

# Supplementary Files for “Multitask Evolution Strategy with Knowledge-Guided External Sampling”

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## S-I. MOTIVATION SUPPLEMENT

### Algorithm S-1: CMA-ES-KT

```

1 Initialize the distribution of each task
2 while termination condition not met do
3   foreach task  $k = 1$  to  $K$  do
4     foreach sample number  $i = 1$  to  $\lambda$  do
5       if transfer rate is satisfied then
6         Randomly select a task  $s$  ( $s \neq k$ ) as source task
7         Sample solution via distribution of task  $s$ 
8       else
9         Sample solution via distribution of task  $k$ 
10      end
11    end
12    Update distribution parameters
13  end
14 end

```

TABLE S-I  
AVERAGE OBJECTIVE VALUE OF CMA-ES WITH CMA-ES-KT.

Problem	CMA-ES		CMA-ES-KT	
	T1	T2	T1	T2
CEC17-MTP1	<b>0.00e+00 =</b>	1.86e+01 -	<b>0.00e+00</b>	<b>0.00e+00</b>
CEC17-MTP2	<b>2.08e-10 +</b>	3.07e+01 -	3.74e-10	<b>0.00e+00</b>
CEC17-MTP3	2.12e+01 -	<b>1.04e+04 +</b>	<b>2.00e+01</b>	1.18e+04
CEC17-MTP4	<b>1.99e+01 +</b>	<b>6.15e-19 +</b>	2.25e+01	1.08e-15
CEC17-MTP5	<b>2.20e-10 +</b>	<b>4.93e+01 +</b>	6.13e-09	7.26e+01
CEC17-MTP6	<b>2.00e-10 +</b>	<b>-1.99e-18 +</b>	1.65e-09	9.01e-08
CEC17-MTP7	4.65e+01 -	1.82e+01 -	<b>4.22e+01</b>	<b>6.66e-16</b>
CEC17-MTP8	<b>0.00e+00 +</b>	<b>1.86e-05 +</b>	3.31e-14	4.34e-04
CEC17-MTP9	<b>1.78e+01 +</b>	<b>1.07e+04 +</b>	2.18e+01	1.68e+04
+ / - / =	12 / 5 / 1		Base	

## S-II. EXPERIMENTAL SETTINGS

The real objective value in WCCI20-MTSO is replaced with the error value type so that the optimal objective value of all problems becomes 0. The results of MTOP and CMTOP are the objective function values and the results of MaTOP are the multitask scores [19].

To ensure a fair comparison, we have made the following settings. The maximum function evaluations  $E_{max}$  are the same for all algorithms on a specific problem, refer to Table S-II. For the fixed population/sample size algorithm, the population/sample size was set as  $N = 100$  for each task for obtaining global optimization performance. For dynamic population/sample size algorithms (NL-SHADE-RSP, VMCH, MFMP), the settings based on the problem dimension recommended in their original article were used. For the algorithm-dependent parameters, the comparison algorithms were run using the general settings recommended in their original article. The ES parameters and variables in CMA-ES and MTES-KG were set as in Table S-III. The parameters of KGxS in MTES-KG were set as  $\tau = 2$ ,  $\alpha = 1/2$ , and  $G = 50$ .

## S-III. REAL-WORLD PROBLEMS AND SETTINGS

### A. MTO Case - Parameter Extraction of Photovoltaic Models (PEPVM)

PEPVM is essential for photovoltaic systems and requires multiple photovoltaic models for validation [22]. Li *et al.* [23] modeled the PEPVM as an MTO problem, executing multiple photovoltaic models simultaneously. For three photovoltaic

TABLE S-II  
COMPARISON ALGORITHMS AND BENCHMARK PROBLEM SUITES.

Algorithms	Description	Optimization type
GA	Genetic algorithm with SBX crossover and polynomial mutation	Unconstrained single-task
DE	Differential evolution algorithm with DE/rand/1/bin operator	Unconstrained single-task
NL-SHADE-RSP [1]	Champion of CEC 2021 numerical optimization competition via improved DE	Unconstrained single-task
CMA-ES [2]	ES with derandomized covariance matrix adaptation	Unconstrained/Constrained single-task
xNES [3]	ES with adaptive natural gradients to update distribution	Unconstrained single-task
OpenAI-ES [4]	Parallelized ES with standard normal distribution gradients	Unconstrained single-task
CORCO [5]	Utilizing the correlation between constraints and objective function	Constrained single-task
DeCODE [6]	Decomposition-based multiobjective approach for constrained optimization	Constrained single-task
VMCH [7]	Voting-mechanism-based ensemble of constraint handling techniques	Constrained single-task
MFEA [8]	Multifactorial evolution-based GA for multitask optimization	Unconstrained/Constrained multitask
MFEA-II [9]	MFEA with online transfer parameter estimation	Unconstrained/Constrained multitask
MFEA-AKT [10]	MFEA with adaptive knowledge transfer via multiple crossover operator	Unconstrained multitask
AT-MFEA [11]	Multifactorial GA with affine transformation-enhanced domain adaptation	Unconstrained/Constrained multitask
MTEA-AD [12]	Multitask GA with adaptive knowledge transfer via anomaly detection	Unconstrained/Constrained multitask
MFMP [13]	Multi-population-based adaptive DE for multitask optimization	Unconstrained/Constrained multitask
MTES [14]	Multitask OpenAI-ES via gradient-free evolution multitasking	Unconstrained multitask
MaTDE [15]	Many-task DE with adaptive archive-based knowledge transfer	Unconstrained many-task
EMaTO-MKT [16]	Multi-source knowledge transfer via local distribution estimation	Unconstrained many-task
BoKT-DE [17]	Bi-objective knowledge transfer framework for many-task optimization	Unconstrained many-task
SBCMAES [18]	Many-task CMA-ES with the framework of symbiosis in biocoenosis	Unconstrained many-task
Benchmark suites	Description	Optimization type
CEC17-MTSO [19]	9 cases of 2-task optimization problems, $N = 100$ , $E_{\max} = 100,000$	Unconstrained multitask
WCCI20-MTSO [20]	10 cases of complex 2-task optimization problems, $N = 100$ , $E_{\max} = 200,000$	Unconstrained multitask
WCCI20-MaTSO [20]	10 cases of $K$ -task optimization problems, $N = 100$ , $K = 10$ , $E_{\max} = 50,000 \cdot K$	Unconstrained many-task
CMT-Benchmark [21]	9 cases of 2-task constrained optimization problems, $N = 100$ , $E_{\max} = 100,000$	Constrained multitask

TABLE S-III  
ES PARAMETERS AND VARIABLES IN CMA-ES AND MTES-KG.

Parameter/Variable	Meaning
$\lambda = N$	Sample number
$\mu = \lfloor \frac{\lambda}{2} \rfloor$	Elite sample number
$\omega_i = \frac{\ln(\mu + \frac{1}{2}) + \ln i}{\mu \ln(\mu + \frac{1}{2}) - \sum_{j=1}^{\mu} \ln j}$	Recommendation weights
$\mu_{\text{eff}} = \frac{1}{\sum_{j=1}^{\mu} \frac{\omega_j^2}{4 + \frac{\mu_{\text{eff}}}{n}}}$	Variance effective selection mass
$c_c = \frac{1}{4 + n + 2 \frac{\mu_{\text{eff}}}{n}}$	Learning rate for cumulation rank-one update
$c_1 = \frac{1}{(n + 1.3)^2 + \mu_{\text{eff}}}$	Learning rate for rank-one update
$c_{\mu} = \min(1 - c_1, 2 \frac{\mu_{\text{eff}} - 2 + \frac{1}{\mu_{\text{eff}}}}{(n + 2)^2 + \mu_{\text{eff}}})$	Learning rate for rank- $\mu$ update
$c_{\sigma} = \frac{\mu_{\text{eff}} + 2}{n + \mu_{\text{eff}} + 5}$	Learning rate for cumulation step-size control
$d_{\sigma} = 1 + c_{\sigma} + 2 \max(\sqrt{\frac{\mu_{\text{eff}} - 1}{n + 1}}, 0)$	Damping parameter for step-size update
$\mathbf{m}^{(0)} = \text{rand}([0, 1], n) \cdot (\mathbf{U} - \mathbf{L})$	Expectation of the distribution
$\mathbf{C}^{(0)} = \mathbf{I}$	Covariance of the distribution
$\sigma^{(0)} = 0.3(\mathbf{U} - \mathbf{L})$	Step-size
$\mathbf{p}_c^{(0)} = \mathbf{0}$	Evolution path
$\mathbf{p}_{\sigma}^{(0)} = \mathbf{0}$	Conjugate evolution path

models, the single-diode model (SDM), the double-diode model (DDM), and the photovoltaic-model-based SDM (SMM), their objective function can be expressed as

- SDM:

$$f(I_{ph}, I_o, R_s, R_{sh}, a) = I_{ph} - I_o \left[ \exp\left(\frac{V + IR_s}{aV_t}\right) - 1 \right] - \frac{V + IR_s}{R_{sh}} - I. \quad (1)$$

- DDM:

$$f(I_{ph}, I_{o1}, I_{o2}, R_s, R_{sh}, a_1, a_2) = I_{ph} - I_{o1} \left[ \exp\left(\frac{V + IR_s}{a_1 V_t}\right) - 1 \right] - I_{o2} \left[ \exp\left(\frac{V + IR_s}{a_2 V_t}\right) - 1 \right] - \frac{V + IR_s}{R_{sh}} - I. \quad (2)$$

- SMM:

$$f(I_{ph}, I_o, R_s, R_{sh}, a) = I_{ph} - I_o \left[ \exp\left(\frac{V + IR_s N_s}{a N_s V_t}\right) - 1 \right] - \frac{V + IR_s N_s}{R_{sh} N_s} - I. \quad (3)$$

These three different models can be combined into a 3-task optimization problem.

The number of dimensions is 5, 7, and 5 for SDM, DDM, and SMM. The population/sample size is set to  $N = 100$  for each task. The number of function evaluations is set to  $E_{\max} = 150,000$  for this 3-task PEPVM problem.

### B. MaTO Case - Planar Kinematic Arm Control Problem (PKACP)

A PKACP [17], [24] contains a kinematic arm with several links and joints and aims to optimize the angle of each joint to minimize the distance from the tip of the arm to the target position. Different target positions constitute different optimization tasks, and a large number of tasks constitute the MaTO problem. The objective function of a PKACP can be expressed as

$$f(a_1, a_2, \dots, a_n, [L, a_{\max}]) = \|P_D - T\|, \quad (4)$$

where  $n$  denotes the number of dimensions,  $L$  is the total length of the links,  $P_D$  is the position of the tip of the arm,  $T$  is the target position, and  $a_{\max}$  is the sum of the maximum angles of all joints. Different combinations of  $L$  and  $a_{\max}$  constitute different tasks.

The number of dimensions is 20 for each task of PKACP. The population/sample size is set to  $N = 40$  for each task. The number of tasks  $K$  is set to 20, 50, 100, 200, and 500 for five problem cases. The number of function evaluations is set to  $E_{\max} = 8,000 \cdot K$  for each problem.

### C. CMTO Case - Optimal Power Flow (OPF)

OPF is an important tool for power systems [25], [26]. It normally contains five optimization objectives including fuel cost, voltage stability, emission, real active power loss, and voltage deviation. The objective functions can be described as

- Fuel cost:

$$f(\mathbf{x}) = \sum_{i=1}^{ng} a_i + b_i P_{G_i} + c_i P_{G_i}^2, \quad (5)$$

- Voltage stability:

$$f(\mathbf{x}) = \max(L_j), L_j = \left\| 1 - \sum_{i=1}^{ng} F_{ij} \frac{V_i}{V_j} \right\|, j = 1, \dots, nl. \quad (6)$$

- Emission:

$$f(\mathbf{x}) = \sum_{i=1}^{ng} \alpha_i + \beta_i P_{G_i} + \gamma_i P_{G_i}^2 + \varrho e^{(\phi_i P_{G_i})}. \quad (7)$$

- Real active power loss:

$$f(\mathbf{x}) = \sum_{i=1}^{nn} \sum_{j \neq i}^{nn} G_{ij} (V_i^2 + V_j^2 - 2V_i V_j \cos(\delta_i - \delta_j)). \quad (8)$$

- Voltage deviation:

$$f(\mathbf{x}) = \sum_{i=1}^{nl} \|V_{L_i} - 1.0\|. \quad (9)$$

In these objective functions,  $\mathbf{x} = (P_{G_2}, \dots, P_{G_{ng}}, V_{G_1}, \dots, V_{G_{ng}}, Q_{C_1}, \dots, Q_{C_{nc}}, T_1, \dots, T_{nt})$ . In addition, OPF also includes constraints on the security of the network operation. The constraints can be described as

$$\begin{aligned}
 P_{G_i}^{\min} &\leq P_{G_i} \leq P_{G_i}^{\max}, i = 1, \dots, ng, \\
 Q_{G_i}^{\min} &\leq Q_{G_i} \leq Q_{G_i}^{\max}, i = 1, \dots, ng, \\
 V_{G_i}^{\min} &\leq V_{G_i} \leq V_{G_i}^{\max}, i = 1, \dots, ng, \\
 Q_{C_i}^{\min} &\leq V_{C_i} \leq V_{C_i}^{\max}, i = 1, \dots, nc, \\
 T_i^{\min} &\leq T_i \leq T_i^{\max}, i = 1, \dots, nt, \\
 V_{L_i}^{\min} &\leq V_{L_i} \leq V_{L_i}^{\max}, i = 1, \dots, nl, \\
 S_{l_i}^{\min} &\leq V_{l_i} \leq V_{l_i}^{\max}, i = 1, \dots, nn.
 \end{aligned} \tag{10}$$

Different bus systems constitute different OPF problems according to the above objective functions and constraints. Here we employ two different bus systems, IEEE-30 and IEEE-57, to form 2-task constrained multitask optimization problems. 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 five problems are constructed.

Based on two bus systems with five different optimization objectives, five 2-task OPF problems are constituted. The number of dimensions is 24 for task 1 and 33 for task 2 in each OPF problem. The population/sample size is set to  $N = 100$  for each task. The number of function evaluations is set to  $E_{\max} = 200,000$  for each problem.

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#### S-IV. DETAILED RESULTS

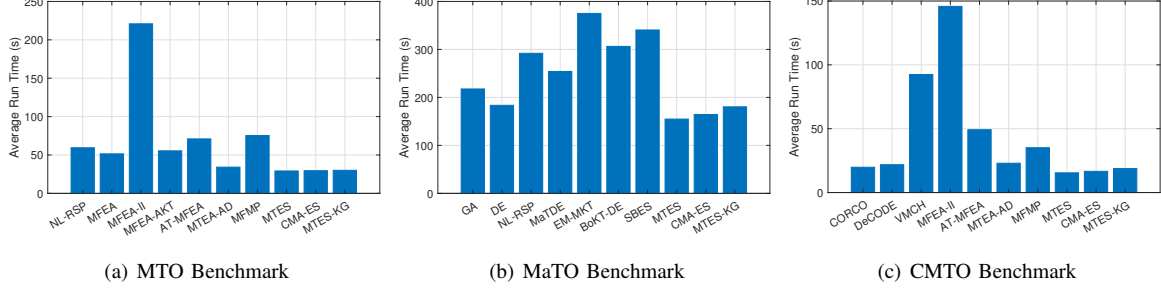


Fig. S-1. Average run-time (s) of each algorithm on all problems for three benchmark suites. NL-RSP stands for NL-SHADE-RSP, EM-MKT stands for EMaTO-MKT, and SBES stands for SBCMAES.

TABLE S-IV  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF COMPARISON IN MULTITASK OPTIMIZATION ENVIRONMENTS.

	NL-SHADE-RSP	CMA-ES	MFEA	MFEA-II	MFEA-AKT	AT-MFEA	MTEA-AD	MFMP	MTEs	MTEs-KG
CECI7-MTP1-T1	3.9562e-02 (2.20e-02) -	8.4445e-01 (5.51e-02) -	2.6392e-01 (6.29e-02) -	5.5232e-01 (5.96e-02) -	4.2471e-02 (1.07e-02) -	9.3438e-01 (5.03e-02) -	9.7626e-15 (3.09e-14) -	5.5333e-04 (1.87e-03) -	0.0000e+00 (0.00e+00) -	0.0000e+00 (0.00e+00) -
CECI7-MTP1-T2	3.1293e+02 (5.74e+01) -	2.8119e+02 (5.09e+01) -	3.2086e+02 (3.04e+01) -	2.6593e+02 (5.87e+01) -	4.4445e+01 (2.34e+01) -	3.1095e+02 (4.11e+01) -	1.1018e-05 (6.02e-05) -	8.7752e+00 (3.88e+00) -	8.7752e+00 (3.88e+00) -	0.0000e+00 (0.00e+00) -
CECI7-MTP2-T1	3.8741e+00 (6.50e-01) -	5.8307e+00 (8.23e-01) -	1.0106e+00 (2.65e-01) -	6.1415e+00 (9.09e-01) -	1.4811e-01 (4.93e-02) -	4.5085e+00 (2.69e-01) -	2.4530e-11 (1.71e-11) -	8.0917e-03 (2.38e-03) -	8.0917e-03 (2.38e-03) -	3.7925e-13 (1.67e-13) -
CECI7-MTP2-T2	2.8551e+02 (5.36e+01) -	1.8099e+01 (4.13e+00) -	1.1514e+02 (4.38e+01) -	3.2461e+02 (7.82e+01) -	7.0590e+00 (2.57e+00) -	3.1660e+00 (4.29e-01) -	9.1112e-08 (4.64e-07) =	8.8648e+00 (3.04e+00) -	8.8648e+00 (3.04e+00) -	0.0000e+00 (0.00e+00) -
CECI7-MTP3-T1	2.0765e+01 (2.88e-01) +	2.1200e+01 (3.84e-02) =	2.1198e+01 (4.13e-02) +	2.0250e+01 (8.32e-02) +	2.1207e+01 (4.37e-02) -	2.1086e+01 (2.82e-01) =	2.0885e-01 (9.82e-02) +	2.0002e+01 (1.36e-02) +	2.0002e+01 (1.36e-02) +	2.1160e+01 (1.32e-01) -
CECI7-MTP3-T2	2.9306e-03 (6.83e-02) +	4.3638e-03 (4.88e+02) +	2.2578e+03 (5.33e+02) +	4.4665e+03 (4.27e+02) +	2.5642e+03 (6.03e+02) +	4.5958e-03 (6.64e+02) +	1.2758e+03 (2.99e+02) +	1.3631e+04 (1.22e+03) -	1.3631e+04 (1.22e+03) -	1.0170e+04 (1.05e+03) -
CECI7-MTP4-T1	3.0494e-02 (6.65e+01) -	6.6221e+02 (1.11e+02) -	3.9930e+02 (2.77e-02) -	5.4600e+02 (9.82e-01) -	3.9284e+02 (1.72e+01) -	4.4662e+02 (4.13e+01) -	1.6256e+02 (1.99e+01) -	3.4429e+02 (1.94e+01) -	3.4429e+02 (1.94e+01) -	1.8374e+01 (3.85e+00) -
CECI7-MTP4-T2	2.6690e-01 (2.29e-01) -	8.9970e-01 (1.67e+01) -	9.0300e-02 (2.77e-02) -	3.6754e+01 (7.89e+00) -	1.3779e-01 (4.41e-02) -	1.2177e+02 (2.88e+01) -	1.8583e-16 (1.93e-16) -	1.0587e+01 (1.94e+01) -	1.0587e+01 (1.94e+01) -	3.8868e-24 (3.09e-24) -
CECI7-MTP5-T1	4.2415e+00 (8.07e-01) -	4.9276e+00 (4.76e-01) -	8.3059e-01 (2.53e-01) -	4.0963e+00 (4.05e-01) -	2.6002e-01 (5.37e-02) -	4.7264e+00 (3.50e-01) -	4.0791e-09 (5.95e-09) -	7.4544e-03 (2.06e-03) -	7.4544e-03 (2.06e-03) -	6.8325e-13 (3.60e-13) -
CECI7-MTP5-T2	2.1718e+02 (1.11e+02) -	1.0488e+04 (4.76e+03) -	1.9524e+02 (5.10e+01) -	1.3498e+03 (3.69e+02) -	1.9532e+02 (9.70e+00) -	9.1688e+03 (4.69e+03) -	7.2882e-01 (9.07e-09) -	9.3734e+01 (1.85e+02) -	9.3734e+01 (1.85e+02) -	4.5882e-01 (1.41e+01) -
CECI7-MTP6-T1	3.5183e+00 (6.85e-01) -	1.9583e+01 (2.71e+00) -	1.7184e+00 (5.92e-01) -	5.6900e+00 (1.08e+00) -	3.6087e-01 (1.03e-01) -	5.3895e+00 (9.11e-01) -	1.5806e-09 (5.67e-09) -	8.0723e-03 (3.47e-03) -	8.0723e-03 (3.47e-03) -	4.7127e-13 (2.47e-13) -
CECI7-MTP6-T2	6.2760e+00 (1.71e+00) -	1.9371e+01 (3.26e+00) -	6.3652e-01 (9.41e-01) -	6.6435e+00 (1.77e+00) -	1.8308e-01 (2.61e-01) -	5.1076e+00 (1.44e+00) -	2.6177e-03 (1.16e-02) -	1.0987e-01 (3.78e-02) -	1.0987e-01 (3.78e-02) -	8.8912e-13 (1.44e-12) -
CECI7-MTP7-T1	2.0938e+02 (9.72e+01) -	9.7165e+03 (4.93e+03) -	5.2819e+02 (2.38e+02) -	2.0473e+03 (8.59e+02) -	1.6934e+02 (5.13e+01) -	1.3496e+04 (4.77e+03) -	3.5975e+01 (1.31e+00) +	5.0445e+01 (1.33e+01) -	5.0445e+01 (1.33e+01) -	4.0739e+01 (6.30e-01) -
CECI7-MTP7-T2	2.9441e+02 (6.95e+01) -	3.7757e+02 (7.84e+01) -	3.4976e+02 (1.88e+01) -	3.7093e+02 (7.13e+01) -	2.0589e+02 (1.15e+02) -	3.8559e+02 (6.62e+01) -	5.8274e+00 (2.38e+01) -	8.9937e+00 (3.03e+00) -	8.9937e+00 (3.03e+00) -	9.9496e-02 (4.01e-01) -
CECI7-MTP8-T1	4.0919e-02 (1.88e-02) -	9.3064e-01 (5.16e-02) -	4.8556e-02 (1.31e-02) -	6.1930e-01 (7.71e-02) -	5.8639e-02 (1.30e-02) -	9.8876e-01 (4.48e-02) -	2.4653e-04 (1.35e-03) -	8.9331e-02 (1.99e-01) -	8.9331e-02 (1.99e-01) -	0.0000e+00 (0.00e+00) -
CECI7-MTP8-T2	1.9270e+01 (2.43e+00) -	2.7501e+01 (3.26e+00) -	5.4686e+00 (1.75e+00) -	2.1431e+01 (2.78e+00) -	3.6913e+00 (6.56e-01) -	2.4831e+01 (3.76e+00) -	1.7307e+00 (6.83e-01) -	5.5548e+00 (2.78e+00) -	5.5548e+00 (2.78e+00) -	4.9686e-11 (8.12e-11) -
CECI7-MTP9-T1	3.1980e+02 (4.22e+01) -	7.4411e+02 (1.30e+02) -	3.9574e+02 (1.32e+01) -	7.2389e+02 (1.12e+02) -	3.6932e+02 (5.72e+01) -	4.6340e+02 (4.97e+01) -	1.5829e+02 (1.52e+01) -	9.9704e+01 (8.88e+01) -	9.9704e+01 (8.88e+01) -	1.8705e+01 (3.53e+00) -
CECI7-MTP9-T2	2.8046e-03 (6.03e+02) +	4.5452e+03 (4.90e+02) +	2.3876e+03 (4.65e+02) +	4.7154e+03 (5.37e+02) +	2.3772e+03 (4.14e+02) +	4.7496e+03 (6.45e+02) +	1.3351e+03 (3.07e+02) +	1.7187e+04 (3.23e+02) -	1.7187e+04 (3.23e+02) -	1.0423e+04 (7.23e+02) -
WCCD20-MTP1-T1	1.5906e+01 (2.44e+00) -	4.9246e+01 (3.31e+00) -	2.0277e+00 (1.34e+00) -	2.5794e+00 (3.40e+00) -	4.4993e+00 (4.31e+00) -	3.7751e+01 (3.32e+00) -	7.4010e-01 (4.44e-01) -	4.5642e+00 (2.24e+00) -	4.5642e+00 (2.24e+00) -	0.0000e+00 (0.00e+00) -
WCCD20-MTP1-T2	1.6531e+01 (2.33e+00) -	4.8483e+01 (4.24e+00) -	2.3697e+00 (1.96e+00) -	2.6247e+01 (3.11e+00) -	4.4763e+00 (4.26e+00) -	3.6973e+01 (3.01e+00) -	9.3383e-01 (4.92e-01) -	4.4954e+00 (2.41e+00) -	4.4954e+00 (2.41e+00) -	0.0000e+00 (0.00e+00) -
WCCD20-MTP2-T1	8.849e-03 (6.89e-03) -	7.8743e-01 (8.82e-02) -	1.5871e-03 (7.91e-04) -	6.8105e-01 (1.17e-01) -	2.4538e-03 (6.79e-04) -	9.5883e-01 (6.83e-02) -	2.4653e-04 (1.35e-03) -	6.1485e-01 (3.89e-01) -	6.1485e-01 (3.89e-01) -	0.0000e+00 (0.00e+00) -
WCCD20-MTP2-T2	6.8061e-03 (6.82e-03) -	8.0204e-01 (8.04e-02) -	1.8963e-03 (1.28e-03) -	5.9710e-01 (9.23e-02) -	2.4179e-03 (9.74e-04) -	9.5368e-01 (5.84e-02) -	2.6527e-13 (8.62e-14) -	6.1985e-01 (3.94e-01) -	6.1985e-01 (3.94e-01) -	0.0000e+00 (0.00e+00) -
WCCD20-MTP3-T1	4.1175e+03 (1.18e+03) -	2.1540e+06 (1.05e+06) -	2.0504e+06 (1.33e+06) -	2.5555e+05 (5.63e+05) -	2.0721e+06 (1.02e+06) -	2.2534e+06 (1.23e+06) -	4.7105e+03 (1.39e+03) -	1.3346e+07 (8.16e+06) -	1.3346e+07 (8.16e+06) -	1.4747e+03 (5.00e+02) -
WCCD20-MTP3-T2	3.8445e+03 (9.29e+02) -	2.3102e+06 (1.14e+06) -	2.4818e+06 (1.69e+06) -	6.3123e+05 (4.09e+05) -	2.1362e+06 (1.00e+06) -	1.8640e+06 (1.00e+06) -	5.0243e+03 (1.32e+03) -	1.3147e+07 (8.68e+06) -	1.3147e+07 (8.68e+06) -	1.4287e+03 (4.87e+02) -
WCCD20-MTP4-T1	3.2898e-01 (5.56e-02) -	1.1190e-01 (6.99e-02) -	4.7881e-01 (6.20e-02) -	5.8726e-01 (9.60e-02) -	5.0033e-01 (1.0e-01) -	5.8608e-01 (1.0e-01) -	3.9821e-01 (4.66e-02) -	6.7222e-01 (1.07e-01) -	6.7222e-01 (1.07e-01) -	8.2260e-02 (2.20e-02) -
WCCD20-MTP4-T2	3.1077e+01 (5.85e-02) -	4.9015e+01 (6.71e-02) -	4.7177e+01 (5.58e-02) -	4.3208e-01 (5.89e-02) -	4.7266e-01 (5.55e-02) -	4.5094e-01 (7.29e-02) -	3.0996e-01 (3.69e-02) -	3.8376e-01 (6.39e-02) -	3.8376e-01 (6.39e-02) -	8.4392e-02 (1.76e-02) -
WCCD20-MTP5-T1	1.0155e+01 (1.61e+00) -	6.9949e-01 (2.25e+01) -	2.8878e+01 (6.42e+00) -	5.6091e+01 (1.48e+01) -	2.5492e+01 (7.82e+00) -	2.6961e+01 (5.26e+00) -	1.0596e+01 (1.10e+00) -	4.0111e+01 (8.46e+00) -	4.0111e+01 (8.46e+00) -	3.7066e+00 (6.47e-01) -
WCCD20-MTP5-T2	1.0037e+01 (2.93e+00) -	6.0705e+01 (1.88e+01) -	3.2326e+01 (3.79e+00) -	4.8761e+01 (1.13e+01) -	2.6855e+01 (8.83e+00) -	2.3865e+01 (5.39e+00) -	1.0785e+01 (1.13e+00) -	2.5043e+01 (7.20e+00) -	2.5043e+01 (7.20e+00) -	5.6105e+00 (8.53e+01) -
WCCD20-MTP6-T1	3.5655e+03 (1.92e+03) -	9.2000e+06 (1.18e+07) -	1.3028e+06 (6.37e+05) -	1.5018e+06 (1.24e+06) -	9.5208e+05 (6.25e+05) -	1.0516e+06 (6.79e+05) -	8.2369e+03 (5.11e+03) -	2.0939e+07 (1.06e+07) -	2.0939e+07 (1.06e+07) -	1.6509e+03 (4.64e+02) -
WCCD20-MTP6-T2	3.4593e+03 (9.33e+02) -	1.3501e+07 (1.57e+07) -	1.0279e+06 (6.27e+05) -	9.8736e+05 (5.14e+05) -	9.7673e+05 (6.92e+05) -	8.3382e+05 (6.04e+05) -	5.8350e+02 (1.79e+03) -	1.4884e+07 (7.52e+06) -	1.4884e+07 (7.52e+06) -	1.4223e+03 (4.08e+02) -
WCCD20-MTP7-T1	1.9992e+02 (1.27e+02) -	1.0029e+03 (3.24e+02) -	1.8315e+02 (3.64e+02) -	8.6400e+02 (3.59e+02) -	5.9163e+02 (2.83e+02) -	6.8804e+02 (3.02e+02) -	1.8202e+02 (1.31e+02) -	1.3847e+03 (4.18e+02) -	1.3847e+03 (4.18e+02) -	9.597e+01 (1.08e+02) -
WCCD20-MTP7-T2	2.6976e+02 (1.46e+02) -	9.3667e+02 (3.85e+02) -	6.9364e+02 (3.80e+02) -	9.4230e+02 (3.41e+02) -	8.3453e+02 (2.38e+02) -	8.1600e+02 (3.48e+02) -	2.3512e+02 (1.04e+02) -	1.4342e+03 (4.51e+02) -	1.4342e+03 (4.51e+02) -	1.9254e+02 (1.80e+02) -
WCCD20-MTP8-T1	2.0742e+01 (2.57e-01) =	2.0183e+01 (7.00e-02) =	2.1187e+01 (2.93e-02) -	2.0231e+01 (9.67e-02) =	2.1179e+01 (4.09e-02) -	2.0111e+01 (6.09e-02) +	2.0708e+01 (1.78e-01) =	1.9997e+01 (1.59e-03) +	1.9997e+01 (1.59e-03) +	2.0750e+01 (5.67e-01) -
WCCD20-MTP8-T2	2.0647e+01 (3.11e-01) -	2.0182e+01 (7.28e-02) +	2.1179e+01 (2.73e-02) =	2.0190e+01 (7.07e-02) +	2.1187e+01 (3.08e-02) =	2.0254e+01 (3.78e-01) +	2.0752e+01 (1.43e-01) =	1.9999e+01 (8.53e-04) +	1.9999e+01 (8.53e-04) +	2.0423e+01 (3.86e+00) -
WCCD20-MTP9-T1	7.4639e+03 (7.13e+02) -	7.1096e+03 (1.02e+03) -	1.3662e+04 (3.73e+02) -	7.0911e+03 (8.77e+02) -	1.2551e+04 (2.39e+03) -	6.2230e+03 (8.05e+02) -	8.0619e+04 (4.30e+02) -	5.3835e+03 (1.06e+03) -	5.3835e+03 (1.06e+03) -	1.8698e+03 (5.73e+02) -
WCCD20-MTP9-T2	2.0500e+01 (8.01e-01) -	2.1450e+01 (5.15e-01) -	2.2466e+01 (2.24e-01) -	2.1285e+01 (6.75e-01) -	2.2440e+01 (2.44e-01) -	2.1529e+01 (6.56e-01) -	2.0586e+01 (3.76e-01) -	2.1475e+01 (7.46e-01) -	2.1475e+01 (7.46e-01) -	1.9839e+01 (1.41e+00) -
WCCD20-MTP10-T1	1.8762e+02 (5.57e+01) -	2.4738e+04 (9.98e+03) -	3.0315e+04 (1.01e+04) -	2.5262e+04 (1.61e+04) -	2.2426e+04 (8.71e+03) -	2.3801e+04 (1.16e+04) -	2.6113e+04 (6.94e+01) -	9.0272e+05 (9.89e+05) -	9.0272e+05 (9.89e+05) -	1.3107e+02 (3.53e+01) -
WCCD20-MTP10-T2	3.7774e+03 (1.18e+03) -	2.3930e+06 (1.58e+06) -	1.5460e+06 (1.09e+06) -	1.8076e+06 (9.32e+05) -	1.6327e+06 (1.16e+06) -	1.6519e+06 (8.23e+05) -	7.2668e+03 (3.77e+03) -	1.2115e+07 (8.47e+06) -	1.2115e+07 (8.47e+06) -	1.9455e+03 (4.04e+02) -
+ / - =	3 / 34 / 1	1 / 26 / 11	4 / 33 / 1	4 / 33 / 1	2 / 35 / 1	4 / 33 / 1	4 / 31 / 3	3 / 35 / 0	3 / 35 / 0	Base
Ranking (p-value)	4.8421 (0.00)	4.7632 (0.00)	7.9211 (0.00)	7.0789 (0.00)	6.6532 (0.00)	2.3268 (0.00)	2.9737 (0.28)	6.0263 (0.00)	6.0263 (0.00)	2.2368

TABLE S-V  
MULTITASK SCORE AND STANDARD DEVIATION OF COMPARISON IN MANY-TASK OPTIMIZATION ENVIRONMENTS.

	GA	DE	NL-SHADE-RSP	CMA-ES	MatDE	EMato-MKT	BoKTD	SBCMAES	MTES	MTES-KG
WCCI20-MatP1	-3.2792e-01 (2.59e-03) -	-3.6399e-01 (4.14e-06) -	-3.5862e-01 (1.38e-03) -	<b>-3.6402e-01 (0.00e+00) =</b>	2.9075e+00 (2.55e-01) -	-3.6402e-01 (1.46e-10) -	-3.6402e-01 (3.31e-09) -	-3.6347e-01 (9.10e-04) -	-3.7408e-02 (2.63e-01) -	<b>-3.6402e-01 (0.00e+00)</b>
WCCI20-MatP2	-1.9218e-01 (4.33e-02) -	-2.4871e-01 (1.08e-03) -	-2.4828e-01 (9.03e-04) -	-2.2991e-01 (2.25e-05) -	9.5948e-02 (5.50e-02) -	-2.4940e-01 (3.56e-04) -	-2.4951e-01 (3.93e-04) -	-2.4992e-01 (5.18e-05) -	1.8417e+00 (2.50e+00) -	<b>-2.4996e-01 (1.76e-05)</b>
WCCI20-MatP3	4.5417e-01 (1.12e-01) -	8.5956e-01 (3.32e-02) -	3.2111e-01 (9.79e-02) -	-1.2252e+00 (1.05e-02) =	1.6858e+00 (4.00e-02) =	-8.2431e-01 (3.53e-02) -	5.9680e-01 (2.51e-02) -	-1.1604e+00 (8.56e-02) -	5.1836e-01 (1.30e-01) -	<b>-1.2259e+00 (4.07e-03)</b>
WCCI20-MatP4	-1.8500e-01 (5.52e-02) -	-1.7541e-01 (2.21e-01) -	-1.2581e-01 (3.59e-02) -	-4.7820e-01 (2.33e-05) -	1.9343e+00 (2.53e-01) -	-4.7775e-01 (1.35e-03) -	-4.7598e-01 (2.35e-02) -	-4.6950e-01 (1.89e-02) -	9.3155e-01 (8.47e-01) -	<b>-4.7822e-01 (9.88e-06)</b>
WCCI20-MatP5	5.3366e-01 (7.44e-02) -	7.7413e-02 (7.48e-02) -	7.3555e-02 (6.46e-02) -	-9.2361e-01 (5.50e-03) =	1.7703e+00 (3.74e-02) -	-5.7200e-01 (6.40e-02) -	-3.4577e-01 (5.61e-02) -	-9.0299e-01 (3.74e-02) -	1.2141e+00 (2.74e-01) -	<b>-9.2461e-01 (4.44e-03)</b>
WCCI20-MatP6	-4.9868e-01 (4.77e-02) +	-1.5015e-01 (2.62e-02) -	5.2640e-01 (3.08e-02) +	5.2432e-01 (5.21e-01) +	1.8801e+00 (2.19e-01) +	<b>-6.3337e-01 (5.24e-02) +</b>	-3.7306e-02 (3.10e-02) -	-2.2480e-01 (1.71e-01) -	1.1014e+00 (2.81e-01) -	<b>-3.8746e-01 (3.56e-02)</b>
WCCI20-MatP7	5.5228e-01 (6.22e-02) -	2.6099e-01 (3.11e-01) -	3.5574e-01 (7.77e-02) -	-9.3197e-01 (5.29e-03) =	1.7266e+00 (5.15e-02) -	-5.2891e-01 (6.54e-02) -	-5.6144e-01 (8.18e-02) -	-9.031e-01 (3.50e-02) -	9.6287e-01 (3.84e-01) -	<b>-9.3264e-01 (2.75e-03)</b>
WCCI20-MatP8	4.2112e-02 (1.00e-01) -	9.6851e-02 (8.12e-02) -	-1.1555e-02 (8.26e-02) -	5.1744e-01 (6.43e-01) -	7.1853e-01 (1.44e-02) -	-3.6380e-01 (3.86e-02) -	-4.8253e-01 (2.92e-02) -	-4.4734e-01 (1.45e-01) -	5.0401e-01 (2.11e-01) -	<b>-5.7271e-01 (3.74e-03)</b>
WCCI20-MatP9	-1.8307e-01 (8.66e-02) -	1.8109e-01 (1.05e-01) -	-2.0476e-01 (5.29e-02) -	3.2357e-01 (3.36e-02) -	-4.8489e-01 (4.29e-02) -	-4.7894e-01 (8.87e-02) -	-3.1091e-01 (2.29e-02) -	-4.7894e-01 (8.87e-02) -	9.1023e-01 (5.20e-01) -	<b>-5.2266e-01 (2.47e-02)</b>
WCCI20-MatP10	-1.8932e-01 (1.01e-01) -	2.5866e-01 (1.03e-01) -	-2.2471e-01 (7.13e-02) -	-8.1973e-02 (4.72e-01) -	1.0420e+00 (2.43e-02) -	-6.1064e-01 (5.77e-02) -	-2.8102e-01 (5.11e-02) -	-5.5342e-01 (1.09e-01) -	1.3161e+00 (3.08e-01) -	<b>-6.7564e-01 (3.75e-02)</b>
+/- / =	1 / 9 / 0	0 / 10 / 0	1 / 5 / 4	1 / 5 / 0	0 / 10 / 0	1 / 9 / 0	0 / 10 / 0	0 / 10 / 0	0 / 10 / 0	Base
Ranking (p-value)	6.6000 (0.00)	6.9000 (0.00)	5.7000 (0.00)	4.0500 (0.06)	9.7000 (0.00)	3.2500 (0.20)	4.5500 (0.02)	3.7000 (0.11)	9.0000 (0.00)	<b>1.5500</b>

TABLE S-VI  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF COMPARISON IN CONSTRAINED MULTITASK OPTIMIZATION ENVIRONMENTS.

	CMA-ES	CORCO	DeCODE	VMCH	MFEA-II	AT-MFEA	MTEA-AD	MFMP	MTES	MTES-KG
CMTP1-T1	<b>0.0000e+00 (0.00e+00) =</b>	1.6047e-01 (1.01e-01) -	1.5465e-01 (8.32e-02) -	1.7924e-03 (1.23e-03) -	4.9333e-02 (1.68e-02) -	2.6674e-03 (1.91e-03) -	9.5564e-01 (5.47e-02) -	4.7629e-01 (2.46e-01) -	1.1881e-03 (3.02e-03) -	<b>0.0000e+00 (0.00e+00)</b>
CMTP1-T2	1.8255e+01 (5.04e+00) -	3.6044e+02 (2.30e+01) -	3.3427e+02 (2.11e+01) -	1.3773e+02 (1.93e+01) -	8.1885e-02 (2.62e+01) -	5.1519e+00 (2.83e+00) -	2.5982e+02 (3.42e+01) -	2.2025e+02 (3.40e+01) -	1.3690e+01 (6.28e+00) -	<b>0.0000e+00 (0.00e+00)</b>
CMTP2-T1	3.3290e-10 (1.47e-10) -	2.5235e+02 (2.62e-01) -	2.4261e+02 (2.14e-01) -	5.8830e-02 (2.92e-02) -	3.5971e-01 (8.35e-02) -	7.4284e-02 (1.08e-02) -	4.6545e+02 (4.71e-01) -	1.0344e+01 (3.65e-01) -	1.0622e-02 (3.52e-03) -	<b>6.4547e-13 (2.63e-13)</b>
CMTP2-T2	1.7787e+01 (3.48e+00) -	3.6256e+02 (1.59e+01) -	3.4001e+02 (1.83e+01) -	1.3301e+02 (2.35e+01) -	2.7444e-01 (9.04e+00) -	2.3418e+00 (5.98e-01) -	2.5468e+02 (3.08e+01) -	8.6031e+02 (5.18e+01) -	1.0345e+01 (4.81e+00) -	<b>0.0000e+00 (0.00e+00)</b>
CMTP3-T1	Na/N	8.9273e-01 (3.15e-01) =	8.0728e-01 (2.50e-01) =	6.8156e-02 (2.25e+02) +	4.8151e-02 (7.10e-03) +	<b>3.7682e-02 (4.33e-03) +</b>	4.3878e+02 (3.95e-01) =	1.3026e+01 (2.94e-01) =	1.5206e+01 (9.60e-01) =	<b>1.2116e+00 (3.16e+00)</b>
CMTP3-T2	1.5253e+04 (5.07e+03) -	8.9443e+03 (3.90e+02) -	8.7664e+03 (4.58e-02) -	4.1922e+03 (1.17e+03) =	5.9326e-01 (1.83e+02) +	<b>4.6290e-02 (8.88e-03) +</b>	3.782e+02 (1.03e+02) =	1.2996e+04 (1.30e+03) =	1.0345e+04 (9.66e+02) =	<b>4.2377e+03 (1.26e+03)</b>
CMTP4-T1	1.7710e+01 (3.96e+00) =	3.6412e+02 (1.86e+01) -	3.3729e+02 (1.80e+01) -	1.3976e+02 (2.23e+01) -	2.0810e+02 (4.02e+01) -	1.4612e+02 (4.28e+01) -	2.2936e+02 (2.46e+01) -	1.5975e+02 (2.39e+01) -	1.9096e+01 (5.14e+00) -	<b>1.6815e+01 (2.90e+00)</b>
CMTP4-T2	<b>3.8351e+02 (3.59e+00) =</b>	4.3535e+02 (5.64e+00) -	4.2928e+02 (4.26e+00) -	4.2015e+02 (5.32e+00) -	4.2223e+02 (5.02e+00) -	4.1570e+02 (4.60e+00) -	4.3210e+02 (6.11e+00) -	4.1621e+02 (7.99e+00) -	4.3200e+02 (8.25e+00) -	<b>3.8360e+02 (4.23e+00)</b>
CMTP5-T1	1.9999e+01 (1.42e-05) -	1.9958e+01 (4.49e-02) -	2.0010e+01 (2.40e-02) -	1.9996e+01 (1.63e-03) -	1.8357e+01 (5.99e-02) -	1.1676e-01 (1.59e-02) -	4.1529e+00 (3.60e-01) -	1.4203e+01 (4.83e+00) -	9.7919e-03 (3.93e-03) -	<b>9.8452e-13 (3.50e-13)</b>
CMTP5-T2	<b>4.0350e+01 (4.45e-01) +</b>	6.6991e+02 (2.95e+02) -	4.1251e+02 (1.26e+02) -	4.8676e+01 (1.16e+00) -	2.0966e+02 (6.61e+01) -	5.0739e+01 (4.13e-01) -	5.3468e+03 (2.17e+03) -	1.9829e+06 (3.19e+05) -	4.7766e+01 (5.15e-01) -	<b>4.0680e-01 (2.21e-01)</b>
CMTP6-T1	2.3008e-10 (1.18e-10) -	2.2283e+00 (2.72e-01) -	1.9596e+00 (2.49e-01) -	4.4491e-02 (1.45e-02) -	7.1495e-02 (9.87e-03) -	7.0917e-02 (1.52e-02) -	4.4869e+00 (3.18e-01) -	1.2257e+01 (3.42e-01) -	2.3766e+00 (1.22e+00) -	<b>5.3178e-13 (2.54e-13)</b>
CMTP6-T2	3.1793e-05 (2.18e-05) -	1.1123e+01 (1.48e+00) -	8.5832e+00 (8.38e-01) -	1.2474e+00 (2.72e-01) -	3.0990e-01 (3.79e-02) -	5.3471e-01 (4.05e-02) -	7.9500e+00 (9.83e-01) -	5.2838e+01 (1.80e+00) -	4.6836e+01 (8.48e+00) -	<b>2.3670e-10 (6.45e-10)</b>
CMTP7-T1	6.2282e+09 (2.25e+09) -	7.7824e+03 (1.60e+03) -	6.0288e+03 (1.12e+03) -	1.6851e+03 (7.41e+02) -	1.6443e+03 (1.44e+02) -	1.4224e+03 (8.91e+02) -	7.3469e+04 (2.75e+04) -	2.1139e+09 (7.49e+08) -	4.7911e+07 (1.77e+08) -	<b>2.7428e+02 (9.69e+02)</b>
CMTP7-T2	1.1250e+04 (0.00e+00) -	3.4845e+02 (1.16e+01) -	3.4107e+02 (1.27e+01) -	1.5095e+02 (3.16e+01) -	1.4038e+02 (3.16e+01) -	1.5634e+02 (3.70e+00) -	3.0325e+02 (4.21e+01) -	2.3442e+02 (1.60e+03) -	2.0060e+03 (4.48e+03) -	<b>6.8025e-01 (3.35e+00)</b>
CMTP8-T1	6.0000e+00 (1.60e-05) -	Na/N	6.1762e+00 (4.56e-03) -	6.0148e+00 (4.56e-03) -	6.0419e+00 (8.74e-03) -	6.0329e+00 (6.70e-03) -	6.3705e+00 (7.49e-02) -	9.3332e+00 (4.24e-01) -	6.9026e+00 (1.34e+00) -	<b>6.0000e+00 (6.93e-06)</b>
CMTP8-T2	Na/N	Na/N	6.2747e+01 (8.97e-01) -	5.5227e+01 (1.25e+00) -	4.9261e+01 (9.96e-01) -	5.0171e+01 (9.76e-01) -	5.3712e+01 (1.02e+00) -	7.1675e+01 (1.32e+00) -	5.3736e+01 (3.12e+00) -	<b>4.5972e-01 (6.07e-01)</b>
CMTP9-T1	8.8587e+04 (2.10e+04) -	Na/N	2.9702e+04 (0.00e+00) =	3.9605e+04 (8.09e+03) =	4.3168e-04 (0.00e+00) =	Na/N	3.6666e+04 (7.07e+03) =	2.9200e+04 (5.03e+03) =	1.5817e+04 (8.21e+02) -	<b>9.8221e+03 (0.00e+00)</b>
CMTP9-T2	1.6854e+04 (1.79e+02) +	1.8789e+04 (1.72e+02) -	1.8574e+04 (1.21e-02) -	1.7245e+04 (1.63e+02) -	<b>1.6300e-04 (1.18e-01) +</b>	1.6640e+04 (2.38e+01) +	1.6922e+04 (6.64e+01) =	1.9984e+04 (1.50e+02) =	1.7726e+04 (7.60e+01) -	<b>1.7006e+04 (2.27e+02)</b>
+/- / =	2 / 13 / 3	0 / 16 / 2	1 / 15 / 2	3 / 14 / 1	3 / 14 / 1	3 / 14 / 1	1 / 14 / 3	0 / 17 / 1	0 / 17 / 1	Base
Ranking (p-value)	4.9444 (0.00)	8.3056 (0.00)	6.7500 (0.00)	4.6944 (0.00)	4.4167 (0.01)	3.5833 (0.09)	6.6944 (0.00)	8.1389 (0.00)	5.5556 (0.00)	<b>1.9167</b>

TABLE S-VII  
AVERAGE RUN-TIME (S) OF COMPARISON IN MULTITASK OPTIMIZATION ENVIRONMENTS.

	NL-SHADE-RSP	CMA-ES	MFEA	MFEA-II	MFEA-AKT	AT-MFEA	MTEA-AD	MFMP	MTES	MTES-KG
CEC17-MTP1	2.7477e+01 -	1.3830e+01 -	3.2143e+01 -	2.0770e+02 -	2.5228e+01 -	4.2191e+01 -	1.6617e+01 -	2.8205e+01 -	<b>6.5166e+00 +</b>	8.8972e+00
CEC17-MTP2	2.5899e+01 -	9.0456e+00 +	2.2120e+01 -	1.4837e+02 -	2.6524e+01 -	3.8265e+01 -	1.8805e+01 -	2.8420e+01 -	<b>7.8229e+00 +</b>	9.6550e+00
CEC17-MTP3	1.9631e+01 -	7.5287e+00 +	1.5381e+01 -	1.0920e+02 -	1.8225e+01 -	2.6919e+01 -	1.2967e+01 -	2.0646e+01 -	<b>6.5718e+00 +</b>	8.3554e+00
CEC17-MTP4	1.8642e+01 -	7.4153e+00 +	1.5000e+01 -	1.0966e+02 -	1.7956e+01 -	2.6809e+01 -	1.2833e+01 -	1.8759e+01 -	<b>6.4120e+00 +</b>	8.1123e+00
CEC17-MTP5	1.8205e+01 -	7.3433e+00 +	1.5005e+01 -	1.0742e+02 -	1.7986e+01 -	2.6696e+01 -	1.2795e+01 -	1.9323e+01 -	<b>6.4117e+00 +</b>	8.3174e+00
CEC17-MTP6	2.5876e+01 -	1.7527e+01 +	2.5624e+01 -	7.4260e+01 -	2.8531e+01 -	3.7014e+01 -	2.3287e+01 -	2.9672e+01 -	<b>1.6824e+01 +</b>	1.8499e+01
CEC17-MTP7	1.9083e+01 -	7.5635e+00 +	1.5295e+01 -	1.0742e+02 -	1.8334e+01 -	2.6889e+01 -	1.2986e+01 -	1.9217e+01 -	<b>6.5966e+00 +</b>	8.6351e+00
CEC17-MTP8	4.0448e+01 -	3.0738e+01 =	3.7564e+01 -	1.3304e+02 -	4.0942e+01 -	4.9621e+01 -	3.5745e+01 -	4.3597e+01 -	<b>2.9152e+01 +</b>	3.0760e+01
CEC17-MTP9	1.9635e+01 -	1.0227e+01 -	1.8768e+01 -	1.1515e+02 -	2.2035e+01 -	3.0307e+01 -	1.4024e+01 -	2.2001e+01 -	<b>7.0091e+00 +</b>	9.7221e+00
WCCI20-MTP1	1.0230e+02 -	6.2918e+01 +	8.2403e+01 -	2.7430e+02 -	9.0146e+01 -	1.0651e+02 -	7.2571e+01 -	1.0092e+02 -	<b>6.0637e+01 +</b>	6.6675e+01
WCCI20-MTP2	6.9774e+01 -	2.8887e+01 +	5.2586e+01 -	2.4782e+02 -	5.9183e+01 -	7.2221e+01 -	3.8383e+01 -	6.6050e+01 -	<b>2.6705e+01 +</b>	3.2683e+01
WCCI20-MTP3	6.9647e+01 -	3.0500e+01 +	5.1987e+01 -	2.4503e+02 -	6.1995e+01 -	7.6068e+01 -	4.0427e+01 -	7.0101e+01 -	<b>2.8256e+01 +</b>	3.4298e+01
WCCI20-MTP4	6.6333e+01 -	2.8319e+01 +	5.0503e+01 -	2.4967e+02 -	6.0636e+01 -	7.3883e+01 -	3.8475e+01 -	6.7041e+01 -	<b>2.6257e+01 +</b>	3.2788e+01
WCCI20-MTP5	6.7479e+01 -	2.8547e+01 +	5.0992e+01 -	2.5117e+02 -	6.0140e+01 -	7.5276e+01 -	3.9182e+01 -	6.8612e+01 -	<b>2.6651e+01 +</b>	3.3428e+01
WCCI20-MTP6	7.1090e+01 -	<b>2.9754e+01 +</b>	5.2718e+01 -	2.5485e+02 -	6.4065e+01 -	7.8093e+01 -	4.0871e+01 +	8.4938e+01 -	3.6129e+01 +	4.7973e+01
WCCI20-MTP7	9.2232e+01 -	4.0307e+01 +	7.3157e+01 -	3.3896e+02 -	8.7393e+01 -	1.0552e+02 -	4.9466e+01 -	9.3631e+01 -	<b>3.5020e+01 +</b>	4.5613e+01
WCCI20-MTP8	8.5888e+01 -	<b>4.6508e+01 +</b>	1.4238e+02 -	6.0195e+02 -	2.4298e+02 -	2.9852e+02 -	6.8990e+01 -	3.6898e+02 -	1.1145e+02 -	6.3451e+01
WCCI20-MTP9	5.8166e+01 +	9.0222e+01 -	1.4806e+02 -	3.2562e+02 -	<b>4.8634e+01 +</b>	7.9119e+01 -	6.2429e+01 +	2.1184e+02 -	8.1651e+01 -	6.9909e+01
WCCI20-MTP10	2.3137e+02 -	6.4422e+01 -	7.7004e+01 -	2.9525e+02 -	6.1904e+01 -	7.8535e+01 -	3.8876e+01 -	6.9740e+01 -	<b>2.8657e+01 +</b>	3.3451e+01
+ / - / =	1 / 18 / 0	14 / 4 / 1	0 / 19 / 0	0 / 19 / 0	1 / 18 / 0	0 / 19 / 0	2 / 17 / 0	0 / 19 / 0	17 / 2 / 0	Base

TABLE S-VIII  
AVERAGE RUN-TIME (S) OF COMPARISON IN MANY-TASK OPTIMIZATION ENVIRONMENTS.

	GA	DE	NL-SHADE-RSP	CMA-ES	MaTDE	EMaTo-MKT	BoKTDE	SBCMAES	MTES	MTES-KG
WCCI20-MaTP1	9.2068e+01 +	6.5554e+01 +	1.5120e+02 -	7.1684e+01 +	1.7365e+02 -	3.0346e+02 -	1.1765e+02 -	2.5103e+02 -	<b>5.9723e+01 +</b>	9.6534e+01
WCCI20-MaTP2	1.4460e+02 -	1.0774e+02 +	2.2177e+02 -	<b>8.4861e+01 +</b>	1.8603e+02 -	3.3097e+02 -	1.5232e+02 -	2.8088e+02 -	9.0183e+01 +	1.1666e+02
WCCI20-MaTP3	1.7882e+02 -	1.3855e+02 -	2.5512e+02 -	1.1466e+02 +	1.8776e+02 -	3.0506e+02 -	1.5852e+02 -	2.7442e+02 -	<b>9.5705e+01 +</b>	1.1911e+02
WCCI20-MaTP4	1.6377e+02 -	1.3310e+02 -	2.3253e+02 -	1.0254e+02 +	2.0893e+02 -	3.1447e+02 -	2.1166e+02 -	2.8689e+02 -	<b>9.7155e+01 +</b>	1.1997e+02
WCCI20-MaTP5	3.1559e+02 -	2.8148e+02 +	3.9824e+02 -	2.7604e+02 +	3.6588e+02 -	4.8850e+02 -	4.4586e+02 -	4.4031e+02 -	<b>2.6409e+02 +</b>	2.8505e+02
WCCI20-MaTP6	1.8380e+02 -	1.4705e+02 -	2.6065e+02 -	1.2303e+02 -	2.1576e+02 -	3.3962e+02 -	3.1150e+02 -	2.7155e+02 -	<b>1.0148e+02 +</b>	1.2186e+02
WCCI20-MaTP7	3.1742e+02 -	2.8426e+02 -	3.8100e+02 -	2.5766e+02 +	3.3258e+02 -	4.4600e+02 -	4.5638e+02 -	4.3609e+02 -	<b>2.5485e+02 +</b>	2.7487e+02
WCCI20-MaTP8	2.6431e+02 -	2.3802e+02 -	3.2910e+02 -	<b>2.1064e+02 +</b>	2.9328e+02 -	4.0563e+02 -	4.0247e+02 -	3.8330e+02 -	2.1235e+02 +	2.3778e+02
WCCI20-MaTP9	2.3864e+02 -	1.9731e+02 -	3.2473e+02 -	1.7585e+02 +	2.6070e+02 -	3.7666e+02 -	3.7232e+02 -	3.6051e+02 -	<b>1.5803e+02 +</b>	1.7906e+02
WCCI20-MaTP10	2.7740e+02 -	2.4237e+02 +	3.6539e+02 -	2.2766e+02 +	3.1673e+02 -	4.3998e+02 -	4.3487e+02 -	4.2069e+02 -	<b>2.1512e+02 +</b>	2.5297e+02
+ / - / =	1 / 9 / 0	4 / 6 / 0	0 / 10 / 0	9 / 1 / 0	0 / 10 / 0	0 / 10 / 0	0 / 10 / 0	0 / 10 / 0	10 / 0 / 0	Base

TABLE S-IX  
AVERAGE RUN-TIME (S) OF COMPARISON IN CONSTRAINED MULTITASK OPTIMIZATION ENVIRONMENTS.

	CMA-ES	CORCO	DeCODE	VMCH	MFEA-II	AT-MFEA	MTEA-AD	MFMP	MTES	MTES-KG
CMTP1	1.1099e+01 =	1.3952e+01 -	1.7177e+01 -	7.6860e+01 -	1.1897e+02 -	3.5635e+01 -	1.4801e+01 -	2.4636e+01 -	<b>8.5604e+00 +</b>	1.1125e+01
CMTP2	1.0708e+01 =	1.3715e+01 -	1.6799e+01 -	7.5237e+01 -	1.2213e+02 -	3.3100e+01 -	1.3607e+01 -	2.2923e+01 -	<b>7.7023e+00 +</b>	1.0789e+01
CMTP3	1.0816e+01 +	1.4541e+01 -	1.5822e+01 -	7.4482e+01 -	1.1588e+02 -	3.4967e+01 -	1.4492e+01 -	2.4178e+01 -	<b>8.3785e+00 +</b>	1.1706e+01
CMTP4	1.1037e+01 +	1.3724e+01 -	1.6459e+01 -	7.7248e+01 -	1.2306e+02 -	3.5717e+01 -	1.4417e+01 -	2.4329e+01 -	<b>8.4144e+00 +</b>	1.1623e+01
CMTP5	1.0631e+01 +	1.4235e+01 -	1.5998e+01 -	7.9695e+01 -	1.2543e+02 -	3.5255e+01 -	1.4470e+01 -	2.4434e+01 -	<b>8.5036e+00 +</b>	1.1678e+01
CMTP6	2.8089e+01 +	3.0614e+01 -	3.3072e+01 -	9.2293e+01 -	1.4223e+02 -	5.3051e+01 -	3.1555e+01 -	4.0707e+01 -	<b>2.5214e+01 +</b>	2.8556e+01
CMTP7	1.1376e+01 +	1.4353e+01 +	1.6090e+01 -	7.5477e+01 -	1.5014e+02 -	4.0700e+01 -	1.9363e+01 -	2.8988e+01 -	<b>9.2208e+00 +</b>	1.5382e+01
CMTP8	<b>3.2258e+01 +</b>	3.4276e+01 +	3.6853e+01 +	1.0389e+02 -	1.9030e+02 -	1.0352e+02 -	6.0221e+01 -	8.4030e+01 -	4.3161e+01 =	4.0935e+01
CMTP9	2.3387e+01 +	2.8929e+01 =	2.8025e+01 =	1.7698e+02 -	2.2428e+02 -	7.0978e+01 -	2.3693e+01 +	4.1837e+01 -	<b>1.9765e+01 +</b>	2.7129e+01
+ / - / =	7 / 0 / 2	2 / 6 / 1	1 / 7 / 1	0 / 9 / 0	0 / 9 / 0	0 / 9 / 0	1 / 8 / 0	0 / 9 / 0	8 / 0 / 1	Base



TABLE S-X  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF COMPONENT ANALYSIS.

	wo-ExS	wo-DiS	wo-DoS	wo-NTM	wo-BCH	MTES-KG
CEC17-MTP1-T1	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP1-T2	1.6715e+01 (3.55e+00) -	1.8042e+01 (4.07e+00) -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP2-T1	2.0137e-10 (9.28e-11) -	4.2567e-13 (1.91e-13) -	1.6615e-10 (1.01e-10) -	3.2951e-13 (1.62e-13) =	<b>3.1921e-13 (1.40e-13)</b> =	3.7925e-13 (1.67e-13)
CEC17-MTP2-T2	1.7877e+01 (4.10e+00) -	1.7909e+01 (3.79e+00) -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP3-T1	2.1202e+01 (3.71e-02) =	<b>2.0785e+01 (2.31e+00)</b> =	2.0970e+01 (1.20e+00) =	2.1201e+01 (4.93e-02) =	2.1203e+01 (3.71e-02) =	2.1160e+01 (1.32e-01)
CEC17-MTP3-T2	<b>9.4377e+03 (1.12e+03)</b> +	9.7098e+03 (8.98e+02) =	9.8392e+03 (1.08e+03) =	1.0316e+04 (9.61e+02) =	1.1718e+04 (6.92e+01) -	1.0170e+04 (1.05e+03)
CEC17-MTP4-T1	<b>1.7048e+01 (3.62e+00)</b> =	1.8838e+01 (4.25e+00) =	1.9170e+01 (3.77e+00) =	2.0629e+01 (3.54e+00) -	1.8738e+01 (4.04e+00) -	1.8374e+01 (3.85e+00)
CEC17-MTP4-T2	5.7426e-19 (7.24e-19) -	3.6583e-24 (3.08e-24) =	1.1243e-18 (1.28e-18) -	4.2162e-24 (3.77e-24) =	<b>3.1993e-24 (5.85e-24)</b> =	3.8868e-24 (3.09e-24)
CEC17-MTP5-T1	2.1450e-10 (8.04e-11) -	7.2469e-13 (4.39e-13) =	2.4105e-10 (9.80e-11) -	7.1262e-13 (3.31e-13) =	7.5300e-13 (4.77e-13) =	<b>6.8325e-13 (3.60e-13)</b>
CEC17-MTP5-T2	4.8525e+01 (2.32e+01) =	4.5301e+01 (1.86e+01) =	<b>4.1023e+01 (8.43e-01)</b> =	4.8606e+01 (1.64e+01) =	4.4506e+01 (1.23e+01) =	4.5882e+01 (1.41e+01)
CEC17-MTP6-T1	2.0474e-10 (1.27e-10) -	<b>4.6369e-13 (2.17e-13)</b> =	2.6473e-10 (1.17e-10) -	5.2160e-13 (2.10e-13) =	5.6399e-13 (3.64e-13) =	4.7127e-13 (2.47e-13)
CEC17-MTP6-T2	5.2118e-04 (1.99e-04) -	1.3663e-09 (2.19e-09) -	8.1133e-09 (1.56e-08) -	2.7986e-12 (1.16e-11) =	1.8562e-12 (3.43e-12) =	<b>8.8912e-13 (1.44e-12)</b>
CEC17-MTP7-T1	4.9541e+01 (2.74e+01) -	5.3909e+01 (2.76e+01) =	4.1232e+01 (6.48e-01) -	<b>4.0594e+01 (7.34e-01)</b> =	4.1592e+01 (4.27e+00) =	4.0739e+01 (6.30e-01)
CEC17-MTP7-T2	1.6715e+01 (4.03e+00) -	1.8407e+01 (4.30e+00) -	<b>0.0000e+00 (0.00e+00)</b> -	<b>0.0000e+00 (0.00e+00)</b> -	4.3115e-01 (2.36e+00) =	9.9496e-02 (4.01e-01)
CEC17-MTP8-T1	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP8-T2	1.8412e-05 (1.76e-05) -	2.1769e-06 (1.19e-05) =	2.1971e-05 (1.95e-05) -	<b>3.0871e-11 (3.57e-11)</b> =	2.3537e-07 (1.29e-06) =	4.9686e-11 (8.12e-11)
CEC17-MTP9-T1	3.1651e+01 (5.99e+01) =	<b>1.7213e+01 (2.22e+00)</b> +	2.5608e+01 (2.74e+01) =	1.8738e+01 (4.04e+00) =	1.9335e+01 (3.78e+00) =	1.8705e+01 (3.53e+00)
CEC17-MTP9-T2	<b>9.5581e+03 (7.79e+02)</b> +	9.6148e+03 (9.83e+02) +	1.0012e+04 (7.49e+02) =	1.0440e+04 (8.73e+02) =	1.1711e+04 (6.83e+01) -	1.0423e+04 (7.23e+02)
WCCI20-MTP1-T1	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP1-T2	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP2-T1	1.1369e-14 (3.47e-14) =	<b>0.0000e+00 (0.00e+00)</b> =	7.5791e-15 (2.88e-14) =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP2-T2	3.7896e-15 (2.08e-14) =	<b>0.0000e+00 (0.00e+00)</b> =	7.5791e-15 (2.88e-14) =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b> =	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP3-T1	2.2883e+03 (6.59e+02) =	1.6695e+03 (5.20e+02) -	1.8498e+03 (4.66e+02) =	<b>1.3633e+03 (4.95e+02)</b> =	2.0888e+03 (6.35e+02) -	1.4747e+03 (5.00e+02)
WCCI20-MTP3-T2	2.1516e+03 (5.67e+02) =	1.7544e+03 (4.82e+02) -	1.6977e+03 (3.95e+02) -	<b>1.3709e+03 (4.81e+02)</b> =	2.0236e+03 (5.06e+02) -	1.4287e+03 (4.87e+02)
WCCI20-MTP4-T1	<b>7.8863e-02 (1.69e-02)</b> =	7.9496e-02 (1.45e-02) =	1.1019e-01 (3.48e-02) =	8.4316e-02 (1.95e-02) =	8.1712e-02 (1.64e-02) =	8.2260e-02 (2.20e-02)
WCCI20-MTP4-T2	8.2665e-02 (2.01e-02) =	8.5794e-02 (1.61e-02) =	<b>7.7817e-02 (1.28e-02)</b> =	8.1188e-02 (1.62e-02) =	2.2279e-01 (1.04e-01) =	8.4392e-02 (1.76e-02)
WCCI20-MTP5-T1	3.8634e+00 (7.43e-01) =	<b>3.4022e+00 (6.92e-01)</b> +	3.8087e+00 (6.51e-01) =	3.6766e+00 (7.03e-01) =	4.1726e+00 (4.94e-01) =	3.7066e+00 (6.47e-01)
WCCI20-MTP5-T2	<b>5.3472e+00 (5.49e-01)</b> =	5.5853e+00 (1.01e+00) =	5.6870e+00 (7.63e-01) =	5.5080e+00 (9.82e-01) =	7.9037e+00 (1.06e+00) =	5.6105e+00 (8.53e-01)
WCCI20-MTP6-T1	1.6830e+03 (3.86e+02) =	1.5680e+03 (4.70e+02) =	1.7047e+03 (5.05e+02) =	<b>1.5424e+03 (4.13e+02)</b> =	1.8689e+03 (1.40e+03) =	1.6509e+03 (4.64e+02)
WCCI20-MTP6-T2	1.671e+03 (4.98e+02) =	1.5682e+03 (4.30e+02) =	1.5252e+03 (4.26e+02) =	1.4491e+03 (4.46e+02) =	2.0295e+03 (1.19e+03) =	<b>1.4223e+03 (4.08e+02)</b>
WCCI20-MTP7-T1	6.4705e+01 (8.35e+01) +	1.2279e+02 (1.19e+02) =	1.0814e+02 (1.31e+02) =	<b>3.8102e+01 (3.94e+01)</b> +	2.0143e+02 (1.74e+02) =	9.3507e+01 (1.08e+02)
WCCI20-MTP7-T2	1.8437e+02 (1.59e+02) =	1.9511e+02 (1.77e+02) =	1.6323e+02 (1.67e+02) =	<b>1.5894e+02 (1.33e+02)</b> =	2.2818e+02 (1.85e+02) =	1.9254e+02 (1.80e+02)
WCCI20-MTP8-T1	2.1182e+01 (4.89e-02) -	2.1118e+01 (3.06e-01) =	<b>2.0418e+01 (3.87e+00)</b> =	2.1171e+01 (5.95e-02) =	2.1185e+01 (3.40e-02) =	2.0750e+01 (5.67e-01)
WCCI20-MTP8-T2	2.1156e+01 (5.56e-02) =	2.1019e+01 (4.02e-01) =	2.1196e+01 (2.81e-02) =	2.1181e+01 (5.70e-02) =	2.1145e+01 (1.59e-01) =	<b>2.0428e+01 (3.86e+00)</b>
WCCI20-MTP9-T1	<b>1.4559e+03 (5.07e+02)</b> +	1.9919e+03 (5.29e+02) =	1.8107e+03 (5.54e+02) =	1.6864e+03 (5.41e+02) =	2.0579e+03 (8.51e+02) =	1.8698e+03 (5.73e+02)
WCCI20-MTP9-T2	2.0339e+01 (4.31e-01) =	<b>1.9087e+01 (1.53e+00)</b> +	2.0676e+01 (6.40e-01) =	2.0143e+01 (4.35e-01) =	2.0365e+01 (7.15e-01) =	1.9839e+01 (1.10e+00)
WCCI20-MTP10-T1	1.4297e+02 (3.56e+01) =	<b>1.3097e+02 (2.87e+01)</b> =	1.3962e+02 (3.71e+01) =	1.3451e+02 (3.68e+01) =	3.2870e+02 (2.14e+02) =	1.3107e+02 (3.53e+01)
WCCI20-MTP10-T2	<b>1.7679e+03 (4.24e+02)</b> =	1.8243e+03 (4.26e+02) =	1.8756e+03 (3.55e+02) =	2.0591e+03 (4.10e+02) =	2.0973e+03 (8.21e+02) =	1.9455e+03 (4.04e+02)
+ / - / =	4 / 13 / 21	4 / 10 / 24	0 / 12 / 26	1 / 4 / 33	0 / 12 / 26	Base
Ranking (p-value)	3.8289 (0.02)	3.3158 (0.29)	3.7105 (0.04)	2.9605 (0.00)	4.3158 (0.83)	<b>2.8684</b>

TABLE S-XI  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF PARAMETER  $\tau$ .

	$\tau=0$	$\tau=1$	$\tau=2$	$\tau=4$	$\tau=8$
CEC17-MTP1-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP1-T2	1.6715e+01 (3.55e+00)	4.3115e+01 (9.67e-01)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP2-T1	2.0137e-10 (9.28e-11)	5.5183e-12 (2.75e-12)	3.0796e-13 (1.08e-13)	4.9797e-14 (4.44e-15)	5.0745e-14 (4.80e-15)
CEC17-MTP2-T2	1.7877e+01 (4.10e+00)	3.0895e-01 (8.26e-01)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP3-T1	2.1202e+01 (3.71e-02)	2.1186e+01 (4.84e-02)	2.1204e+01 (4.18e-02)	2.1159e+01 (1.93e-01)	2.0662e+01 (5.93e-01)
CEC17-MTP3-T2	9.4377e+03 (1.12e+03)	1.0061e+04 (1.08e+03)	9.7576e+03 (8.96e+02)	1.0622e+04 (1.04e+03)	1.1458e+04 (1.17e+03)
CEC17-MTP4-T1	1.7048e+01 (3.62e+00)	1.9833e+01 (4.23e+00)	2.0098e+01 (4.08e+00)	2.0430e+01 (5.34e+00)	2.3813e+01 (5.47e+00)
CEC17-MTP4-T2	5.7426e-19 (7.24e-19)	4.2311e-22 (6.05e-22)	2.9776e-24 (2.91e-24)	3.2090e-26 (8.91e-27)	3.0568e-26 (4.32e-27)
CEC17-MTP5-T1	2.1450e-10 (8.04e-11)	4.6708e-12 (2.10e-12)	6.5992e-13 (2.88e-13)	1.3530e-13 (6.92e-14)	1.3719e-13 (6.51e-14)
CEC17-MTP5-T2	4.8525e+01 (2.32e+01)	4.2051e+01 (1.01e+01)	4.4705e+01 (1.24e+01)	7.7347e+01 (1.24e+01)	8.2458e+01 (3.48e-01)
CEC17-MTP6-T1	2.0474e-10 (1.27e-10)	5.2557e-12 (2.45e-12)	6.2155e-13 (3.35e-13)	5.0745e-14 (4.42e-15)	5.1100e-14 (3.82e-15)
CEC17-MTP6-T2	5.2118e-04 (1.99e-04)	2.5240e-08 (4.87e-08)	9.9973e-13 (1.92e-12)	-1.9888e-18 (0.00e+00)	-1.9888e-18 (0.00e+00)
CEC17-MTP7-T1	4.9541e+01 (2.74e+01)	4.2204e+01 (1.01e+01)	4.0984e+01 (7.49e-01)	4.1063e+01 (4.67e-01)	4.2144e+01 (2.92e-01)
CEC17-MTP7-T2	1.6715e+01 (4.03e+00)	1.2271e+00 (3.68e+00)	2.6532e-01 (1.45e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP8-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP8-T2	1.8412e-05 (1.76e-05)	8.2435e-09 (1.22e-08)	3.6511e-11 (3.82e-11)	4.2593e-15 (1.07e-14)	1.6146e-02 (5.50e-02)
CEC17-MTP9-T1	3.1651e+01 (5.99e+01)	1.8772e+01 (4.00e+00)	1.9136e+01 (3.48e+00)	2.2685e+01 (5.22e+00)	2.4211e+01 (4.89e+00)
CEC17-MTP9-T2	9.5581e+03 (7.79e+02)	1.0040e+04 (8.75e+02)	1.0834e+04 (7.15e+02)	1.1117e+04 (7.12e+02)	1.1843e+04 (6.68e+02)
WCCI20-MTP1-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	4.7070e-07 (2.58e-06)	2.2566e-02 (5.87e-02)
WCCI20-MTP1-T2	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	2.3107e-03 (1.27e-02)	2.1894e-02 (6.84e-02)
WCCI20-MTP2-T1	1.1369e-14 (3.47e-14)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP2-T2	3.7896e-15 (2.08e-14)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP3-T1	2.2883e+03 (6.59e+02)	1.8533e+03 (4.87e+02)	1.4210e+03 (4.79e+02)	1.1537e+03 (5.06e+02)	1.0444e+03 (4.41e+02)
WCCI20-MTP3-T2	2.1516e+03 (5.67e+02)	1.6448e+03 (4.91e+02)	1.3654e+03 (4.33e+02)	1.1659e+03 (3.99e+02)	1.0265e+03 (4.15e+02)
WCCI20-MTP4-T1	7.8863e-02 (1.69e-02)	8.5334e-02 (1.89e-02)	9.5376e-02 (2.71e-02)	1.0594e-01 (2.77e-02)	1.2167e-01 (2.07e-02)
WCCI20-MTP4-T2	8.2665e-02 (2.01e-02)	7.8120e-02 (1.57e-02)	8.1673e-02 (1.52e-02)	8.2769e-02 (1.41e-02)	8.1050e-02 (1.36e-02)
WCCI20-MTP5-T1	3.8634e+00 (7.43e-01)	3.6254e+00 (5.71e-01)	3.7692e+00 (6.31e-01)	3.6397e+00 (6.00e-01)	3.6907e+00 (5.20e-01)
WCCI20-MTP5-T2	5.3472e+00 (5.49e-01)	5.3765e+00 (7.31e-01)	5.5168e+00 (8.70e-01)	5.5954e+00 (7.31e-01)	5.4149e+00 (8.01e-01)
WCCI20-MTP6-T1	1.6830e+03 (3.86e+02)	1.6706e+03 (4.23e+02)	1.4988e+03 (4.91e+02)	1.5012e+03 (4.26e+02)	1.8371e+03 (4.98e+02)
WCCI20-MTP6-T2	1.5671e+03 (4.98e+02)	1.6333e+03 (4.55e+02)	1.5503e+03 (5.12e+02)	1.5370e+03 (4.89e+02)	1.6947e+03 (3.93e+02)
WCCI20-MTP7-T1	6.4705e+01 (8.35e+01)	7.1219e+01 (8.04e+01)	6.1984e+01 (7.92e+01)	1.1149e+02 (1.17e+02)	9.0917e+01 (1.17e+02)
WCCI20-MTP7-T2	1.8437e+02 (1.59e+02)	1.6958e+02 (1.25e+02)	1.4081e+02 (1.35e+02)	1.7235e+02 (1.19e+02)	2.4451e+02 (1.71e+02)
WCCI20-MTP8-T1	2.1182e+01 (4.89e-02)	2.0446e+01 (3.86e+00)	2.1057e+01 (3.59e-01)	2.0559e+01 (6.08e-01)	1.9998e+01 (2.74e-03)
WCCI20-MTP8-T2	2.1156e+01 (5.56e-02)	2.1189e+01 (2.69e-02)	2.0364e+01 (3.86e+00)	2.0438e+01 (5.74e-01)	1.9999e+01 (8.38e-04)
WCCI20-MTP9-T1	1.4559e+03 (5.07e+02)	1.7159e+03 (4.90e+02)	1.9304e+03 (5.58e+02)	2.3274e+03 (3.50e+02)	2.5311e+03 (4.83e+02)
WCCI20-MTP9-T2	2.0339e+01 (4.31e-01)	2.0166e+01 (5.22e-01)	1.9945e+01 (1.02e+00)	1.9717e+01 (1.36e+00)	1.9646e+01 (1.15e+00)
WCCI20-MTP10-T1	1.4297e+02 (3.56e+01)	1.3366e+02 (3.58e+01)	1.3186e+02 (4.19e+01)	1.2817e+02 (2.98e+01)	1.4076e+02 (3.36e+01)
WCCI20-MTP10-T2	1.7679e+03 (4.24e+02)	1.9911e+03 (3.70e+02)	1.9872e+03 (3.90e+02)	1.9466e+03 (3.47e+02)	2.2011e+03 (4.62e+02)
Ranking (p-value)	3.5000 (0.01)	2.9474 (0.28)	2.5526	2.27895 (0.51)	3.2105 (0.06)

TABLE S-XII  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF PARAMETER  $\alpha$ .

	$\alpha=0$	$\alpha=1/4$	$\alpha=1/2$	$\alpha=3/4$	$\alpha=1$
CEC17-MTP1-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP1-T2	1.8042e+01 (4.07e+00)	5.3064e-01 (1.73e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP2-T1	4.2567e-13 (1.91e-13)	6.3416e-14 (9.54e-15)	3.5379e-13 (1.80e-13)	3.7386e-12 (1.67e-12)	1.6615e-10 (1.01e-10)
CEC17-MTP2-T2	1.7909e+01 (3.79e+00)	2.4133e-01 (6.23e-01)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP3-T1	2.0785e+01 (2.31e+00)	2.1206e+01 (4.50e-02)	2.1206e+01 (4.07e-02)	2.1202e+01 (4.44e-02)	2.0970e+01 (1.20e+00)
CEC17-MTP3-T2	9.7098e+03 (8.98e+02)	1.0068e+04 (8.47e+02)	1.0222e+04 (1.16e+03)	9.8951e+03 (8.22e+02)	9.8392e+03 (1.08e+03)
CEC17-MTP4-T1	1.8838e+01 (4.25e+00)	1.8838e+01 (4.89e+00)	2.1027e+01 (5.08e+00)	1.9966e+01 (4.52e+00)	1.9170e+01 (3.77e+00)
CEC17-MTP4-T2	3.6583e-24 (3.08e-24)	7.1564e-26 (1.07e-25)	4.1071e-24 (4.01e-24)	6.9887e-22 (6.38e-22)	1.1243e-18 (1.28e-18)
CEC17-MTP5-T1	7.2469e-13 (4.39e-13)	9.5272e-14 (4.02e-14)	7.0954e-13 (3.93e-13)	8.8596e-12 (4.05e-12)	2.4105e-10 (9.80e-11)
CEC17-MTP5-T2	4.5301e+01 (1.86e+01)	4.2478e+01 (9.82e+00)	5.0033e+01 (1.73e+01)	6.0986e+01 (2.07e+01)	4.1023e+01 (8.43e-01)
CEC17-MTP6-T1	4.6369e-13 (2.17e-13)	6.9929e-14 (1.41e-14)	4.6748e-13 (1.88e-13)	6.7165e-12 (2.86e-12)	2.6473e-10 (1.17e-10)
CEC17-MTP6-T2	1.3663e-09 (2.19e-09)	7.3403e-15 (1.43e-14)	1.5833e-12 (4.42e-12)	2.7621e-12 (1.97e-12)	8.1133e-09 (1.56e-08)
CEC17-MTP7-T1	5.3909e+01 (2.76e+01)	4.2596e+01 (1.04e+01)	4.0621e+01 (7.17e-01)	4.0855e+01 (5.53e-01)	4.1232e+01 (6.48e-01)
CEC17-MTP7-T2	1.8407e+01 (4.30e+00)	1.6020e+00 (3.59e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP8-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP8-T2	2.1769e-06 (1.19e-05)	1.1463e-13 (2.01e-13)	2.5089e-11 (2.95e-11)	3.1732e-08 (4.37e-08)	2.1971e-05 (1.95e-05)
CEC17-MTP9-T1	1.7213e+01 (2.22e+00)	1.8573e+01 (4.22e+00)	1.9667e+01 (3.87e+00)	2.0098e+01 (4.86e+00)	2.5608e+01 (2.74e+01)
CEC17-MTP9-T2	9.6148e+03 (9.83e+02)	1.0270e+04 (9.08e+02)	1.0405e+04 (7.61e+02)	1.0709e+04 (7.07e+02)	1.0012e+04 (7.49e+02)
WCCI20-MTP1-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP1-T2	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP2-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	7.5791e-15 (2.88e-14)
WCCI20-MTP2-T2	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	7.5791e-15 (2.88e-14)
WCCI20-MTP3-T1	1.6695e+03 (5.20e+02)	1.3923e+03 (4.16e+02)	1.5250e+03 (4.97e+02)	1.5660e+03 (4.82e+02)	1.8498e+03 (4.66e+02)
WCCI20-MTP3-T2	1.7544e+03 (4.82e+02)	1.3108e+03 (4.56e+02)	1.5796e+03 (4.67e+02)	1.7408e+03 (4.49e+02)	1.6977e+03 (3.95e+02)
WCCI20-MTP4-T1	7.9496e-02 (1.45e-02)	8.6597e-02 (1.57e-02)	8.5134e-02 (1.91e-02)	1.0017e-01 (2.32e-02)	1.1019e-01 (3.48e-02)
WCCI20-MTP4-T2	8.5794e-02 (1.61e-02)	8.0994e-02 (1.76e-02)	7.4974e-02 (1.20e-02)	8.1835e-02 (1.75e-02)	7.7817e-02 (1.28e-02)
WCCI20-MTP5-T1	3.4022e+00 (6.92e-01)	3.5908e+00 (6.46e-01)	3.5688e+00 (6.07e-01)	3.9211e+00 (5.89e-01)	3.8087e+00 (6.51e-01)
WCCI20-MTP5-T2	5.5853e+00 (1.01e+00)	5.2921e+00 (8.11e-01)	5.4760e+00 (7.40e-01)	5.6037e+00 (8.56e-01)	5.6870e+00 (7.63e-01)
WCCI20-MTP6-T1	1.5680e+03 (4.70e+02)	1.5141e+03 (4.87e+02)	1.5729e+03 (4.35e+02)	1.5183e+03 (4.56e+02)	1.7047e+03 (5.05e+02)
WCCI20-MTP6-T2	1.5682e+03 (4.30e+02)	1.4693e+03 (4.52e+02)	1.5422e+03 (5.01e+02)	1.6161e+03 (3.86e+02)	1.5252e+03 (4.26e+02)
WCCI20-MTP7-T1	1.2279e+02 (1.19e+02)	6.3182e+01 (1.03e+02)	7.1612e+01 (7.98e+01)	8.8311e+01 (1.49e+02)	1.0814e+02 (1.31e+02)
WCCI20-MTP7-T2	1.9511e+02 (1.77e+02)	1.9608e+02 (1.67e+02)	1.6098e+02 (1.34e+02)	1.5201e+02 (1.32e+02)	1.6323e+02 (1.67e+02)
WCCI20-MTP8-T1	2.1118e+01 (3.06e-01)	2.1160e+01 (6.78e-02)	2.1142e+01 (2.17e-01)	1.9770e+01 (5.37e+00)	2.0418e+01 (3.87e+00)
WCCI20-MTP8-T2	2.1019e+01 (4.02e-01)	2.1155e+01 (1.51e-01)	2.1186e+01 (3.83e-02)	2.1143e+01 (2.19e-01)	2.1196e+01 (2.81e-02)
WCCI20-MTP9-T1	1.9919e+03 (5.29e+02)	1.9251e+03 (5.61e+02)	1.9420e+03 (6.09e+02)	1.5885e+03 (4.47e+02)	1.8107e+03 (5.54e+02)
WCCI20-MTP9-T2	1.9087e+01 (1.53e+00)	1.9786e+01 (1.08e+00)	2.0209e+01 (5.52e-01)	2.0145e+01 (1.06e+00)	2.0676e+01 (6.40e-01)
WCCI20-MTP10-T1	1.3097e+02 (2.87e+01)	1.3836e+02 (2.99e+01)	1.3156e+02 (3.99e+01)	1.3043e+02 (3.92e+01)	1.3962e+02 (3.71e+01)
WCCI20-MTP10-T2	1.8243e+03 (4.26e+02)	1.8683e+03 (3.80e+02)	1.9651e+03 (3.96e+02)	1.9397e+03 (3.98e+02)	1.8756e+03 (3.55e+02)
Ranking (p-value)	2.9342 (0.45)	2.6579	2.8816 (0.54)	3.1053 (0.22)	3.4211 (0.04)

TABLE S-XIII  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF PARAMETER  $G$ .

	$G=10$	$G=20$	$G=50$	$G=100$	$G=200$
CEC17-MTP1-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP1-T2	0.0000e+00 (0.00e+00)	3.3165e-02 (1.82e-01)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	3.3165e-02 (1.82e-01)
CEC17-MTP2-T1	3.2963e-13 (1.62e-13)	3.3828e-13 (1.51e-13)	3.7748e-13 (1.42e-13)	3.3899e-13 (1.48e-13)	3.1234e-13 (1.77e-13)
CEC17-MTP2-T2	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP3-T1	2.1190e+01 (5.35e-02)	2.1159e+01 (2.23e-01)	2.1173e+01 (2.10e-01)	2.0451e+01 (3.87e+00)	2.1198e+01 (3.47e-02)
CEC17-MTP3-T2	9.9747e+03 (9.49e+02)	9.8478e+03 (1.02e+03)	9.8365e+03 (1.04e+03)	1.0014e+04 (9.76e+02)	1.0297e+04 (8.08e+02)
CEC17-MTP4-T1	1.8274e+01 (3.88e+00)	2.0795e+01 (6.53e+00)	2.0629e+01 (4.25e+00)	2.0695e+01 (4.18e+00)	1.9501e+01 (4.15e+00)
CEC17-MTP4-T2	1.6100e-23 (1.74e-23)	6.9278e-24 (8.95e-24)	3.0854e-24 (2.05e-24)	3.1092e-24 (2.56e-24)	3.1424e-24 (2.43e-24)
CEC17-MTP5-T1	8.2737e-13 (6.16e-13)	9.4709e-13 (1.17e-12)	7.1700e-13 (4.14e-13)	6.4298e-13 (2.63e-13)	6.8088e-13 (3.27e-13)
CEC17-MTP5-T2	4.8262e+01 (1.66e+01)	4.8862e+01 (1.63e+01)	4.8602e+01 (1.64e+01)	4.5691e+01 (1.39e+01)	5.0091e+01 (1.80e+01)
CEC17-MTP6-T1	6.2936e-13 (3.44e-13)	4.9673e-13 (1.63e-13)	4.9412e-13 (2.25e-13)	5.0940e-13 (3.19e-13)	5.7607e-13 (2.57e-13)
CEC17-MTP6-T2	1.4550e-12 (3.28e-12)	1.5021e-12 (2.70e-12)	1.6684e-12 (2.70e-12)	1.0331e-12 (1.83e-12)	1.1565e-12 (2.64e-12)
CEC17-MTP7-T1	4.0702e+01 (5.87e-01)	4.0625e+01 (5.75e-01)	4.0673e+01 (5.13e-01)	4.0531e+01 (5.79e-01)	4.0571e+01 (5.23e-01)
CEC17-MTP7-T2	3.9798e-01 (1.60e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP8-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
CEC17-MTP8-T2	1.4207e-10 (1.88e-10)	6.0182e-11 (5.51e-11)	2.6695e-11 (2.19e-11)	3.4083e-11 (3.68e-11)	2.9829e-11 (3.87e-11)
CEC17-MTP9-T1	1.9833e+01 (2.90e+00)	1.8606e+01 (2.92e+00)	1.9800e+01 (3.29e+00)	2.0131e+01 (3.81e+00)	1.8340e+01 (3.25e+00)
CEC17-MTP9-T2	1.0088e+04 (9.46e+02)	1.0255e+04 (1.07e+03)	1.0380e+04 (1.03e+03)	1.0558e+04 (7.53e+02)	1.0333e+04 (7.56e+02)
WCCI20-MTP1-T1	0.0000e+00 (0.00e+00)	4.6006e-06 (2.52e-05)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP1-T2	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP2-T1	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP2-T2	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)	0.0000e+00 (0.00e+00)
WCCI20-MTP3-T1	1.5280e+03 (4.49e+02)	1.6438e+03 (4.78e+02)	1.3561e+03 (4.78e+02)	1.4907e+03 (4.73e+02)	1.5351e+03 (4.18e+02)
WCCI20-MTP3-T2	1.5242e+03 (5.21e+02)	1.3886e+03 (5.33e+02)	1.3540e+03 (5.28e+02)	1.3069e+03 (3.69e+02)	1.5327e+03 (4.75e+02)
WCCI20-MTP4-T1	8.8040e-02 (1.64e-02)	8.5960e-02 (1.49e-02)	8.3404e-02 (1.93e-02)	8.2872e-02 (1.78e-02)	7.9355e-02 (1.32e-02)
WCCI20-MTP4-T2	8.5221e-02 (1.64e-02)	8.5414e-02 (1.73e-02)	8.0576e-02 (1.78e-02)	8.0419e-02 (1.46e-02)	7.4340e-02 (1.41e-02)
WCCI20-MTP5-T1	3.8523e+00 (7.30e-01)	3.5827e+00 (5.50e-01)	3.8015e+00 (6.82e-01)	3.6444e+00 (5.00e-01)	3.8021e+00 (6.97e-01)
WCCI20-MTP5-T2	5.5910e+00 (9.15e-01)	5.4314e+00 (8.89e-01)	5.6828e+00 (8.75e-01)	5.5054e+00 (8.33e-01)	5.5477e+00 (1.06e+00)
WCCI20-MTP6-T1	1.5812e+03 (4.83e+02)	1.3815e+03 (3.54e+02)	1.6371e+03 (4.44e+02)	1.6899e+03 (4.46e+02)	1.6449e+03 (4.29e+02)
WCCI20-MTP6-T2	1.4246e+03 (3.68e+02)	1.5895e+03 (4.57e+02)	1.6009e+03 (4.11e+02)	1.4991e+03 (4.07e+02)	1.4199e+03 (4.09e+02)
WCCI20-MTP7-T1	1.0711e+02 (1.33e+02)	9.0863e+01 (9.04e+01)	9.9263e+01 (1.41e+02)	5.1434e+01 (6.82e+01)	9.2416e+01 (1.08e+02)
WCCI20-MTP7-T2	1.9645e+02 (1.75e+02)	1.5997e+02 (1.43e+02)	1.9311e+02 (1.56e+02)	2.0059e+02 (1.53e+02)	1.7843e+02 (1.55e+02)
WCCI20-MTP8-T1	2.0320e+01 (3.86e+00)	2.0476e+01 (3.87e+00)	2.0289e+01 (3.86e+00)	2.0846e+01 (5.29e-01)	1.9654e+01 (5.35e+00)
WCCI20-MTP8-T2	2.1132e+01 (2.17e-01)	2.1166e+01 (4.14e-02)	2.0476e+01 (3.87e+00)	2.1180e+01 (3.69e-02)	2.1067e+01 (3.63e-01)
WCCI20-MTP9-T1	2.0611e+03 (6.41e+02)	1.7115e+03 (6.30e+02)	1.6656e+03 (4.95e+02)	1.4681e+03 (4.24e+02)	1.7612e+03 (5.61e+02)
WCCI20-MTP9-T2	1.9940e+01 (9.49e-01)	2.0214e+01 (4.44e-01)	2.0138e+01 (5.84e-01)	2.0160e+01 (6.39e-01)	1.9902e+01 (1.12e+00)
WCCI20-MTP10-T1	1.2273e+02 (3.25e+01)	1.3787e+02 (4.87e+01)	1.3464e+02 (3.47e+01)	1.3067e+02 (2.70e+01)	1.3651e+02 (2.97e+01)
WCCI20-MTP10-T2	1.9531e+03 (3.77e+02)	1.8981e+03 (3.93e+02)	1.9524e+03 (4.49e+02)	2.0121e+03 (4.60e+02)	2.0281e+03 (2.70e+02)
Ranking (p-value)	3.2105 (0.26)	3.1579 (0.32)	2.8026	2.8816 (0.82)	2.9474 (0.68)

TABLE S-XIV  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF PARAMETER  $\alpha$  ANALYSIS.

	$\alpha=1/4$	$\alpha=1/2$	Fixed-Control
CEC17-MTP1-T1	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP1-T2	5.3064e-01 (1.73e+00) -	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP2-T1	<b>6.3416e-14 (9.54e-15) +</b>	3.5379e-13 (1.80e-13) -	1.7805e-13 (7.05e-14)
CEC17-MTP2-T2	2.4133e-01 (6.23e-01) -	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP3-T1	2.1206e+01 (4.50e-02) =	2.1206e+01 (4.07e-02) =	<b>2.1194e+01 (4.65e-02)</b>
CEC17-MTP3-T2	1.0068e+04 (8.47e+02) =	1.0222e+04 (1.16e+03) =	<b>1.0053e+04 (1.16e+03)</b>
CEC17-MTP4-T1	<b>1.8838e+01 (4.89e+00) =</b>	2.1027e+01 (5.08e+00) =	1.9501e+01 (3.55e+00)
CEC17-MTP4-T2	<b>7.1564e-26 (1.07e-25) +</b>	4.1071e-24 (4.01e-24) -	1.1816e-24 (1.07e-24)
CEC17-MTP5-T1	<b>9.5272e-14 (4.02e-14) +</b>	7.0954e-13 (3.93e-13) -	3.4716e-13 (1.64e-13)
CEC17-MTP5-T2	<b>4.2478e+01 (9.82e+00) =</b>	5.0033e+01 (1.73e+01) =	4.7064e+01 (1.55e+01)
CEC17-MTP6-T1	<b>6.9929e-14 (1.41e-14) +</b>	4.6748e-13 (1.88e-13) -	2.9991e-13 (1.95e-13)
CEC17-MTP6-T2	<b>7.3403e-15 (1.43e-14) +</b>	1.5833e-12 (4.42e-12) -	2.0369e-13 (4.54e-13)
CEC17-MTP7-T1	4.2596e+01 (1.04e+01) =	4.0621e+01 (7.17e-01) =	<b>4.0566e+01 (5.48e-01)</b>
CEC17-MTP7-T2	1.6020e+00 (3.59e+00) -	<b>0.0000e+00 (0.00e+00) +</b>	3.9798e-01 (2.18e+00)
CEC17-MTP8-T1	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
CEC17-MTP8-T2	<b>1.1463e-13 (2.01e-13) +</b>	2.5089e-11 (2.95e-11) -	7.0268e-12 (9.40e-12)
CEC17-MTP9-T1	<b>1.8573e+01 (4.22e+00) =</b>	1.9667e+01 (3.87e+00) =	1.9203e+01 (5.14e+00)
CEC17-MTP9-T2	<b>1.0270e+04 (9.08e+02) =</b>	1.0405e+04 (7.61e+02) =	1.0583e+04 (9.77e+02)
WCCI20-MTP1-T1	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP1-T2	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP2-T1	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP2-T2	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00) =</b>	<b>0.0000e+00 (0.00e+00)</b>
WCCI20-MTP3-T1	<b>1.3923e+03 (4.16e+02) =</b>	1.5250e+03 (4.97e+02) =	1.5616e+03 (5.23e+02)
WCCI20-MTP3-T2	<b>1.3108e+03 (4.56e+02) =</b>	1.5796e+03 (4.67e+02) =	1.4307e+03 (4.89e+02)
WCCI20-MTP4-T1	8.6597e-02 (1.57e-02) =	8.5134e-02 (1.91e-02) =	<b>8.4465e-02 (1.91e-02)</b>
WCCI20-MTP4-T2	8.0994e-02 (1.76e-02) =	<b>7.4974e-02 (1.20e-02) =</b>	7.9354e-02 (1.16e-02)
WCCI20-MTP5-T1	3.5908e+00 (6.46e-01) =	<b>3.5688e+00 (6.07e-01) =</b>	3.6809e+00 (6.00e-01)
WCCI20-MTP5-T2	<b>5.2921e+00 (8.11e-01) =</b>	5.4760e+00 (7.40e-01) =	5.3932e+00 (6.46e-01)
WCCI20-MTP6-T1	<b>1.5141e+03 (4.87e+02) +</b>	1.5729e+03 (4.35e+02) =	1.5877e+03 (3.70e+02)
WCCI20-MTP6-T2	<b>1.4693e+03 (4.52e+02) =</b>	1.5422e+03 (5.01e+02) =	1.4911e+03 (4.10e+02)
WCCI20-MTP7-T1	<b>6.3182e+01 (1.03e+02) +</b>	7.1612e+01 (7.98e+01) +	1.2590e+02 (1.78e+02)
WCCI20-MTP7-T2	1.9608e+02 (1.67e+02) =	1.6098e+02 (1.34e+02) =	<b>1.2516e+02 (1.21e+02)</b>
WCCI20-MTP8-T1	2.1160e+01 (6.78e-02) =	2.1142e+01 (2.17e-01) =	<b>2.0337e+01 (3.86e+00)</b>
WCCI20-MTP8-T2	2.1155e+01 (1.51e-01) =	2.1186e+01 (3.83e-02) =	<b>2.1119e+01 (2.55e-01)</b>
WCCI20-MTP9-T1	1.9251e+03 (5.61e+02) -	1.9420e+03 (6.09e+02) -	<b>1.6105e+03 (4.77e+02)</b>
WCCI20-MTP9-T2	<b>1.9786e+01 (1.08e+00) =</b>	2.0209e+01 (5.52e-01) =	1.9993e+01 (7.31e-01)
WCCI20-MTP10-T1	1.3836e+02 (2.99e+01) =	<b>1.3156e+02 (3.99e+01) +</b>	1.3356e+02 (2.95e+01)
WCCI20-MTP10-T2	<b>1.8683e+03 (3.80e+02) +</b>	1.9651e+03 (3.96e+02) =	2.0398e+03 (4.32e+02)
+ / - / =	9 / 4 / 25	3 / 7 / 28	Base
Ranking (p-value)	<b>1.8947</b>	2.1974 (0.18)	1.9079 (0.95)

TABLE S-XV  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION OF FLEXIBILITY EXPERIMENTS.

	xNES	MTES-KG (xNES)	OpenAI-ES	MTES-KG (OpenAI-ES)
CEC17-MTP1-T1	2.7530e+01 (2.16e+00) -	<b>6.9966e+00 (6.38e-01)</b>	<b>2.3161e-06 (6.52e-06) =</b>	5.8641e-04 (2.22e-03)
CEC17-MTP1-T2	2.7310e+04 (1.53e+03) -	<b>6.6365e+03 (6.53e+02)</b>	<b>1.2437e+01 (6.30e+00) =</b>	1.2835e+01 (5.64e+00)
CEC17-MTP2-T1	2.1186e+01 (4.14e-02) -	<b>1.9408e+01 (2.55e-01)</b>	7.3849e-04 (1.83e-04) -	<b>1.9476e-04 (6.06e-05)</b>
CEC17-MTP2-T2	2.7401e+04 (1.43e+03) -	<b>6.4900e+03 (8.57e+02)</b>	1.2935e+01 (5.36e+00) =	<b>1.2769e+01 (4.82e+00)</b>
CEC17-MTP3-T1	2.1208e+01 (3.43e-02) =	<b>2.1203e+01 (3.29e-02)</b>	2.0004e+01 (1.76e-02) -	<b>2.0001e+01 (8.49e-03)</b>
CEC17-MTP3-T2	1.5565e+04 (3.61e+02) =	<b>1.5504e+04 (3.34e+02)</b>	9.1512e+03 (1.39e+03) =	<b>9.0250e+03 (1.01e+03)</b>
CEC17-MTP4-T1	2.6739e+04 (1.94e+03) -	<b>6.7393e+03 (8.55e+02)</b>	<b>1.3366e+01 (7.34e+00) =</b>	1.4659e+01 (7.12e+00)
CEC17-MTP4-T2	1.1035e+05 (7.24e+03) -	<b>3.1405e+04 (2.88e+03)</b>	9.1581e-06 (6.25e-06) -	<b>6.3338e-07 (6.22e-07)</b>
CEC17-MTP5-T1	2.1183e+01 (3.54e-02) -	<b>1.9462e+01 (2.73e-01)</b>	6.9606e-04 (1.72e-04) -	<b>1.7750e-04 (5.12e-05)</b>
CEC17-MTP5-T2	3.5463e+09 (3.93e+08) -	<b>1.8547e+08 (6.27e+07)</b>	8.8478e+02 (1.67e+03) =	<b>8.6972e+02 (1.45e+03)</b>
CEC17-MTP6-T1	2.1188e+01 (4.43e-02) -	<b>1.9445e+01 (2.35e-01)</b>	6.9641e-04 (2.35e-04) -	<b>1.8360e-04 (6.83e-05)</b>
CEC17-MTP6-T2	<b>1.5079e+01 (6.81e-01) +</b>	2.5720e+01 (1.43e+00)	4.4785e+00 (3.07e+00) =	<b>4.4774e+00 (3.40e+00)</b>
CEC17-MTP7-T1	3.5652e+09 (4.26e+08) -	<b>1.8581e+08 (4.04e+07)</b>	1.0776e+03 (1.51e+03) =	<b>1.0074e+03 (1.92e+03)</b>
CEC17-MTP7-T2	2.7688e+04 (1.52e+03) -	<b>6.4976e+03 (7.47e+02)</b>	1.3930e+01 (6.19e+00) -	<b>1.3266e+01 (4.78e+00)</b>
CEC17-MTP8-T1	2.8260e+01 (1.38e+00) -	<b>7.8429e+00 (9.45e-01)</b>	<b>2.4874e-04 (1.35e-03) =</b>	5.8505e-04 (2.21e-03)
CEC17-MTP8-T2	7.2176e+01 (1.80e+00) -	<b>5.5540e+01 (1.90e+00)</b>	8.9387e+00 (4.72e+00) =	<b>8.8089e+00 (5.23e+00)</b>
CEC17-MTP9-T1	2.7177e+04 (1.67e+03) -	<b>6.5045e+03 (7.51e+02)</b>	1.4460e+01 (5.52e+00) -	<b>1.2172e+01 (5.37e+00)</b>
CEC17-MTP9-T2	<b>1.5559e+04 (4.05e+02) =</b>	1.5568e+04 (2.97e+02)	9.2268e+03 (1.07e+03) =	<b>9.1281e+03 (1.05e+03)</b>
WCCI20-MTP1-T1	5.3930e+01 (1.25e+00) -	<b>3.8376e+01 (1.27e+00)</b>	<b>9.3863e+00 (4.40e+00) =</b>	1.0832e+01 (4.29e+00)
WCCI20-MTP1-T2	5.3301e+01 (1.69e+00) -	<b>3.8671e+01 (1.50e+00)</b>	1.1187e+01 (5.80e+00) -	<b>9.1726e+00 (4.69e+00)</b>
WCCI20-MTP2-T1	1.6057e+02 (1.30e+01) -	<b>4.0194e+01 (5.05e+00)</b>	<b>1.8899e-03 (3.97e-03) +</b>	3.5327e-03 (6.02e-03)
WCCI20-MTP2-T2	1.6540e+02 (1.18e+01) -	<b>3.9787e+01 (4.67e+00)</b>	2.2174e-03 (5.23e-03) -	<b>1.4815e-03 (4.07e-03)</b>
WCCI20-MTP3-T1	3.3611e+07 (9.45e+06) -	<b>2.0792e+07 (6.63e+06)</b>	<b>9.8868e+06 (6.16e+06) =</b>	1.1772e+07 (8.09e+06)
WCCI20-MTP3-T2	3.4574e+07 (6.93e+06) -	<b>2.2195e+07 (6.51e+06)</b>	<b>1.1418e+07 (8.40e+06) =</b>	1.2333e+07 (7.02e+06)
WCCI20-MTP4-T1	2.6929e+00 (1.58e-01) -	<b>1.1016e+00 (2.43e-01)</b>	7.7651e-02 (1.21e-01) -	<b>6.0923e-02 (1.30e-02)</b>
WCCI20-MTP4-T2	2.9039e+00 (2.07e-01) -	<b>1.9780e+00 (3.68e-01)</b>	4.8214e-02 (9.07e-03) =	<b>4.6789e-02 (7.44e-03)</b>
WCCI20-MTP5-T1	2.1876e+04 (7.04e+03) -	<b>2.9303e+03 (1.11e+03)</b>	6.0608e+00 (2.09e+00) =	<b>5.7041e+00 (1.53e+00)</b>
WCCI20-MTP5-T2	1.7947e+04 (6.00e+03) -	<b>3.3737e+03 (1.74e+03)</b>	7.0326e+00 (1.46e+00) =	<b>6.8116e+00 (1.23e+00)</b>
WCCI20-MTP6-T1	<b>1.6742e+07 (4.84e+06) =</b>	1.9035e+07 (5.63e+06)	7.1109e+06 (3.90e+06) =	<b>6.5180e+06 (3.74e+06)</b>
WCCI20-MTP6-T2	<b>1.7050e+07 (4.65e+06) =</b>	1.7980e+07 (6.53e+06)	<b>7.6250e+06 (4.72e+06) =</b>	7.9045e+06 (7.16e+06)
WCCI20-MTP7-T1	<b>1.9814e+03 (1.70e+02) +</b>	2.1602e+03 (2.61e+02)	1.4167e+03 (3.68e+02) -	<b>1.3710e+03 (4.47e+02)</b>
WCCI20-MTP7-T2	<b>2.0478e+03 (2.00e+02) =</b>	2.1738e+03 (2.20e+02)	<b>1.3442e+03 (4.02e+02) =</b>	1.4718e+03 (3.45e+02)
WCCI20-MTP8-T1	<b>2.1184e+01 (4.00e-02) =</b>	2.1189e+01 (3.57e-02)	2.0001e+01 (4.52e-03) =	<b>2.0001e+01 (2.66e-03)</b>
WCCI20-MTP8-T2	2.1181e+01 (5.03e-02) =	<b>2.1181e+01 (3.88e-02)</b>	2.0003e+01 (1.02e-02) =	<b>2.0002e+01 (8.94e-03)</b>
WCCI20-MTP9-T1	1.4270e+04 (3.31e+02) =	<b>1.4265e+04 (2.80e+02)</b>	5.7446e+03 (9.79e+02) -	<b>5.6342e+03 (7.91e+02)</b>
WCCI20-MTP9-T2	<b>2.2839e+01 (2.22e-01) =</b>	2.2889e+01 (2.01e-01)	2.2964e+01 (5.11e-01) -	<b>2.2827e+01 (7.09e-01)</b>
WCCI20-MTP10-T1	<b>5.2081e+04 (1.85e+04) +</b>	7.0737e+04 (3.33e+04)	1.2699e+06 (9.79e+05) =	<b>1.2112e+06 (7.82e+05)</b>
WCCI20-MTP10-T2	<b>1.6562e+07 (3.52e+06) =</b>	1.8494e+07 (6.98e+06)	<b>8.8056e+06 (6.47e+06) =</b>	9.0341e+06 (5.96e+06)
+ / - / =	3 / 24 / 11	Base	1 / 13 / 24	Base

TABLE S-XVI  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION ON PROBLEMS OF PARAMETER EXTRACTION OF PHOTOVOLTAIC MODELS.

	NL-SHADE-RSP	CMA-ES	MFEA	MFEA-II	MFEA-AKT	AT-MFEA	MTEA-AD	MRMP	MTES	MTES-KG
PEPVM-T1	9.8602e-04 (3.90e-17) -	1.7344e-02 (1.30e-02) -	1.7134e-03 (4.64e-04) -	1.9335e-03 (4.31e-04) -	1.5924e-03 (4.19e-04) -	1.9954e-03 (3.48e-04) -	1.5463e-03 (4.71e-04) -	9.8602e-04 (4.97e-13) -	5.9040e-02 (1.40e-02) -	9.8602e-04 (2.05e-17) -
PEPVM-T2	9.8314e-04 (1.23e-06) =	1.9273e-02 (1.49e-02) -	1.7242e-03 (4.93e-04) -	2.1660e-03 (4.31e-04) -	1.4704e-03 (3.60e-04) -	1.9623e-03 (3.43e-04) -	1.5992e-03 (4.41e-04) -	1.0863e-03 (1.15e-04) -	5.2377e-02 (1.01e-02) -	9.8298e-04 (1.16e-06) -
PEPVM-T3	2.4251e-03 (2.32e-17) +	1.3154e-01 (8.75e-02) -	3.1159e-03 (9.61e-04) -	2.5720e-03 (3.35e-04) +	3.1407e-03 (1.32e-03) =	2.3474e-03 (5.69e-05) +	2.7915e-03 (5.35e-04) =	2.4251e-03 (1.76e-17) +	1.1155e-01 (3.18e-02) -	2.5776e-03 (6.94e-05) -
+/-/ =	1/1/1	0/3/0	0/3/0	1/2/0	0/2/1	1/2/0	0/2/1	1/2/0	0/3/0	Base
Ranking (p-value)	1.6667	9.3333 (0.00)	6.3333 (0.00)	6.3333 (0.00)	5.6667 (0.02)	6.0000 (0.01)	5.0000 (0.05)	2.1667 (0.77)	9.6667 (0.00)	2.8333 (0.50)

TABLE S-XVII  
MULTITASK SCORE AND STANDARD DEVIATION ON PLANAR KINEMATIC ARM CONTROL PROBLEMS.

	GA	DE	NL-SHADE-RSP	CMA-ES	MatDE	EMaTo-MKT	BaKTDE	SBCMAES	MTES	MTES-KG
PKACP-20T	3.1765e-01 (3.29e-03) -	3.4512e-01 (1.79e-03) -	3.4762e-01 (1.63e-03) -	2.4010e-01 (1.39e-02) -	2.7989e-01 (4.86e-03) -	3.4390e-01 (2.37e-03) -	3.4563e-01 (2.13e-03) -	2.2922e-01 (2.03e-02) -	2.7988e+00 (2.41e-01) -	3.5061e-01 (3.80e-04) -
PKACP-50T	3.2193e-01 (2.33e-03) -	3.5426e-01 (1.02e-03) -	3.3613e-01 (8.42e-04) -	2.4043e-01 (9.02e-03) -	2.8399e-01 (2.64e-03) -	3.5196e-01 (1.47e-03) -	3.5699e-01 (1.18e-03) -	2.4102e-01 (8.97e-03) -	2.8671e+00 (1.15e-01) -	3.5924e-01 (6.13e-04) -
PKACP-100T	3.2127e-01 (1.96e-03) -	3.5291e-01 (1.01e-03) -	3.3531e-01 (6.62e-04) -	2.4697e-01 (7.15e-03) -	2.8346e-01 (2.69e-03) -	3.5196e-01 (1.18e-03) -	3.5232e-01 (7.09e-04) -	2.1921e-01 (9.95e-03) -	2.8463e+00 (1.14e-01) -	3.5836e-01 (1.87e-04) -
PKACP-200T	3.2075e-01 (1.42e-03) -	3.5000e-01 (8.56e-04) -	3.3529e-01 (5.59e-04) -	2.5420e-01 (3.05e-03) -	2.8719e-01 (1.51e-03) -	3.4936e-01 (8.19e-04) -	3.5390e-01 (4.40e-04) -	2.1997e-01 (1.54e-02) -	2.8437e+00 (9.30e-02) -	3.5597e-01 (1.69e-04) -
PKACP-500T	3.2091e-01 (8.44e-04) -	3.5037e-01 (3.66e-04) -	3.35219e-01 (2.43e-04) -	2.4835e-01 (2.73e-03) -	2.8665e-01 (9.48e-04) -	3.5011e-01 (4.39e-04) -	3.5364e-01 (1.81e-04) -	2.3652e-01 (1.04e-02) -	2.8544e+00 (4.65e-02) -	3.5532e-01 (9.42e-05) -
+/-/ =	0/5/0	0/5/0	0/5/0	0/5/0	0/5/0	0/5/0	0/5/0	0/5/0	0/5/0	Base
Ranking (p-value)	6.0000 (0.00)	4.0000 (0.11)	2.6000 (0.40)	8.2000 (0.00)	7.0000 (0.00)	5.0000 (0.03)	2.4000 (0.46)	8.8000 (0.00)	10.000 (0.00)	1.0000

TABLE S-XVIII  
AVERAGE OBJECTIVE VALUE AND STANDARD DEVIATION ON OPTIMAL POWER FLOW PROBLEMS.

	CMA-ES	CORCO	DcCODE	VMCH	MFEA-II	AT-MFEA	MTEA-AD	MRMP	MTES	MTES-KG
OPFP1-T1	8.0415e+02 (1.03e+01) -	8.0235e+02 (6.39e-01) -	8.0041e+02 (5.32e-05) -	8.0041e+02 (1.02e-04) -	8.0045e+02 (1.78e-02) -	8.0047e+02 (5.12e-02) -	8.0314e+02 (1.87e+00) -	8.0438e+02 (2.65e+00) -	8.0401e+02 (5.08e-05) -	8.0401e+02 (5.08e-05) -
OPFP1-T2	4.1768e+02 (1.46e+02) -	NaN (NaN) -	4.1666e+04 (7.48e-02) -	4.1666e+04 (2.30e-01) -	4.1685e+02 (9.52e+00) -	4.1692e+04 (1.87e+01) -	4.2086e+04 (2.34e+02) -	4.3948e+04 (1.57e+03) -	4.1666e+04 (2.14e-03) -	4.1666e+04 (2.14e-03) -
OPFP2-T1	1.3975e-01 (2.56e-03) -	1.3657e-01 (1.16e-04) -	1.3643e-01 (3.27e-05) -	1.3632e-01 (2.12e-05) -	1.3692e-01 (1.77e-04) -	1.3781e-01 (4.63e-04) -	1.3833e-01 (2.95e-04) -	1.3873e-01 (3.50e-04) -	1.3629e-01 (5.36e-06) -	1.3629e-01 (5.36e-06) -
OPFP2-T2	2.7152e-01 (4.77e-03) -	2.7902e-01 (6.63e-03) -	2.6929e-01 (3.86e-04) -	2.6891e-01 (1.02e-03) -	2.7338e-01 (1.72e-03) -	2.7825e-01 (3.00e-03) -	2.8586e-01 (1.62e-03) -	2.9449e-01 (2.58e-03) -	2.6779e-01 (9.66e-05) -	2.6779e-01 (9.66e-05) -
OPFP3-T1	2.0823e-01 (1.01e-02) -	2.0324e-01 (4.96e-04) -	2.0482e-01 (5.39e-09) -	2.0482e-01 (2.07e-08) -	2.0482e-01 (3.16e-07) -	2.0483e-01 (1.93e-05) -	2.1369e-01 (5.69e-03) -	2.1837e-01 (7.21e-03) -	2.0482e-01 (1.56e-12) -	2.0482e-01 (1.56e-12) -
OPFP3-T2	1.0192e+00 (1.95e-01) -	NaN (NaN) -	9.5358e-01 (7.19e-06) -	9.5357e-01 (1.22e-05) -	9.5440e-01 (3.65e-04) -	9.5474e-01 (8.31e-04) -	1.1227e+00 (3.44e-02) -	1.2406e+00 (9.86e-02) -	9.5355e-01 (5.11e-06) -	9.5355e-01 (5.11e-06) -
OPFP4-T1	4.2226e+00 (1.79e+00) -	3.4136e+00 (4.39e-01) -	3.0839e+00 (7.31e-06) -	3.0839e+00 (5.18e-05) -	3.0854e+00 (5.91e-04) -	3.1094e+00 (2.88e-02) -	4.1751e+00 (5.94e-01) -	4.4110e+00 (3.74e-01) -	3.0839e+00 (3.51e-05) -	3.0839e+00 (3.51e-05) -
OPFP4-T2	1.1924e+01 (5.50e+00) -	NaN (NaN) -	9.8770e+00 (2.17e-03) -	9.8777e+00 (4.94e-03) -	1.0226e+01 (1.47e-01) -	1.0596e+01 (3.33e-01) -	1.3263e+01 (6.95e-01) -	1.7060e+01 (1.66e+00) -	9.8709e+00 (1.05e-03) -	9.8709e+00 (1.05e-03) -
OPFP5-T1	1.4694e-01 (8.99e-02) =	1.0743e-01 (1.07e-02) -	8.5638e-02 (3.53e-05) -	8.5645e-02 (2.59e-04) -	9.1047e-02 (1.18e-03) -	9.2830e-02 (5.09e-03) -	1.3506e-02 (2.19e-02) -	1.6092e-01 (1.11e-02) -	8.5576e-02 (1.91e-07) -	8.5576e-02 (1.91e-07) -
OPFP5-T2	6.9582e-01 (1.56e-01) -	NaN (NaN) -	5.8684e-01 (1.47e-03) -	5.8637e-01 (1.89e-03) -	6.2723e-02 (1.44e-02) -	6.4896e-01 (2.96e-02) -	8.4902e-01 (3.27e-02) -	1.0440e+00 (7.85e-02) -	5.8354e-01 (4.36e-04) -	5.8354e-01 (4.36e-04) -
+/-/ =	0/9/1	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	0/10/0	Base
Ranking (p-value)	7.6500 (0.00)	7.8000 (0.00)	2.9000 (0.63)	2.6500 (0.76)	4.3000 (0.13)	5.5500 (0.01)	8.2500 (0.00)	9.4500 (0.00)	2.2500	2.2500