

```

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=5263
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_2_1_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 = 57
21     Pop_size = 10
22     Tolerance_iteration_unchanged_number = 10
23     Chrom_size = 6
24     Iter_num_GA = 300
25     Select_rate = 0.8
26     Crossover_rate = 0.9
27     Mutation_rate = 0.9
28     Mu_oper_type = 2
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] = 10.82   temp_best_value_gen = 10.82
37   The No. 0 iteration is finished!
38
39 Beging the No. 1 iteration:
40   obj[gen-1] = 10.82   temp_best_value_gen = 10.82
41   No, maintain solution and obj[gen] = 10.82 , and the tolerance_counter = 1
42   solution chromosome =
43     first level: [ 2.27 4.61]
44     second level: [0. 4.]
45     third level: [2. 8.] ]
46   The No. 1 iteration is finished!
47
48 Beging the No. 2 iteration:
49   obj[gen-1] = 10.82   temp_best_value_gen = 9.83
50   Yes, update solution and obj[gen] = 9.83
51   solution chromosome =
52     first level: [ 2.01 4.4 ]
53     second level: [0. 4.]
54     third level: [2. 8.] ]
55   The No. 2 iteration is finished!
56
57 Beging the No. 3 iteration:
58   obj[gen-1] = 9.83   temp_best_value_gen = 9.83
59   No, maintain solution and obj[gen] = 9.83 , and the tolerance_counter = 1
60   solution chromosome =
61     first level: [ 2.01 4.4 ]
62     second level: [0. 4.]
63     third level: [2. 8.] ]
64   The No. 3 iteration is finished!
65
66 Beging the No. 4 iteration:
67   obj[gen-1] = 9.83   temp_best_value_gen = 9.83
68   No, maintain solution and obj[gen] = 9.83 , and the tolerance_counter = 2
69   solution chromosome =
70     first level: [ 2.01 4.4 ]
71     second level: [0. 4.]
72     third level: [2. 8.] ]
73   The No. 4 iteration is finished!
74
75 Beging the No. 5 iteration:
76   obj[gen-1] = 9.83   temp_best_value_gen = 9.26
77   Yes, update solution and obj[gen] = 9.26
78   solution chromosome =
79     first level: [ 2.01 4.27]

```

```

80     second level: [0. 4.]
81     third level: [2. 8.] ]
82     The No. 5 iteration is finished!
83
84     Beging the No. 6 iteration:
85     obj[gen-1] = 9.26    temp_best_value_gen = 9.26
86     No, maintain solution and obj[gen] = 9.26 , and the tolerance_counter = 1
87     solution chromosome =
88     first level: [ [2.01 4.27]
89     second level: [0. 4.]
90     third level: [2. 8.] ]
91     The No. 6 iteration is finished!
92
93     Beging the No. 7 iteration:
94     obj[gen-1] = 9.26    temp_best_value_gen = 8.27
95     Yes, update solution and obj[gen] = 8.27
96     solution chromosome =
97     first level: [ [2.01 4.06]
98     second level: [0. 4.]
99     third level: [2. 8.] ]
100    The No. 7 iteration is finished!
101
102    Beging the No. 8 iteration:
103    obj[gen-1] = 8.27    temp_best_value_gen = 8.27
104    No, maintain solution and obj[gen] = 8.27 , and the tolerance_counter = 1
105    solution chromosome =
106    first level: [ [2.01 4.06]
107    second level: [0. 4.]
108    third level: [2. 8.] ]
109    The No. 8 iteration is finished!
110
111    Beging the No. 9 iteration:
112    obj[gen-1] = 8.27    temp_best_value_gen = 8.27
113    No, maintain solution and obj[gen] = 8.27 , and the tolerance_counter = 2
114    solution chromosome =
115    first level: [ [2.01 4.06]
116    second level: [0. 4.]
117    third level: [2. 8.] ]
118    The No. 9 iteration is finished!
119
120    Beging the No. 10 iteration:
121    obj[gen-1] = 8.27    temp_best_value_gen = 8.27
122    No, maintain solution and obj[gen] = 8.27 , and the tolerance_counter = 3
123    solution chromosome =
124    first level: [ [2.01 4.06]
125    second level: [0. 4.]
126    third level: [2. 8.] ]
127    The No. 10 iteration is finished!
128
129    Beging the No. 11 iteration:
130    obj[gen-1] = 8.27    temp_best_value_gen = 8.27
131    No, maintain solution and obj[gen] = 8.27 , and the tolerance_counter = 4
132    solution chromosome =
133    first level: [ [2.01 4.06]
134    second level: [0. 4.]
135    third level: [2. 8.] ]
136    The No. 11 iteration is finished!
137
138    Beging the No. 12 iteration:
139    obj[gen-1] = 8.27    temp_best_value_gen = 8.27
140    No, maintain solution and obj[gen] = 8.27 , and the tolerance_counter = 5
141    solution chromosome =
142    first level: [ [2.01 4.06]
143    second level: [0. 4.]
144    third level: [2. 8.] ]
145    The No. 12 iteration is finished!
146
147    Beging the No. 13 iteration:
148    obj[gen-1] = 8.27    temp_best_value_gen = 6.01
149    Yes, update solution and obj[gen] = 6.01
150    solution chromosome =
151    first level: [ [2.17 4.44]
152    second level: [0. 2.]
153    third level: [4. 7.] ]
154    The No. 13 iteration is finished!
155
156    Beging the No. 14 iteration:
157    obj[gen-1] = 6.01    temp_best_value_gen = 6.01
158    No, maintain solution and obj[gen] = 6.01 , and the tolerance_counter = 1
159    solution chromosome =
160    first level: [ [2.17 4.44]
161    second level: [0. 2.]
162    third level: [4. 7.] ]
163    The No. 14 iteration is finished!

```

```
164
165 Beging the No. 15 iteration:
166 obj[gen-1] = 6.01 temp_best_value_gen = 6.01
167 No, maintain solution and obj[gen] = 6.01 , and the tolerance_counter = 2
168 solution chromosome =
169 first level: [ 2.17 4.44]
170 second level: [0. 2.]
171 third level: [4. 7.] ]
172 The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175 obj[gen-1] = 6.01 temp_best_value_gen = 5.25
176 Yes, update solution and obj[gen] = 5.25
177 solution chromosome =
178 first level: [ 2. 4.27]
179 second level: [0. 2.]
180 third level: [4. 8.] ]
181 The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
184 obj[gen-1] = 5.25 temp_best_value_gen = 5.25
185 No, maintain solution and obj[gen] = 5.25 , and the tolerance_counter = 1
186 solution chromosome =
187 first level: [ 2. 4.27]
188 second level: [0. 2.]
189 third level: [4. 8.] ]
190 The No. 17 iteration is finished!
191
192 Beging the No. 18 iteration:
193 obj[gen-1] = 5.25 temp_best_value_gen = 5.25
194 No, maintain solution and obj[gen] = 5.25 , and the tolerance_counter = 2
195 solution chromosome =
196 first level: [ 2. 4.27]
197 second level: [0. 2.]
198 third level: [4. 8.] ]
199 The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202 obj[gen-1] = 5.25 temp_best_value_gen = 5.25
203 No, maintain solution and obj[gen] = 5.25 , and the tolerance_counter = 3
204 solution chromosome =
205 first level: [ 2. 4.27]
206 second level: [0. 2.]
207 third level: [4. 8.] ]
208 The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211 obj[gen-1] = 5.25 temp_best_value_gen = 4.08
212 Yes, update solution and obj[gen] = 4.08
213 solution chromosome =
214 first level: [ 2. 4.02]
215 second level: [0. 2.]
216 third level: [4. 7.] ]
217 The No. 20 iteration is finished!
218
219 Beging the No. 21 iteration:
220 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
221 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 1
222 solution chromosome =
223 first level: [ 2. 4.02]
224 second level: [0. 2.]
225 third level: [4. 7.] ]
226 The No. 21 iteration is finished!
227
228 Beging the No. 22 iteration:
229 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
230 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 2
231 solution chromosome =
232 first level: [ 2. 4.02]
233 second level: [0. 2.]
234 third level: [4. 7.] ]
235 The No. 22 iteration is finished!
236
237 Beging the No. 23 iteration:
238 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
239 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 3
240 solution chromosome =
241 first level: [ 2. 4.02]
242 second level: [0. 2.]
243 third level: [4. 7.] ]
244 The No. 23 iteration is finished!
245
246 Beging the No. 24 iteration:
247 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
```

```

248 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 4
249 solution chromosome =
250     first level: [ [2.  4.02]
251     second level: [0. 2.]
252     third level: [4. 7.] ]
253 The No. 24 iteration is finished!
254
255 Beging the No. 25 iteration:
256 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
257 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 5
258 solution chromosome =
259     first level: [ [2.  4.02]
260     second level: [0. 2.]
261     third level: [4. 7.] ]
262 The No. 25 iteration is finished!
263
264 Beging the No. 26 iteration:
265 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
266 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 6
267 solution chromosome =
268     first level: [ [2.  4.02]
269     second level: [0. 2.]
270     third level: [4. 7.] ]
271 The No. 26 iteration is finished!
272
273 Beging the No. 27 iteration:
274 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
275 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 7
276 solution chromosome =
277     first level: [ [2.  4.02]
278     second level: [0. 2.]
279     third level: [4. 7.] ]
280 The No. 27 iteration is finished!
281
282 Beging the No. 28 iteration:
283 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
284 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 8
285 solution chromosome =
286     first level: [ [2.  4.02]
287     second level: [0. 2.]
288     third level: [4. 7.] ]
289 The No. 28 iteration is finished!
290
291 Beging the No. 29 iteration:
292 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
293 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 9
294 solution chromosome =
295     first level: [ [2.  4.02]
296     second level: [0. 2.]
297     third level: [4. 7.] ]
298 The No. 29 iteration is finished!
299
300 Beging the No. 30 iteration:
301 obj[gen-1] = 4.08 temp_best_value_gen = 4.08
302 No, maintain solution and obj[gen] = 4.08 , and the tolerance_counter = 10
303 solution chromosome =
304     first level: [ [2.  4.02]
305     second level: [0. 2.]
306     third level: [4. 7.] ]
307 The No. 30 iteration is finished!
308
309
310 -----
311 The iteration is terminated and then visulize the solution:
312 solution chromosome =
313     first level: [ [2.  4.02]
314     second level: [0. 2.]
315     third level: [4. 7.] ]
316 Objective function values and some other indicators:
317     Obj0 = 2.00      Obj1 = 2.77      Obj0 + Obj1 = 4.77
318     Total movement of crane: 0.77
319     Total waiting time in berth position: 2.00
320     Total index of q during berthing: 27.00
321 Specific arrangement for each vessel:
322     V_id: 0          li: 4.0          xi: 2.0          bow of i: 0.0          tail of i: 4.0          gama_i0: 0.0          gama_i1: 2.0
323         duration_time_i: 2.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
324     V_id: 1          li: 8.0          xi: 4.0          bow of i: 0.0          tail of i: 8.0          gama_i0: 2.0          gama_i1: 3.0
325         duration_time_i: 1.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0
326
327 Algorithm finished and the total CPU time: 259 s
328 End
329

```