1

I. PROBLEM PARAMETERS

| $m{n}$ | The total number of fruit trees in the orchard |
|-----------------|---|
| t | Number of mature fruit trees, that is, the total number of subtasks |
| Ratio | The maturity rate of fruit trees |
| $oldsymbol{y}$ | Coordinates of mature fruit trees |
| Yield | The yield of mature fruit trees, that is, the task amount of subtasks |
| s | $= \{1, 2,, t\}$. Serial number of mature fruit trees |
| $m{r}$ | The number of robots |
| Cr | Congestion degree in the current environment |
| LEN, WID | The length and width of the orchard |
| len, wid | The length and width of the robot model used in this paper are 1.5 and 1 respectively |
| Wm | Maximum load of a robot, which is 300 kilograms (kg) in this paper $$ |
| $oldsymbol{w}$ | Robot's load |
| $oldsymbol{Sw}$ | Self-weight of a robot |
| Dp | The driving power of the robot, whose maximum is 2000 watts in this paper |
| $oldsymbol{v}$ | Average moving speed of a robot |
| $oldsymbol{T}$ | A task, which consists of multiple subtasks |
| TS | A task set, which consists of multiple tasks |
| AT | A collection of all tasks |
| Tp | Time of harvesting preprocessing of subtasks |
| Wt | The task amount of a task |
| Pr | The proportion of a subtask's completion in a task to its total task amount |
| $oldsymbol{k}$ | The number of subtasks in a task |
| $oldsymbol{N}$ | Number of tasks in a TS |
| TN | Total number of tasks |
| time | = $\{time_1, time_2,, time_{TN}\}.$ The task duration to complete tasks |
| TIME | = $\{TIME_1, TIME_2,, TIME_r\}.$ The TS duration to complete $TS\mathbf{s}$ |
| Na | Number of adjacent fruit trees, whose maximum value is $\boldsymbol{4}$ |
| $m{i},m{j}$ | Index |

II. PSEUDOCODE OF ALGORITHMS

Algorithm 2 Initial solution generation

```
Input: Yield, Wm, y, r, cr, Pnum
Output: AT, FIT
 1: AT \leftarrow \emptyset
 2: for i = 1 \to r - 1 do
        tempr = r - i
        Cluster_i \leftarrow \mathbf{Kmeans}(y, tempr) // The mature fruit trees are clustered into tempr clusters, and a cluster Cluster_i closest to the
    warehouse is obtained
       [rem, [T_1, T_2, ..., T_k]] \leftarrow Cluster_i // rem is the remaining subtasks, whose task weight is much less than Wm. It is assumed that
    the subtasks in the Cluster_i can be divided into k tasks except rem
        Update y with y, Cluster<sub>i</sub>, and rem // Recalculate the subtasks that are not assigned
        AT \leftarrow AT \cup [T_1, T_2, ..., T_k] // \text{ Update } AT
 7:
 8: end for
```

Algorithm 3 Proposed SSA

```
Input: AT, Yield, Wm, y, cr, Pnum
Output: AT
 1: [T_1, T_2, ..., T_s] \leftarrow AT // Suppose a solution contains s tasks
 2: i = 1
 3: for i = 1 \rightarrow s do
        Seq_1 \leftarrow T_i // Get the subtask sequence
 4:
        Randomly generate Seq<sub>2</sub> // Randomly generated sequence
 5:
        Newpop \leftarrow Seq_1 \cup Seq_2
 6:
        Pop \leftarrow Newpop
 7.
        while Size of Pop < Pnum do
 8:
            abest \leftarrow Select(Pop) // Select the sequence with the shortest task duration
 9:
             Newpop \leftarrow \mathbf{IDGA1}(gbest, Newpop)^{^{\prime}}/\!/ Generate new sequences
10:
             Pop \leftarrow Pop \cup Newpop // Store the newly generated sequences in the population
11:
        end while
12:
        qbest \leftarrow \mathbf{Select}(Pop)
13:
        T_i \leftarrow qbest // Update subtask sequence
15: end for
16: AT \leftarrow [T_1, T_2, ..., T_s] // Update the solution
17: Return AT
```

Algorithm 4 Proposed TBM

```
Input: AT, Yield, Wm, y, r, Cr, Pnum, TN, difference threshold THD, etc
Output: Archive
 1: z \leftarrow \max(\text{ceil}(\text{sum}(Yield)/Wm), \text{ceil}(TN/r)*r) // Get the number of unoccupied tasks, where \text{ceil}(*) means round up and \text{sum}(*)
    means add together
 2: AT \leftarrow [T_1, ..., T_{TN}, T_{TN+1}, ..., T_{TN+z}] //Suppose the solution AT contains TN tasks and add z empty tasks to it
 3: [MTC, LTC, thd] \leftarrow AT // Choose the most time-consuming task and the most time-saving task from AT, and get the time difference
 4: archive \leftarrow AT // Initialize archive
 5: while thd \geq THD or overloaded tasks exist do
        [MTC, LTC] \leftarrow exchange(MTC, LTC) // Algorithm 5
 6.
        AT \leftarrow [AT, MTC, LTC] // Update AT
 7:
        archive \leftarrow archive \cup AT
 8:
       [MTC, LTC, thd] \leftarrow AT // Update MTC, LTC, and thd
10: end while
```

11: $Archive \leftarrow Selection(archive, Pnum)$ // Screen out Pnum solutions with the minimum TEC

Algorithm 5 Proposed exchange operator

```
Input: MTC, LTC
Output: TempC, TempS
 1: /***Transfer subtasks from MTC header***/
 2: tt_1 = Inf // Initialize total time <math>tt_1
 3: tt_2 \leftarrow [MTC, LTC] // Get total time tt_2 of two tasks
 4: [TempC_1, TempS_1] = [MTC, LTC]
 5: while tt_2 < tt_1 do
       [TC_1, TS_1] = [TempC_1, TempS_1] //Update TC_1 and TS_1
 7:
       tt_1 = tt_2 // Update tt_1
       [TempC_1, TempS_1] \leftarrow Transfer1(TC_1, TS_1) // Gradually transfer subtasks from TC_1 header to TS_1
 ۸٠
       tt_2 \leftarrow [TempC_1, TempS_1] // Update tt_2
10: end while
11: /***Transfer subtasks from MTC tail***/
12: tt_1 = Inf // Initialize tt_1
13: tt_2 \leftarrow [MTC, LTC] // Initialize tt_2
14: [TempC_2, TempS_2] = [MTC, LTC]
15: while tt_2 < tt_1 do
       [TC_2, TS_2] = [TempC_2, TempS_2]
16:
17:
18:
       [TempC_2, TempS_2] \leftarrow Transfer2(TC_2, TS_2) // Gradually transfer subtasks from TC_2 tail to TS_2
       tt_2 \leftarrow [TempC_2, TempS_2] // Update tt_2
19:
20: end while
21: [TempC, TempS] \leftarrow \text{Select}([TC_1, TS_1], [TC_2, TS_2]) // Filter out the group with the shortest total task duration as output
```

Algorithm 6 Proposed NTOM

```
Input: AT, Yield, Wm, y, r, cr, Pnum, THD, etc
Output: Archive
 1: [Cor] \leftarrow Locate(AT, Y) // Get the center coordinates, Cor, of each task in the current solution
 2: if rand \leq \frac{1}{3} then
         op_1 \leftarrow MTC
 3: else if \frac{2}{3} \le \text{rand} \le \frac{2}{3} then
          op_1 \leftarrow LTC
 4: else
          Random select a task as op1
 5: end if// Initialize op1
 6: Cor_{op_1} \leftarrow [Cor, op_1] // Get the center coordinate of op_1, Cor_{op_1}
 7: sort1 \leftarrow [Cor, Cor_{op_1}] // Get the ranking of the distance from each center coordinate to the op_1 center coordinate
 8: sort2 \leftarrow AT // Get the ranking of task duration of each task
 9: sort \leftarrow sum(sort1, sort2) // Get the comprehensive ranking of each task
10: op_2 \leftarrow AT(sort) // Select the task with the first comprehensive ranking, op_2
11: thd \leftarrow [op_1, op_2] // Get the time difference thd
12: while thd \geq THD do
        [Temp\overline{F}, TempS] \leftarrow \mathbf{KGLS}(op_1, op_2) // Knowledge-guided local search operation
13:
        AT \leftarrow [AT, TempF, TempS] // Update AT
14:
15:
        archive \leftarrow archive \cup AT
        [op_1, op_2, thd] \leftarrow AT // Update op_1, op_2, and thd
16:
17: end while
18: Archive \leftarrow Selection(archive, Pnum) // Screen out Pnum solutions with the minimum TEC
```

Algorithm 7 Proposed PTAM

```
Input: Yield, archive, r, Pnum
Output: ARCHIVE, FIT
 1: d \leftarrow archive // Suppose the archive contains d solutions
 2: ARCHIVE \leftarrow \emptyset // Initialize the output archive
 3: FIT \leftarrow \emptyset // Initialize the fitness value corresponding to ARCHIVE
 4: for i = 1 \rightarrow d do
        AT \leftarrow archive(i)
        [T_1, T_2, ..., T_{TN}] \leftarrow AT // Suppose a solution contains TN tasks
 6:
        [seq1, seq2] = randi(TN) // Randomly generate two sequences from 1 to TN, which are used to disrupt the tasks in AT
 7:
 8:
        [sol1, TIME1] \leftarrow \mathbf{IDGA2}([T_1, T_2, ..., T_{TN}], idx_1, r) // Using IDGA2 to generate the task assignment result sol1. And the task
    duration vector TIME1 of the robot is obtained
        fit1 \leftarrow \max(TIME1) // Get the MCT value of sol1
 9:
10:
        [sol2, TIME2] \leftarrow \textbf{IDGA2} ([T_1, T_2, ..., T_{TN}], seq2, r)
11:
        fit2 \leftarrow \max(TIME2)
        Newpop \leftarrow seq1 \cup seq2

Pop \leftarrow Newpop
12:
13:
        Fit \leftarrow fit1 \cup fit2
14:
        while Size of Pop \leq Pnum do
15:
            gbest \leftarrow \textbf{Select}(Pop, Fit) // Select the sequence with the smallest MCT
16:
17:
            Newpop \leftarrow \mathbf{IDGA2}(gbest, Newpop) // Generate new sequences
            [sol, TIME] \leftarrow \textbf{IDGA2}([T_1, T_2, ..., T_{TN}], Newpop, r)
18:
            fit \leftarrow \max(TIME)
19:
            Pop \leftarrow Pop \cup Newpop // Store the newly generated sequences in the population
20:
            Fit \leftarrow Fit \cup fit
21:
22:
        end while
        [sol, TIME] \leftarrow \textbf{IDGA2}([T_1, T_2, ..., T_{TN}], gbest, r)
23:
        [ARCHIVE, FIT] \leftarrow [ARCHIVE, FIT] \cup [sol, [sum(TIME), max(TIME)]] // Calculate TEC and MCT. Update the
    output archive and its fitness value
25: end for
```

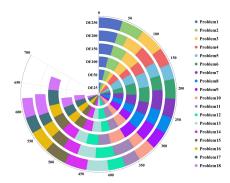
III. PARAMETER VALIDATION

This section calibrated the main parameters of the RNSGA algorithm. The parameter under validation is the THD, which directly impacts the termination criteria of the TBM and NTOM, thereby affecting the search process and efficiency of the entire algorithm. Based on past experimental results and empirical analysis, we carefully determine the range of THD values: 25, 50, 100, 150, 200, 250. Each of these six parameter values corresponds to a variant of the algorithm THD25, THD50, THD100, THD150, THD200, THD250, with all variants identical except for the THD parameter. Each variant underwent comparative experiments according to the experimental settings outlined in the first section.

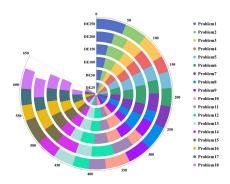
To visually assess which parameter is most suitable for the algorithm, we first compute the HV and IGD values for each of the six variants across 180 test instances. Subsequently, we obtain the rankings of each variant for these metrics in each test instance. Finally, we aggregate the rankings of each variant across ten test instances for each test problem.

Fig. 1 presents the statistical results of each variant in a runway format, with each test problem represented by a different color. A shorter runway indicates a higher overall ranking, suggesting that the corresponding variant's parameter is more applicable. Overall, the differences in rankings between each variant are not significant, indicating that the value of parameter THD do not extremely impact the algorithm. Considering both Fig. 1(a) and Fig. 1(b), THD50 shows relatively higher overall rankings; therefore, we select THD = 50 as the final parameter setting.

In addition, in order to reduce the complexity of calculation, some parameters are set to fixed values. For example, the P value in Eq. 4 and the POW value in Eq. 6 are both set to 1. The maximum load Wm of the robot is set to 300.



(a) The ranking of each variant on IGD



(b) The ranking of each variant on HV

Fig. 1. Sum of rankings for different THD values

IV. VERIFICATION OF RNSGA COMPONENTS

In the RNSGA algorithm, several important components include the solution initialization methods, SSA, TBM, NTOM, and PTAM. To enhance the clarity of the paper, these components are verified and analyzed together in this section. The paper proposes five initialization methods: underloaded initialization, uniform initialization, fully loaded initialization, overloaded initialization, and random initialization. These correspond to variants V1, V2, V3, V4, and V5, respectively. Experimental results show that V1 performs the best, as illustrated in Fig. 2. Therefore, the underloaded initialization method is used in both the RNSGA and subsequent comparative experiments. Variant V6 corresponds to the RNSGA without SSA, used to validate the effectiveness of SSA. Variants V7 and V8 correspond to the RNSGA without TBM and NTOM, respectively, to verify the effectiveness of these two mechanisms. Finally, the variant V9 replaces the PTAM with a random task allocation method to verify the effectiveness of PTAM.

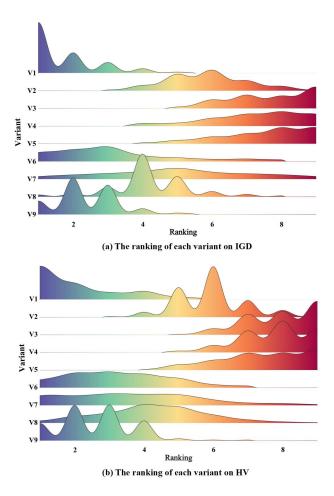


Fig. 2. Verification of RNSGA components

The figure shows the approximate ranking distribution of each variant across all test instances in the form of peaks. Whether considering the IGD and HV indicators, V1 consistently ranks first more frequently than the other variants. Among the initialization methods, V2's uniform initialization results in each task's load being close to the average load during initialization. This results in a large number of TN, causing subsequent TBM to be ineffective and the initialization solution to be deemed unnecessary for further optimization. Thus, the initialized result is output directly. V3's fully loaded initialization results in all tasks being fully loaded except for the last task. This solution completes all tasks with fewer TN. Even with the addition of some empty tasks in TBM to distribute the load, most tasks remain fully loaded. The same applies to V4's overloaded initialization method. These tasks' slow movement speeds significantly impact task duration, and this effect becomes more pronounced as the map size increases, leading to lower rankings. The random initialization of V5 can be adjusted greatly through TBM and NTOM, but the large number of fully loaded and overloaded tasks still makes complete optimization difficult.

In summary, with a fixed *Yield*, the *time* robots spend on harvesting remains constant. According to Eq. 4, the significant factor affecting the objective value is the duration all robots spend moving. Therefore, it is necessary to balance the number of trips each robot makes and their speed for each trip. In V1's results, the speed of each task is not lowered immensely, and the number of tasks is well-controlled. Most importantly, the results allow TBM and NTOM to function effectively. Hence, the underloaded initialization method is more suitable for RNSGA.

As shown in the figure, the results of variants V6-V9 rank higher overall compared to variants V2-V5, demonstrating the significant impact of the initialization method. However, there is still a considerable gap in ranking distribution compared to V1. Therefore, SSA, TBM, NTOM, and PTAM play crucial and irreplaceable roles in RNSGA. SSA is used to adjust the sequence of subtasks within each task, ensuring smooth transitions between subtasks and reducing unnecessary travel time. A good subtask order can also reduce harvesting preprocessing time. TBM relieves the load of heavily loaded tasks by filling empty tasks, reducing TEC through reasonable subtask transfers, and balancing the load across tasks. NTOM further improves solution quality by optimizing the task structure between adjacent tasks, preventing excessive dispersion of subtasks. PTAM offers greater robustness compared to random task allocation, using IDGA2 to guide the search toward better allocation solutions.

V. RESULTS ON MORE PROBLEMS

To validate the robustness of RNSGA, we conduct further tests on the model established by Dai et al. [1]. The termination for all problems are the maximum elapsed CPU time for $n \times 0.05$ seconds. Considering the different characteristics of the model, we remove the premature termination for optimization in RNSGA. This allows RNSGA to further refine solutions even for small-scale problems. The experimental results are presented in Table I.

From the experimental results, RNSGA demonstrated strong robustness and superiority, particularly in terms of HV results, where it significantly outperformed other algorithms. However, due to the limited number of tasks in this test problem, it was challenging to fully showcase RNSGA's capability in solving large-scale problems. Furthermore, setting the total distance traveled by the robots as an optimization objective is less meaningful than considering the total energy consumption of the robots. This also validates the reasonableness of the model proposed in this paper.

TABLE I
TEST RESULTS ON MORE PROLEMS

| | | | | GD | | | |
|---|--|--|--|---|--|--|---|
| Algorithm/Problem | AMOEA | CDABC | MODABC | MOEA/D | NSGA-II | MOTS | RNSGA |
| 50×4 | 1.2543e+02 (4.31e+01) - | 4.6131e+01 (2.73e+01) = | 4.7436e+01 (2.12e+01) = | | 1.9322e+02 (5.05e+01) - | 2.5470e+02 (3.58e+01) - | 5.7275e+01 (3.86e+01) |
| 50×5 | 1.5417e+02 (3.63e+01) - | 9.0770e+01 (3.21e+01) = | 9.8736e+01 (3.08e+01) = | | 2.5606e+02 (4.82e+01) - | 3.6054e+02 (3.51e+01) - | 7.7126e+01 (3.73e+01) |
| 50×6 | 2.1189e+02 (7.61e+01) - | 1.4456e+02 (4.58e+01) = | 1.5242e+02 (4.59e+01) = | 7.1931e+02 (1.06e+02) - | 3.7920e+02 (5.97e+01) - | 4.6988e+02 (3.94e+01) - | 1.2934e+02 (3.96e+01) |
| 50×7 | 1.7983e+02 (6.32e+01) - | 9.3208e+01 (3.00e+01) = | 9.7906e+01 (3.37e+01) = | 7.3334e+02 (1.12e+02) - | 4.1102e+02 (6.46e+01) - | 4.9649e+02 (6.42e+01) - | 9.5239e+01 (6.30e+01) |
| 60×4 | 1.9249e+02 (5.17e+01) - | 1.1334e+02 (4.30e+01) = | 1.1342e+02 (4.50e+01) = | 7.7069e+02 (8.93e+01) - | 4.6797e+02 (5.61e+01) - | 6.1879e+02 (4.45e+01) - | 1.2773e+02 (5.32e+01) |
| 60×5 | 2.7236e+02 (7.29e+01) - | 1.3350e+02 (3.82e+01) = | 1.4714e+02 (4.74e+01) - | 8.6292e+02 (7.58e+01) - | 5.7144e+02 (6.67e+01) - | 7.0623e+02 (4.93e+01) - | 1.0041e+02 (4.26e+01 |
| 60×6 | 2.5928e+02 (4.10e+01) - | 1.1542e+02 (2.60e+01) = | 1.5299e+02 (3.22e+01) - | 5.5922e+02 (6.17e+01) - | 2.5565e+02 (2.85e+01) - | 2.9204e+02 (4.33e+01) - | 1.0383e+02 (1.64e+01 |
| 60×7 | 3.4747e+02 (3.67e+01) - | 1.7603e+02 (3.70e+01) = | 1.8449e+02 (4.00e+01) = | 7.0518e+02 (8.59e+01) - | 3.4358e+02 (5.92e+01) - | 3.6330e+02 (5.57e+01) - | 1.8347e+02 (1.81e+01 |
| 70×4 | 3.6400e+02 (3.61e+01) - | 2.1474e+02(2.74e+01) = | 2.1488e+02 (2.73e+01) = | 7.5686e+02 (8.95e+01) - | 3.7530e+02 (4.29e+01) - | 4.6257e+02 (4.96e+01) - | 2.0075e+02 (1.51e+01 |
| 70×5 | 4.5231e+02 (4.36e+01) - | 1.5298e+02 (2.90e+01) = | 1.5993e+02 (2.83e+01) = | 8.8857e+02 (8.08e+01) - | 4.8285e+02 (6.07e+01) - | 5.5227e+02 (3.81e+01) - | 1.4269e+02 (3.33e+01 |
| 70×6 | 4.2525e+02 (6.85e+01) - | 2.6029e+02 (6.26e+01) = | 2.6568e+02 (6.82e+01) = | 1.0834e+03 (6.24e+01) - | 7.0370e+02 (5.89e+01) - | 8.0064e+02 (4.92e+01) - | 2.7461e+02 (4.85e+01 |
| 70×7 | 4.9521e+02 (5.85e+01) - | 3.2363e+02 (4.09e+01) = | 3.2582e+02 (4.67e+01) = | 1.1298e+03 (1.02e+02) - | 8.1028e+02 (5.95e+01) - | 9.3588e+02 (5.84e+01) - | 2.9760e+02 (5.27e+01 |
| 80×4 | 4.4620e+02 (6.43e+01) - | 1.3886e+02 (3.11e+01) = | 1.5132e+02(3.04e+01) = | 5.4513e+02 (6.39e+01) - | 2.8074e+02 (7.27e+01) - | 2.7844e+02 (6.18e+01) - | 1.4500e+02 (2.40e+01 |
| 80×5 | 4.5917e+02 (7.18e+01) - | 2.0828e+02 (3.16e+01) = | 2.2187e+02 (3.94e+01) = | 7.2534e+02 (9.91e+01) - | 4.3192e+02 (5.37e+01) - | 4.7508e+02 (6.52e+01) - | 1.8998e+02 (3.53e+01 |
| 80×6 | 5.8631e+02 (3.54e+01) - | 2.1493e+02 (2.77e+01) = | 2.2711e+02(2.74e+01) = | 8.4912e+02 (5.58e+01) - | 4.1334e+02 (4.73e+01) - | 4.4977e+02 (5.15e+01) - | 1.9184e+02 (1.64e+01 |
| 80×7 | 6.6698e+02 (4.60e+01) - | 1.6059e+02(3.48e+01) = | 1.9211e+02 (4.09e+01) - | 9.0280e+02 (8.57e+01) - | 4.7598e+02 (5.80e+01) - | 5.2658e+02 (2.73e+01) - | 1.4845e+02 (3.95e+01 |
| 100×4 | 6.1722e+02 (5.54e+01) - | 3.6515e+02 (4.41e+01) = | 3.7744e+02 (4.02e+01) = | 1.2267e+03 (1.22e+02) - | 7.8514e+02 (5.07e+01) - | 8.6911e+02 (6.40e+01) - | 3.4877e+02 (6.24e+01 |
| 100×5 | 8.1815e+02 (5.62e+01) - | 2.7269e+02 (4.43e+01) = | 2.8008e+02(3.79e+01) = | 1.2749e+03 (1.06e+02) - | 8.2017e+02 (6.57e+01) - | 8.9516e+02 (5.20e+01) - | 2.9220e+02 (5.66e+01 |
| 100×6 | 4.8977e+02 (3.97e+01) - | 2.1104e+02 (2.68e+01) - | 2.3394e+02 (3.01e+01) - | 6.1009e+02 (1.14e+02) - | 3.1515e+02 (4.88e+01) - | 3.3203e+02 (5.10e+01) - | 1.4427e+02 (2.12e+01 |
| 100×7 | 6.2603e+02 (5.44e+01) - | 1.9727e+02 (3.31e+01) = | 2.0682e+02(3.75e+01) = | 7.3981e+02 (7.57e+01) - | 3.9062e+02 (6.58e+01) - | 4.1746e+02 (5.84e+01) - | 1.8641e+02 (2.32e+01 |
| 120×4 | 5.3799e+02 (2.36e+01) - | 3.0923e+02 (3.79e+01) = | 3.1541e+02(2.89e+01) = | 9.1745e+02 (6.61e+01) - | 5.3733e+02 (5.43e+01) - | 5.8857e+02 (2.82e+01) - | 3.1278e+02 (2.20e+01 |
| 120×5 | 5.8426e+02 (4.50e+01) - | 3.8821e+02 (2.24e+01) = | | 1.0920e+03 (8.25e+01) - | 6.9216e+02 (4.88e+01) - | 7.4782e+02 (4.25e+01) - | 4.0086e+02 (1.56e+01 |
| 120×6 | 9.8342e+02 (6.94e+01) - | | 2.5008e+02 (4.94e+01) = | | 6.6944e+02 (8.87e+01) - | 7.6243e+02 (6.73e+01) - | 2.8362e+02 (5.09e+01 |
| | | | | | | | |
| 120×0 120×7 | | 8.6627e+02 (5.07e+01) = | 8.6460e+02(5.79e+01) = | 1.8556e+03 (8.36e+01) - | 1.3813e+03 (5.91e+01) - | 1.4764e+03 (5.74e+01) - | 8.4512e+02 (4.38e+01 |
| | 4.8222e+02 (5.99e+01) + 1/23/0 | 8.6627e+02 (5.07e+01) = 0/1/23 | 8.6460e+02 (5.79e+01) = 0/4/20 | 1.8556e+03 (8.36e+01) - 0/24/0 | 1.3813e+03 (5.91e+01) - 0/24/0 | 1.4764e+03 (5.74e+01) - 0/24/0 | 8.4512e+02 (4.38e+01) |
| 120×7 +/-/= | 4.8222e+02 (5.99e+01) + 1/23/0 | 0/1/23 | 0/4/20 F | 0/24/0 IV | 0/24/0 | 0/24/0 | |
| 120×7 +/-/= Algorithm/Problem | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA | 0/1/23 CDABC | 0/4/20 H MODABC | 0/24/0 HV MOEA/D | 0/24/0 NSGA-II | 0/24/0 MOTS | RNSGA |
| 120×7 +/-/= Algorithm/Problem 50×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = | 0/4/20 F MODABC 1.8266e-01 (1.18e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - | MOTS 1.5446e-01 (1.33e-02) - | RNSGA 1.9411e-01 (1.51e-02) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - | 0/24/0 NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - | 0/24/0 NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - | 0/24/0 NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.32e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - | 0/24/0 NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) - | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) | , |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.4066e-01 (2.97e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = | 0/4/20 F MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) = | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) 2.7559e-01 (9.47e-03) |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.2603e-02 (2.17e-02) - 1.4066e-01 (2.97e-02) - 1.1119e-01 (2.56e-02) - 1.1119e-01 (2.56e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = | 0/4/20 F MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.07e-02) - 2.4008e-01 (1.07e-02) - 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) = 2.4726e-01 (1.17e-02) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) | 0/24/0 NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.35e-02) 2.0413e-01 (1.04e-02) 2.5570e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) 2.7559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) 2.6298e-01 (8.05e-03) |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 60×7 60×4 60×5 60×6 60×7 70×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.4066e-01 (2.97e-02) - 1.1119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = 2.5581e-01 (1.10e-02) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) = 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.4828e-01 (1. | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 3.1.5222e-01 (1.02e-02) 2.7559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) |
| 120×7 +//= Algorithm/Problem 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.4066e-01 (2.97e-02) - 1.119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - 1.1887e-01 (2.53e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.35e-02) = 2.52581e-01 (1.10e-02) = 2.6098e-01 (9.18e-03) - 1.6098e-01 (1.918e-03) - 1.6098e-01 (1.918e-03) - 1.6098e-01 (1.918e-03) - 1.6098e-01 (1.918e-03) - 1.6098e-01 (9.18e-03) - 1.6098e-01 | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) - 2.4008e-01 (1.07e-02) - 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (1.35e-02) - 2.5778e-01 (1.36e-03) - 0.578e-01 (1.36e-03) | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.6034e-01 (1.27e-02) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.2001e-01 (9.90e-03) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) 2.7559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) 2.6298e-01 (8.05e-03) 2.7100e-01 (9.54e-03) |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.2603e-02 (2.17e-02) - 1.4066e-01 (2.97e-02) - 1.1119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - 1.1887e-01 (2.53e-02) - 1.125e-01 (2.70e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) - 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) - 2.75660e-01 (1.39e-02) = 2.5256e-01 (1.10e-02) = 2.5256e-01 (1.10e-02) = 2.5296e-01 (1.10e-02) = 2.6098e-01 (9.18e-03) - 2.4029e-01 (1.44e-02) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.00e-02) - 2.4008e-01 (1.07e-02) - 2.4008e-01 (1.07e-02) - 2.4367e-01 (1.06e-02) - 2.6883e-01 (1.50e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.5778e-01 (9.13e-03) - 2.3797e-01 (1.58e-02) - 2.3796e-01 (1. | 0/24/0 W MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.6034e-01 (1.27e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.2001e-01 (9.90e-03) - 2.0412e-01 (1.18e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1644e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) 2.7559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) 2.6298e-01 (8.05e-03) 2.7100e-01 (9.54e-03) 2.5165e-01 (1.19e-02) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.119e-01 (2.56e-02) - 1.119e-01 (2.56e-02) - 1.1898e-01 (2.73e-02) - 1.1898e-01 (2.73e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (2.70e-02) - 1.0509e-01 (2.32e-02) - 1.0509e-01 (2.32e-02) - 1.0509e-01 (2.32e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3489e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = 2.6098e-01 (9.18e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 2.4828e-01 (1.50e-02) - 2.4828e-01 (1.50e-02) - 2.4726e-01 (1.7e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.3797e-01 (1.58e-02) - 2.2576e-01 (7.98e-03) - | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.5034e-01 (1.27e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.14e-02) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.9e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.001e-01 (9.90e-03) - 2.0412e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.8813e-01 (1.38e-02) - 2.1144e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03) 2.5165e-01 (1.30e-02 2.6298e-01 (8.05e-03 2.7100e-01 (9.54e-03) 2.5165e-01 (1.19e-02 2.3969e-01 (8.97e-03) |
| 120×7 +/-/= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.1119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - 1.1827e-01 (2.53e-02) - 1.1226e-01 (2.70e-02) - 1.0509e-01 (2.32e-02) - 1.231e-01 (4.48e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.39e-02) = 2.5256e-01 (1.09e-02) = 2.6098e-01 (1.91e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.089e-02) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) = 2.4008e-01 (1.07e-02) = 2.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) = 2.4726e-01 (1.25e-02) - 2.5778e-01 (1.25e-02) - 2.5778e-01 (1.58e-02) - 2.5778e-01 (1.58e-02) - 3.797e-01 (1.58e-02) - 3.6512e-01 (1.98e-03) - 3.6512e-01 (1.98e-02) = | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 1.5572e-01 (1.41e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2012e-01 (1.90e-03) - 2.0012e-01 (1.90e-03) - 2.0012e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.164e-01 (1.30e-02) - 2.0803e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03 2.6175e-01 (1.30e-02 2.6298e-01 (8.05e-03) 2.7100e-01 (9.54e-03) 2.5165e-01 (1.90e-02 2.3969e-01 (8.97e-03) 3.7604e-01 (2.33e-02) |
| 120×7 +/-/= **Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 80×5 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.4104e-02 (1.81e-02) - 1.119e-01 (2.56e-02) - 1.1199e-01 (2.56e-02) - 1.1187e-01 (2.53e-02) - 1.1226e-01 (2.73e-02) - 1.1226e-01 (2.73e-02) - 1.1226e-01 (2.70e-02) - 1.0509e-01 (2.32e-02) - 2.4311e-01 (4.48e-02) - 2.7243e-01 (4.04e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = 2.5256e-01 (1.36e-02) = 2.6098e-01 (9.18e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.00e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 2.4526e-01 (1.06e-02) - 2.6883e-01 (1.50e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.3797e-01 (1.58e-02) - 2.3797e-01 (1.58e-02) - 3.6512e-01 (1.93e-02) - 4.0668e-01 (2.08e-02) = | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.6034e-01 (1.27e-02) - 1.5146e-01 (1.17e-02) - 1.5146e-01 (1.17e-02) - 1.5154e-01 (1.14e-02) - 2.1501e-01 (1.86e-02) - 2.7027e-01 (3.35e-02) | NSGA-II 1.7.115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.2001e-01 (9.00e-03) - 2.0412e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.813e-01 (8.25e-03) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.4175e-01 (2.16e-02) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03 2.6175e-01 (1.30e-02 2.6298e-01 (8.07e-03 2.5165e-01 (1.19e-02 2.3969e-01 (8.7e-03 3.7604e-01 (2.33e-02 4.1667e-01 (1.55e-02 3.7844e-01 (8.39e-03 |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×7 70×4 70×5 70×6 80×4 80×5 80×6 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (3.32e-02) - 1.4066e-01 (2.17e-02) - 9.2603e-02 (2.17e-02) - 1.119e-01 (2.56e-02) - 1.119e-01 (2.56e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (2.70e-02) - 1.226e-01 (2.70e-02) - 1.226e-01 (2.70e-02) - 1.226e-01 (2.73e-02) - 2.311e-01 (4.48e-02) - 2.7243e-01 (4.04e-02) - 2.2561e-01 (1.74e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.35e-02) = 2.5256e-01 (1.35e-02) = 2.52581e-01 (1.0e-02) = 2.6098e-01 (1.04e-02) - 2.808e-01 (1.08e-03) - 3.7373e-01 (1.89e-02) = 4.1534e-01 (1.42e-02) = 4.154e-01 (1.42e-02 | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) - 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.15e-02) - 2.5778e-01 (9.13e-03) - 2.5778e-01 (9.13e-03) - 3.797e-01 (1.58e-02) - 2.2576e-01 (7.98e-03) - 3.6512e-01 (7.98e-03) - 3.6512e-01 (1.93e-02) = 4.0668e-01 (2.08e-02) - 3.6132e-01 (1.35e-02) - | 1V MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 1.5393e-01 (1.51e-02) - 1.3905e-01 (2.32e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.34e-02) - 1.3889e-01 (1.17e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 2.7027e-01 (3.35e-02) - 2.7027e-01 (3.35e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.001e-01 (9.90e-03) - 2.0412e-01 (1.18e-02) - 3.19457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 3.1827e-01 (1.79e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.4175e-01 (2.16e-02) - 3.0893e-01 (1.24e-02) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) 2.67559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) 2.6298e-01 (8.05e-03) 2.7100e-01 (9.54e-03) 2.5165e-01 (1.19e-02) 2.3969e-01 (8.97e-03) 3.7604e-01 (2.33e-02) 4.1667e-01 (1.55e-02) 3.7844e-01 (8.47e-03) 3.1862e-01 (8.17e-03) |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 80×5 80×6 80×7 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.4066e-01 (2.97e-02) - 1.119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - 1.1887e-01 (2.53e-02) - 1.1226e-01 (2.70e-02) - 1.0509e-01 (2.32e-02) - 2.4311e-01 (4.48e-02) - 2.4311e-01 (4.48e-02) - 2.2561e-01 (1.74e-02) - 1.2115e-01 (2.92e-02) - | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) = 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.4437e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = 2.5256e-01 (1.9.8e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.89e-02) = 3.6809e-01 (1.42e-02) = 3.6809e-01 (1.42e-02) = 3.0722e-01 (8.71e-03) - 3.0496e-01 (9.36e-03) | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) - 2.4008e-01 (1.07e-02) - 2.4088-01 (1.50e-02) - 2.5786e-01 (1.24e-02) - 2.4828e-01 (1.25e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.5776e-01 (7.98e-03) - 3.6512e-01 (1.98e-03) - 3.6512e-01 (1.93e-02) = 4.0668e-01 (2.08e-02) = 3.6132e-01 (1.55e-02) - 3.0027e-01 (1.15e-02) - | 0/24/0 W MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.8898e-01 (1.43e-02) - 1.5146e-01 (1.17e-02) - 1.5146e-01 (1.17e-02) - 1.5146e-01 (1.16e-02) - 2.1501e-01 (1.86e-02) - 2.7027e-01 (3.35e-02) - 2.2075e-01 (1.13e-02) - 1.7297e-01 (1.58e-02) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.1822e-01 (1.45e-02) - 2.1822e-01 (1.45e-02) - 3.18193e-01 (8.77e-03) - 3.1193e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 3.827e-01 (1.29e-02) - 2.5931e-01 (1.26e-02) - 2.5931e-01 (1.26e-02) - | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.0468e-01 (2.34e-02) - 3.0493e-01 (1.24e-02) - 3.0893e-01 (1.24e-02) - 2.4933e-01 (1.24e-02) - 2.4933e-01 (1.24e-02) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03 2.7100e-01 (9.54e-03 2.7100e-01 (9.54e-03 2.7100e-01 (9.54e-03 3.7604e-01 (2.33e-02 4.1667e-01 (1.55e-02 3.7844e-01 (8.49e-03 3.1842e-01 (8.47e-03 3.1862e-01 (8.47e-03 |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 80×5 80×6 80×7 100×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.119e-01 (2.56e-02) - 1.119e-01 (2.56e-02) - 1.1897e-01 (2.53e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (2.70e-02) - 1.126e-01 (4.04e-02) - 2.7243e-01 (4.04e-02) - 2.7243e-01 (4.04e-02) - 1.215e-01 (2.72e-02) - 1.1215e-01 (2.72e-02) - 1.215e-01 (2.72e-02) - 1.215e-01 (2.72e-02) - 1.217e-01 (2.72e-02) - 1.2470e-01 (2.73e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.39e-02) = 2.5256e-01 (1.09e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 2.4029e-01 (1.44e-02) = 2.4808e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 3.6809e-01 (1.42e-02) = 3.0722e-01 (8.71e-03) - 3.0496e-01 (9.36e-03) - 3.0496e-01 (9.36e-03) = 3.6405e-01 (9.56e-03) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 3.6512e-01 (1.98e-02) - 2.3797e-01 (1.58e-02) - 2.3797e-01 (1.58e-02) - 3.0132e-01 (1.35e-02) - 3.0132e-01 (1.35e-02) - 3.0027e-01 (1.15e-02) - 3.0027e-01 (1.15e-02) - 3.9982e-01 (9.07e-03) - 1.012e-02 - 1.012e-03 - 0.012e-01 (1.15e-02) - 2.9982e-01 (9.07e-03) - 0.012e-03 - 0.0 | 0/24/0 W MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.5912e-01 (1.70e-02) - 1.532e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.5146e-01 (1.37e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 2.1501e-01 (1.86e-02) - 2.7027e-01 (1.13e-02) - 1.7297e-01 (1.58e-02) - 1.7297e-01 (1.58e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.4922e-01 (1.29e-03) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.2001e-01 (9.90e-03) - 2.2001e-01 (9.90e-03) - 2.1912e-01 (1.18e-02) - 1.4947e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 3.1827e-01 (1.79e-02) - 2.5931e-01 (1.26e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.0893e-01 (1.24e-02) - 2.4933e-01 (1.24e-02) - 2.4933e-01 (6.28e-03) - 2.4861e-01 (1.02e-02) - | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03 2.6175e-01 (1.30e-02 2.6298e-01 (8.95e-03 2.5165e-01 (1.19e-02 2.3969e-01 (8.97e-03 3.7604e-01 (2.33e-02 4.1667e-01 (1.55e-02 3.7844e-01 (8.49e-03 3.1862e-01 (8.17e-03 3.1652e-01 (1.27e-02 |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 80×4 80×5 80×6 80×7 100×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (3.32e-02) - 1.4066e-01 (2.17e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.119e-01 (2.56e-02) - 1.1198-01 (2.73e-02) - 1.1226e-01 (2.70e-02) - 1.1226e-01 (2.70e-02) - 1.226e-01 (2.70e-02) - 1.226e-01 (2.70e-02) - 1.215e-01 (4.48e-02) - 2.7243e-01 (4.04e-02) - 2.7243e-01 (4.04e-02) - 1.2115e-01 (2.92e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.25795e-01 (1.43e-02) - 1.5795e-01 (1.43e-0 | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) = 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.4437e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = 2.5256e-01 (1.9.8e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.89e-02) = 3.6809e-01 (1.42e-02) = 3.6809e-01 (1.42e-02) = 3.0722e-01 (8.71e-03) - 3.0496e-01 (9.36e-03) | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) = 2.4008e-01 (1.07e-02) = 2.4726e-01 (1.24e-02) - 2.4726e-01 (1.24e-02) - 2.4726e-01 (1.25e-02) - 2.4726e-01 (1.25e-02) - 2.4726e-01 (1.35e-02) - 2.4726e-01 (1.35e-02) - 2.5778e-01 (1.35e-02) - 2.5778e-01 (1.35e-02) - 2.5778e-01 (1.35e-02) - 2.2576e-01 (1.93e-02) - 2.2576e-01 (1.93e-02) - 3.6512e-01 (1.93e-02) - 3.0612e-01 (1.35e-02) - 3.0027e-01 (1.15e-02) - 2.9982e-01 (9.07e-03) - 3.6013e-01 (7.71e-03) = | 0/24/0 IV MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 2.1501e-01 (1.35e-02) - 2.7075e-01 (1.36e-02) - 2.7075e-01 (1.13e-02) - 1.7297e-01 (1.58e-02) - 1.8616e-01 (1.85e-02) - 1.8616e-01 (1.85e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.001e-01 (9.90e-03) - 2.001e-01 (9.90e-03) - 2.012e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 2.5916e-01 (7.06e-03) - 2.5916e-01 (1.26e-02) - 2.5916e-01 (1.09e-02) - 2.5916e-01 (1.09e-02) - 2.9737e-01 (1.09e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1644e-01 (1.38e-02) - 2.1644e-01 (1.30e-02) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.4175e-01 (2.16e-02) - 3.4175e-01 (2.16e-02) - 3.493e-01 (1.24e-02) - 2.4933e-01 (6.28e-03) - 2.4861e-01 (1.02e-02) - 2.8835e-01 (8.82e-03) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03 2.6175e-01 (1.30e-02 2.6298e-01 (8.05e-03 2.7100e-01 (9.54e-03 2.7100e-01 (9.54e-03 3.7604e-01 (1.35e-02 3.7604e-01 (1.35e-02 3.7604e-01 (1.75e-02 3.7604e-01 (1.77e-02 3.7604e-01 (1.77e-02 3.7604e-01 (1.77e-02 3.7604e-01 (1.77e-02 3.7604e-01 (1.77e-02 3.7604e-01 (1.77e-02 4.3760e-01 (1.25e-02 4.3760e-01 (1.25e-02 |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 80×4 80×5 80×6 80×7 100×4 100×5 100×6 100×7 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (3.32e-02) - 1.4066e-01 (2.17e-02) - 1.4066e-01 (2.97e-02) - 1.119e-01 (2.56e-02) - 1.1226e-01 (2.70e-02) - 1.1226e-01 (2.70e-02) - 1.1226e-01 (2.70e-02) - 1.1226e-01 (2.70e-02) - 1.1256e-01 (2.73e-02) - 1.1256e-01 (2.73e-02) - 1.1256e-01 (2.73e-02) - 1.2156e-01 (2.73e-02) - 2.7243e-01 (4.04e-02) - 2.2561e-01 (1.74e-02) - 1.2115e-01 (2.92e-02) - 1.2170e-01 (2.73e-02) - 3.1170e-01 (2.73e-02) - 2.7206e-01 (1.78e-02) - 2.7206e-01 (1.78e-02) - 2.7200e-01 (3.04e-02) - 2.7200e-01 (3.04 | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.35e-02) = 2.5256e-01 (1.35e-02) = 2.52581e-01 (1.10e-02) = 2.6098e-01 (1.44e-02) = 2.6098e-01 (1.44e-02) = 2.808e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 3.6809e-01 (1.42e-02) = 3.0722e-01 (8.71e-03) - 3.6405e-01 (9.56e-03) = 4.3835e-01 (1.77e-02) = 4.3535e-01 (1.77e-02) = 4.0693e-01 (1.60e-02) = 4.0694e-01 (1.60e-02) = 4.0694e-01 (1.6 | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 1.8913e-01 (1.03e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.24e-02) - 2.6883e-01 (1.50e-02) = 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.15e-02) - 2.5778e-01 (1.15e-03) - 2.5778e-01 (1.15e-03) - 3.797e-01 (1.58e-03) - 3.6512e-01 (1.93e-02) = 4.0668e-01 (2.08e-02) = 3.0127e-01 (1.15e-02) - 3.0027e-01 (1.15e-02) - 3.0027e-01 (1.15e-02) - 3.9982e-01 (9.07e-03) = 4.2882e-01 (1.96e-02) = 4.2882e-01 (1.96e-02) = 4.2882e-01 (1.56e-02) = 4.2882e-01 (1.5 | 1V MOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.15e-02) - 1.5393e-01 (1.51e-02) - 1.5393e-01 (1.51e-02) - 1.5393e-01 (1.34e-02) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3805e-01 (1.34e-02) - 1.3805e-01 (1.17e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 2.7027e-01 (3.35e-02) - 2.7027e-01 (3.35e-02) - 1.8616e-01 (1.85e-02) - 1.8616e-01 (1.85e-02) - 2.3067e-01 (1.52e-02) - 2.4928e-01 (2.95e-02) - | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.9e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.001e-01 (9.90e-03) - 2.001e-01 (1.18e-02) - 3.1812e-01 (1.174e-02) - 3.5641e-01 (1.74e-02) - 2.5916e-01 (1.29e-02) - 2.5916e-01 (1.29e-02) - 2.5916e-01 (1.29e-02) - 3.7084e-01 (2.16e-02) - 3.7084e-01 (2.16e-02) - 3.3688e-01 (2.16e-02) - 3.3688e-01 (2.16e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.4175e-01 (2.16e-02) - 3.4851e-01 (1.24e-02) - 2.4891e-01 (1.02e-02) - 2.4891e-01 (1.02e-02) - 2.4891e-01 (1.02e-02) - 2.8835e-01 (8.82e-03) - 3.5151e-01 (1.91e-02) - 3.2614e-01 (1.91e-02) - 3.2614e-01 (1.91e-02) - 3.2614e-01 (1.91e-02) - 3.2614e-01 (1.93e-02) - 3.2614e-01 (1.93 | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) 2.62798e-01 (8.05e-03) 2.5165e-01 (1.19e-02 2.3969e-01 (1.95e-03) 3.7604e-01 (2.33e-02) 4.1667e-01 (1.55e-02) 3.7844e-01 (8.49e-03) 3.1862e-01 (8.47e-03) 3.1862e-01 (1.27e-02) 4.3760e-01 (1.25e-02) 4.3760e-01 (1.56e-02) 4.1540e-01 (1.75e-02) |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 80×5 80×7 100×4 100×5 100×6 100×7 120×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - 1.1226e-01 (2.70e-02) - 1.226e-01 (2.70e-02) - 1.226e-01 (2.73e-02) - 1.226e-01 (2.73e-02) - 1.226e-01 (2.73e-02) - 1.250e-01 (2.73e-02) - 2.7243e-01 (4.04e-02) - 2.7505e-01 (1.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.78e-02) - 2.7200e-01 (3.04e-02) - 2.7200e-01 (3.04e-02) - 2.8252e-01 (1.73e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.39e-02) = 2.5256e-01 (1.10e-02) = 2.6098e-01 (9.18e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 3.6809e-01 (1.42e-02) = 3.6405e-01 (9.36e-03) - 3.6405e-01 (9.56e-03) = 4.3835e-01 (1.7re-02) = 4.0693e-01 (1.60e-02) = 4.0695e-01 (1.20e-02) = 4.0695e-01 (1.2 | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) - 2.4008e-01 (1.07e-02) - 2.4726e-01 (1.24e-02) - 2.4726e-01 (1.24e-02) - 2.4726e-01 (1.25e-02) - 2.4726e-01 (1.25e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.5778e-01 (9.13e-03) - 2.5778e-01 (1.58e-02) - 2.2576e-01 (1.93e-02) - 4.0668e-01 (2.08e-02) - 3.6512e-01 (1.93e-02) - 4.0668e-01 (2.07e-03) - 3.6132e-01 (1.95e-02) - 2.9982e-01 (9.07e-03) - 3.6013e-01 (7.71e-03) = 4.2382e-01 (1.96e-02) - 3.9915e-01 (1.50e-02) - 3.9915e-01 (1. | 0/24/0 WOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 2.5572e-01 (1.41e-02) - 2.1501e-01 (1.86e-02) - 2.2075e-01 (1.13e-02) - 1.8616e-01 (1.85e-02) - 2.2075e-01 (1.55e-02) - 2.8616e-01 (1.58e-02) - 2.3067e-01 (1.52e-02) - 2.4928e-01 (3.29e-02) - 2.2988e-01 (2.05e-02) - 2.3906e-01 (1.33e-02) - 2.3906e-01 (1.33e-02) - 2.3906e-01 (1.55e-02) - 2.2988e-01 (2.05e-02) - 2.2988e-01 (2.05e-02) - 2.3906e-01 (1.33e-02) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7535e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.001e-01 (9.90e-03) - 2.001e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 3.5541e-01 (1.76e-02) - 2.937e-01 (1.09e-02) - 3.9084e-01 (2.16e-02) - 3.7084e-01 (2.16e-02) - 3.3688e-01 (2.16e-02) - 3.3688e-01 (2.16e-02) - 3.5190e-01 (1.19e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-03) - 1.5437e-01 (7.40e-03) - 1.5437e-01 (7.40e-03) - 1.0858e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1644e-01 (1.38e-02) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (8.12e-03) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.0493e-01 (1.24e-02) - 3.0893e-01 (1.24e-02) - 2.8835e-01 (1.24e-02) - 2.8835e-01 (8.82e-03) - 2.8835e-01 (8.82e-03) - 3.5151e-01 (1.91e-02) - 3.2614e-01 (1.83e-02) - 3.2614e-01 (1.83e-02) - 3.3383e-01 (9.91e-03) - 3.3385e-01 (9.91e-03) | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.04e-02 2.5070e-01 (1.32e-02 1.5304e-01 (9.46e-03 1.5222e-01 (1.02e-02 2.7559e-01 (9.47e-03 2.5165e-01 (1.09e-02 2.6298e-01 (8.95e-03 2.5165e-01 (1.19e-02 2.3969e-01 (8.97e-03 3.7604e-01 (1.55e-02 4.1667e-01 (1.55e-02 3.7844e-01 (8.49e-03 3.1652e-01 (1.27e-02 4.3760e-01 (1.56e-02 |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 100×5 80×7 100×4 100×5 100×6 100×7 120×4 120×5 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.3063e-01 (3.32e-02) - 1.4066e-01 (2.17e-02) - 9.4104e-02 (1.81e-02) - 9.4104e-02 (1.81e-02) - 1.1199e-01 (2.56e-02) - 1.1199e-01 (2.56e-02) - 1.1199e-01 (2.53e-02) - 1.126e-01 (2.70e-02) - 1.1887e-01 (2.53e-02) - 1.126e-01 (2.70e-02) - 1.2470e-01 (4.04e-02) - 2.25561e-01 (1.74e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 2.5795e-01 (1.43e-02) - 2.5795e-01 (1.73e-02) - 2.7243e-01 (2.73e-02) - 2.7240e-01 (3.04e-02) - 2.8252e-01 (1.73e-02) - 2.7240e-01 (1.80e-02) - 2.7240e-01 (1.80e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) - 2.7660e-01 (1.39e-02) = 2.5256e-01 (1.35e-02) = 2.5256e-01 (1.35e-02) = 2.5258e-01 (1.10e-02) = 2.6098e-01 (9.18e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.89e-02) = 4.1534e-01 (9.36e-03) - 3.0496e-01 (9.36e-03) - 3.6405e-01 (9.56e-03) = 4.0853e-01 (1.10e-02) = 4.093e-01 (1.10e-02) = 4.1550e-01 (1.20e-02) = 4.1550e-01 (1.20e-02) = | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) = 1.4367e-01 (1.06e-02) - 1.3726e-01 (1.06e-02) - 2.6883e-01 (1.50e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.3797e-01 (1.58e-02) - 2.3797e-01 (1.58e-02) - 2.3796e-01 (7.98e-03) - 3.6512e-01 (1.93e-02) = 4.0668e-01 (2.08e-02) = 3.6132e-01 (1.35e-02) - 3.0027e-01 (1.15e-02) - 2.9982e-01 (9.07e-03) - 3.6013e-01 (7.10e-03) = 4.2382e-01 (1.96e-02) = 4.9818e-01 (1.50e-02) = 4.9818e-01 (1.16e-02) = 4.9818e-01 (1.16e-02) = 4.9818e-01 (1.16e-02) = 4.9818e-01 (1.14e-02) = 4.9818e-01 (1.14e-02) = 4.9818e-01 (1.14e-02) = 4.9818e-01 (1.14e-02) = 4.9818e-01 (1.09e-03) - 1.9658e-01 (1. | W MOEA/D | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7353e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.2001e-01 (9.09e-03) - 2.0412e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 2.5931e-01 (1.29e-02) - 2.5931e-01 (1.29e-02) - 2.5916e-01 (7.60e-03) - 2.9737e-01 (1.09e-02) - 3.3688e-01 (2.10e-02) - 3.5190e-01 (1.19e-02) - 3.5190e-01 (1.19e-02) - | MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-02) - 1.5437e-01 (7.40e-03) - 1.5437e-01 (7.40e-03) - 1.9658e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.813e-01 (8.25e-03) - 2.1184e-01 (1.38e-02) - 2.1144e-01 (1.40e-02) - 2.0605e-01 (9.80e-03) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (1.03e-02) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.4175e-01 (2.16e-02) - 3.893e-01 (1.24e-02) - 2.4933e-01 (6.28e-03) - 2.4861e-01 (1.02e-02) - 2.8835e-01 (8.82e-03) - 3.5151e-01 (1.91e-02) - 3.2514e-01 (1.81e-02) - 3.3383e-01 (9.91e-03) - 3.2544e-01 (8.85e-03) - | RNSGA 1.9411e-01 (1.51e-02 1.7088e-01 (1.33e-02 2.0413e-01 (1.32e-02 2.5070e-01 (1.32e-02 2.5070e-01 (1.32e-02 2.5559e-01 (9.47e-03 2.6175e-01 (1.30e-02 2.6298e-01 (8.05e-03 2.7100e-01 (9.36e-03 2.7100e-01 (9.36e-03 2.7100e-01 (9.36e-03 3.7604e-01 (8.9e-03 3.7604e-01 (2.33e-02 4.1667e-01 (8.7e-03 3.1862e-01 (8.7e-03 3.1862e-01 (8.7e-03 3.1862e-01 (1.7e-02 4.7640e-01 (1.73e-02 4.1540e-01 (1.73e-02 4.1540e-01 (1.73e-02 4.153e-01 (1.42e-02 4.153e-01 (1.42e-02 4.153e-01 (1.42e-02 4.1500e-01 (1.42e-02 4.1500e-01 (1.42e-02 4.1500e-01 (1.42e-02 4.1500e-01 (1.42e-02 4.1200e-01 (1.42e-02 |
| 120×7 +//= Algorithm/Problem 50×4 50×5 50×6 50×7 60×4 60×5 60×6 60×7 70×4 70×5 70×6 70×7 80×4 80×5 80×7 100×4 100×5 100×6 100×7 120×4 | 4.8222e+02 (5.99e+01) + 1/23/0 AMOEA 1.2608e-01 (3.08e-02) - 9.5661e-02 (2.03e-02) - 1.3063e-01 (3.32e-02) - 1.8958e-01 (2.18e-02) - 9.4104e-02 (1.81e-02) - 9.2603e-02 (2.17e-02) - 1.119e-01 (2.56e-02) - 1.1698e-01 (2.73e-02) - 1.1226e-01 (2.70e-02) - 1.226e-01 (2.70e-02) - 1.226e-01 (2.73e-02) - 1.226e-01 (2.73e-02) - 1.226e-01 (2.73e-02) - 1.250e-01 (2.73e-02) - 2.7243e-01 (4.04e-02) - 2.7505e-01 (1.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.73e-02) - 1.2470e-01 (2.78e-02) - 2.7200e-01 (3.04e-02) - 2.7200e-01 (3.04e-02) - 2.8252e-01 (1.73e-02) | 0/1/23 CDABC 1.8552e-01 (1.47e-02) = 1.5670e-01 (1.27e-02) - 1.9241e-01 (1.04e-02) - 2.4148e-01 (9.04e-03) = 1.4437e-01 (9.31e-03) - 1.3889e-01 (1.15e-02) = 2.5256e-01 (1.39e-02) = 2.5256e-01 (1.10e-02) = 2.6098e-01 (9.18e-03) - 2.4029e-01 (1.44e-02) = 2.2808e-01 (8.08e-03) - 3.7373e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 4.1534e-01 (1.89e-02) = 3.6809e-01 (1.42e-02) = 3.6405e-01 (9.36e-03) - 3.6405e-01 (9.56e-03) = 4.3835e-01 (1.7re-02) = 4.0693e-01 (1.60e-02) = 4.0695e-01 (1.20e-02) = 4.0695e-01 (1.2 | 0/4/20 MODABC 1.8266e-01 (1.18e-02) - 1.5228e-01 (1.10e-02) - 1.5228e-01 (1.10e-02) - 2.4008e-01 (1.07e-02) - 2.4008e-01 (1.07e-02) - 2.4726e-01 (1.24e-02) - 2.4726e-01 (1.24e-02) - 2.4726e-01 (1.25e-02) - 2.4726e-01 (1.25e-02) - 2.4726e-01 (1.17e-02) - 2.4828e-01 (1.25e-02) - 2.5778e-01 (9.13e-03) - 2.5778e-01 (9.13e-03) - 2.5778e-01 (1.58e-02) - 2.2576e-01 (1.93e-02) - 4.0668e-01 (2.08e-02) - 3.6512e-01 (1.93e-02) - 4.0668e-01 (2.07e-03) - 3.6132e-01 (1.95e-02) - 2.9982e-01 (9.07e-03) - 3.6013e-01 (7.71e-03) = 4.2382e-01 (1.96e-02) - 3.9915e-01 (1.50e-02) - 3.9915e-01 (1. | 0/24/0 WOEA/D 1.0910e-01 (1.19e-02) - 8.9664e-02 (1.20e-02) - 1.1521e-01 (1.70e-02) - 1.5393e-01 (1.51e-02) - 9.4665e-02 (7.70e-03) - 9.0183e-02 (9.88e-03) - 1.3905e-01 (2.32e-02) - 1.4513e-01 (1.34e-02) - 1.3889e-01 (1.43e-02) - 1.5146e-01 (1.17e-02) - 1.5572e-01 (1.41e-02) - 2.5572e-01 (1.41e-02) - 2.1501e-01 (1.86e-02) - 2.2075e-01 (1.13e-02) - 1.8616e-01 (1.85e-02) - 2.2075e-01 (1.55e-02) - 2.8616e-01 (1.58e-02) - 2.3067e-01 (1.52e-02) - 2.4928e-01 (3.29e-02) - 2.2988e-01 (2.05e-02) - 2.3906e-01 (1.33e-02) - 2.3906e-01 (1.33e-02) - 2.3906e-01 (1.55e-02) - 2.2988e-01 (2.05e-02) - 2.2988e-01 (2.05e-02) - 2.3906e-01 (1.33e-02) | NSGA-II 1.7115e-01 (1.54e-02) - 1.4922e-01 (1.29e-02) - 1.7535e-01 (9.91e-03) - 2.1056e-01 (1.06e-02) - 1.2725e-01 (7.79e-03) - 1.2107e-01 (1.06e-02) - 2.3881e-01 (1.08e-02) - 2.1822e-01 (1.45e-02) - 2.2723e-01 (7.91e-03) - 2.001e-01 (9.90e-03) - 2.001e-01 (1.18e-02) - 1.9457e-01 (8.77e-03) - 3.1193e-01 (2.85e-02) - 3.5641e-01 (1.74e-02) - 3.5541e-01 (1.76e-02) - 2.937e-01 (1.09e-02) - 3.9084e-01 (2.16e-02) - 3.7084e-01 (2.16e-02) - 3.3688e-01 (2.16e-02) - 3.3688e-01 (2.16e-02) - 3.5190e-01 (1.19e-02) | 0/24/0 MOTS 1.5446e-01 (1.33e-02) - 1.3093e-01 (1.07e-03) - 1.5437e-01 (7.40e-03) - 1.5437e-01 (7.40e-03) - 1.0858e-01 (1.02e-02) - 1.1116e-01 (6.87e-03) - 1.0813e-01 (8.25e-03) - 2.1854e-01 (1.38e-02) - 2.1644e-01 (1.38e-02) - 2.0893e-01 (7.17e-03) - 1.9179e-01 (8.12e-03) - 1.8027e-01 (8.12e-03) - 3.0468e-01 (2.34e-02) - 3.0493e-01 (1.24e-02) - 3.0893e-01 (1.24e-02) - 2.8835e-01 (1.24e-02) - 2.8835e-01 (8.82e-03) - 2.8835e-01 (8.82e-03) - 3.5151e-01 (1.91e-02) - 3.2614e-01 (1.83e-02) - 3.2614e-01 (1.83e-02) - 3.3383e-01 (9.91e-03) - 3.3385e-01 (9.91e-03) | RNSGA 1.9411e-01 (1.51e-02) 1.7088e-01 (1.33e-02) 2.0413e-01 (1.04e-02) 2.5070e-01 (1.32e-02) 1.5304e-01 (9.46e-03) 1.5222e-01 (1.02e-02) 2.7559e-01 (9.47e-03) 2.6175e-01 (1.30e-02) 2.6298e-01 (8.05e-03) 2.7100e-01 (9.54e-03) 2.5165e-01 (1.19e-02) 2.3969e-01 (8.97e-03) |

VI. TABLES

| | | I | GD | | | | I | HV | |
|-----------|-------|---------|---------|------------------------|-----------|-------|---------|----------|------------------------|
| RNSGA VS. | R^+ | R^{-} | P-value | P -value \leq 0.05 | RNSGA VS. | R^+ | R^{-} | P-value | P -value \leq 0.05 |
| AMOEA | 171.0 | 0.0 | 0.00018 | Yes | AMOEA | 171.0 | 0.0 | 0.00018 | Yes |
| CDABC | 171.0 | 0.0 | 0.00018 | Yes | CDABC | 144.5 | 26.5 | 0.00739 | Yes |
| MODABC | 171.0 | 0.0 | 0.00018 | Yes | MODABC | 153.0 | 18.0 | 0.001632 | Yes |
| MOEA/D | 171.0 | 0.0 | 0.00018 | Yes | MOEA/D | 171.0 | 0.0 | 0.00018 | Yes |
| NSGA-II | 171.0 | 0.0 | 0.00018 | Yes | NSGA-II | 171.0 | 0.0 | 0.000166 | Yes |
| MOTS | 171.0 | 0.0 | 0.00018 | Yes | MOTS | 171.0 | 0.0 | 0.00018 | Yes |

 $\begin{tabular}{ll} TABLE~III\\ Comparison~of~default~output~results~of~each~algorithm \end{tabular}$

| Problem | AMOE | Δ | CDABO | ~ | MODAI | RC . | IGD MOEA | /D | NSGA- | п | MOTS | | RNSG | Δ |
|---|--|--|--|--|--|--|--|--|---|---|--|---|--|---|
| 1 Toblem | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Ran |
| 100×0.4 | 5.1518e+02 | 6 | 4.6690e+02 | 4 | 4.1894e+02 | 1 | 4.3953e+02 | 3 | 5.3235e+02 | 7 | 5.0704e+02 | 5 | 4.2888e+02 | 2 |
| 100×0.6 | 8.0482e+02 | 5 | 7.0743e+02 | 2 | 7.4638e+02 | 4 | 7.4254e+02 | 3 | 8.3056e+02 | 7 | 8.0806e+02 | 6 | 5.5656e+02 | 1 |
| 100×0.8 | 1.0965e+03 | 5 | 1.0527e+03 | 4 | 9.8477e+02 | 1 | 1.1661e+03 | 7 | 1.0180e+03 | 3 | 1.1132e+03 | 6 | 9.9520e+02 | 2 |
| 225×0.4 | 1.1742e+03 | 5 | 1.1380e+03 | 3 | 1.0902e+03 | 1 | 1.2611e+03 | 6 | 1.1403e+03 | 4 | 1.3817e+03 | 7 | 1.1200e+03 | 2 |
| 225×0.6 | 1.8060e+03 | 1 | 2.1786e+03 | 5 | 2.0148e+03 | 4 | 2.3529e+03 | 7 | 1.9670e+03 | 2 | 2.2634e+03 | 6 | 1.9900e+03 | 3 |
| 225×0.8 | 3.0859e+03 | 2 | 3.4801e+03 | 6 | 3.0036e+03 | 1 | 3.3570e+03 | 5 | 3.3459e+03 | 4 | 4.3612e+03 | 7 | 3.2697e+03 | 3 |
| 400×0.4 | 2.3327e+03 | 3 | 2.3685e+03 | 4 | 2.2472e+03 | 2 | 2.5230e+03 | 6 | 2.4687e+03 | 5 | 2.9843e+03 | 7 | 2.2014e+03 | 1 |
| 400×0.6 | 4.8605e+03 | 5 | 4.6043e+03 | 2 | 4.7519e+03 | 4 | 5.0525e+03 | 6 | 4.6809e+03 | 3 | 5.4123e+03 | 7 | 4.5604e+03 | 1 |
| 400×0.8 | 7.1626e+03 | 6 | 6.4450e+03 | 2 | 6.7967e+03 | 5 | 7.6711e+03 | 7 | 6.7228e+03 | 4 | 6.6859e+03 | 3 | 6.4306e+03 | 1 |
| 625×0.4 | 4.1705e+03 | 1 | 4.3305e+03 | 2 | 4.7312e+03 | 4 | 5.0325e+03 | 6 | 4.7497e+03 | 5 | 6.3396e+03 | 7 | 4.6782e+03 | 3 |
| 625×0.6 | 1.1179e+04 | 5 | 1.1337e+04 | 6 | 1.0614e+04 | 2 | 1.1631e+04 | 7 | 1.0881e+04 | 4 | 1.0492e+04 | 1 | 1.0833e+04 | 3 |
| 625×0.8 | 1.7924e+04 | 6 | 1.4381e+04 | 5 | 1.3340e+04 | 1 | 1.3693e+04 | 2 | 1.3883e+04 | 4 | 2.1538e+04 | 7 | 1.3866e+04 | 3 |
| 900×0.4 | 9.1196e+03 | 1 | 9.4849e+03 | 3 | 9.4790e+03 | 2 | 1.1265e+04 | 6 | 1.0168e+04 | 4 | 1.1367e+04 | 7 | 1.0373e+04 | 5 |
| 900×0.6 | 1.8096e+04 | 6 | 1.7326e+04 | 4 | 1.7251e+04 | 3 | 1.7408e+04 | 5 | 1.6037e+04 | 1 | 2.6006e+04 | 7 | 1.6507e+04 | 2 |
| 900×0.8 | 3.8528e+04 | 6 | 3.1771e+04 | 5 | 2.9394e+04 | 1 | 2.9888e+04 | 2 | 3.0073e+04 | 3 | 4.3463e+04 | 7 | 3.1029e+04 | 4 |
| 1225×0.4 | 1.1894e+04 | 6 | 7.6778e+03 | 3 | 7.8513e+03 | 5 | 7.7506e+03 | 4 | 7.3753e+03 | 2 | 2.6556e+04 | 7 | 6.8136e+03 | 1 |
| 1225×0.6 | 8.7504e+04 | 6 | 6.4954e+04 | 3 | 7.3035e+04 | 5 | 6.4850e+04 | 2 | 6.4976e+04 | 4 | 1.0829e+05 | 7 | 8.4838e+03 | 1 |
| 1225×0.8 | 1.1045e+05 | 6 | 9.5029e+04 | 3 | 9.4998e+04 | 2 | 1.0545e+05 | 5 | 9.8886e+04 | 4 | 1.5509e+05 | 7 | 8.3481e+03 | 1 |
| Total rank | | 81 | | 66 | | 48 | | 89 | | 70 | | 111 | | 39 |
| | | | | | | | HV | | | | | | | |
| Problem | AMOE | A | CDABO | C | MODAI | 3C | MOEA | /D | NSGA- | П | MOTS | 5 | RNSG | A |
| | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Ran |
| 100×0.4 | 9.2072e-02 | 7 | 1.1101e-01 | 2 | 1.1115e-01 | 1 | 1.0788e-01 | 3 | 9.3004e-02 | 6 | 9.4613e-02 | 5 | 1.0599e-01 | 4 |
| | | | | | | 3 | | | | 6 | 1.2606e-01 | 7 | 1 5 (22 - 01 | 1 |
| 100×0.6 | 1.3408e-01 | 5 | 1.5384e-01 | 2 | 1.5332e-01 | | 1.4719e-01 | 4 | 1.3051e-01 | | 1.20006-01 | | 1.5632e-01 | |
| 100×0.6 100×0.8 | 1.9080e-01 | 5 6 | 2.1134e-01 | 2 | 2.1120e-01 | 3 | 1.9256e-01 | 4 4 | 1.9227e-01 | 5 | 1.6616e-01 | 7 | 2.1809e-01 | 1 |
| | | | | | | 3 2 | | | | | | | | 1 1 |
| 100×0.8 225×0.4 225×0.6 | 1.9080e-01 1.9349e-01 2.2522e-01 | 6 5 6 | 2.1134e-01 2.0982e-01 2.4233e-01 | 2 3 4 | 2.1120e-01 2.1438e-01 2.4528e-01 | 3 2 2 | 1.9256e-01 1.9747e-01 2.4324e-01 | 4 4 3 | 1.9227e-01 1.8609e-01 2.3551e-01 | 5 6 5 | 1.6616e-01 1.7096e-01 1.7473e-01 | 7 7 7 | 2.1809e-01 2.1554e-01 2.5924e-01 | 1 1 |
| 100×0.8 225×0.4 | 1.9080e-01 1.9349e-01 | 6 5 | 2.1134e-01 2.0982e-01 | 2 3 4 3 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 | 3 2 2 2 | 1.9256e-01 1.9747e-01 | 4 4 3 4 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 | 5 6 5 5 | 1.6616e-01 1.7096e-01 | 7 7 7 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 | 1 1 1 |
| 100×0.8 225×0.4 225×0.6 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 | 6 5 6 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 | 2 3 4 3 3 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 | 3 2 2 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 | 4 4 3 4 2 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 | 5 6 5 5 5 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 | 7 7 7 7 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 | 1 1 1 |
| 100×0.8 225×0.4 225×0.6 225×0.8 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 | 6 5 6 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 | 2 3 4 3 3 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 | 3 2 2 2 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 | 4 4 3 4 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 | 5 6 5 5 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 | 7 7 7 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 | 1 1 1 |
| 100×0.8 225×0.4 225×0.6 225×0.8 400×0.4 400×0.6 400×0.8 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 | 6 5 6 6 6 6 7 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 | 2 3 4 3 3 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 | 3 2 2 2 4 4 4 3 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.9203e-01 | 4 4 3 4 2 5 5 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.9697e-01 | 5 6 5 5 5 3 4 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 | 7 7 7 7 7 7 6 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 | 1 1 1 1 1 |
| 100×0.8 225×0.4 225×0.6 225×0.8 400×0.4 400×0.6 400×0.8 625×0.4 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 | 6 5 6 6 6 7 6 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.4418e-01 | 2 3 4 3 3 2 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 | 3 2 2 2 2 4 4 3 3 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 | 4 4 3 4 2 5 5 4 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 | 5 6 5 5 5 3 4 5 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 | 7 7 7 7 7 7 6 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 | 1 1 1 1 1 1 |
| 100×0.8 225×0.4 225×0.6 225×0.8 400×0.4 400×0.6 400×0.8 625×0.4 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 2.8701e-01 | 6 5 6 6 6 6 7 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.4418e-01 3.6596e-01 | 2 3 4 3 2 2 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.5035e-01 | 3 2 2 2 4 4 3 3 4 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.9203e-01 3.2751e-01 3.5994e-01 | 4 4 3 4 2 5 5 4 3 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.9697e-01 3.2231e-01 3.5016e-01 | 5 6 5 5 5 3 4 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 | 7 7 7 7 7 7 6 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 3.5330e-01 3.7848e-01 | 1 1 1 1 1 1 1 |
| $\begin{array}{c} 100\!\times\!0.8\\ 225\!\times\!0.4\\ 225\!\times\!0.6\\ 225\!\times\!0.8\\ 400\!\times\!0.4\\ 400\!\times\!0.6\\ 400\!\times\!0.8\\ 625\!\times\!0.4\\ 625\!\times\!0.6\\ 625\!\times\!0.8 \end{array}$ | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 2.8701e-01 3.1526e-01 | 6 5 6 6 6 6 7 6 7 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.6596e-01 4.3399e-01 | 2 3 4 3 3 2 2 2 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.5035e-01 4.1650e-01 | 3 2 2 2 4 4 3 3 4 5 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.9203e-01 3.2751e-01 | 4 4 3 4 2 5 5 5 4 3 3 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.9697e-01 3.2231e-01 3.5016e-01 4.1918e-01 | 5 6 5 5 5 5 3 4 5 5 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 3.0044e-01 | 7 7 7 7 7 7 6 7 6 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 3.5330e-01 3.7848e-01 4.4769e-01 | 1 1 1 1 1 1 1 1 |
| $\begin{array}{c} 100{\times}0.8 \\ 225{\times}0.4 \\ 225{\times}0.6 \\ 225{\times}0.8 \\ 400{\times}0.4 \\ 400{\times}0.6 \\ 400{\times}0.8 \\ 625{\times}0.4 \\ 625{\times}0.6 \\ 625{\times}0.8 \\ 900{\times}0.4 \end{array}$ | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 2.8701e-01 3.1526e-01 3.9854e-01 | 6 5 6 6 6 6 7 6 7 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.4418e-01 4.3399e-01 4.3324e-01 | 2 3 4 3 3 2 2 2 2 2 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.5035e-01 4.1650e-01 4.0184e-01 | 3 2 2 2 4 4 3 3 4 5 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.2751e-01 3.5994e-01 4.2453e-01 4.2801e-01 | 4 4 3 4 2 5 5 4 3 3 3 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.9697e-01 3.2231e-01 4.1918e-01 4.2295e-01 | 5 6 5 5 5 5 3 4 5 5 4 4 5 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 3.044e-01 3.2702e-01 | 7 7 7 7 7 6 7 6 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 3.5330e-01 3.7848e-01 4.4769e-01 4.4347e-01 | 1 1 1 1 1 1 1 1 |
| $\begin{array}{c} 100{\times}0.8 \\ 225{\times}0.4 \\ 225{\times}0.6 \\ 225{\times}0.8 \\ 400{\times}0.4 \\ 400{\times}0.6 \\ 400{\times}0.8 \\ 625{\times}0.4 \\ 625{\times}0.6 \\ 625{\times}0.8 \\ 900{\times}0.4 \end{array}$ | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 2.8701e-01 3.1526e-01 | 6 5 6 6 6 6 7 6 7 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.6596e-01 4.3399e-01 | 2 3 4 3 3 2 2 2 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.5035e-01 4.1650e-01 | 3 2 2 2 4 4 3 3 4 5 5 3 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.9203e-01 3.2751e-01 3.5994e-01 4.2453e-01 | 4 4 3 4 2 5 5 4 3 3 4 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.9697e-01 3.2231e-01 3.5016e-01 4.1918e-01 | 5 6 5 5 5 3 4 5 5 4 5 4 5 5 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 3.0044e-01 | 7 7 7 7 7 7 6 7 6 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 3.5330e-01 3.7848e-01 4.4769e-01 | 1 1 1 1 1 1 1 1 1 |
| $\begin{array}{c} 100{\times}0.8 \\ 225{\times}0.4 \\ 225{\times}0.6 \\ 225{\times}0.8 \\ 400{\times}0.4 \\ 400{\times}0.6 \\ 400{\times}0.8 \\ 625{\times}0.4 \\ 625{\times}0.6 \\ 625{\times}0.8 \\ 900{\times}0.4 \end{array}$ | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 2.8701e-01 3.1954e-01 4.1559e-01 4.3816e-01 | 6 5 6 6 6 6 7 6 7 6 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.4418e-01 4.3399e-01 4.3324e-01 | 2 3 4 3 3 2 2 2 2 2 2 2 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.3044e-01 3.5035e-01 4.1650e-01 4.0184e-01 5.0494e-01 5.9424e-01 | 3 2 2 2 4 4 3 3 4 5 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.2751e-01 3.5994e-01 4.2453e-01 4.2801e-01 | 4 4 3 4 2 5 5 4 3 3 3 4 5 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.9697e-01 3.2231e-01 4.1918e-01 4.2295e-01 | 5 6 5 5 5 5 3 4 5 5 5 4 4 5 5 2 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 3.0702e-01 4.4801e-01 | 7 7 7 7 7 7 6 7 6 7 7 6 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 3.5330e-01 3.7848e-01 4.4769e-01 4.4347e-01 | 1 1 1 1 1 1 1 1 1 |
| 100×0.8 225×0.4 225×0.6 225×0.8 400×0.4 400×0.8 625×0.4 625×0.6 625×0.8 900×0.4 900×0.6 900×0.8 1225×0.4 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 2.8701e-01 3.9854e-01 4.1559e-01 | 6 5 6 6 6 7 6 7 6 6 6 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.6596e-01 4.3399e-01 4.3324e-01 5.1049e-01 | 2 3 4 3 3 2 2 2 2 2 2 2 2 2 2 4 3 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.5035e-01 4.01650e-01 4.0184e-01 5.0494e-01 | 3 2 2 2 2 4 4 3 3 4 5 5 5 3 4 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.9203e-01 3.2751e-01 3.5994e-01 4.2801e-01 4.9850e-01 | 4 4 3 4 2 5 5 4 3 3 3 4 5 5 5 5 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.2231e-01 3.5016e-01 4.1918e-01 4.2295e-01 | 5 6 5 5 5 5 3 4 5 5 5 4 4 5 5 2 2 2 2 2 2 2 2 2 2 2 2 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 3.7420e-01 4.4801e-01 2.8691e-01 | 7 7 7 7 7 7 6 7 6 7 7 6 7 | 2.1809e-01 2.1554e-01 2.5924e-01 3.1337e-01 2.7339e-01 3.7726e-01 4.3255e-01 3.5330e-01 4.769e-01 4.4347e-01 5.1289e-01 | 1 1 1 1 1 1 1 1 1 1 |
| 100×0.8 225×0.4 225×0.6 225×0.8 400×0.4 400×0.6 625×0.4 625×0.6 625×0.8 900×0.4 900×0.6 900×0.8 1225×0.4 1225×0.6 | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.5531e-01 3.1750e-01 3.1854e-01 3.9854e-01 4.3816e-01 3.7598e-01 4.0395e-01 | 6 5 6 6 6 7 6 7 6 6 6 7 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 4.1194e-01 3.4596e-01 4.3324e-01 5.1049e-01 5.9178e-01 4.2731e-01 5.2346e-01 | 2 3 4 3 3 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.9913e-01 3.3044e-01 4.1650e-01 4.0184e-01 5.0494e-01 4.2649e-01 4.8155e-01 | 3 2 2 2 4 4 3 3 4 5 5 3 3 4 5 5 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4259e-01 3.2203e-01 3.2751e-01 4.2453e-01 4.2801e-01 4.9850e-01 5.7888e-01 4.2433e-01 4.2433e-01 5.1292e-01 | 4 4 3 4 2 5 5 4 3 3 3 4 5 5 5 4 3 4 5 4 4 5 4 5 5 4 4 5 5 4 4 5 5 5 4 4 5 5 5 4 4 5 5 5 5 4 4 5 5 5 5 5 4 4 5 5 5 5 5 5 5 4 5 | 1.9227e-01 1.8609e-01 2.3551e-01 2.8509e-01 2.5103e-01 3.5993e-01 3.2931e-01 3.2231e-01 4.1918e-01 4.2295e-01 6.0011e-01 4.2991e-01 5.2694e-01 | 5 6 5 5 5 5 5 4 4 5 5 5 2 2 2 2 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.0322e-01 3.0322e-01 3.0702e-01 4.4801e-01 2.8691e-01 3.8549e-01 | 7 7 7 7 7 7 6 7 6 7 7 7 | 2.1809e-01 2.1554e-01 3.1534e-01 3.1337e-01 2.7339e-01 4.3255e-01 3.5330e-01 4.7469e-01 4.4347e-01 5.1289e-01 6.0716e-01 4.3877e-01 8.1811e-01 | 1 1 1 1 1 1 1 1 1 1 1 |
| $\begin{array}{c} 100{\times}0.8 \\ 225{\times}0.4 \\ 225{\times}0.6 \\ 225{\times}0.8 \\ 400{\times}0.4 \\ 400{\times}0.8 \\ 625{\times}0.4 \\ 625{\times}0.6 \\ 625{\times}0.8 \\ 900{\times}0.4 \\ 900{\times}0.6 \end{array}$ | 1.9080e-01 1.9349e-01 2.2522e-01 2.7956e-01 2.2849e-01 3.4018e-01 3.1750e-01 2.8701e-01 3.1526e-01 3.9854e-01 4.1559e-01 4.3816e-01 3.7598e-01 | 6 5 6 6 6 7 6 7 6 6 6 | 2.1134e-01 2.0982e-01 2.4233e-01 2.9136e-01 2.5710e-01 3.6676e-01 3.4418e-01 3.6596e-01 4.3399e-01 4.3324e-01 5.1049e-01 4.2731e-01 | 2 3 4 3 3 2 2 2 2 2 2 2 2 2 2 4 3 | 2.1120e-01 2.1438e-01 2.4528e-01 2.9385e-01 2.5206e-01 3.5447e-01 3.39913e-01 3.5035e-01 4.1650e-01 4.0184e-01 5.9424e-01 4.2649e-01 | 3 2 2 2 2 4 4 3 3 4 5 5 5 3 4 | 1.9256e-01 1.9747e-01 2.4324e-01 2.9091e-01 2.5799e-01 3.4359e-01 3.9203e-01 3.5994e-01 4.2453e-01 4.2801e-01 4.9850e-01 4.2433e-01 4.2433e-01 | 4 4 3 4 2 5 5 4 3 3 3 4 5 5 5 5 | 1.9227e-01 1.8609e-01 2.3551e-01 2.3551e-01 2.5509e-01 2.5103e-01 3.5993e-01 3.2231e-01 3.5016e-01 4.1918e-01 4.295e-01 4.9695e-01 6.0011e-01 4.2991e-01 | 5 6 5 5 5 5 3 4 5 5 5 4 4 5 5 2 2 2 2 2 2 2 2 2 2 2 2 | 1.6616e-01 1.7096e-01 1.7473e-01 2.0640e-01 1.9813e-01 3.0509e-01 3.8386e-01 2.4102e-01 3.2322e-01 3.7420e-01 4.4801e-01 2.8691e-01 | 7 7 7 7 7 7 6 7 6 7 7 6 7 | 2.1809e-01 2.1554e-01 3.1537e-01 2.7539e-01 3.7726e-01 3.5330e-01 3.5330e-01 3.7848e-01 4.4769e-01 4.4347e-01 5.1289e-01 4.3877e-01 | 1 1 1 1 1 1 1 1 1 1 |

VII. FIGURES

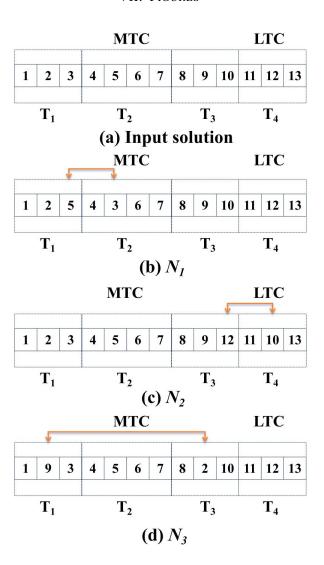


Fig. 3. Near task optimization mechanism

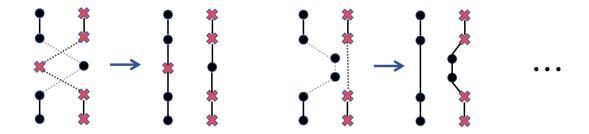


Fig. 4. Some simple examples of rationalizing the path through NTOM

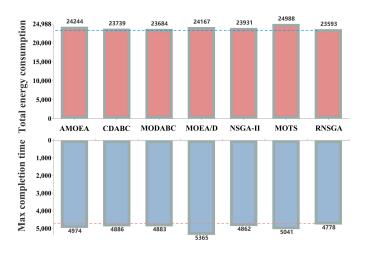


Fig. 5. Objective values for algorithms in a instance

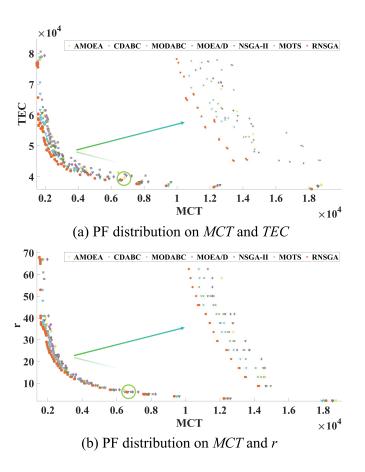


Fig. 6. PF distribution on 625×0.6 scenario

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