01)	2.0823e+01 (1.14e-01)	1.9740e+01 (4.60e-01)	1.7968e+01 (4.68e+00)	3.4474e+00 (2.60e-01)	2.0004e+01 (1.50e-02)	2.0200e+01 (1.07e-02)	3.3129e+00 (2.19e-01)	3.5771e+00 (3.28e-01)	2.0000e+01 (5.75e-04)	9.1929e-03 (6.17e-03)
B17-P7-T1	5.4326e-02 (7.84e+02)	1.0690e+03 (7.86e+02)	3.5434e+04 (2.90e+04)	3.4127e+02 (2.16e+02)	8.8268e+01 (9.28e+00)	4.7805e+01 (4.10e+01)	4.8502e+01 (2.15e+00)	9.2748e+01 (1.15e+01)	6.8245e+01 (3.82e+00)	6.1131e+01 (2.86e+01)	4.4985e-01 (4.53e-01) +
B17-P7-T2	3.9665e-01 (9.48e-02)	1.9842e+00 (5.71e-01)	1.6128e+01 (4.03e+01)	4.3411e+02 (3.16e-02)	2.7436e+01 (6.19e-02)	8.8771e-03 (1.69e-03)	1.2043e+01 (2.59e-01)	3.4287e+01 (8.91e-02)	1.3315e+01 (2.54e-02)	3.2484e-01 (8.95e-05) +	2.8867e-03 (7.35e-05)
B17-P8-T1	1.4512e+01 (1.36e+01)	1.8769e+01 (1.55e+01)	4.7125e-00 (3.44e+00) +	2.8321e+01 (1.06e+01)	1.5576e+01 (1.13e+01)	3.8437e+01 (3.36e+01)	1.8033e+01 (3.79e+00)	1.0551e+01 (4.77e+00)	1.7436e+01 (1.59e+01)	1.3693e+01 (7.98e-01)	1.4717e+01 (1.17e+00)
B17-P8-T2	9.3387e-01 (8.01e-01)	2.1057e+00 (1.98e+00)	2.8321e+01 (1.45e-01)	3.0449e+00 (3.56e+00)	2.5000e+01 (3.90e-01)	1.0488e+00 (8.92e-01)	1.2256e+01 (1.40e-01)	1.6721e+01 (2.23e+01)	1.1423e+01 (1.30e-01)	2.6218e+02 (8.43e-02)	3.2199e-03 (9.80e-04)
B17-P9-T1	9.2499e-01 (2.75e-01)	8.3732e-01 (2.03e-01)	4.7592e-02 (1.43e-02)	8.9133e-02 (2.33e-02)	3.4358e-01 (1.74e-01)	3.6358e-02 (6.66e-03) +	2.1929e+00 (2.11e-01)	3.8401e-01 (2.92e-01)	2.8497e-01 (4.07e-01)	4.2844e-02 (1.37e-02)	2.9584e-01 (7.31e-01)
B17-P9-T2	2.0337e+01 (3.95e-02)	2.9052e+01 (3.29e-02)	1.9054e+01 (4.76e+00)	2.0435e+01 (3.37e-02)	2.0335e+01 (3.78e-03)	2.0295e+01 (2.17e-04)	2.0306e+01 (1.39e-03)	1.2406e+01 (9.15e-03)	1.2406e+01 (9.15e-03) +	2.0307e+01 (1.82e-02)	1.9721e+01 (3.72e-00)
B19-P1-T1	9.3007e-03 (1.98e-03)	2.5908e-02 (3.68e-02)	2.4984e-03 (3.39e-05) +	1.0819e-02 (8.72e-03)	1.1347e-02 (1.68e-03)	1.4701e-02 (4.79e-03)	1.4675e-01 (8.39e-02)	1.2822e-02 (2.12e-03)	1.2538e-02 (1.70e-03)	1.0291e-02 (2.02e-03)	3.5425e-03 (1.25e-04)
B19-P1-T2	1.2654e-01 (4.63e-02)	9.3295e-01 (4.99e-02)	1.1123e+01 (1.19e-02)	5.6766e-02 (1.27e-02)	5.7913e-02 (1.35e-02)	4.5278e-02 (5.67e-03)	6.9980e-02 (1.43e-02)	5.6906e-02 (9.35e-03)	5.9521e-02 (9.20e-03)	1.3623e-02 (6.48e-03) +	2.3828e-02 (6.48e-03)
B19-P2-T1	5.8868e-03 (3.38e-04)	5.9488e-03 (2.45e-03)	2.4984e-03 (3.39e-05) +	2.5763e-03 (1.72e-04)	6.4462e-03 (2.47e-04)	5.4545e-03 (2.24e-04)	6.9223e-03 (6.09e-04)	7.4883e-03 (9.32e-04)	7.5806e-03 (6.34e-04)	3.5098e-03 (1.21e-04)	2.0208e-03 (1.21e-04)
B19-P2-T2	6.2805e-02 (4.04e-02)	1.1149e-01 (1.74e-02)	2.0435e-01 (3.15e-03)	2.2409e-01 (4.85e-02)	9.7315e-02 (2.38e-02)	2.3732e-02 (1.41e-02)	2.6362e-02 (4.05e-03)	2.7977e-02 (1.71e-02)	4.2748e-02 (1.59e-02)	5.4198e-02 (2.38e-02)	1.7071e-02 (3.00e-03)
B19-P3-T1	1.4051e-05 (5.77e-03)	1.2056e-01 (5.22e-02)	1.6844e-01 (4.94e-02)	2.5436e-01 (7.53e-02)	8.8072e-02 (2.44e-02)	9.5602e-02 (3.95e-02)	3.4670e-02 (2.98e-02)	8.6262e-02 (2.05e-02)	1.2172e-01 (5.09e-02)	9.6493e-02 (15.19e-02)	5.4198e-02 (2.38e-02) +
B19-P3-T2	2.7282e-02 (4.99e-03)	6.4376e-01 (2.60e-02)	7.9049e-02 (3.88e-02)	1.0100e-01 (3.56e-02)	2.8227e-02 (3.00e-03)	4.2544e-02 (4.45e-03)	2.9565e-02 (4.58e-03)	3.9146e-02 (4.48e-03)	5.4572e-02 (6.64e-03)	1.7071e-02 (3.00e-03)	1.7071e-02 (3.00e-03) +
B19-P4-T1	4.1420e-01 (1.80e-01)	2.3367e-01 (7.27e-02)	2.1441e-01 (3.75e-02)	2.3375e-01 (3.89e-02)	2.2369e-01 (6.79e-02)	1.5202e-01 (5.88e-02) +	1.9955e-01 (1.14e-01)	2.2744e-01 (7.82e-02)	2.6405e-01 (7.78e-02)	2.8261e-01 (1.95e-01)	1.6236e-01 (9.09e-03)
B19-P4-T2	4.3035e-01 (2.14e-01)	2.3367e-01 (7.27e-02)	2.1441e-01 (3.75e-02)	2.3375e-01 (3.89e-02)	2.2369e-01 (6.79e-02)	1.5202e-01 (5.88e-02) +	1.9955e-01 (1.14e-01)	2.2744e-01 (7.82e-02)	2.6405e-01 (7.78e-02)	2.8261e-01 (1.95e-01)	1.6236e-01 (9.09e-03)
B19-P5-T1	3.2121e-02 (9.40e-03)	3.3896e-02 (1.14e-02)	3.3976e-02 (1.25e-02)	3.3976e-02 (1.25e-02)	3.0718e-02 (1.23e-02)	2.7475e-02 (7.85e-02)	1.8373e-01 (7.97e-02) +	2.1860e-01 (1.05e-01)	2.9342e-01 (8.59e-02)	3.1342e-01 (9.19e-02)	4.1261e-01 (4.26e-01)
B19-P5-T2	3.2117e-02 (2.46e-02)	7.7767e-02 (4.46e-02)	6.0479e-02 (5.99e-03)	1.9371e-01 (8.84e-02)	2.0478e-01 (7.44e-02)	5.0066e-02 (1.17e-02)	2.9556e-02 (6.35e-02)	2.6819e-02 (4.32e-02)	2.7604e-02 (1.88e-03)	1.1252e-02 (1.76e-03) +	2.3828e-01 (8.04e-03)
B19-P6-T1	1.9605e-01 (1.72e-01)	2.9298e-01 (1.67e-01)	5.0610e-01 (2.85e-01)	5.7077e-01 (7.85e-02)	3.6981e-02 (3.77e-02)	2.9634e-02 (7.74e-03)	5.0066e-02 (1.17e-02)	1.6511e-01 (7.71e-03)	2.9556e-02 (6.35e-02)	2.6819e-02 (4.32e-02)	1.1252e-02 (1.76e-03) +
B19-P6-T2	1.0737e-01 (2.54e-02)	7.7767e-02 (4.46e-02)	6.0479e-02 (5.99e-03)	1.9371e-01 (8.84e-02)	2.0478e-01 (7.44e-02)	5.0066e-02 (1.17e-02)	2.9556e-02 (6.35e-02)	2.6819e-02 (4.32e-02)	2.7604e-02 (1.88e-03)	1.0666e-02 (9.20e-02) +	2.3828e-01 (8.04e-03)
B19-P7-T1	1.2831e-01 (1.16e-01)	2.8534e-02 (3.65e-02)	1.9667e-01 (3.64e-02)	2.0474e-01 (7.44e-02)	5.0099e-02 (3.03e-02)	2.1207e-01 (4.89e-02)	1.0291e-01 (4.64e-02)	1.4735e-01 (4.25e-02)	5.0597e-02 (3.66e-02)	1.5597e-02 (4.49e-02)	1.7191e-02 (4.32e-02) +
B19-P7-T2	1.2831e-01 (1.16e-01)	2.8534e-02 (3.65e-02)	1.9667e-01 (3.64e-02)	2.0474e-01 (7.44e-02)	5.0099e-02 (3.03e-02)	2.1207e-01 (4.89e-02)	1.0291e-01 (4.64e-02)	1.4735e-01 (4.25e-02)	5.0597e-02 (3.66e-02)	1.5597e-02 (4.49e-02)	1.7191e-02 (4.32e-02) +
B19-P8-T1	3.9276e-01 (1.30e-01)	3.8666e-01 (8.18e-01)	1.7210e-01 (3.91e-01)	6.0998e-01 (1.98e-01)	6.0998e-01 (1.98e-01)	1.4671e-01 (4.78e-02)	1.2249e-05 (5.09e-04)	3.6411e-01 (8.12e-00)	3.9481e-01 (9.87e-01)	1.1513e-01 (3.86e-00) +	3.0086e-01 (8.19e-00)
B19-P8-T2	4.6800e-01 (1.26e-01)	4.7657e-01 (1.35e-01)	1.9064e-01 (4.92e-01)	8.1307e-01 (2.35e-01)	1.9973e-01 (1.31e-01)	1.9553e-01 (4.43e-00)	2.8647e-01 (1.53e-00)	4.2718e-01 (4.33e-01)	5.0226e-01 (1.37e-01)	1.7853e-01 (7.10e-00) +	2.8580e-01 (1.27e-01)
B19-P5-T1	1.5661e-02 (7.10e-01)	1.6465e-02 (5.66e-01)	8.0944e-04 (5.20e-01)	6.2503e-01 (4.88e-01) +	1.4028e-02 (5.62e-01)	1.1384e-02 (5.25e-01)	7.9678e-03 (1.04e-03)	1.7792e-02 (4.58e-01)	1.5129e-02 (5.69e-01)	8.2179e-01 (5.42e-01)	6.6565e-01 (5.10e-01)
B19-P5-T2	1.2994e-01 (5.77e-01)	1.2994e-02 (2.45e-01)	4.0404e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.2994e-02 (4.77e-01)	1.9263e-01 (3.04e-01) +
B19-P6-T1	3.0087e-02 (2.55e-01)	3.0087e-02 (2.55e-01)	1.3808e-02 (2.45e-01)	1.3808e-02 (2.45e-01)	1.3808e-02 (2.45e-01)	3.2288e-02 (3.29e-01)	3.5796e-01 (2.13e-03) +	3.5590e-02 (1.15e-01)	2.8718e-02 (3.05e-01)	2.6687e-02 (6.48e-01)	1.4996e-02 (6.02e-01)
B19-P6-T2	3.4945e-02 (4.04e-01)	1.4294e-02 (3.05e-01)	1.5002e-02 (2.11e-01)	1.5							

TABLE S-V
AVERAGE HV VALUES FOR COMPARISON ON THREE MULTI OBJECTIVE MULTITASK BENCHMARK SUITES.

	SPEA2	NSGA-III	MOEA/D-DE	LMOCO	MO-MFEA	MO-MFEA-II	MOMFEA-SADE	EMT-EI	EMT-PD	EMT-GS	MTEA-DCK
B17-P1-T1	0 (0) -	0 (0) -	1.5787e-03 (8.65e-03) -	2.4872e-01 (1.70e-02) -	7.0796e-02 (2.97e-03) -	3.4127e-01 (1.92e-03) -	7.4948e-02 (3.24e-02) -	5.1353e-02 (2.95e-02) -	1.6934e-01 (3.32e-02) -	3.4722e-01 (0.59e-05) -	3.4731e-01 (8.29e-05)
B17-P1-T2	1.2266e-02 (1.71e-02) -	0 (0) -	3.5164e-03 (8.78e-03) -	6.8999e-03 (2.19e-02) -	2.7277e-02 (1.65e-02) -	3.7787e-01 (1.08e-02) -	7.5912e-02 (2.99e-02) -	2.1394e-02 (1.83e-02) -	9.2318e-02 (2.67e-02) -	4.4385e-01 (3.39e-04) +	4.4308e-01 (6.43e-04)
B17-P2-T1	4.2385e-01 (1.39e-02) -	4.1800e-01 (1.84e-02) -	2.3255e-01 (1.17e-01) =	3.0271e-01 (1.17e-01) -	4.3522e-01 (9.67e-03) -	4.3655e-01 (8.02e-03) -	4.4402e-01 (2.43e-04) -	4.3129e-01 (1.91e-02) -	4.3692e-01 (8.95e-03) -	4.4460e-01 (1.59e-04) -	4.4474e-01 (1.24e-04)
B17-P2-T2	5.3347e-02 (9.13e-02) -	8.1991e-02 (1.04e-01) -	3.4715e-01 (3.51e-05) +	1.4860e-01 (1.13e-01) -	3.3050e-01 (9.30e-03) -	3.1359e-01 (7.43e-02) -	3.4439e-01 (2.76e-04) -	3.2759e-01 (1.37e-02) -	3.3236e-01 (1.07e-02) -	3.4723e-01 (1.16e-04) -	3.4706e-01 (1.46e-04)
B17-P3-T1	0 (0) -	0 (0) -	0 (0) -	0 (0) -	2.6829e-02 (2.74e-02) -	3.4219e-01 (1.29e-03) -	2.8097e-02 (1.06e-02) -	1.6388e-02 (2.26e-02) -	9.7838e-02 (8.11e-02) -	1.5520e-01 (1.52e-01) -	3.4726e-01 (1.01e-04)
B17-P3-T2	6.7985e-01 (2.73e-02) -	6.5512e-01 (1.13e-01) -	6.9950e-01 (8.90e-03) -	7.1400e-01 (6.05e-04) -	7.0841e-01 (3.30e-04) -	7.1845e-01 (7.33e-03) -	7.0812e-01 (5.32e-04) -	7.0455e-01 (7.33e-03) -	6.5521e-01 (1.70e-01) -	7.1975e-01 (1.67e-04) +	7.1920e-01 (3.09e-04)
B17-P4-T1	1.5847e-01 (8.65e-02) -	0 (0) -	3.1134e-02 (8.79e-02) -	1.3931e-01 (9.14e-02) -	7.0886e-01 (2.78e-03) -	0 (0) -	4.6501e-02 (8.23e-02) -	1.3487e-01 (1.09e-01) -	7.2000e-01 (1.17e-04) +	7.1950e-01 (5.65e-04)	
B17-P4-T2	0 (0) -	0 (0) -	0 (0) -	0 (0) -	2.5178e-01 (1.40e-01) +	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	2.3223e-01 (3.27e-01)
B17-P5-T1	0 (0) -	0 (0) -	5.2388e-03 (1.26e-02) -	9.9650e-04 (3.64e-03) -	0 (0) -	1.8893e-01 (3.66e-02) -	0 (0) -	1.8711e-01 (3.39e-02) -	3.9344e-03 (1.42e-02) -	2.4901e-01 (6.11e-02) -	3.1543e-01 (1.73e-02)
B17-P5-T2	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =
B17-P6-T1	2.6588e-01 (1.95e-02) -	1.9197e-01 (2.05e-02) -	2.9174e-01 (5.16e-02) -	3.1040e-01 (1.39e-02) -	2.3645e-01 (1.95e-02) -	3.4181e-01 (4.79e-03) -	0 (0) -	2.3378e-01 (2.54e-02) -	1.9850e-01 (2.81e-02) -	3.4603e-01 (3.73e-03) +	3.4267e-01 (8.17e-03)
B17-P6-T2	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) =
B17-P7-T1	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	0 (0) -	1.0481e-01 (8.90e-02) -
B17-P7-T2	2.8159e-01 (8.01e-02) -	0 (0) -	4.7963e-02 (1.05e-01) -	6.6657e-01 (3.55e-02) -	3.9745e-01 (6.30e-02) -	7.1102e-01 (2.31e-03) -	6.0729e-01 (2.44e-01) -	3.3755e-01 (8.38e-02) -	5.5523e-01 (3.12e-02) -	7.1998e-01 (1.36e-04) =	7.1996e-01 (1.11e-04)
B17-P8-T1	0 (0) =	0 (0) =	1.4787e-01 (2.59e-01) +	3.0104e-03 (1.48e-02) -	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =
B17-P8-T2	7.1102e-02 (9.99e-02) -	3.2384e-02 (8.28e-02) -	1.4818e-01 (1.51e-01) -	6.0310e-03 (3.30e-02) -	2.6798e-01 (1.44e-01) -	8.3778e-02 (1.26e-01) -	3.1013e-01 (1.50e-01) -	2.9280e-01 (1.32e-01) -	3.0191e-01 (1.27e-01) -	4.1856e-01 (8.99e-02) -	4.4342e-01 (1.64e-03)
B17-P9-T1	2.5865e-02 (6.32e-02) -	1.0113e-02 (3.31e-02) -	5.2336e-01 (2.44e-02) +	4.6050e-01 (4.25e-02) =	4.4433e-01 (9.93e-02) -	5.4305e-01 (1.15e-02) +	0 (0) -	1.9653e-01 (1.55e-01) -	7.1966e-03 (1.73e-02) -	5.3460e-01 (2.28e-02) +	3.9204e-01 (1.78e-01) -
B17-P9-T2	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	1.4800e-02 (8.11e-02)
B19-P1-T1	9.9997e-01 (3.08e-07) +	9.9987e-01 (9.72e-05) -	9.9997e-01 (2.82e-06) =	9.9968e-01 (3.30e-03) -	9.9997e-01 (5.11e-07) +	9.9941e-01 (1.50e-03) -	9.9817e-01 (3.27e-03) -	9.9997e-01 (6.32e-07) +	9.9997e-01 (4.32e-07) +	9.9997e-01 (3.85e-07) +	9.9997e-01 (5.09e-06) -
B19-P1-T2	9.9436e-01 (3.95e-03) -	9.9455e-01 (3.60e-03) -	9.9375e-01 (3.52e-03) -	9.8949e-01 (3.52e-03) -	9.9969e-01 (1.80e-04) =	9.9928e-01 (1.07e-03) -	9.9974e-01 (6.70e-04) =	9.9997e-01 (2.19e-05) +	9.9964e-01 (5.58e-04) =	9.9997e-01 (2.19e-05)	9.9952e-01 (7.01e-04) -
B19-P2-T1	8.7036e-01 (2.44e-04) -	8.6420e-01 (6.60e-03) -	8.7205e-01 (5.97e-04) +	8.7186e-01 (4.86e-04) -	8.7004e-01 (3.02e-04) -	8.6914e-01 (3.27e-04) -	8.6327e-01 (8.70e-03) -	8.6974e-01 (3.49e-04) -	8.6929e-01 (6.25e-04) -	8.7188e-01 (9.60e-05) -	8.7188e-01 (9.60e-05) -
B19-P2-T2	9.4739e-01 (2.12e-02) -	9.2388e-01 (2.94e-02) -	8.7134e-01 (6.71e-03) -	9.8873e-01 (1.23e-04) +	9.8212e-01 (2.66e-03) -	9.7097e-01 (9.22e-03) -	9.8860e-01 (2.16e-04) -	9.8844e-01 (2.16e-04) -	9.7005e-01 (7.28e-03) -	9.8750e-01 (9.75e-04) -	9.8750e-01 (9.75e-04) -
B19-P3-T1	6.3111e-01 (1.18e-01) -	6.1326e-01 (1.05e-01) -	5.4762e-01 (8.90e-02) -	7.4325e-01 (1.28e-01) -	7.4540e-01 (4.40e-02) -	6.8628e-01 (7.86e-02) -	5.2186e-01 (2.74e-02) -	7.4830e-01 (5.41e-02) +	6.8104e-01 (1.14e-01) -	6.8284e-01 (0.77e-02) -	7.4605e-01 (5.82e-02) -
B19-P3-T2	8.5783e-01 (6.19e-03) -	7.8366e-01 (6.34e-02) -	7.8366e-01 (8.73e-02) -	7.0390e-01 (7.73e-02) -	8.5753e-01 (3.75e-03) -	8.1419e-01 (5.43e-02) -	8.3460e-01 (7.26e-03) -	8.2614e-01 (4.20e-03) -	8.3737e-01 (4.57e-02) -	8.7317e-01 (5.25e-03)	8.7317e-01 (5.25e-03) -
B19-P4-T1	8.1742e-01 (1.42e-01) -	7.7154e-01 (1.45e-01) -	7.4824e-01 (7.82e-02) -	7.3811e-01 (1.15e-01) -	8.2130e-01 (1.10e-01) -	8.8104e-01 (9.85e-02) +	8.2465e-01 (1.87e-01) +	8.0166e-01 (9.05e-02) -	8.3733e-01 (1.19e-01) -	7.4207e-01 (8.20e-02) -	7.6338e-01 (3.01e-02) -
B19-P4-T2	9.4792e-01 (2.66e-02) -	9.3991e-01 (2.85e-02) -	9.3445e-01 (2.15e-02) -	9.2980e-01 (2.13e-02) -	9.5171e-01 (2.86e-02) -	9.4939e-01 (2.91e-02) -	9.5559e-01 (2.25e-02) +	9.3868e-01 (2.82e-02) -	9.3977e-01 (1.98e-02) -	9.3565e-01 (6.37e-03) -	9.3565e-01 (6.37e-03) -
B19-P5-T1	7.6994e-01 (2.18e-02) -	7.5806e-01 (4.24e-02) -	7.5208e-01 (4.72e-02) -	7.0274e-01 (4.80e-02) -	7.6925e-01 (1.99e-02) -	7.6505e-01 (6.85e-03) -	7.7250e-01 (1.93e-02) -	7.7559e-01 (1.57e-02) -	7.7870e-01 (6.67e-03) -	8.0124e-01 (5.29e-03)	8.0124e-01 (5.29e-03)
B19-P5-T2	9.8440e-01 (1.79e-02) -	9.6453e-01 (6.15e-02) -	9.7804e-01 (1.28e-02) -	7.5324e-01 (9.81e-02) -	9.3238e-01 (6.21e-02) -	9.5148e-01 (7.82e-02) -	9.9060e-01 (3.64e-04) +	8.7951e-01 (8.47e-02) -	9.3215e-01 (5.34e-02) -	9.8919e-01 (1.76e-03) -	9.9374e-01 (3.55e-03) -
B19-P6-T1	9.9344e-01 (2.75e-03) -	9.9199e-01 (2.77e-03) -	9.8850e-01 (1.27e-03) -	9.8638e-01 (1.57e-03) -	9.9432e-01 (3.33e-03) -	9.9348e-01 (3.84e-03) -	9.8290e-01 (7.74e-03) -	9.9192e-01 (2.42e-03) -	9.9305e-01 (3.86e-03) -	9.9442e-01 (4.66e-03) +	9.9442e-01 (4.66e-03) +
B19-P6-T2	9.6545e-02 (5.97e-02) -	1.7281e-01 (4.23e-02) -	1.8015e-01 (2.50e-02) -	1.6164e-01 (2.77e-02) -	2.3676e-01 (4.58e-02) -	8.2276e-01 (7.20e-02) -	8.5044e-02 (4.41e-02) -	1.0105e-01 (5.60e-02) -	1.2620e-01 (8.15e-02) -	2.1754e-01 (3.19e-02) -	2.1754e-01 (3.19e-02) -
B19-P7-T1	9.9751e-01 (3.54e-03) -	9.9971e-01 (2.48e-03) -	9.9527e-01 (2.03e-03) -	9.9338e-01 (1.77e-03) -	9.9927e-01 (1.60e-03) -	9.9853e-01 (2.25e-03) -	9.9829e-01 (2.53e-03) -	9.9970e-01 (1.84e-04) -	9.9926e-01 (1.97e-03) -	9.9830e-01 (2.32e-03) -	9.9992e-01 (7.54e-05)
B19-P7-T2	9.9556e-01 (1.63e-03) -	9.9807e-01 (1.64e-03) -	9.9641e-01 (2.25e-03) -	9.9462e-01 (1.32e-03) -	9.9909e-01 (1.23e-03) -	9.9848e-01 (2.07e-03) -	9.9917e-01 (3.86e-04) -	9.9900e-01 (1.42e-03) -	9.9900e-01 (1.42e-03) -	9.9986e-01 (1.94e-03) -	9.9972e-01 (1.49e-04) +
B19-P8-T1	9.6998e-01 (3.59e-02) -	9.5778e-01 (4.63e-02) -	9.2479e-01 (6.27e-02) -	8.6773e-01 (5.37e-02) -	9.4682e-01 (3.98e-02) -	0 (0) -	9.7347e-01 (3.01e-02) -	9.4579e-01 (5.87e-02) -	9.4579e-01 (5.87e-02) -	9.8837e-01 (2.45e-03) -	9.8984e-01 (1.97e-03)
B19-P8-T2	8.9997e-01 (7.12e-02) -	8.6171e-01 (7.88e-02) -	8.4531e-01 (6.59e-02) -	7.6211e-01 (3.60e-02) -	9.3908e-01 (3.55e-02) -	9.6029e-01 (9.76e-03) -	9.3942e-01 (4.99e-02) -	9.1853e-01 (6.76e-02) -	9.5699e-01 (1.07e-02) -	9.7699e-01 (3.40e-03)	9.7699e-01 (3.40e-03)
B19-P9-T1	9.6670e-01 (2.77e-02) -	9.9975e-01 (4.52e-02) -	9.9961e-01 (5.42e-02) -	9.9961e-01 (3.04e-04) -	9.8775e-01 (2.60e-02) -	9.9937e-01 (7.98e-04) -	9.9954e-01 (4.51e-04) -	7.60165e-01 (1.87e-01) -	9.9412e-01 (8.42e-02) -	1.0000e+00 (1.40e-05) -	9.9922e-01 (4.33e-04) -
B19-P9-T2	1.5681e-01 (5.78e-02) -	1.9329e-01 (4.36e-02) -	1.8894e-01 (2.78e-02) -	1.5002e-01 (3.33e-02) -	1.5450e-01 (4.05e-02) -	2.0228e-01 (5.38e-02) -	2.2793e-01 (8.48e-02) -	1.8606e-01 (4.82e-02) -	1.1889e-01 (5.01e-02) -	1.3139e-01 (1.67e-02) -	3.1191e-01 (6.10e-02)
B19-P10-T1	6.5888e-01 (3.62e-02) -	5.9341e-01 (3.67e-02) -	6.8738e-01 (1.57e-01) -	4.9185e-01 (1.53e-01) -	1.4114e-01 (1.90e-02) -	5.7120e-01 (5.06e-02) -	2.4357e-01 (3.14e-02) -	5.4696e-01 (1.84e-01) -	6.1941e-01 (4.42e-02) -	5.0923e-01 (1.59e-01) -	7.5292e-01 (3.84e-02)
B19-P10-T2	8.4999e-01 (7.11e-02) -	8.1525e-01 (8.58e-02) -	7.3879e-01 (5.29e-02) -	8.4702e-01 (8.75e-02) -	9.8075e-01 (9.93e-02) -	9.1205e-01 (2.90e-02) +	8.4291e-01 (6.95e-02) -	8.3212e-01 (7.12e-02) -	9.3252e-01 (2.38e-02) +	8.7552e-01 (4.27e-02)	
B21-P1-T1	0 (0) =	0 (0) =	6.7771e-02 (1.06e-01) -	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =
B21-P1-T2	9.9470e-01 (2.78e-03) +	9.9465e-01 (2.15e-03) +	9.9670e-01 (1.97e-03) +	0 (0) =	9.9472e-01 (2.86e-03) +	9.9485e-01 (4.49e-04) +	3.7691e-02 (7.51e-02) +	9.9434e-02 (2.99e-03) +	9.9474e-01 (2.25e-03) +	0 (0) =	0 (0) =
B21-P2-T1	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	0 (0) =	3.7776e-02 (2.07e-03) -	0 (0) =	0 (0) =	2.2878e-02 (6.52e-02) +	

TABLE S-VI
AVERAGE IGD+ VALUES FOR COMPARISON ON MULTIOBJECTIVE MANY-TASK BENCHMARK SUITE.

	SPEA2	NSGA-III	MOEA/D-DE	LMOCSO	MO-MFEA	MOMFEDA-SADEF	EMT-ET	EMT-PD	MO-SBO	MO-MzTDE	MTEA-DCK				
B21-MaTP1-T1	1.0466e-03 (3.07e+03)	1.8547e-03 (3.84e+03)	-	1.7722e-02 (1.17e+02)	1.1553e-00 (1.48e+00)	-	3.3683e-01 (1.13e+01)	-	2.2240e+03 (1.26e+02)	-	4.4618e+02 (1.84e+03)	-	2.9746e+02 (5.50e+01)	-	5.1572e-03 (1.96e+03)
B21-MaTP1-T2	1.7129e-03 (3.82e+03)	9.3433e-02 (2.54e+03)	1.9305e-02 (1.19e+02)	1.5374e-00 (2.41e+00)	3.2016e+00 (8.86e+00)	-	2.7720e+03 (1.71e+02)	-	3.0501e+01 (6.60e+00)	1.8596e+01 (3.70e+00)	5.2371e+02 (1.84e+03)	-	2.9911e+02 (6.46e+01)	-	5.2823e-03 (1.28e+03)
B21-MaTP1-T3	1.0491e+03 (4.04e+03)	8.4418e+02 (2.55e+03)	1.7934e+02 (1.22e+02)	1.1246e+00 (1.63e+00)	3.0849e+01 (8.84e+00)	-	2.3496e+03 (1.55e+02)	-	3.4045e+01 (1.17e+01)	1.9756e+01 (6.03e+00)	5.1875e+02 (1.84e+03)	-	3.1699e+02 (7.09e+01)	-	5.6640e-03 (1.58e+03)
B21-MaTP1-T5	1.7816e+03 (4.43e+03)	1.7101e+03 (3.48e+03)	2.1634e+02 (1.14e+02)	1.9918e+01 (1.20e+00)	3.0647e+01 (6.78e+00)	-	2.6922e+03 (1.55e+02)	-	3.3324e+01 (9.32e+00)	-	2.1100e+01 (6.07e+00)	-	5.5337e+02 (1.87e+03)	-	3.5292e+02 (9.72e+01)
B21-MaTP1-T6	1.0441e+03 (3.08e+03)	5.5166e+02 (1.85e+03)	2.0093e+02 (1.54e+02)	1.7138e+00 (2.71e+00)	3.4835e+01 (1.15e+01)	-	2.4027e+03 (1.55e+02)	-	3.1954e+01 (7.33e+00)	1.8466e+01 (4.66e+00)	5.3233e+02 (1.85e+03)	-	3.2212e+02 (5.21e+01)	-	5.5997e-03 (1.80e+03)
B21-MaTP1-T7	5.6236e+02 (2.02e+03)	3.0080e+03 (2.67e+03)	2.4835e+02 (2.11e+02)	1.1806e+00 (2.28e+00)	2.9398e+01 (8.26e+00)	-	2.3330e+03 (1.54e+02)	-	3.2224e+01 (9.79e+00)	1.6867e+01 (5.90e+00)	5.2155e+02 (1.87e+03)	-	2.5134e+02 (5.63e+01)	-	5.3080e-03 (1.62e+03)
B21-MaTP1-T8	1.7158e+03 (3.33e+03)	5.3560e+03 (4.40e+03)	1.8672e+02 (1.24e+02)	9.7268e+01 (1.28e+00)	3.2590e+01 (1.18e+01)	-	3.1128e+01 (2.11e+02)	-	3.3967e+01 (8.52e+00)	-	2.0235e+01 (4.30e+00)	-	5.3257e+02 (1.85e+03)	-	4.3109e+02 (1.03e+02)
B21-MaTP1-T9	1.3776e+03 (3.48e+03)	5.1468e+02 (1.85e+03)	2.0782e+02 (1.38e+02)	1.3988e+01 (1.58e+00)	3.2429e+01 (7.32e+00)	-	2.0209e+01 (1.36e+02)	-	3.1528e+01 (8.26e+00)	1.8020e+01 (5.47e+00)	5.1517e+02 (1.56e+03)	-	2.5247e+02 (6.28e+01)	-	6.2583e-03 (2.17e+03)
B21-MaTP1-T10	1.0386e+03 (3.08e+03)	6.4755e+02 (1.94e+03)	2.0152e+02 (0.96e+01)	1.3521e+00 (2.25e+00)	3.6264e+01 (9.93e+00)	-	2.7977e+01 (6.29e+04)	-	3.2369e+01 (8.47e+00)	1.9388e+01 (5.56e+00)	5.1190e+02 (1.85e+03)	-	2.9834e+02 (7.44e+01)	-	5.8024e-03 (2.31e+03)
B21-MaTP2-T1	1.0291e+03 (7.82e+02)	1.0759e+03 (8.62e+02)	1.1859e+03 (3.24e+02)	5.1063e+02 (4.07e+01)	4.8923e+02 (4.44e+02)	-	1.1070e+03 (1.63e+01)	-	6.1927e+02 (8.00e+01)	4.9976e+02 (9.66e+01)	3.9410e+02 (7.13e+01)	-	1.8053e+02 (4.98e+01)	-	1.8053e+02 (4.98e+01)
B21-MaTP2-T2	1.1235e+03 (1.08e+03)	1.0366e+03 (7.95e+02)	1.1475e+03 (2.82e+02)	4.8722e+02 (6.16e+01)	5.8354e+02 (4.42e+02)	-	1.0209e+03 (4.29e+01)	-	6.8000e+02 (8.15e+01)	5.8242e+02 (8.32e+01)	3.7699e+02 (1.21e+02)	-	3.6281e+02 (4.97e+01)	-	1.5230e-02 (3.16e+01)
B21-MaTP2-T3	1.2053e+03 (9.36e+02)	8.5773e+02 (4.58e+02)	1.1309e+02 (2.58e+02)	5.0000e+02 (5.45e+01)	1.2365e+03 (1.62e+01)	-	7.0472e+02 (9.21e+01)	-	6.1383e+02 (7.64e+01)	4.76639e+02 (1.33e+02)	3.9212e+02 (7.48e+01)	-	1.8518e+02 (3.32e+02)	-	1.8518e+02 (3.32e+02)
B21-MaTP2-T4	8.8670e+02 (4.65e+02)	9.7634e+02 (6.24e+02)	1.1559e+02 (2.86e+02)	4.7409e+02 (5.97e+01)	1.0850e+03 (3.64e+01)	-	6.8209e+02 (6.72e+01)	-	6.1080e+02 (8.46e+01)	4.7177e+02 (1.24e+02)	3.8448e+02 (4.88e+01)	-	1.8452e+02 (4.06e+01)	-	1.8452e+02 (4.06e+01)
B21-MaTP2-T5	1.0105e+03 (7.68e+02)	9.9427e+02 (7.43e+02)	1.2375e+02 (2.91e+02)	4.8310e+02 (4.92e+01)	8.7543e+02 (3.02e+01)	-	6.8021e+02 (8.96e+01)	-	6.0481e+02 (7.32e+01)	4.73642e+02 (1.60e+02)	3.6957e+02 (6.03e+01)	-	1.7355e+02 (4.77e+01)	-	1.7355e+02 (4.77e+01)
B21-MaTP2-T6	9.3544e+02 (6.28e+02)	9.2661e+02 (6.39e+02)	1.1834e+02 (3.13e+02)	4.7844e+02 (6.14e+01)	1.1848e+02 (4.20e+01)	-	7.0574e+02 (9.56e+01)	-	6.2851e+02 (9.26e+01)	4.73049e+02 (8.64e+01)	4.1836e+02 (6.65e+01)	-	1.9425e+02 (3.54e+01)	-	1.9425e+02 (3.54e+01)
B21-MaTP2-T7	8.4851e+02 (6.43e+02)	1.0709e+03 (8.58e+02)	1.2075e+02 (2.16e+02)	4.9565e+02 (8.91e+01)	8.3305e+02 (4.64e+02)	-	6.6932e+02 (1.02e+02)	-	6.2573e+02 (7.47e+01)	5.5439e+02 (1.45e+02)	3.8461e+02 (5.68e+01)	-	1.7829e+02 (3.38e+02)	-	1.7829e+02 (3.38e+02)
B21-MaTP2-T8	9.9957e+02 (7.25e+02)	1.0825e+03 (2.82e+02)	1.1777e+02 (2.82e+02)	4.9015e+02 (7.02e+01)	8.3471e+02 (4.74e+02)	-	6.1243e+02 (5.11e+01)	-	6.8262e+02 (8.46e+01)	4.7571e+02 (7.62e+01)	4.71248e+02 (7.94e+01)	-	4.0332e+02 (7.14e+01)	-	4.0332e+02 (7.14e+01)
B21-MaTP2-T9	9.4056e+02 (6.16e+02)	1.0888e+03 (1.09e+03)	1.2282e+02 (3.09e+02)	5.0408e+02 (8.40e+01)	8.3458e+02 (4.74e+02)	-	6.1526e+02 (4.74e+02)	-	6.6355e+02 (1.05e+02)	4.7044e+02 (7.02e+01)	5.1219e+02 (8.92e+01)	-	2.5247e+02 (6.28e+01)	-	2.5247e+02 (6.28e+01)
B21-MaTP2-T10	1.0369e+03 (7.04e+02)	1.1065e+03 (7.92e+02)	1.2588e+02 (2.98e+02)	4.9010e+02 (7.53e+01)	8.3452e+02 (4.52e+02)	-	6.1915e+02 (1.06e+02)	-	6.6900e+02 (8.30e+01)	4.7025e+02 (7.04e+01)	4.7329e+02 (1.07e+02)	-	4.3531e+02 (8.57e+01)	-	4.9145e-02 (4.02e+02)
B21-MaTP3-T1	1.1161e+00 (4.60e+01)	-	1.1860e+00 (4.57e+01)	9.8814e+01 (1.44e+01)	6.2178e+01 (6.30e+02)	-	1.1407e+00 (4.58e+01)	-	1.8161e+00 (2.88e+02)	1.0208e+00 (1.80e+02)	1.1607e+00 (4.59e+01)	-	1.0967e+00 (2.17e+02)	-	1.0967e+00 (2.17e+02)
B21-MaTP3-T2	1.1235e+03 (1.08e+03)	1.0366e+03 (7.95e+02)	1.1475e+03 (2.82e+02)	4.8722e+02 (6.16e+01)	8.3854e+02 (4.42e+02)	-	1.0209e+03 (4.29e+01)	-	6.8000e+02 (8.15e+01)	5.8242e+02 (8.32e+01)	3.7699e+02 (1.21e+02)	-	3.6281e+02 (4.97e+01)	-	1.5230e-02 (3.16e+01)
B21-MaTP3-T3	1.2053e+03 (9.36e+02)	8.5773e+02 (4.58e+02)	1.1309e+02 (2.58e+02)	5.0000e+02 (5.45e+01)	1.2365e+03 (1.62e+01)	-	7.0472e+02 (9.21e+01)	-	6.1383e+02 (7.64e+01)	4.76639e+02 (1.33e+02)	3.9212e+02 (7.48e+01)	-	1.8518e+02 (3.32e+02)	-	1.8518e+02 (3.32e+02)
B21-MaTP3-T4	8.8670e+02 (4.65e+02)	9.7634e+02 (6.24e+02)	1.1559e+02 (2.86e+02)	4.7409e+02 (5.97e+01)	1.0850e+03 (3.64e+01)	-	6.8209e+02 (6.72e+01)	-	6.1080e+02 (8.46e+01)	4.7177e+02 (1.24e+02)	3.8448e+02 (4.88e+01)	-	1.8452e+02 (4.06e+01)	-	1.8452e+02 (4.06e+01)
B21-MaTP3-T5	1.0105e+03 (7.68e+02)	9.9427e+02 (7.43e+02)	1.2375e+02 (2.93e+02)	4.8310e+02 (4.92e+01)	8.3307e+02 (4.03e+01)	-	6.8021e+02 (8.96e+01)	-	6.0481e+02 (7.32e+01)	4.73642e+02 (1.60e+02)	3.6957e+02 (6.03e+01)	-	1.7355e+02 (4.77e+01)	-	1.7355e+02 (4.77e+01)
B21-MaTP3-T6	1.1230e+03 (4.71e+02)	1.0723e+03 (2.15e+03)	1.2313e+02 (3.06e+02)	4.8063e+02 (4.20e+01)	8.3406e+02 (3.27e+02)	-	6.1097e+02 (4.00e+01)	-	6.0290e+02 (3.72e+02)	4.0295e+02 (3.53e+02)	1.02330e+02 (2.74e+02)	-	1.0178e+00 (4.55e+01)	-	1.0178e+00 (4.55e+01)
B21-MaTP3-T7	9.2970e+02 (7.65e+02)	1.0825e+03 (2.13e+02)	1.1777e+02 (2.82e+02)	4.9015e+02 (7.02e+01)	8.3417e+02 (4.74e+02)	-	6.1700e+02 (5.26e+02)	-	6.0330e+02 (2.16e+02)	4.0202e+02 (3.50e+02)	1.01790e+02 (2.16e+02)	-	1.0196e+00 (4.55e+01)	-	1.0196e+00 (4.55e+01)
B21-MaTP3-T8	1.2212e+03 (6.36e+02)	1.2739e+03 (6.32e+02)	1.2606e+02 (2.40e+02)	4.8098e+02 (4.06e+01)	8.3458e+02 (3.28e+02)	-	6.1386e+02 (4.05e+01)	-	6.0204e+02 (3.10e+02)	4.0283e+02 (3.50e+02)	1.01930e+02 (2.16e+02)	-	1.01930e+02 (4.05e+01)	-	1.01930e+02 (4.05e+01)
B21-MaTP3-T9	1.2904e+03 (7.71e+02)	1.1905e+03 (4.56e+01)	1.2088e+02 (1.09e+02)	4.8831e+01 (1.13e+01)	8.3452e+01 (3.09e+01)	-	6.1380e+02 (4.05e+01)	-	6.0208e+02 (3.08e+02)	4.0180e+02 (3.07e+02)	1.0189e+02 (2.07e+02)	-	1.0189e+02 (4.05e+01)	-	1.0189e+02 (4.05e+01)
B21-MaTP3-T10	1.2094e+03 (6.39e+02)	1.1905e+03 (1.09e+03)	1.2089e+02 (1.09e+02)	4.8831e+01 (1.09e+01)	8.3453e+01 (3.09e+01)	-	6.1380e+02 (4.06e+01)	-	6.0208e+02 (3.09e+02)	4.0180e+02 (3.09e+02)	1.0180e+02 (2.08e+02)	-	1.0180e+02 (4.05e+01)	-	1.0180e+02 (4.05e+01)
B21-MaTP4-T1	2.3806e+03 (5.67e+03)	1.3970e+03 (4.34e+03)	2.0020e+03 (5.51e+03)	2.1514e+02 (4.07e+03)	2.2718e+03 (4.04e+03)	-	1.9816e+03 (4.05e+03)	-	1.5638e+03 (4.05e+03)	1.7483e+03 (4.05e+03)	2.1486e+03 (4.05e+03)	-	2.0404e+02 (5.12e+02)	-	2.0404e+02 (5.12e+02)
B21-MaTP4-T2	2.8823e+02 (2.15e+03)	2.0769e+07 (1.13e+08)	4.1422e+02 (2.27e+08)	2.0725e+07 (1.13e+08)	7.9681e+07 (1.07e+07)	-	9.3498e+07 (1.37e+07)	-	1.2204e+08 (4.155e+08)	6.1216e+08 (7.39e+08)	1.7439e+08 (8.82e+08)	-	1.1601e+02 (1.19e+02)	-	1.1601e+02 (1.19e+02)
B21-MaTP4-T3	2.0784e+07 (1.47e+07)	2.0369e+07 (5.07e+02)	1.7040e+07 (2.53e+02)	2.0101e+07 (2.00e+01)	8.0430e+06 (4.99e+01)	-	1.9529e+07 (1.67e+01)	-	5.7882e+06 (3.28e+01)	6.6269e+06 (4.00e+01)	1.5287e+07 (4.00e+01)	-	2.0509e+09 (6.98e+08)	-	2.0509e+09 (6.98e+08)
B21-MaTP4-T4	2.0316e+03 (4.06e+03)	2.3736e+03 (4.02e+03)	2.0464e+03 (4.02e+03)	4.0646e+02 (4.27e+03)	1.7313e+03 (9.85e+02)	-	2.0367e+03 (4.04e+03)	-	1.6921e+03 (4.01e+03)	2.1737e+03 (4.02e+03)	4.8087e+02 (8.37e+03)	-	1.6546e-02 (5.75e+02)	-	1.6546e-02 (5.75e+02)
B21-MaTP4-T5	2.0429e+04 (2.02e+04)	2.1514e+02 (2.60e+04)	2.0428e+02 (2.65e+04)	2.0090e+02 (2.57e+04)	8.5134e+02 (5.40e+04)	-	1.8746e+02 (4.07e+04)	-	1.5866e+02 (4.07e+04)	1.8746e+02 (4.07e+04)	2.0275e+02 (7.00e+04)	-	1.2044e-02 (1.52e+02)	-	1.2044e-02 (1.52e+02)
B21-MaTP4-T6	1.4493e+00 (1.60e+01)	1.3591e+02 (1.29e+01)	1.3912e+02 (1.08e+01)	1.4685e+02 (2.26e+01)	1.2534e+02 (1.06e+01)	-	1.1206e+02 (6.60e+01)	-	1.6352e+02 (1.04e+01)	1.2130e+02 (1.04e+01)	2.0217e+02 (1.06e+01)	-	2.8337e+02 (9.61e+02)	-	2.8337e+02 (9.61e+02)
B21-MaTP4-T7	1.5274e+02 (1.16e+01)	1.2074e+02 (1.37e+01)	1.6224e+02 (1.30e+01)	1.4876e+02 (2.35e+01)	1.2539e+02 (1.19e+01)	-	1.4018e+02 (1.16e+								

TABLE S-VII

TABLE S-VIII
AVERAGE IGD+ VALUES FOR COMPONENT ANALYSIS.

	All-DKT	All-CKT	Invert-KT	W/O-DKT	W/O-DKT-A	W/O-DKT-R	W/O-CKT	W/O-CKT-C	W/O-CKT-S	All-DE	All-CSO	MTEA/DCK
B17-P1-T1	2.038e-03 (1.57e-04)	1.8789e-03 (4.25e-05)	1.911e-03 (3.98e-05)	1.8991e-03 (5.43e-05)	1.9216e-03 (6.70e-05)	1.9151e-03 (4.81e-05)	2.106e-03 (2.06e-04)	1.8779e-03 (5.21e-05)	1.9002e-03 (5.43e-05)	1.9693e-03 (6.31e-05)	1.8192e-00 (2.37e-00)	1.9098e-03 (4.50e-05)
B17-P1-T2	5.675e-03 (2.92e-03)	3.6367e-03 (4.28e-04)	3.7483e-03 (3.58e-04)	3.9263e-03 (6.58e-04)	3.2085e-02 (2.20e-04)	5.5352e-03 (3.56e-03)	3.8111e-03 (3.08e-04)	3.4839e-03 (3.83e-04)	3.3092e-03 (3.44e-04)	7.0818e-03 (2.66e-01)	3.4199e-03 (3.78e-04)	
B17-P2-T1	2.4942e-03 (7.75e-05)	2.4310e-03 (3.60e-05)	2.4591e-03 (9.76e-05)	2.4388e-03 (6.93e-05)	2.4415e-03 (6.65e-05)	2.4733e-03 (9.55e-05)	2.4767e-03 (4.87e-05)	2.3964e-03 (5.62e-05)	2.4648e-03 (7.65e-05)	2.4827e-03 (7.17e-05)	2.7390e-03 (1.42e-04)	2.4806e-03 (7.63e-05)
B17-P2-T2	2.6101e-03 (2.59e-03)	2.0291e-03 (5.98e-05)	2.0923e-03 (7.96e-05)	2.0151e-03 (7.91e-05)	2.0214e-03 (6.72e-05)	2.0572e-03 (7.92e-05)	2.0730e-03 (9.17e-05)	2.2167e-03 (7.21e-05)	2.0476e-03 (7.63e-05)	2.1907e-03 (1.54e-04)	2.5805e-03 (2.48e-04)	2.0619e-03 (8.42e-05)
B17-P3-T1	1.9252e-01 (6.96e+00)	1.9544e-03 (5.51e-05)	1.9875e-03 (5.17e-05)	1.9746e-03 (6.73e-05)	1.9656e-03 (5.12e-05)	1.9608e-01 (5.86e-00)	2.0764e-03 (5.49e-05)	1.9613e-03 (5.22e-05)	1.2339e-01 (4.98e+00)	8.3614e-01 (4.39e-01)	1.9475e-03 (5.43e-05)	
B17-P3-T2	4.0543e-03 (2.77e-04)	3.1911e-03 (1.46e-04)	3.6407e-03 (1.90e-04)	3.1982e-03 (1.20e-04)	3.2626e-03 (1.75e-04)	3.4818e-03 (1.66e-04)	3.8894e-03 (2.07e-04)	3.1496e-03 (1.26e-04)	3.4823e-03 (1.76e-04)	3.6686e-03 (1.96e-04)	1.1375e-03 (2.50e-03)	3.4022e-03 (1.99e-04)
B17-P4-T1	1.4667e-01 (5.86e+00)	1.5862e-01 (5.86e+00)	1.5262e-01 (1.60e+00)	1.2023e-00 (1.83e-00)	1.1940e-01 (2.01e+00)	9.8603e-00 (9.89e+00)	5.7102e-01 (7.57e-01)	1.7151e-01 (5.36e-00)	4.9887e-01 (5.46e-00)	4.1309e-00 (6.8e-00)	6.9138e-00 (2.63e+00)	1.5863e-01 (3.45e-01)
B17-P4-T2	4.5311e-01 (2.16e-02)	3.7911e-02 (1.53e-02)	3.8592e-02 (1.54e-02)	4.5366e-02 (2.08e-02)	3.3203e-02 (1.24e-02)	3.2901e-02 (1.35e-02)	3.4488e-02 (1.13e-02)	3.5101e-02 (1.25e-02)	6.6014e-02 (1.91e-02)	1.7282e-00 (2.20e-00)	3.3161e-02 (1.29e-02)	
B17-P5-T1	4.7396e-03 (5.27e-03)	7.5289e-03 (7.78e-03)	4.9467e-03 (4.96e-03)	5.7091e-03 (5.82e-03)	9.5477e-03 (7.85e-03)	7.9790e-03 (8.08e-03)	2.0756e-03 (8.08e-03)	5.7626e-03 (5.71e-03)	7.0097e-03 (6.92e-03)	5.5450e-03 (5.72e-03)	1.0244e-00 (1.56e-01)	5.1482e-03 (5.75e-03)
B17-P6-T1	3.0266e-03 (1.50e-04)	2.0699e-03 (8.18e-01)	9.0833e-03 (5.19e-03)	3.0916e-03 (1.67e+00)	8.009e-01 (5.71e-01)	2.9017e-03 (1.16e-04)	2.9653e-03 (1.50e-04)	2.4118e-03 (8.18e-01)	2.9258e-03 (8.40e-05)	2.0020e-01 (1.64e-02)	1.3848e-01 (6.02e-01)	4.4905e-01 (4.53e-01)
B17-P7-T1	1.9133e-02 (1.36e-02)	4.0550e-01 (6.14e-01)	4.5171e-01 (5.57e-01)	4.4732e-01 (1.12e-00)	4.5147e-01 (6.31e-02)	4.4926e-01 (5.28e-01)	4.5192e-01 (7.89e-01)	4.5012e-01 (6.13e-01)	4.5122e-01 (5.04e-01)	4.9679e-01 (4.77e+00)	2.3195e-01 (4.75e-02)	4.4905e-01 (4.53e-01)
B17-P8-T1	1.4497e-01 (1.16e-01)	1.4837e-01 (1.46e-01)	1.4778e-01 (1.20e-01)	1.4853e-01 (1.39e-01)	1.4849e-01 (2.01e-00)	1.4685e-01 (8.06e-01)	1.4783e-01 (2.04e-00)	1.4783e-01 (1.24e-00)	1.4783e-01 (1.24e-00)	1.4783e-01 (1.24e-00)	1.4783e-01 (1.24e-00)	1.4783e-01 (1.24e-00)
B17-P9-T1	1.5581e-01 (2.50e-01)	2.4525e-02 (1.36e-02)	6.0711e-02 (3.47e-02)	7.3633e-02 (4.66e-02)	5.8131e-02 (3.34e-02)	1.0001e-01 (5.75e-02)	4.9840e-02 (1.07e-02)	6.3160e-02 (4.76e-02)	9.1151e-02 (6.06e-02)	1.2791e-01 (3.61e-02)	5.4180e-02 (2.89e-02)	
B17-P9-T2	1.4199e-01 (2.38e-01)	6.2627e-02 (2.34e-02)	5.1874e-02 (1.24e-02)	4.5151e-02 (6.76e-03)	1.2742e-01 (2.39e-01)	3.3360e-01 (6.19e-01)	1.1507e-01 (5.18e-00)	1.7956e-01 (5.18e-00)	2.5184e-01 (3.72e-01)	1.9861e-01 (2.94e-03)	1.6986e-01 (1.76e-01)	2.9584e-01 (7.31e-01)
B17-P10-T1	3.1618e-01 (0.97e-00)	1.7576e-01 (3.21e+00)	1.5154de-01 (8.38e-00)	2.0387e-01 (4.99e-02)	1.5968e-01 (5.46e-00)	1.9097e-01 (5.18e-00)	1.9730e-01 (5.18e-00)	1.8381e-01 (6.18e-00)	2.0383e-01 (2.10e-02)	1.3150e-01 (1.57e-00)	1.9712e-01 (3.72e-00)	
B19-P1-T1	3.5872e-03 (1.63e-04)	3.5890e-03 (1.61e-04)	3.6047e-03 (1.53e-04)	3.5096e-03 (1.48e-04)	3.5783e-03 (1.31e-04)	3.5064e-03 (1.52e-04)	3.5260e-03 (1.48e-04)	3.5780e-03 (1.21e-04)	3.5984e-03 (1.22e-04)	3.5611e-03 (1.35e-04)	3.6833e-03 (1.72e-04)	3.5125e-03 (1.25e-04)
B19-P1-T2	7.4420e-02 (2.05e-02)	1.5052e-02 (5.46e-03)	1.8376e-02 (7.02e-03)	1.4720e-02 (7.10e-03)	1.4425e-02 (7.26e-03)	1.8333e-02 (6.40e-03)	8.6595e-02 (6.39e-03)	1.6152e-02 (7.26e-03)	1.3177e-02 (5.85e-03)	6.0090e-02 (2.42e-02)	1.3022e-02 (6.48e-03)	
B19-P2-T1	3.6193e-02 (1.38e-02)	3.5564e-03 (1.53e-04)	3.5748e-03 (1.67e-04)	3.5814e-03 (1.27e-04)	3.5369e-03 (1.22e-04)	3.5236e-03 (1.42e-04)	3.4563e-03 (1.23e-04)	3.5236e-03 (1.33e-04)	3.4584e-03 (1.33e-04)	3.5550e-03 (1.75e-04)	3.5000e-03 (1.21e-04)	
B19-P2-T2	4.5518e-03 (1.45e-04)	3.6343e-03 (2.87e-04)	3.9159e-03 (5.09e-04)	3.5524e-03 (2.02e-04)	3.6264e-03 (3.12e-04)	3.6849e-03 (2.67e-04)	5.2831e-03 (1.26e-04)	3.6153e-03 (1.65e-04)	3.6818e-03 (1.28e-04)	1.3269e-02 (6.68e-03)	3.5784e-03 (1.94e-04)	
B19-P3-T1	1.2044e-01 (5.92e-01)	5.7258e-02 (3.36e-02)	6.0713e-02 (3.47e-02)	5.2022e-02 (3.36e-02)	7.3633e-02 (4.66e-02)	5.6969e-02 (3.36e-02)	5.8131e-02 (3.42e-02)	1.0001e-01 (5.75e-02)	4.9840e-02 (1.07e-02)	6.3160e-02 (4.76e-02)	9.1151e-02 (6.06e-02)	1.2791e-01 (3.61e-02)
B19-P3-T2	2.4268e-02 (7.75e-03)	1.8928e-02 (8.17e-03)	2.5296e-02 (6.57e-03)	2.0607e-02 (6.23e-03)	2.2053e-02 (9.62e-03)	1.7772e-02 (4.47e-03)	1.9131e-02 (5.81e-03)	2.0131e-02 (4.03e-03)	1.8505e-02 (4.93e-03)	4.4554e-02 (6.44e-03)	2.2344e-02 (4.24e-02)	1.7071e-02 (3.74e-03)
B19-P4-T1	2.7801e-01 (9.42e-03)	2.4017e-01 (1.59e-03)	1.6303e-01 (8.89e-03)	1.6539e-01 (1.40e-03)	1.6904e-01 (1.40e-03)	1.6490e-01 (1.00e-03)	1.6265e-01 (1.06e-03)	1.7717e-01 (1.41e-02)	1.5786e-01 (1.06e-02)	1.8763e-01 (8.12e-03)	1.9716e-01 (9.06e-03)	1.6123e-01 (9.06e-03)
B19-P4-T2	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	1.7814e-02 (5.85e-02)	
B19-P5-T1	6.7305e-02 (7.75e-03)	6.0484e-02 (8.45e-03)	6.0485e-02 (8.78e-03)	5.9364e-02 (8.28e-03)	6.1655e-02 (3.06e-03)	6.2455e-02 (7.13e-03)	6.2777e-02 (7.37e-03)	5.8585e-02 (8.17e-03)	5.7624e-02 (4.36e-03)	6.0718e-02 (4.87e-03)	2.5351e-01 (1.36e-02)	6.0327e-02 (7.01e-03)
B19-P5-T2	8.1404e-01 (5.59e-02)	6.4360e-01 (5.08e-02)	8.0934e-01 (5.57e-02)	6.7800e-01 (5.23e-02)	8.0477e-01 (5.23e-02)	7.2070e-01 (4.99e-02)	7.9852e-01 (6.13e-02)	8.2701e-01 (5.14e-02)	7.5227e-01 (7.51e-02)	7.3795e-01 (3.93e-02)	1.2434e-01 (5.52e-02)	7.1794e-02 (4.23e-02)
B19-P6-T1	2.4828e-02 (8.38e-03)	3.6730e-02 (3.30e-03)	2.0441e-02 (3.40e-03)	1.9567e-02 (3.37e-03)	1.9177e-02 (2.60e-03)	1.7639e-02 (3.24e-03)	3.0286e-02 (1.01e-02)	1.8695e-02 (3.74e-03)	1.8762e-02 (3.56e-03)	1.7765e-02 (3.06e-03)	1.6103e-01 (4.35e-02)	1.7399e-02 (3.74e-03)
B19-P6-T2	3.6732e-02 (6.57e-02)	1.8349e-02 (3.02e-02)	2.0046e-02 (2.83e-02)	2.0116e-02 (3.02e-02)	1.8557e-02 (2.92e-02)	1.8557e-02 (2.92e-02)	1.8383e-02 (2.92e-02)	1.8383e-02 (2.92e-02)	1.8383e-02 (2.92e-02)	1.8383e-02 (2.92e-02)	1.8383e-02 (2.92e-02)	
B19-P7-T1	1.0404e-01 (5.76e-02)	1.2576e-01 (2.72e-02)	1.3126e-01 (3.52e-02)	1.0981e-01 (2.84e-02)	1.0859e-01 (2.35e-02)	1.2576e-01 (2.72e-02)	1.0859e-01 (2.35e-02)	1.0859e-01 (2.35e-02)	1.0859e-01 (2.35e-02)	1.0859e-01 (2.35e-02)	1.1796e-01 (2.76e-02)	
B19-P7-T2	2.7817e-04 (2.00e+04)	2.0784e-04 (1.05e-04)	2.3427e-04 (1.07e-04)	2.0784e-04 (1.05e-04)	2.0784e-04 (1.04e-04)	2.0784e-04 (1.04e-04)	2.0784e-04 (1.04e-04)	2.0784e-04 (1.04e-04)	2.0784e-04 (1.04e-04)	2.0784e-04 (1.04e-04)	2.1145e-04 (1.05e-04)	2.1145e-04 (1.05e-04)
B19-P8-T1	2.3069e-01 (1.55e-01)	1.9722e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	2.3070e-01 (1.55e-01)	
B19-P8-T2	1.0 (0) =	1.5862e-01 (2.18e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	1.7950e-01 (2.07e-01)	
B19-P9-T1	1.7976e-01 (2.31e-04)	1.7976e-01 (1.51e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)	1.7976e-01 (1.60e-04)
B19-P9-T2	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	9.9795e-02 (3.39e-04)	
B19-P10-T1	4.4280e-02 (3.47e-04)	4.2810e-02 (1.60e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	3.9047e-02 (1.76e-04)	
B19-P10-T2	8.6763e-01 (6.84e-02)	9.0471e-01 (8.52e-02)	8.0944e-01 (8.40e-02)	9.0957e-01 (3.27e-03)	8.6364e-01 (2.14e-03)	7.5797e-01 (2.30e-01)	3.2013e-02 (1.07e-02)	3.2013e-02 (1.07e-02)	3.2013e-02 (1.07e-02)	3.2013e-02 (1.07e-02)	3.2013e-02 (1.07e-02)	
B19-P11-T1	4.9427e-01 (4.47e-02)	4.3736e-01 (7.17e-02)	4.2109e-01 (7.25e-02)	4.2109e-01 (7.25e-02)	4.2109e-01 (7.25e-02)	4.2109e-01 (7.25e-02)	3.9112e-02 (6.26e-02)	3.9112e-02 (6.26e-02)	3.9112e-02 (6.26e-02)	3.9112e-02 (6.26e-02)	3.9112e-02 (6.26e-02)	
B19-P11-T2	1.4132e-01 (3.76e-03)	1.5227e-01 (3.85e-03)	1.5227e-01 (3.85e-03)	1.5227e-01 (3.85e-03)	1.5227e-01 (3.85e-03)	1.5227e-01						

TABLE S-X
AVERAGE IGD+ VALUES FOR PARAMETER τ ANALYSIS.

	$\tau = 0.01$	$\tau = 0.05$	$\tau = 0.1$	$\tau = 0.2$	$\tau = 0.4$
B21-P1-T1	2.6096e+04 (2.31e+04)	2.0213e+04 (1.19e+04)	1.8734e+04 (9.16e+03)	2.7548e+04 (2.17e+04)	2.9602e+04 (1.52e+04)
B21-P1-T2	1.9653e+04 (1.29e+04)	1.8224e+04 (1.13e+04)	1.8239e+04 (1.12e+04)	2.6200e+04 (1.84e+04)	2.1787e+04 (1.03e+04)
B21-P2-T1	2.2048e+01 (5.92e+00)	2.0421e+01 (4.91e+00)	2.2009e+01 (4.32e+00)	2.2292e+01 (5.27e+00)	2.2974e+01 (4.50e+00)
B21-P2-T2	2.1851e+01 (5.47e+00)	2.0679e+01 (4.81e+00)	2.1048e+01 (5.59e+00)	2.1609e+01 (5.18e+00)	2.1837e+01 (4.97e+00)
B21-P3-T1	4.0179e+02 (2.41e+02)	3.4238e+02 (2.33e+02)	4.2255e+02 (3.00e+02)	4.2224e+02 (2.45e+02)	2.7543e+02 (2.15e+02)
B21-P3-T2	5.4041e+02 (3.38e+02)	5.9911e+02 (2.90e+02)	4.9551e+02 (2.90e+02)	5.7720e+02 (2.71e+02)	4.4487e+02 (2.49e+02)
B21-P4-T1	2.2922e+01 (8.70e+00)	2.0294e+01 (6.18e+00)	2.4902e+01 (9.89e+00)	1.9855e+01 (6.25e+00)	2.1022e+01 (7.21e+00)
B21-P4-T2	2.8303e+01 (1.18e+01)	2.9923e+01 (1.34e+01)	2.6212e+01 (7.74e+00)	2.8818e+01 (1.34e+01)	2.6398e+01 (1.01e+01)
B21-P5-T1	5.8430e+01 (4.19e+01)	7.4721e+01 (5.26e+01)	6.6672e+01 (5.20e+01)	9.2314e+01 (4.44e+01)	6.9129e+01 (4.39e+01)
B21-P5-T2	2.4989e+01 (3.25e+01)	3.0766e+01 (3.86e+01)	2.9447e+01 (3.77e+01)	3.5169e+01 (3.84e+01)	4.5323e+01 (4.93e+01)
B21-P6-T1	8.2278e+01 (1.48e+01)	8.3929e+01 (1.76e+01)	8.1238e+01 (1.73e+01)	8.4894e+01 (1.59e+01)	8.2640e+01 (1.54e+01)
B21-P6-T2	9.1940e+01 (2.17e+01)	9.6702e+01 (2.20e+01)	8.6048e+01 (1.71e+01)	8.9467e+01 (1.89e+01)	8.7740e+01 (1.97e+01)
B21-P7-T1	2.5475e+01 (9.77e+00)	2.6894e+01 (9.91e+00)	2.5939e+01 (8.52e+00)	2.7024e+01 (9.84e+00)	3.3018e+01 (1.01e+01)
B21-P7-T2	4.4415e+01 (1.21e+01)	4.3895e+01 (9.29e+00)	4.3121e+01 (1.44e+01)	4.3564e+01 (1.07e+01)	4.3101e+01 (1.09e+01)
B21-P8-T1	1.4688e+03 (1.28e+03)	2.3321e+03 (3.59e+03)	1.6824e+03 (1.82e+03)	1.3433e+03 (1.18e+03)	1.1318e+03 (1.07e+03)
B21-P8-T2	6.7127e+02 (3.05e+02)	6.3399e+02 (1.93e+02)	5.8157e+02 (1.96e+02)	5.4308e+02 (1.43e+02)	5.1682e+02 (1.91e+02)
B21-P9-T1	6.3322e+03 (7.01e+02)	6.2150e+03 (9.63e+02)	5.9638e+03 (8.56e+02)	6.0858e+03 (7.77e+02)	6.1765e+03 (9.24e+02)
B21-P9-T2	6.6221e+02 (5.71e+02)	5.9508e+02 (3.72e+02)	9.2389e+02 (1.45e+03)	6.7580e+02 (7.23e+02)	6.9848e+02 (5.18e+02)
B21-P10-T1	2.4052e+01 (7.50e+00)	2.3477e+01 (6.58e+00)	2.5660e+01 (6.41e+00)	2.4917e+01 (3.85e+00)	2.1480e+01 (5.48e+00)
B21-P10-T2	8.5905e+04 (5.72e+04)	9.7089e+04 (5.87e+04)	9.2442e+04 (5.15e+04)	9.7192e+04 (5.55e+04)	1.4019e+05 (9.29e+04)
Ranking (p)	3.000 (0.317)	3.050 (0.271)	2.500	3.500 (0.045)	2.950 (0.368)

TABLE S-XI
AVERAGE HV VALUES FOR PARAMETER τ ANALYSIS.

	$\tau = 0.01$	$\tau = 0.05$	$\tau = 0.1$	$\tau = 0.2$	$\tau = 0.4$
B21-P1-T1	2.0511e-03 (7.81e-03)	1.3436e-02 (6.46e-02)	2.8127e-03 (1.51e-02)	9.2748e-04 (5.08e-03)	1.7940e-04 (9.83e-04)
B21-P1-T2	0 (0)	3.1036e-03 (1.70e-02)	2.8311e-03 (1.55e-02)	0 (0)	0 (0)
B21-P2-T1	4.0415e-02 (7.85e-02)	4.0656e-02 (6.38e-02)	1.8720e-02 (3.98e-02)	3.5151e-02 (7.63e-02)	1.0532e-02 (1.93e-02)
B21-P2-T2	8.9519e-03 (1.95e-02)	9.5867e-03 (2.45e-02)	2.7241e-02 (7.21e-02)	1.9951e-02 (7.05e-02)	8.9241e-03 (2.65e-02)
B21-P3-T1	6.7841e-03 (2.87e-02)	1.5391e-02 (5.94e-02)	1.8872e-02 (8.16e-02)	1.0868e-02 (4.21e-02)	2.2107e-02 (5.40e-02)
B21-P3-T2	1.2045e-02 (4.76e-02)	0 (0)	0 (0)	0 (0)	5.9116e-03 (3.24e-02)
B21-P4-T1	1.1527e-02 (5.17e-02)	8.6841e-04 (3.51e-03)	1.7375e-03 (6.66e-03)	1.1215e-02 (3.76e-02)	1.6366e-03 (5.90e-03)
B21-P4-T2	1.1717e-03 (4.75e-03)	1.2082e-02 (4.78e-02)	4.9127e-03 (2.69e-02)	6.7042e-03 (3.58e-02)	4.7648e-03 (1.38e-02)
B21-P5-T1	3.7520e-02 (9.51e-02)	3.9161e-02 (9.34e-02)	3.6749e-02 (9.07e-02)	1.4716e-02 (5.47e-02)	1.6734e-02 (6.83e-02)
B21-P5-T2	3.3374e-02 (1.03e-01)	5.4861e-02 (1.05e-01)	4.3569e-02 (9.52e-02)	3.2093e-02 (8.75e-02)	5.9559e-02 (1.43e-01)
B21-P6-T1	2.6943e-02 (7.29e-02)	2.2652e-02 (4.70e-02)	3.7415e-02 (7.86e-02)	2.0997e-02 (4.89e-02)	1.8360e-02 (4.10e-02)
B21-P6-T2	1.6005e-02 (3.53e-02)	1.9628e-03 (8.47e-03)	3.2161e-02 (8.90e-02)	1.3334e-02 (5.85e-02)	1.7147e-02 (5.06e-02)
B21-P7-T1	2.2983e-03 (1.26e-02)	1.1575e-02 (6.34e-02)	0 (0)	0 (0)	0 (0)
B21-P7-T2	6.0321e-03 (3.30e-02)	0 (0)	9.9385e-03 (3.93e-02)	1.9581e-03 (1.07e-02)	7.0169e-03 (2.43e-02)
B21-P8-T1	1.3330e-03 (4.55e-03)	2.1689e-03 (5.93e-03)	6.4790e-03 (1.55e-02)	3.0053e-03 (1.04e-02)	2.1719e-02 (6.64e-02)
B21-P8-T2	3.0303e-03 (1.66e-02)	0 (0)	1.0812e-03 (5.92e-03)	0 (0)	1.7193e-03 (7.62e-03)
B21-P9-T1	1.5776e-03 (8.64e-03)	1.0851e-04 (3.33e-04)	1.0197e-03 (4.39e-03)	4.9041e-04 (2.69e-03)	1.1578e-02 (6.34e-02)
B21-P9-T2	0 (0)	0 (0)	0 (0)	4.2669e-03 (1.77e-02)	0 (0)
B21-P10-T1	2.5581e-02 (6.18e-02)	2.2203e-02 (7.08e-02)	6.5175e-03 (3.27e-02)	0 (0)	2.5070e-02 (7.49e-02)
B21-P10-T2	0 (0)	9.3200e-04 (5.10e-03)	0 (0)	5.0353e-03 (2.76e-02)	0 (0)
Ranking (p)	2.875 (0.689)	2.900 (0.652)	2.675	3.475 (0.109)	3.075 (0.423)

TABLE S-XII
AVERAGE IGD+ VALUES FOR PARAMETER α_0^C ANALYSIS.

	$\alpha_0^C = 0.1$	$\alpha_0^C = 0.2$	$\alpha_0^C = 0.3$	$\alpha_0^C = 0.4$	$\alpha_0^C = 0.5$
B21-P1-T1	2.1709e+04 (1.51e+04)	2.1075e+04 (1.23e+04)	2.2862e+04 (1.37e+04)	3.0695e+04 (2.62e+04)	2.2372e+04 (1.42e+04)
B21-P1-T2	2.4242e+04 (1.33e+04)	2.5307e+04 (1.80e+04)	1.9286e+04 (9.32e+03)	2.0923e+04 (1.01e+04)	2.0281e+04 (1.20e+04)
B21-P2-T1	2.2341e+01 (1.15e+01)	2.1657e+01 (5.14e+00)	2.1117e+01 (5.28e+00)	2.3752e+01 (1.13e+01)	2.7618e+01 (1.89e+01)
B21-P2-T2	2.1771e+01 (5.08e+00)	2.1988e+01 (4.84e+00)	2.0422e+01 (4.52e+00)	2.0904e+01 (5.28e+00)	2.4115e+01 (1.58e+01)
B21-P3-T1	4.1636e+02 (2.50e+02)	3.7932e+02 (2.88e+02)	3.7309e+02 (2.55e+02)	2.8409e+02 (1.73e+02)	3.2443e+02 (2.00e+02)
B21-P3-T2	5.1615e+02 (3.25e+02)	5.9003e+02 (3.36e+02)	4.0038e+02 (3.03e+02)	4.0888e+02 (2.42e+02)	4.2025e+02 (2.98e+02)
B21-P4-T1	2.1447e+01 (6.35e+00)	1.9521e+01 (7.64e+00)	2.3459e+01 (8.65e+00)	2.1981e+01 (8.55e+00)	2.3035e+01 (5.25e+00)
B21-P4-T2	2.9021e+01 (1.09e+01)	2.5038e+01 (6.87e+00)	2.6756e+01 (1.04e+01)	2.7576e+01 (8.75e+00)	2.7641e+01 (7.00e+00)
B21-P5-T1	7.1494e+01 (5.53e+01)	8.6465e+01 (4.19e+01)	6.5818e+01 (5.94e+01)	7.6472e+01 (5.36e+01)	7.4687e+01 (5.85e+01)
B21-P6-T1	8.4725e+01 (2.18e+01)	8.5333e+01 (1.48e+01)	8.2767e+01 (1.55e+01)	8.3132e+01 (1.46e+01)	8.6552e+01 (1.23e+01)
B21-P6-T2	8.8304e+01 (1.35e+01)	9.2552e+01 (1.62e+01)	9.6001e+01 (2.19e+01)	9.2723e+01 (1.84e+01)	9.1869e+01 (1.46e+01)
B21-P7-T1	2.5886e+01 (8.87e+00)	2.8278e+01 (1.02e+01)	2.7683e+01 (1.16e+01)	2.4443e+01 (7.48e+00)	2.8268e+01 (9.19e+00)
B21-P7-T2	4.0136e+01 (1.19e+01)	4.2004e+01 (1.47e+01)	4.6899e+01 (1.33e+01)	4.5497e+01 (1.28e+01)	4.4822e+01 (1.02e+01)
B21-P8-T1	1.5640e+03 (1.80e+03)	1.8456e+03 (2.03e+03)	1.5486e+03 (1.38e+03)	1.9506e+03 (2.23e+03)	9.5740e+02 (8.16e+02)
B21-P8-T2	5.6770e+02 (1.67e+02)	6.2279e+02 (2.46e+02)	7.7976e+02 (5.30e+02)	5.8489e+02 (1.83e+02)	6.7751e+02 (3.19e+02)
B21-P9-T1	6.1373e+03 (7.64e+02)	6.0987e+03 (8.91e+02)	6.2055e+03 (8.36e+02)	6.2676e+03 (1.03e+03)	6.0076e+03 (1.07e+03)
B21-P9-T2	5.6821e+02 (3.22e+02)	7.2823e+02 (8.84e+02)	6.2028e+02 (6.76e+02)	5.5506e+02 (3.42e+02)	7.4262e+02 (7.30e+02)
B21-P10-T1	2.2934e+01 (6.34e+00)	2.5167e+01 (9.10e+00)	2.8600e+01 (7.49e+00)	2.3254e+01 (5.92e+00)	2.4369e+01 (6.50e+00)
B21-P10-T2	9.9238e+04 (4.92e+04)	8.7731e+04 (3.68e+04)	9.5927e+04 (5.19e+04)	1.0060e+05 (6.12e+04)	1.0387e+05 (5.77e+04)
Ranking (p)	2.600	3.150 (0.271)	2.950 (0.483)	3.050 (0.368)	3.250 (0.193)

TABLE S-XIII
AVERAGE HV VALUES FOR THE INITIAL VALUE OF PARAMETER α_0^c ANALYSIS.

	$\alpha_0^c = 0.1$	$\alpha_0^c = 0.2$	$\alpha_0^c = 0.3$	$\alpha_0^c = 0.4$	$\alpha_0^c = 0.5$
B21-P1-T1	8.1435e-03 (2.69e-02)	1.5935e-03 (6.78e-03)	9.8558e-03 (3.90e-02)	4.5583e-03 (2.50e-02)	3.0849e-02 (1.07e-01)
B21-P1-T2	3.0534e-03 (1.67e-02)	2.2328e-03 (1.22e-02)	0 (0)	0 (0)	0 (0)
B21-P2-T1	3.4287e-02 (5.84e-02)	3.2583e-02 (6.13e-02)	5.1677e-02 (9.80e-02)	2.8450e-02 (5.86e-02)	3.8569e-02 (7.56e-02)
B21-P2-T2	1.1044e-02 (2.86e-02)	9.3142e-03 (3.12e-02)	1.8003e-02 (5.42e-02)	2.9337e-02 (9.55e-02)	3.2340e-02 (5.80e-02)
B21-P3-T1	8.9245e-03 (4.89e-02)	2.5578e-02 (7.15e-02)	9.1872e-03 (3.96e-02)	1.2119e-02 (5.78e-02)	1.1669e-02 (6.35e-02)
B21-P3-T2	1.0405e-02 (4.23e-02)	0 (0)	9.2093e-04 (5.04e-03)	8.9138e-05 (4.88e-04)	1.2584e-03 (6.89e-03)
B21-P4-T1	9.0826e-03 (4.97e-02)	1.1552e-02 (3.51e-02)	4.6519e-03 (1.58e-02)	8.5845e-04 (4.28e-03)	0 (0)
B21-P4-T2	0 (0)	3.8333e-03 (2.03e-02)	1.4889e-04 (8.15e-04)	9.0905e-03 (4.98e-02)	2.8837e-03 (1.58e-02)
B21-P5-T1	4.0264e-02 (1.04e-01)	9.8233e-03 (4.64e-02)	7.1707e-02 (1.25e-01)	2.5269e-02 (7.96e-02)	3.7558e-02 (9.17e-02)
B21-P5-T2	1.0258e-02 (4.41e-02)	3.4121e-02 (9.61e-02)	4.3057e-02 (1.18e-01)	3.5422e-02 (8.65e-02)	2.3022e-02 (8.28e-02)
B21-P6-T1	4.6265e-02 (8.99e-02)	2.6738e-02 (7.76e-02)	4.0479e-02 (7.57e-02)	2.8637e-02 (6.65e-02)	1.2502e-02 (2.88e-02)
B21-P6-T2	8.6012e-04 (2.14e-03)	1.3159e-02 (5.61e-02)	1.3158e-02 (6.34e-02)	5.3177e-03 (2.13e-02)	2.0302e-03 (9.98e-03)
B21-P7-T1	3.0947e-02 (9.59e-02)	1.8534e-02 (5.44e-02)	7.1896e-03 (2.64e-02)	2.6298e-02 (7.23e-02)	1.4329e-03 (7.43e-03)
B21-P7-T2	0 (0)	1.4070e-02 (5.37e-02)	0 (0)	0 (0)	0 (0)
B21-P8-T1	2.6739e-02 (6.32e-02)	1.9720e-02 (6.64e-02)	3.0240e-02 (6.82e-02)	1.0073e-02 (3.09e-02)	2.6726e-02 (6.20e-02)
B21-P8-T2	3.1469e-03 (1.72e-02)	0 (0)	0 (0)	0 (0)	0 (0)
B21-P9-T1	3.3329e-03 (5.14e-02)	4.7508e-02 (8.04e-02)	3.8099e-02 (7.23e-02)	4.6042e-02 (7.46e-02)	6.8142e-02 (1.08e-01)
B21-P9-T2	0 (0)	3.0332e-03 (1.66e-02)	6.4909e-04 (3.56e-03)	0 (0)	0 (0)
B21-P10-T1	9.2251e-02 (1.66e-01)	9.2372e-02 (1.55e-01)	1.5270e-02 (4.29e-02)	6.5851e-02 (9.37e-02)	5.5314e-02 (9.79e-02)
B21-P10-T2	0 (0)	0 (0)	0 (0)	3.0321e-03 (1.66e-02)	0 (0)
Ranking (p)	2.950 (0.802)	2.850 (0.960)	2.825	3.150 (0.515)	3.225 (0.423)

TABLE S-XIV
AVERAGE HV VALUES FOR COMPARISON ON OPTIMAL POWER FLOW PROBLEMS.

SPEA2	LMOCSO	CMOCSO	CCMO	MO-MFEA	MO-MFEA-II	EMT-ET	EMT-PD	MTEA-DCK
OPF-P1-T1	1.0306e-01 (1.47e-04) -	0 (0) -	1.0310e-01 (1.50e-04) -	1.0325e-01 (8.23e-05) -	1.0334e-01 (4.80e-05) -	1.0342e-01 (2.03e-04) =	1.0330e-01 (5.41e-05) -	L0345e-01 (6.76e-05)
OPF-P1-T2	5.2423e-02 (2.23e-03) -	0 (0) -	5.2698e-02 (1.02e-03) -	4.9162e-02 (1.04e-02) -	5.3002e-02 (2.05e-04) -	5.2965e-02 (3.15e-04) -	5.2852e-02 (3.86e-04) -	5.3241e-02 (7.88e-05)
OPF-P2-T1	6.7595e-02 (8.87e-04) -	4.3929e-03 (7.32e-03) -	6.7200e-02 (5.07e-04) -	6.7931e-02 (5.67e-04) -	6.7677e-02 (7.99e-04)	6.8620e-02 (4.00e-04) -	6.7370e-02 (7.37e-04) -	6.7405e-02 (9.71e-04) -
OPF-P2-T2	1.4443e-02 (1.98e-03) -	1.6639e-02 (1.25e-03) -	1.3543e-02 (2.87e-03) -	1.7821e-02 (1.39e-03) +	1.8816e-02 (1.39e-03) +	1.7816e-02 (1.27e-03) +	1.7587e-02 (1.57e-03) +	1.6712e-02 (1.06e-03)
OPF-P3-T1	1.0158e-01 (1.39e-03) -	4.3471e-02 (8.67e-03) -	1.0132e-01 (1.44e-03) -	1.0242e-01 (1.56e-03) -	1.0194e-01 (1.29e-03) -	1.0223e-01 (1.28e-03) -	1.0064e-01 (1.53e-03) -	1.0106e-01 (1.50e-03) -
OPF-P3-T2	9.3137e-02 (4.38e-03) -	9.1341e-03 (1.10e-02) -	4.0097e-02 (2.61e-03) -	3.3631e-02 (6.73e-03) -	4.1057e-02 (2.16e-03) -	4.0488e-02 (4.24e-03) -	4.1524e-02 (2.00e-03) -	4.4776e-02 (1.11e-03)
OPF-P4-T1	6.3851e-02 (1.47e-03) -	2.7531e-02 (5.81e-03) -	6.3958e-02 (1.17e-03) -	6.4200e-02 (1.11e-03) -	6.0089e-02 (2.33e-03) -	6.3806e-02 (1.33e-03) -	6.0956e-02 (1.83e-03) -	6.1653e-02 (2.33e-03) -
OPF-P4-T2	2.7564e-02 (3.15e-03) -	3.5298e-03 (6.15e-03) -	3.0141e-02 (1.28e-03) -	2.7743e-02 (3.62e-03) -	3.2666e-02 (1.58e-03) -	3.3216e-02 (2.16e-03) =	3.1526e-02 (2.51e-03) -	3.2156e-02 (1.84e-03) -
+/-=	0/8/0	0/8/0	0/7/1	0/8/0	1/6/1	1/5/2	1/7/0	1/7/0
Ranking (p)	6.500 (0.000)	9.000 (0.000)	6.000 (0.001)	5.500 (0.004)	3.625 (0.144)	2.625 (0.465)	4.937 (0.015)	5.187 (0.009)
								Base

TABLE S-XV
AVERAGE HV VALUES FOR COMPARISON ON SYNCHRONOUS OPTIMAL PULSE-WIDTH MODULATION PROBLEMS.

SPEA2	LMOCSO	CMOCSO	CCMO	MO-MFEA	MO-MFEA-II	EMT-ET	EMT-PD	MTEA-DCK
SOPM-P1-T1	2.3306e-01 (1.95e-01) =	0 (0) -	6.0617e-02 (8.93e-02) -	1.0179e-01 (1.42e-01) -	2.5149e-01 (1.88e-01) =	1.7911e-01 (1.44e-01) =	1.7987e-02 (9.85e-02) -	2.3249e-01 (1.97e-01) =
SOPM-P1-T2	1.2595e-01 (2.16e-01) -	0 (0) -	4.5025e-02 (1.25e-01) -	5.2553e-02 (1.11e-01) -	2.9464e-01 (2.91e-01) -	1.5423e-01 (2.37e-01) -	1.7840e-02 (9.77e-01) -	5.8679e-01 (5.56e-02)
SOPM-P1-T3	4.4711e-01 (3.34e-01) =	0 (0) -	9.6634e-02 (2.26e-01) -	1.4414e-01 (2.71e-01) -	4.9415e-01 (3.40e-01) =	5.3189e-01 (3.11e-01) =	2.7035e-02 (1.25e-01) -	6.3044e-01 (5.02e-02)
SOPM-P2-T1	1.1833e-01 (2.32e-01) -	0 (0) -	8.3003e-02 (1.67e-01) -	1.4001e-01 (2.37e-01) -	1.9949e-01 (2.72e-01) -	2.5932e-01 (2.90e-01) =	0 (0) -	4.6618e-01 (1.16e-01)
SOPM-P2-T2	6.9835e-02 (1.59e-01) -	0 (0) -	4.5394e-02 (1.20e-01) -	3.2070e-02 (9.29e-02) -	1.4028e-01 (2.38e-01) -	1.3339e-01 (2.02e-01) -	0 (0) -	3.7078e-01 (6.28e-02)
SOPM-P2-T3	1.6535e-01 (2.27e-01) -	0 (0) -	2.5403e-02 (8.53e-02) -	5.5510e-02 (1.49e-01) -	1.5886e-01 (2.23e-01) -	2.0825e-01 (2.31e-01) -	0 (0) -	4.3680e-01 (8.40e-03)
+/-=	0/4/2	0/6/0	0/6/0	0/6/0	0/4/2	0/3/3	0/6/0	0/4/2
Ranking (p)	4.333 (0.073)	8.750 (0.000)	6.833 (0.000)	6.000 (0.004)	3.000 (0.342)	3.166 (0.291)	8.250 (0.000)	3.166 (0.291)
								Base

TABLE S-XVI
AVERAGE HV VALUES FOR COMPARISON ON SENSOR COVERAGE PROBLEMS.

SPEA2	NSGA-III	MOEA-D-DE	LMOCSO	MO-MFEA	EMT-PD	MO-SBO	MO-MaTDE	MTEA-DCK
MOSCP-5T-T1	2.2172e-01 (6.67e-03) -	2.1673e-01 (7.65e-03) -	1.9058e-01 (8.47e-03) -	1.8884e-01 (6.80e-03) -	2.3967e-01 (3.37e-03) -	2.4179e-01 (7.37e-03) =	2.2397e-01 (5.53e-03) -	2.0789e-01 (6.80e-03) -
MOSCP-5T-T2	2.2689e-01 (5.80e-03) -	2.2272e-01 (6.10e-03) -	1.9467e-01 (8.09e-03) -	1.9521e-01 (8.71e-03) -	2.4730e-01 (3.11e-03) -	2.5077e-01 (5.90e-03) =	2.2957e-01 (6.32e-03) -	2.1394e-01 (7.32e-03) -
MOSCP-5T-T3	2.3465e-01 (6.15e-03) -	2.2491e-01 (6.61e-03) -	2.0017e-01 (7.31e-03) -	2.0205e-01 (6.88e-03) -	2.5423e-01 (2.81e-03) -	2.5645e-01 (6.88e-03) =	2.3437e-01 (6.70e-03) -	2.1876e-01 (6.34e-03) -
MOSCP-5T-T4	2.3277e-01 (6.32e-03) -	2.2924e-01 (7.83e-03) -	1.9924e-01 (8.25e-03) -	1.9971e-01 (8.77e-03) -	2.5459e-01 (2.69e-03) -	2.5597e-01 (6.87e-03) -	2.3601e-01 (5.09e-03) -	2.1658e-01 (6.92e-03) -
MOSCP-5T-T5	2.3242e-01 (7.02e-03) -	2.2439e-01 (6.38e-03) -	1.9821e-01 (8.13e-03) -	2.0308e-01 (9.65e-03) -	2.5145e-01 (2.52e-03) -	2.5249e-01 (5.32e-03) -	2.3402e-01 (5.84e-03) -	2.1581e-01 (6.35e-03) -
MOSCP-10T-T1	2.0806e-01 (7.26e-03) -	2.0420e-01 (6.31e-03) -	1.7760e-01 (8.46e-03) -	1.7441e-01 (8.12e-03) -	2.2401e-01 (2.92e-03) -	2.2469e-01 (6.20e-03) -	2.1007e-01 (4.48e-03) -	1.9455e-01 (8.31e-03) -
MOSCP-10T-T2	2.0663e-01 (5.48e-03) -	2.0242e-01 (7.00e-03) -	1.7933e-01 (6.21e-03) -	1.7663e-01 (8.79e-03) -	2.2561e-01 (2.65e-03) -	2.2568e-01 (6.17e-03) -	2.0790e-01 (4.28e-03) -	1.9252e-01 (6.13e-03) -
MOSCP-10T-T3	2.1190e-01 (5.42e-03) -	2.0856e-01 (5.90e-03) -	1.8126e-01 (8.80e-03) -	1.8477e-01 (7.37e-03) -	2.3207e-01 (2.62e-03) -	2.3266e-01 (5.65e-03) -	2.1281e-01 (4.99e-03) -	1.9797e-01 (8.12e-03) -
MOSCP-10T-T4	2.1673e-01 (7.17e-03) -	2.1484e-01 (7.78e-03) -	1.8817e-01 (8.22e-03) -	1.8559e-01 (7.94e-03) -	2.3844e-01 (2.10e-03) -	2.3853e-01 (4.73e-03) -	2.1981e-01 (5.01e-03) -	2.0439e-01 (7.12e-03) -
MOSCP-10T-T5	2.2173e-01 (6.20e-03) -	2.1786e-01 (7.95e-03) -	1.9018e-01 (7.61e-03) -	1.9232e-01 (6.59e-03) -	2.4327e-01 (2.43e-03) -	2.4247e-01 (5.67e-03) -	2.2461e-01 (5.80e-03) -	2.0722e-01 (6.57e-03) -
MOSCP-10T-T6	2.1827e-01 (7.30e-03) -	2.1557e-01 (6.70e-03) -	1.8833e-01 (5.92e-03) -	1.9148e-01 (7.94e-03) -	2.4087e-01 (2.20e-03) -	2.3917e-01 (4.70e-03) -	2.2261e-01 (4.65e-03) -	2.0570e-01 (5.91e-03) -
MOSCP-10T-T7	2.2587e-01 (5.06e-03) -	2.2049e-01 (7.81e-03) -	1.9582e-01 (6.70e-03) -	1.9808e-01 (7.85e-03) -	2.4752e-01 (2.28e-03) -	2.4586e-01 (4.61e-03) -	2.2891e-01 (5.57e-03) -	2.0935e-01 (6.07e-03) -
MOSCP-10T-T8	2.2439e-01 (6.47e-03) -	2.1955e-01 (5.12e-03) -	1.9286e-01 (7.71e-03) -	1.9771e-01 (9.06e-03) -	2.4643e-01 (1.90e-03) -	2.4393e-01 (4.48e-03) -	2.2919e-01 (4.41e-03) -	2.0890e-01 (6.28e-03) -
MOSCP-10T-T9	2.1226e-01 (6.06e-03) -	2.0424e-01 (6.97e-03) -	1.7975e-01 (5.60e-03) -	1.8549e-01 (6.74e-03) -	2.2810e-01 (1.52e-03) -	2.2646e-01 (3.16e-03) -	2.1340e-01 (4.45e-03) -	1.9523e-01 (5.91e-03) -
MOSCP-10T-T10	2.1001e-01 (4.77e-03) -	2.0521e-01 (4.99e-03) -	1.7991e-01 (5.50e-03) -	1.8441e-01 (6.94e-03) -	2.2533e-01 (1.45e-03) -	2.2344e-01 (3.27e-03) -	2.1101e-01 (3.93e-03) -	1.9576e-01 (6.65e-03) -
+/-=	0/15/0	0/						