

```

1 "E:\1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1_LW_ \ \ \ \ \2\6 \ \ \ \ \2 python code\01_My_Python_Code\Scripts\python.
   exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=52493
2
3 import sys; print('Python %s on %s' % (sys.version, sys.platform))
4 sys.path.extend(['E:\1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1_LW_ \ \ \ \ \2\6 \ \ \ \ \2 python code\
   01_My_Python_Code', 'E:/1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1_LW_ \ \ \ \ \2\6 \ \ \ \ \2 python code/
   01_My_Python_Code'])
5
6 PyDev console: starting.
7
8 Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
9 >>> runfile('E:/1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1_LW_ \ \ \ \ \2\6 \ \ \ \ \2 python code\01_My_Python_Code/
   main_BACASP_official_ENSGA-II.py', wdir='E:/1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1_LW_ \ \ \ \ \2\6 \ \ \ \ \2
   python code\01_My_Python_Code')
10 Backend TkAgg is interactive backend. Turning interactive mode on.
11 Waiting 1s.....
12
13 This is the R_7_3_standerd_test.xlsx optimization process solved by ENSGA-II algorithm.
14
15 Start
16
17 Before iteration:
18   Read basic data
19   Parameter setting:
20     trail = 58
21     Pop_size = 30
22     Tolerance_iteration_unchanged_number = 10
23     Chrom_size = 21
24     Iter_num_GA = 300
25     Select_rate = 0.85
26     Crossover_rate = 0.95
27     Mutation_rate = 0.95
28     Mu_oper_type = 1
29     vessel_move_way = 2
30     coefficient for Obj1= 1.9
31     coefficient for Obj2= 0.10000000000000009
32     gen = 0
33
34 Iteration begin:
35 Beging the No. 0 iteration:
36   obj[0] = 21.30   temp_best_value_gen = 21.30
37   The No. 0 iteration is finished!
38
39 Beging the No. 1 iteration:
40   obj[gen-1] = 21.30   temp_best_value_gen = 21.30
41   No, maintain solution and obj[gen] = 21.30 , and the tolerance_counter = 1
42   solution chromosome =
43     first level: [ [ 1.5 6. 13. 19.5 25.5 1.5 3. ]
44     second level: [ 4. 5. 2. 7. 1. 1. 3. ]
45     third level: [ 2. 4. 8. 2. 2. 3. 4. ] ]
46   The No. 1 iteration is finished!
47
48 Beging the No. 2 iteration:
49   obj[gen-1] = 21.30   temp_best_value_gen = 21.30
50   No, maintain solution and obj[gen] = 21.30 , and the tolerance_counter = 2
51   solution chromosome =
52     first level: [ [ 1.5 6. 13. 19.5 25.5 1.5 3. ]
53     second level: [ 4. 5. 2. 7. 1. 1. 3. ]
54     third level: [ 2. 4. 8. 2. 2. 3. 4. ] ]
55   The No. 2 iteration is finished!
56
57 Beging the No. 3 iteration:
58   obj[gen-1] = 21.30   temp_best_value_gen = 19.80
59   Yes, update solution and obj[gen] = 19.80
60   solution chromosome =
61     first level: [ [ 1.5 6. 13. 2.5 25.5 19.5 3. ]
62     second level: [ 4. 5. 2. 1. 1. 7. 7. ]
63     third level: [ 2. 4. 8. 3. 2. 2. 4. ] ]
64   The No. 3 iteration is finished!
65
66 Beging the No. 4 iteration:
67   obj[gen-1] = 19.80   temp_best_value_gen = 19.80
68   No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 1
69   solution chromosome =
70     first level: [ [ 1.5 6. 13. 2.5 25.5 19.5 3. ]
71     second level: [ 4. 5. 2. 1. 1. 7. 7. ]
72     third level: [ 2. 4. 8. 3. 2. 2. 4. ] ]
73   The No. 4 iteration is finished!
74
75 Beging the No. 5 iteration:
76   obj[gen-1] = 19.80   temp_best_value_gen = 19.80
77   No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 2
78   solution chromosome =
79     first level: [ [ 1.5 6. 13. 2.5 25.5 19.5 3. ]

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80     second level: [4. 5. 2. 1. 1. 7. 7.]
81     third level: [2. 4. 8. 3. 2. 2. 4.] ]
82     The No. 5 iteration is finished!
83
84     Beging the No. 6 iteration:
85     obj[gen-1] = 19.80   temp_best_value_gen = 19.80
86     No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 3
87     solution chromosome =
88     first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
89     second level: [4. 5. 2. 1. 1. 7. 7.]
90     third level: [2. 4. 8. 3. 2. 2. 4.] ]
91     The No. 6 iteration is finished!
92
93     Beging the No. 7 iteration:
94     obj[gen-1] = 19.80   temp_best_value_gen = 19.80
95     No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 4
96     solution chromosome =
97     first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
98     second level: [4. 5. 2. 1. 1. 7. 7.]
99     third level: [2. 4. 8. 3. 2. 2. 4.] ]
100    The No. 7 iteration is finished!
101
102    Beging the No. 8 iteration:
103    obj[gen-1] = 19.80   temp_best_value_gen = 19.80
104    No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 5
105    solution chromosome =
106    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
107    second level: [4. 5. 2. 1. 1. 7. 7.]
108    third level: [2. 4. 8. 3. 2. 2. 4.] ]
109    The No. 8 iteration is finished!
110
111    Beging the No. 9 iteration:
112    obj[gen-1] = 19.80   temp_best_value_gen = 19.80
113    No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 6
114    solution chromosome =
115    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
116    second level: [4. 5. 2. 1. 1. 7. 7.]
117    third level: [2. 4. 8. 3. 2. 2. 4.] ]
118    The No. 9 iteration is finished!
119
120    Beging the No. 10 iteration:
121    obj[gen-1] = 19.80   temp_best_value_gen = 19.80
122    No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 7
123    solution chromosome =
124    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
125    second level: [4. 5. 2. 1. 1. 7. 7.]
126    third level: [2. 4. 8. 3. 2. 2. 4.] ]
127    The No. 10 iteration is finished!
128
129    Beging the No. 11 iteration:
130    obj[gen-1] = 19.80   temp_best_value_gen = 19.80
131    No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 8
132    solution chromosome =
133    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
134    second level: [4. 5. 2. 1. 1. 7. 7.]
135    third level: [2. 4. 8. 3. 2. 2. 4.] ]
136    The No. 11 iteration is finished!
137
138    Beging the No. 12 iteration:
139    obj[gen-1] = 19.80   temp_best_value_gen = 19.80
140    No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 9
141    solution chromosome =
142    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
143    second level: [4. 5. 2. 1. 1. 7. 7.]
144    third level: [2. 4. 8. 3. 2. 2. 4.] ]
145    The No. 12 iteration is finished!
146
147    Beging the No. 13 iteration:
148    obj[gen-1] = 19.80   temp_best_value_gen = 19.80
149    No, maintain solution and obj[gen] = 19.80 , and the tolerance_counter = 10
150    solution chromosome =
151    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
152    second level: [4. 5. 2. 1. 1. 7. 7.]
153    third level: [2. 4. 8. 3. 2. 2. 4.] ]
154    The No. 13 iteration is finished!
155
156
157    -----
158    The iteration is terminated and then visulize the solution:
159    solution chromosome =
160    first level: [ [ 1.5  6.  13.  2.5 25.5 19.5 3. ]
161    second level: [4. 5. 2. 1. 1. 7. 7.]
162    third level: [2. 4. 8. 3. 2. 2. 4.] ]
163    Objective function values and some other indicators:

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164      Obj0 = 9.00      Obj1 = 27.00      Obj0 + Obj1 = 36.00
165      Total movement of crane: 0.00
166      Total waiting time in berth position: 27.00
167      Total index of q during berthing: 349.00
168      Specific arrangement for each vessel:
169      V_id: 0      li: 3.0      xi: 1.5      bow of i: 0.0      tail of i: 3.0      gama_i0: 4.0      gama_i1: 7.0
170      duration_time_i: 3.0      demand_i: 100.0      work load_i: 100.0      work load gap_i: 0
171      V_id: 1      li: 6.0      xi: 6.0      bow of i: 3.0      tail of i: 9.0      gama_i0: 5.0      gama_i1: 7.0
172      duration_time_i: 2.0      demand_i: 100.0      work load_i: 100.0      work load gap_i: 0
173      V_id: 2      li: 8.0      xi: 13.0      bow of i: 9.0      tail of i: 17.0      gama_i0: 2.0      gama_i1: 3
174      .0      duration_time_i: 1.0      demand_i: 60.0      work load_i: 60.0      work load gap_i: 0
175      V_id: 3      li: 5.0      xi: 2.5      bow of i: 0.0      tail of i: 5.0      gama_i0: 1.0      gama_i1: 4.0
176      duration_time_i: 3.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
177      V_id: 4      li: 9.0      xi: 25.5      bow of i: 21.0      tail of i: 30.0      gama_i0: 1.0      gama_i1: 5
178      .0      duration_time_i: 4.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
179      V_id: 5      li: 3.0      xi: 19.5      bow of i: 18.0      tail of i: 21.0      gama_i0: 7.0      gama_i1:
180      10.0      duration_time_i: 3.0      demand_i: 120.0      work load_i: 120.0      work load gap_i: 0
181      V_id: 6      li: 6.0      xi: 3.0      bow of i: 0.0      tail of i: 6.0      gama_i0: 7.0      gama_i1: 8.0
182      duration_time_i: 1.0      demand_i: 80.0      work load_i: 80.0      work load gap_i: 0
183
184      176
185      177 Algorithm finished and the total CPU time: 1103 s
186      178 End
187      179

```