```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=36159
 3
     import sys; print('Python %s on %s' % (sys.version, sys.platform))
     01_My_Python_Code', 'E:/1 \\ \text{0} \\ \
     01_My_Python_Code'])
 6
    PyDev console: starting.
    Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
 8
    python code/01_My_Python_Code')
10 Backend TkAgg is interactive backend. Turning interactive mode on.
     Waiting 1s.....
12
13
    This is the R_2_1 _standard_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 = 13
21
            Pop\_size = 20
             Tolerance iteration unchanged number = 5
23
             Chrom\_size = 6
            Iter_num_GA = 300
24
25
             Select_rate = 0.75
26
             Crossover rate = 0.8
             Mutation rate = 0.9
27
28
             Mu_oper_type = 2
29
             vessel\_move\_way = 2
30
            coefficient for Obj1= 0.5
            coefficient for Obj2= 1.5
31
             gen = 0
32
33
     Iteration begin:
34
35
     Beging the No. 0 iteration:
         obj[0] = 14.00 temp_best_value_gen = 14.00
36
37
         The No. 0 iteration is finished!
38
39
     Beging the No. 1 iteration:
40
         obj[gen-1] = 14.00 temp_best_value_gen = 10.44
         Yes, update solution and obj[gen] = 10.44
41
         solution chromosome =
42
43
             first level: [ [2.23 6.03]
            second level: [2. 1.]
44
            third level: [2. 6.]]
45
46
         The No. 1 iteration is finished!
47
48
     Beging the No. 2 iteration:
         obj[gen-1] = 10.44 temp_best_value_gen = 10.44
49
50
         No, maintain solution and obj[gen] = 10.44, and the tolerance_counter = 1
51
         solution chromosome =
52
             first level: [ [2.23 6.03]
53
             second level: [2. 1.]
54
            third level: [2. 6.]]
55
         The No. 2 iteration is finished!
56
57
     Beging the No. 3 iteration:
58
         obi[gen-1] = 10.44 temp best value gen = 10.44
59
         No, maintain solution and obj[gen] = 10.44, and the tolerance_counter = 2
60
         solution chromosome =
61
             first level: [ [2.23 6.03]
62
             second level: [2. 1.]
            third level: [2. 6.]]
63
         The No. 3 iteration is finished!
64
65
     Beging the No. 4 iteration:
66
67
         obj[gen-1] = 10.44 temp_best_value_gen = 10.44
68
         No, maintain solution and obj[gen] = 10.44, and the tolerance_counter = 3
69
         solution chromosome =
70
            first level: [ [2.23 6.03]
             second level: [2. 1.]
71
            third level: [2. 6.]
73
         The No. 4 iteration is finished!
74
75
     Beging the No. 5 iteration:
         obi[gen-1] = 10.44 temp best value gen = 10.44
76
         No, maintain solution and obj[gen] = 10.44, and the tolerance counter = 4
77
78
         solution chromosome =
             first level: [ [2.23 6.03]
```

```
80
          second level: [2. 1.]
 81
          third level: [2. 6.]]
 82
       The No. 5 iteration is finished!
 83
     Beging the No. 6 iteration:
 85
       obj[gen-1] = 10.44 temp best value gen = 9.36
        Yes, update solution and obj[gen] = 9.36
 86
 87
       solution chromosome =
 88
          first level: [[2.1 4.02]
 89
          second level: [3. 0.]
 90
          third level: [3. 8.]]
 91
       The No. 6 iteration is finished!
 92
 93 Beging the No. 7 iteration:
 94
        obj[gen-1] = 9.36 temp_best_value_gen = 9.36
 95
       No, maintain solution and obj[gen] = 9.36, and the tolerance_counter = 1
 96
       solution chromosome =
 97
          first level: [ [2.1 4.02]
 98
          second level: [3. 0.]
 99
          third level: [3. 8.]
100
       The No. 7 iteration is finished!
101
102 Beging the No. 8 iteration:
       obj[gen-1] = 9.36 temp best value gen = 9.36
103
104
       No, maintain solution and obj[gen] = 9.36, and the tolerance_counter = 2
105
        solution chromosome =
          first level: [[2.1 4.02]
106
          second level: [3. 0.]
107
108
          third level: [3. 8.]]
109
       The No. 8 iteration is finished!
110
111 Beging the No. 9 iteration:
112
        obj[gen-1] = 9.36 temp_best_value_gen = 9.36
113
       No, maintain solution and obj[gen] = 9.36, and the tolerance_counter = 3
       solution chromosome =
114
115
          first level: [ [2.1 4.02]
116
          second level: [3. 0.]
          third level: [3, 8,]]
117
118
       The No. 9 iteration is finished!
119
120 Beging the No. 10 iteration:
121
       obj[gen-1] = 9.36 temp_best_value_gen = 9.36
       No, maintain solution and obj[gen] = 9.36, and the tolerance_counter = 4
122
123
        solution chromosome =
124
          first level: [[2.1 4.02]
125
          second level: [3. 0.]
126
          third level: [3. 8.]]
127
       The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
130
        obj[gen-1] = 9.36 temp_best_value_gen = 8.43
131
        Yes, update solution and obj[gen] = 8.43
132
       solution chromosome =
          first level: [ [2.1 4.01]
133
134
          second level: [3. 0.]
135
          third level: [3. 7.]]
136
       The No. 11 iteration is finished!
137
138 Beging the No. 12 iteration:
139
       obj[gen-1] = 8.43 temp_best_value_gen = 8.43
140
       No, maintain solution and obj[gen] = 8.43, and the tolerance_counter = 1
141
        solution chromosome =
142
          first level: [[2.1 4.01]
          second level: [3. 0.]
143
          third level: [3. 7.]]
144
145
       The No. 12 iteration is finished!
146
147 Beging the No. 13 iteration:
148
        obj[gen-1] = 8.43 temp_best_value_gen = 7.34
        Yes, update solution and obj[gen] = 7.34
149
150
       solution chromosome =
          first level: [ [2.36 4.01]
151
152
          second level: [1. 0.]
153
          third level: [4. 7.]]
154
       The No. 13 iteration is finished!
155
156 Beging the No. 14 iteration:
157
       obj[gen-1] = 7.34 temp_best_value_gen = 7.34
158
       No, maintain solution and obj[gen] = 7.34, and the tolerance_counter = 1
159
        solution chromosome =
160
          first level: [ [2.36 4.01]
          second level: [1. 0.]
161
162
          third level: [4. 7.]]
163
       The No. 14 iteration is finished!
```

```
164
165 Beging the No. 15 iteration:
        obj[gen-1] = 7.34 temp_best_value_gen = 7.34
166
167
       No, maintain solution and obj[gen] = 7.34, and the tolerance_counter = 2
168
        solution chromosome =
169
          first level: [ [2.36 4.01]
170
          second level: [1. 0.]
171
          third level: [4. 7.]]
172
        The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175
       obj[gen-1] = 7.34 temp_best_value_gen = 4.11
        Yes, update solution and obj[gen] = 4.11
176
177
       solution chromosome =
          first level: [ [2.06 4.01]
178
179
          second level: [1. 0.]
180
          third level: [3. 7.]]
181
        The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
       obj[gen-1] = 4.11 temp_best_value_gen = 4.11
184
185
       No, maintain solution and obj[gen] = 4.11, and the tolerance_counter = 1
        solution chromosome =
186
187
          first level: [ [2.06 4.01]
          second level: [1. 0.]
188
189
          third level: [3. 7.]]
190
        The No. 17 iteration is finished!
191
192
     Beging the No. 18 iteration:
193
       obj[gen-1] = 4.11 temp_best_value_gen = 4.11
194
       No, maintain solution and obj[gen] = 4.11, and the tolerance counter = 2
195
       solution chromosome =
196
          first level: [ [2.06 4.01]
197
          second level: [1. 0.]
198
          third level: [3. 7.]]
199
       The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202
       obj[gen-1] = 4.11 temp_best_value_gen = 4.11
203
        No, maintain solution and obj[gen] = 4.11, and the tolerance_counter = 3
204
        solution chromosome =
205
          first level: [ [2.06 4.01]
206
          second level: [1. 0.]
207
          third level: [3. 7.]]
208
        The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211
       obj[gen-1] = 4.11 temp_best_value_gen = 4.11
212
       No, maintain solution and obj[gen] = 4.11, and the tolerance_counter = 4
213
       solution chromosome =
214
          first level: [ [2.06 4.01]
215
          second level: [1. 0.]
216
          third level: [3. 7.]]
       The No. 20 iteration is finished!
217
218
219 Beging the No. 21 iteration:
220
       obj[gen-1] = 4.11 temp best value gen = 4.11
221
       No, maintain solution and obj[gen] = 4.11, and the tolerance_counter = 5
222
        solution chromosome
223
          first level: [ [2.06 4.01]
224
          second level: [1. 0.]
225
          third level: [3. 7.]]
226
       The No. 21 iteration is finished!
227
228
229
230 The iteration is terminated and then visulize the solution:
231
       solution chromosome =
          first level: [ [2.06 4.01]
232
233
          second level: [1. 0.]
234
          third level: [3. 7.]
235
        Objective function values and some other indicators:
236
          Obj0 = 3.00
                                Obj1 = 1.74
                                                      Obj0 + Obj1 = 4.74
237
          Total movement of crane: 0.74
238
          Total waiting time in berth position: 1.00
239
          Total index of q during berthing: 22.00
240
        Specific arrangement for each vessel:
          V_id: 0
241
                             1i: 4.0
                                                 xi: 2.1
                                                                     bow of i: 0.1
                                                                                                tail of i: 4.1
                                                                                                                         gama i0: 1.0
                                                                                                                                                    gama_i1: 4.0
                    duration_time_i: 3.0
                                                      demand_i: 160.0
                                                                                    work load_i: 160.0
                                                                                                                    work load gap_i: 0
                                                                     bow of i: 0.0
242
          V id: 1
                             li: 8.0
                                                                                                tail of i: 8.0
                                                                                                                         gama_i0: 0.0
                                                                                                                                                    gama_i1: 1.0
                                                      demand i: 120.0
                    duration time i: 1.0
                                                                                    work load i: 120.0
                                                                                                                    work load gap_i: 0
244 Algorithm finished and the total CPU time: 366 s
245 End
```