test_AoAFinder

July 7, 2023

```python
# change directory to the root of the project (assuming that the notebook is in
 the draft folder)
import os
os.chdir("..")
print("Current working directory: %s" % os.getcwd())
```

Current working directory:
c:\Users\bcynuaa\Desktop\LocalProject\Help\CFDPostFlutterHelp\CODE\CLShakeAoA

```python
from src.classes.AoAFinder import AoAFinder
mesh_filename: str = "C://Project//Mesh//001_t010.x"
Minf: float = 0.72
dt: float = -0.2
aoa_finder: AoAFinder = AoAFinder(mesh_filename, Minf)
```

config: CalculationSettings.py is imported.
config: InpFileSettings.py is imported.
config: Cfl3d.py is imported.
config: Meshes.py is imported.
utils: Path is imported.
utils: RunExe is imported.
classes: CalculationTask imported
classes: AoAFinder.py is imported.

```python
import numpy as np
import matplotlib.pyplot as plt
```

```python
AoA_array: np.ndarray = np.linspace(0.5, 2.0, 4)
AoA_array = np.hstack([AoA_array, np.linspace(2.1, 2.55, 10)])
AoA_array = np.hstack([AoA_array, np.linspace(2.6, 3.1, 26)])
AoA_array
```

```
array([0.5 , 1.  , 1.5 , 2.  , 2.1 , 2.15, 2.2 , 2.25, 2.3 , 2.35, 2.4 ,
       2.45, 2.5 , 2.55, 2.6 , 2.62, 2.64, 2.66, 2.68, 2.7 , 2.72, 2.74,
       2.76, 2.78, 2.8 , 2.82, 2.84, 2.86, 2.88, 2.9 , 2.92, 2.94, 2.96,
       2.98, 3.  , 3.02, 3.04, 3.06, 3.08, 3.1 ])
```

```
for AoA in AoA_array:
    aoa_finder.runTask(AoA, dt)
    pass
```

Task folder created: D:\Project\Data\001_t010\M_0.720\A_0.500
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 0.500000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_0.500
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_1.000
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 1.000000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_1.000
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_1.500
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 1.500000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_1.500
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.000
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.000000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.000
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.100
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.100000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.100

```
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.150
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.150000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.150
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.200
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.200000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.200
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.250
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.250000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.250
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.300
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.300000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.300
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.350
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.350000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.350
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.400
```

Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.400000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.400
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.450
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.450000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.450
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.500
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.500000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.500
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.550
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.550000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.550
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.600
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.600000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.600
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.620
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.620000, dt:

-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.620
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.640
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.640000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.640
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.660
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.660000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.660
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.680
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.680000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.680
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.700
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.700000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.700
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.720
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.720000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.720

```
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.740
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.740000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.740
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.760
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.760000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.760
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.780
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.780000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.780
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.800
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.800000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.800
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.820
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.820000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.820
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.840
```

Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.840000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.840
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.860
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.860000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.860
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.880
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.880000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.880
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.900
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.900000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.900
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.920
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.920000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.920
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.940
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.940000, dt:

-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.940
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.960
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.960000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.960
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_2.980
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 2.980000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_2.980
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_3.000
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 3.000000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_3.000
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_3.020
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 3.020000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_3.020
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_3.040
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 3.040000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_3.040

```
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_3.060
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 3.060000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_3.060
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_3.080
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 3.080000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_3.080
Calculation task finished
Results readed
Task folder created: D:\Project\Data\001_t010\M_0.720\A_3.100
Inp file overwritten: C:\Project\CFL3D\cfl3d.inp
Running calculation task for
mesh: C://Project//Mesh//001_t010.x, Minf: 0.720000, AoA: 3.100000, dt:
-0.200000
Files copied from exe path to task folder:
D:\Project\Data\001_t010\M_0.720\A_3.100
Calculation task finished
Results readed
```

```python
df = aoa_finder.dataframe.copy()
```

```python
df = aoa_finder.dataframe.copy()
df = df.sort_values(by=["AoA"])
```

```python
df[["AoA", "CL", "converge", "dudy min"]]
```

```
     AoA        CL  converge          dudy min
0   0.50  0.677888      True  65951.95828167339
1   1.00  0.777508      True  73102.98139346729
2   1.50  0.884594      True  86948.05889688394
3   2.00  1.001967      True  81088.62359393851
4   2.10  1.027272      True  78155.93942822874
5   2.15  1.040096      True  77765.36585343152
6   2.20  1.052521      True  77859.34704722116
7   2.25  1.065262      True  77727.44675086495
8   2.30  1.077643      True   76643.7683797178
```
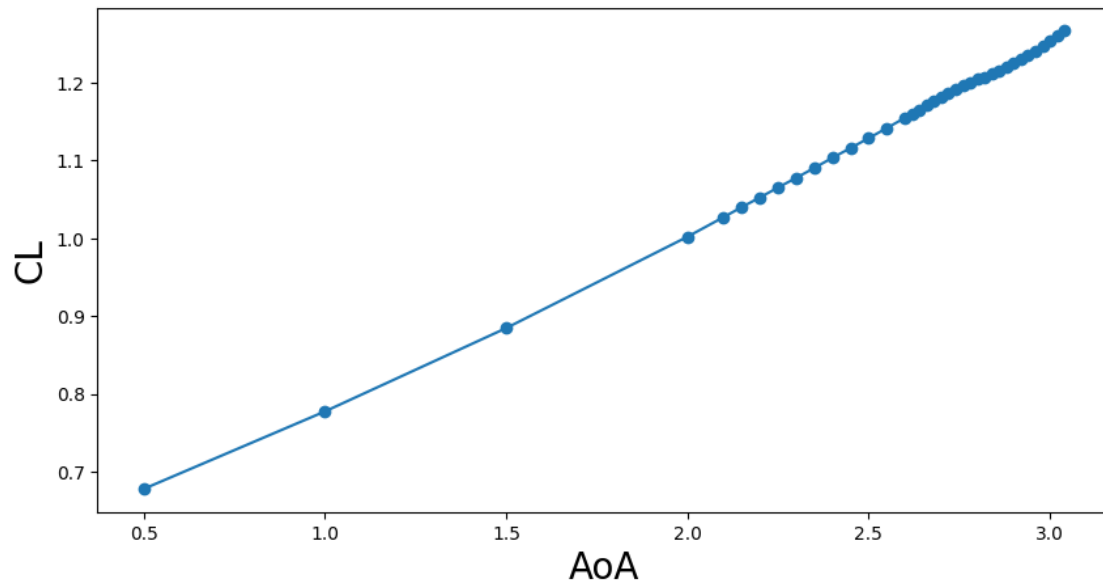
```
9    2.35   1.090430     True   75838.22036509101
10   2.40   1.103481     True   75662.44425830053
11   2.45   1.116003     True   75849.61916926035
12   2.50   1.128688     True   75657.47634364519
13   2.55   1.141633     True    74669.6482100774
14   2.60   1.154852     True    73935.8129775958
15   2.62   1.160060     True   73463.32225190876
16   2.64   1.165158     True   73248.92119791369
17   2.66   1.170816     True   72721.35343082523
18   2.68   1.176354     True   72354.30716518029
19   2.70   1.181686     True   72638.86072061768
20   2.72   1.186643     True   72585.59556368031
21   2.74   1.191847     True   71344.72312636331
22   2.76   1.196038     True   72407.10663709129
23   2.78   1.200590     True   73222.93049808426
24   2.80   1.204191     True   73899.07521902915
25   2.82   1.206947     True    74623.8639622166
26   2.84   1.210907     True   74954.92973531171
27   2.86   1.215637     True   74177.42082632068
28   2.88   1.220174     True   73617.41296247097
29   2.90   1.224758     True   73070.52103791002
30   2.92   1.229840     True   72456.34522305349
31   2.94   1.234599     True   71883.82680555203
32   2.96   1.239949     True   71344.68004452328
33   2.98   1.247332     True   70339.64121073287
34   3.00   1.253735     True   69823.30100519609
35   3.02   1.260384     True    69511.6028497193
36   3.04   1.266897     True   69467.11853346216
37   3.06   0.000000    False   68969.27912741933
38   3.08   0.000000    False   68317.88180070175
39   3.10   0.000000    False   67909.51133636587
```

```python
# "converge" is True
df_ = df[df["converge"] == "True"]
df_[["AoA", "CL", "converge", "dudy min"]]
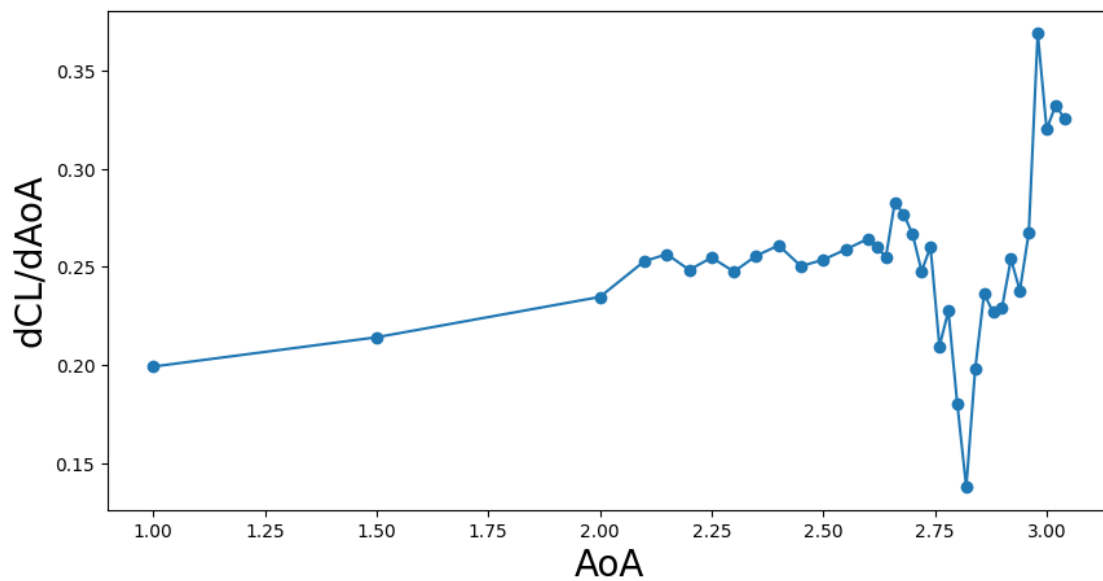```

```
     AoA        CL  converge            dudy min
0   0.50  0.677888      True   65951.95828167339
1   1.00  0.777508      True   73102.98139346729
2   1.50  0.884594      True   86948.05889688394
3   2.00  1.001967      True   81088.62359393851
4   2.10  1.027272      True   78155.93942822874
5   2.15  1.040096      True   77765.36585343152
6   2.20  1.052521      True   77859.34704722116
7   2.25  1.065262      True   77727.44675086495
8   2.30  1.077643      True    76643.7683797178
9   2.35  1.090430      True   75838.22036509101
```

```
10  2.40  1.103481      True  75662.44425830053
11  2.45  1.116003      True  75849.61916926035
12  2.50  1.128688      True  75657.47634364519
13  2.55  1.141633      True   74669.6482100774
14  2.60  1.154852      True   73935.8129775958
15  2.62  1.160060      True  73463.32225190876
16  2.64  1.165158      True  73248.92119791369
17  2.66  1.170816      True  72721.35343082523
18  2.68  1.176354      True  72354.30716518029
19  2.70  1.181686      True  72638.86072061768
20  2.72  1.186643      True  72585.59556368031
21  2.74  1.191847      True  71344.72312636331
22  2.76  1.196038      True  72407.10663709129
23  2.78  1.200590      True  73222.93049808426
24  2.80  1.204191      True  73899.07521902915
25  2.82  1.206947      True   74623.8639622166
26  2.84  1.210907      True  74954.92973531171
27  2.86  1.215637      True  74177.42082632068
28  2.88  1.220174      True  73617.41296247097
29  2.90  1.224758      True  73070.52103791002
30  2.92  1.229840      True  72456.34522305349
31  2.94  1.234599      True  71883.82680555203
32  2.96  1.239949      True  71344.68004452328
33  2.98  1.247332      True  70339.64121073287
34  3.00  1.253735      True  69823.30100519609
35  3.02  1.260384      True   69511.6028497193
36  3.04  1.266897      True  69467.11853346216
```
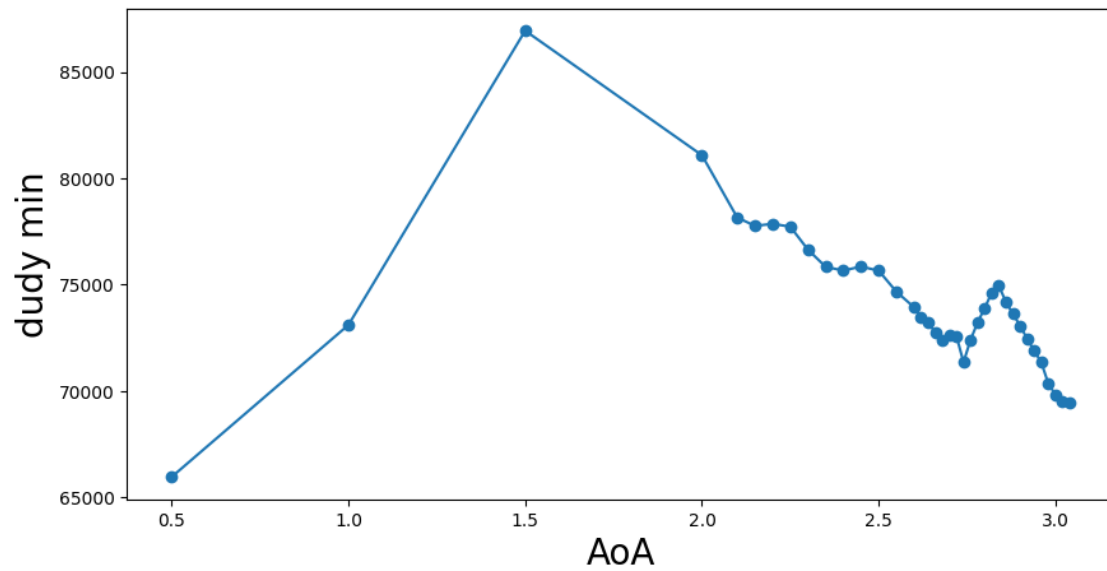
```python
plt.figure(figsize=(10, 5))
plt.plot(df_["AoA"], df_["CL"], 'o-')
plt.xlabel("AoA", fontsize=20)
plt.ylabel("CL", fontsize=20)
plt.show()
```

```
[ ]: plt.figure(figsize=(10, 5))
     plt.plot(df_["AoA"], df_["CL"].diff()/df_["AoA"].diff(), 'o-')
     plt.xlabel("AoA", fontsize=20)
     plt.ylabel("dCL/dAoA", fontsize=20)
     plt.show()
```

```
plt.figure(figsize=(10, 5))
plt.plot(df_["AoA"], df_["dudy min"], 'o-')
plt.xlabel("AoA", fontsize=20)
plt.ylabel("dudy min", fontsize=20)
plt.show()
```

[ ]: