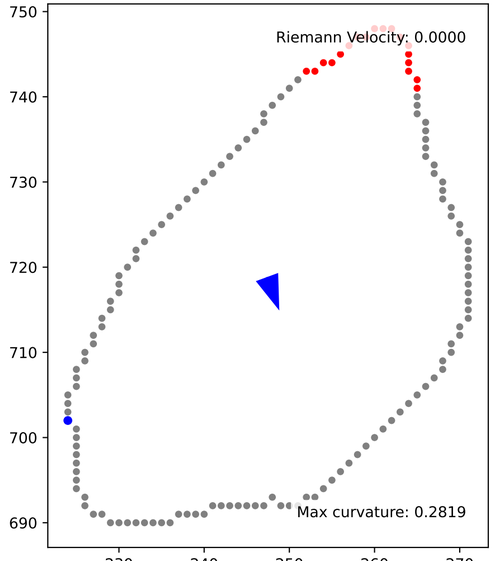
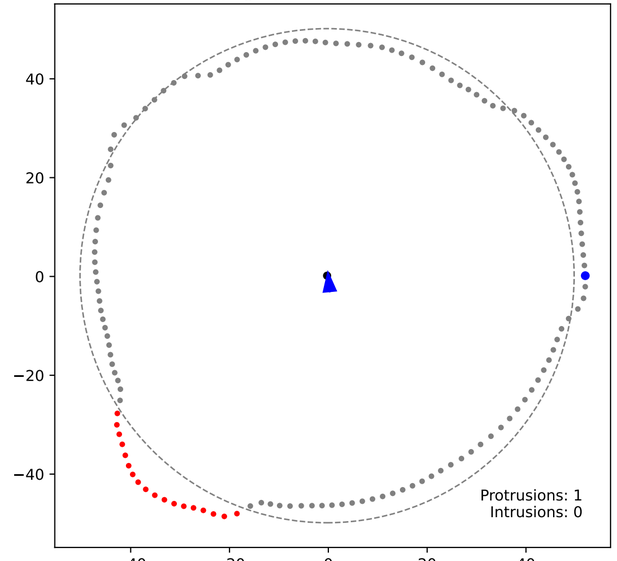
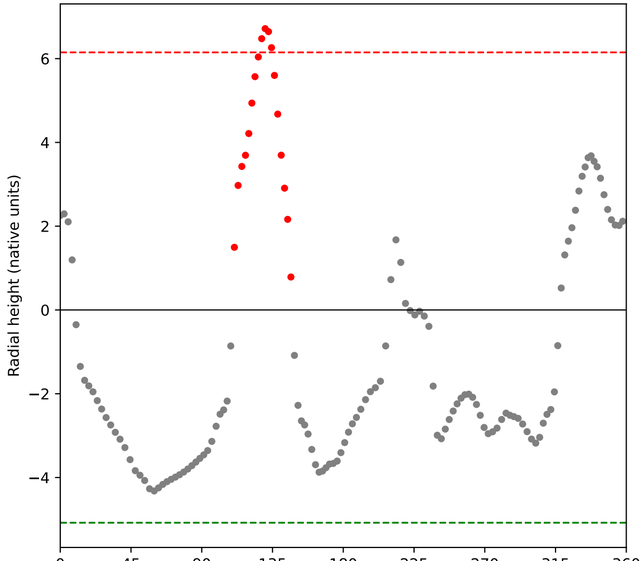
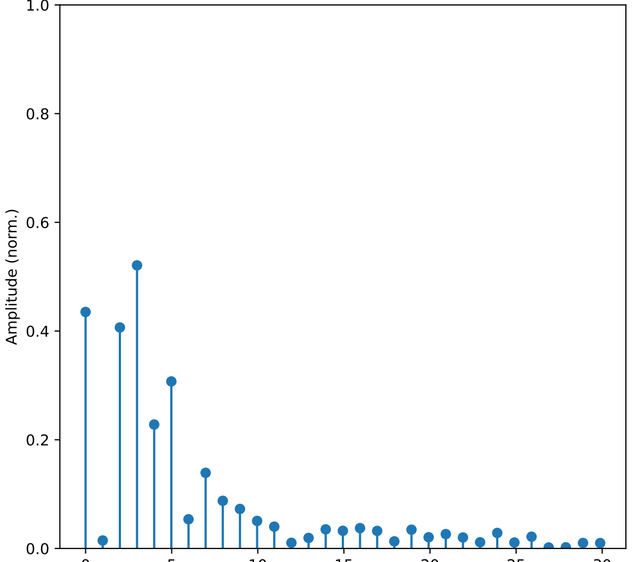
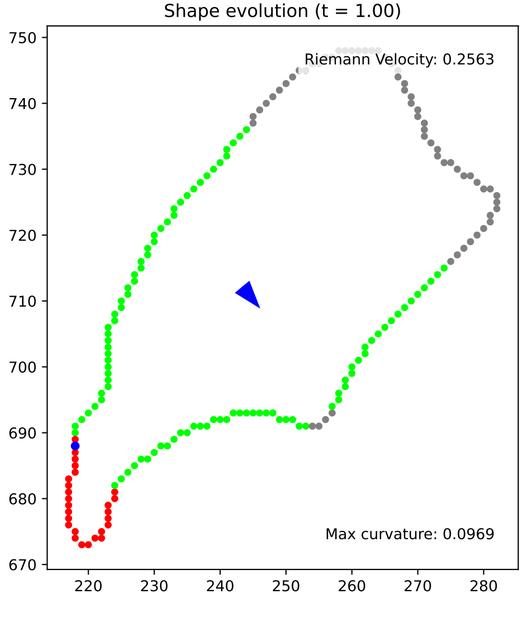
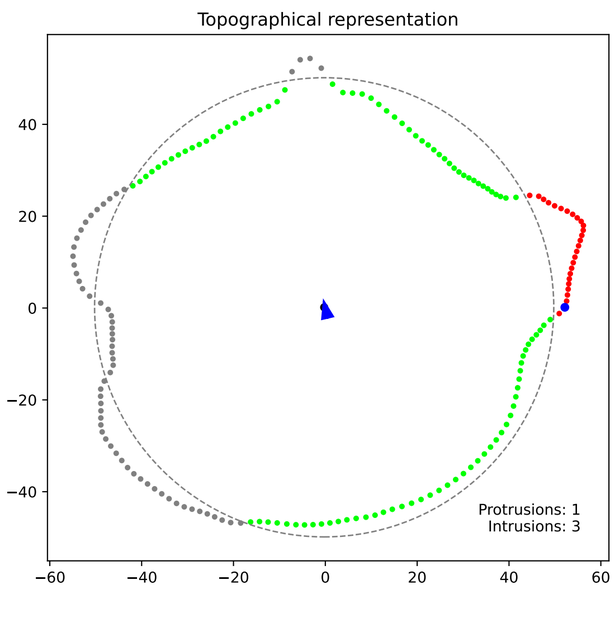

Shape evolution (t = 0.00)
Riemann Velocity: 0.0000
Max curvature: 0.2819
750
740
730
720
710
700
690
230
240
250
260
270

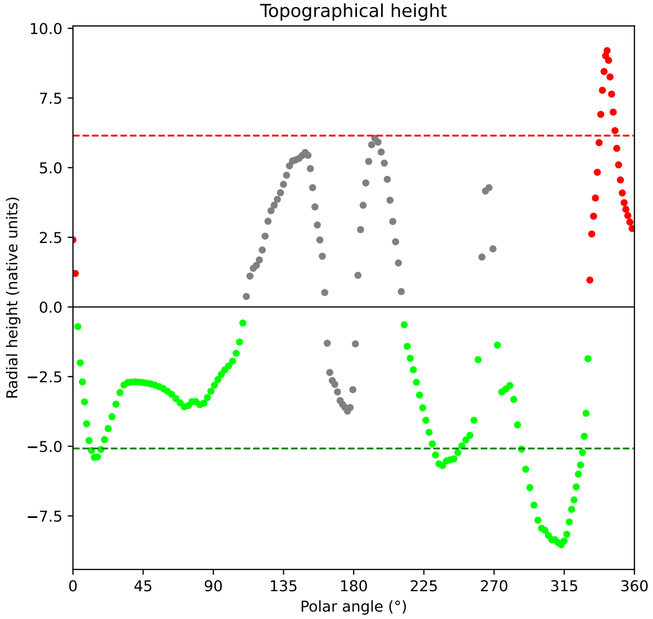

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

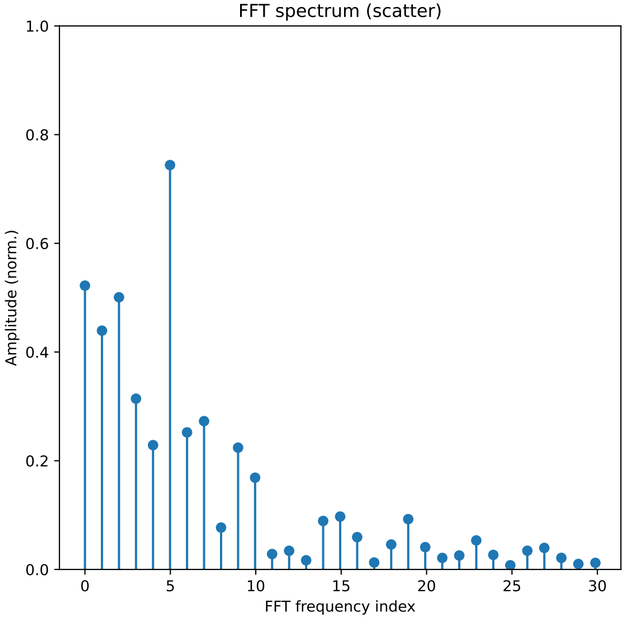

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

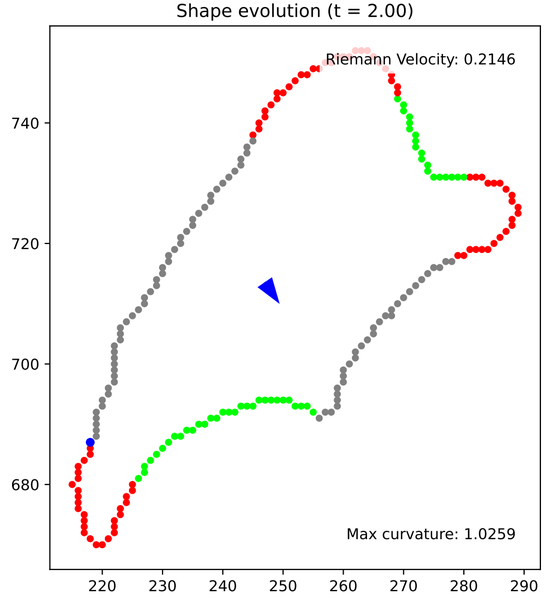

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

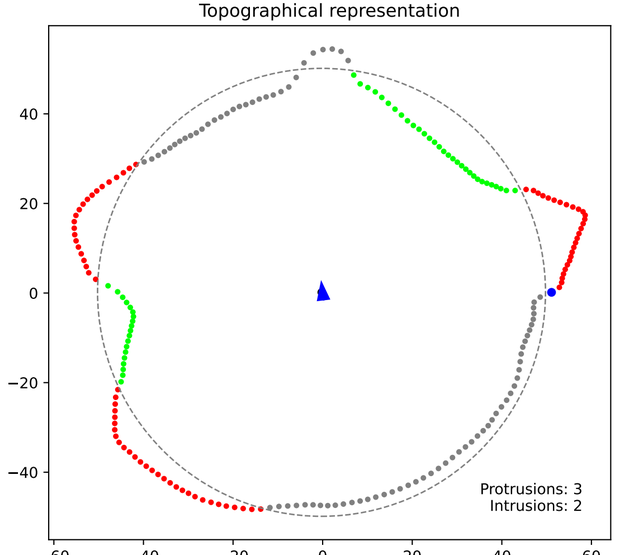

Shape evolution (t = 1.00)
Riemann Velocity: 0.2563
Max curvature: 0.0969

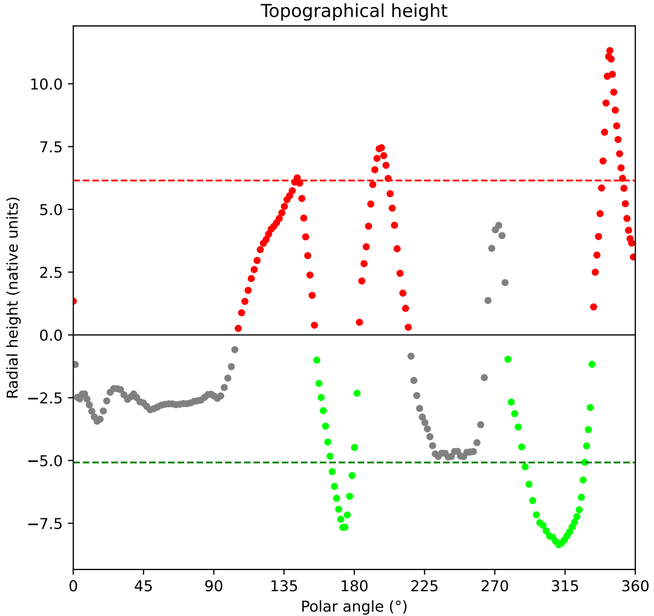

Topographical representation
Protrusions: 1
Intrusions: 3

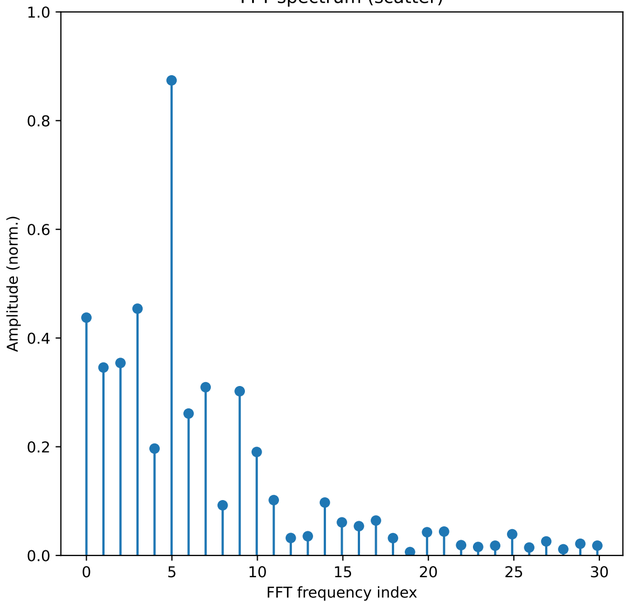

Topographical height
Radial height (native units)
Polar angle (°)

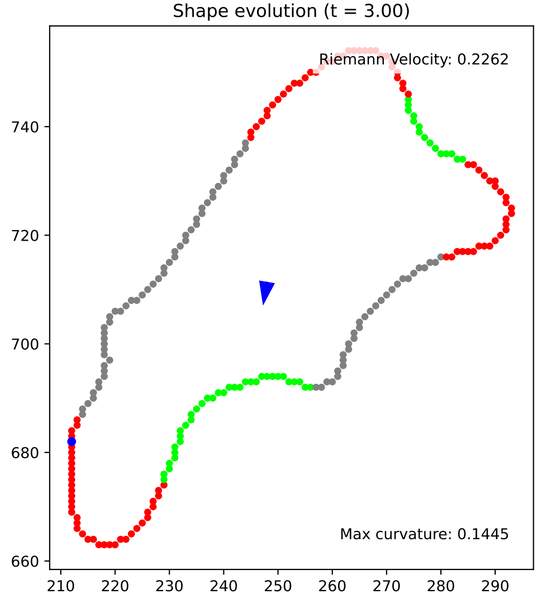

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index

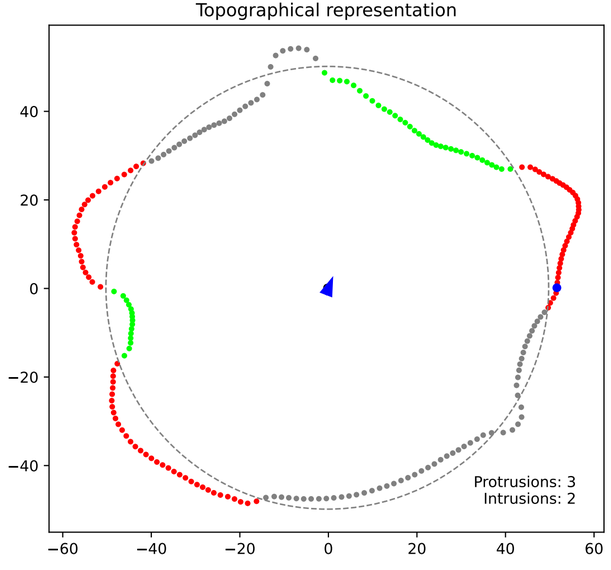

Shape evolution (t = 2.00)
Riemann Velocity: 0.2146
Max curvature: 1.0259
740
720
700
680
220
230
240
250
260
270
280
290

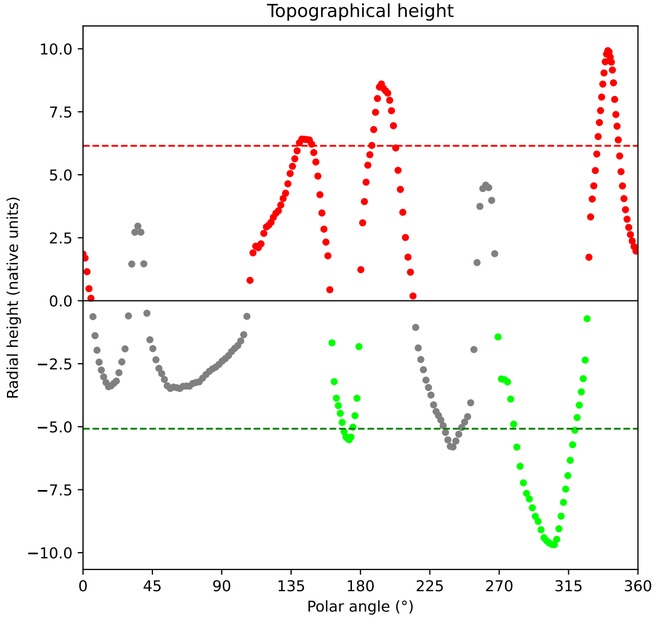

Topographical representation
Protrusions: 3
Intrusions: 2
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

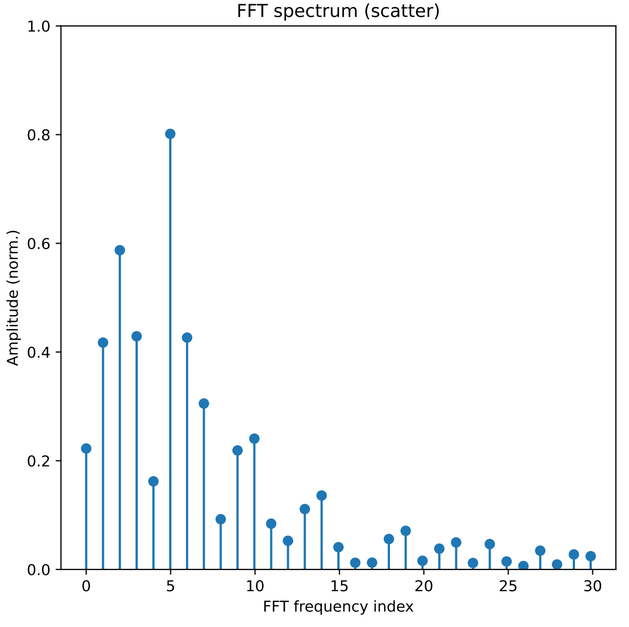

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

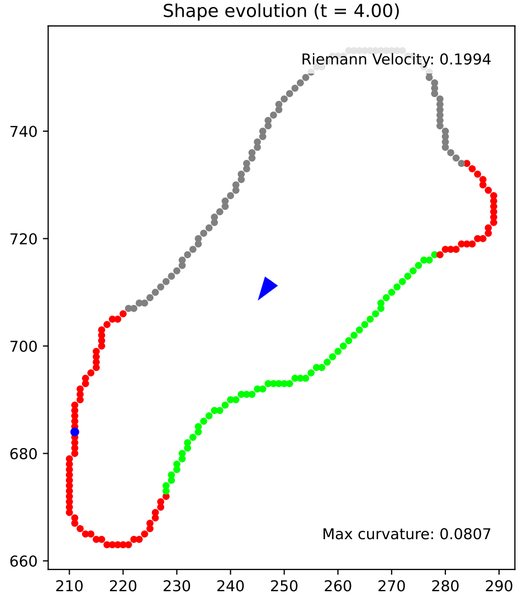

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

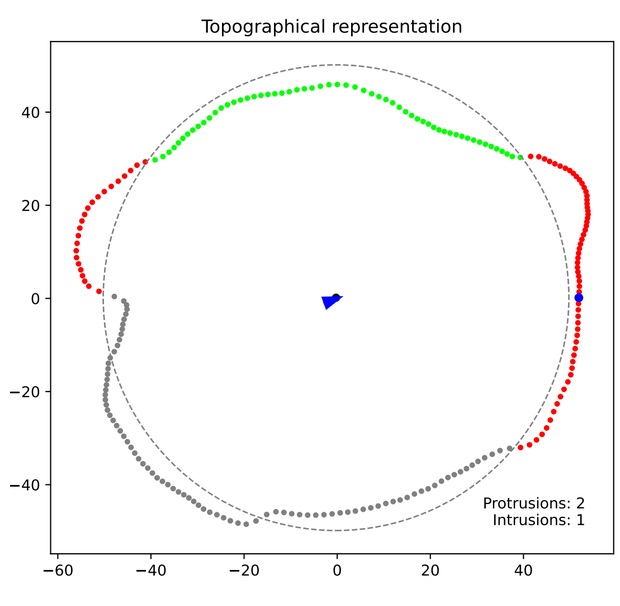

Shape evolution (t = 3.00)
Riemann Velocity: 0.2262
Max curvature: 0.1445
740
720
700
680
660
210
220
230
240
250
260
270
280
290

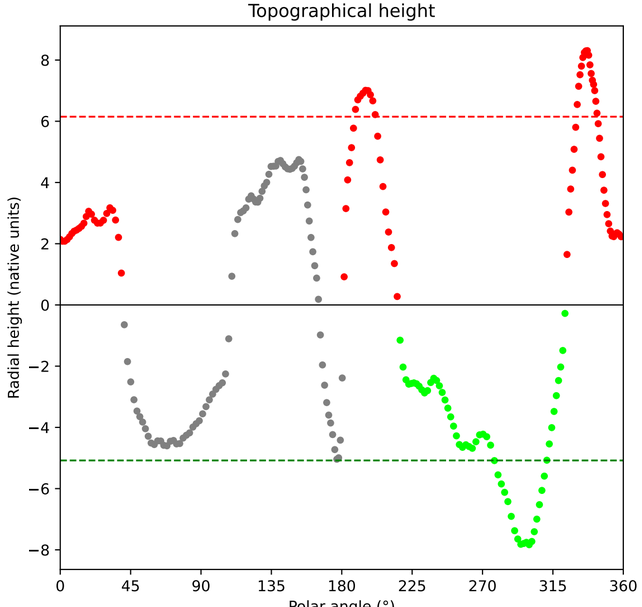

Topographical representation
Protrusions: 3
Intrusions: 2
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

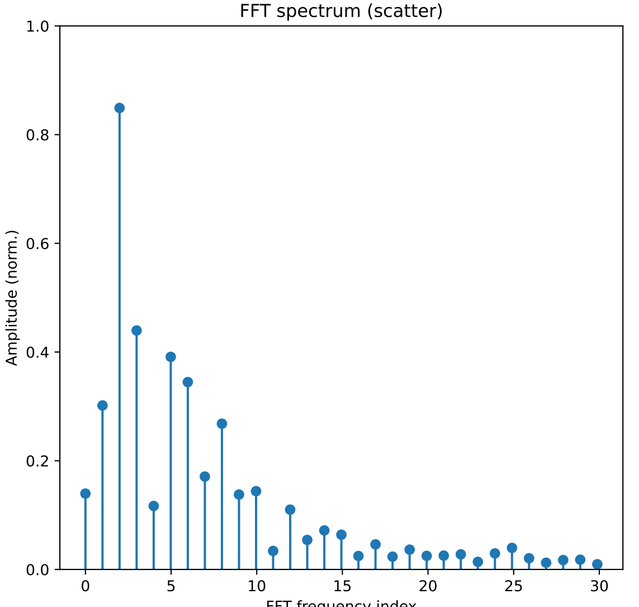

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
0
45
90
135
180
225
270
315
360

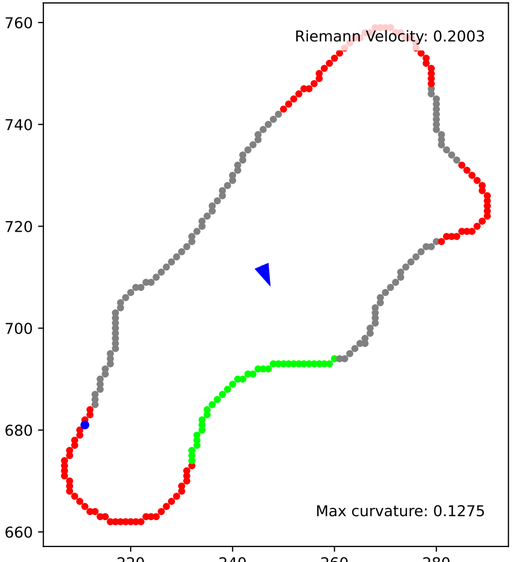

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

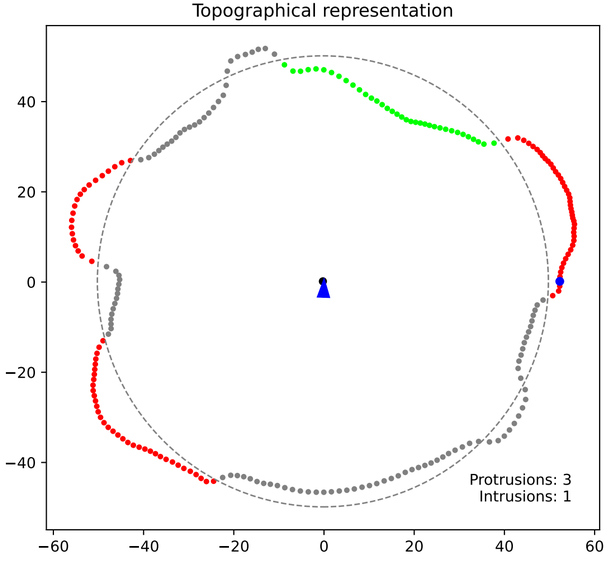

Shape evolution (t = 4.00)
Riemann Velocity: 0.1994
Max curvature: 0.0807
740
720
700
680
660
210
220
230
240
250
260
270
280
290

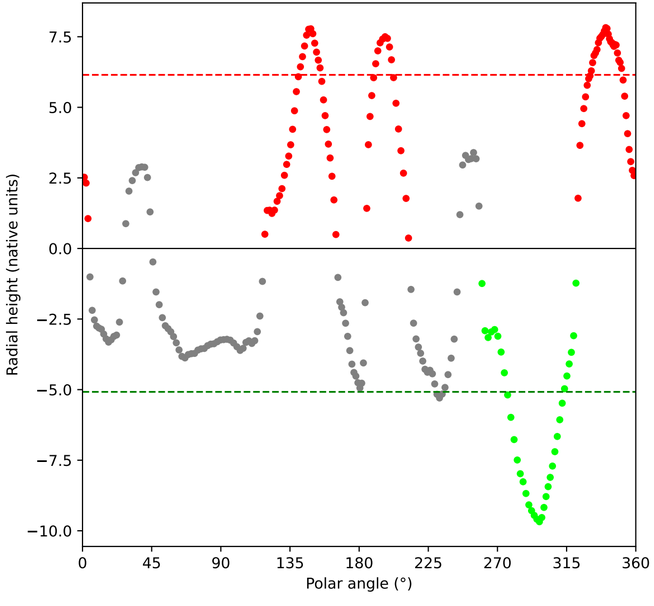

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

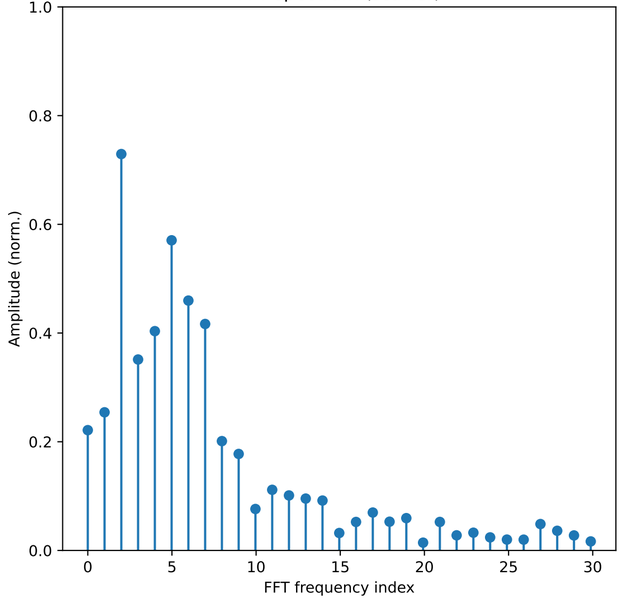

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
−8
0
45
90
135
180
225
270
315
360

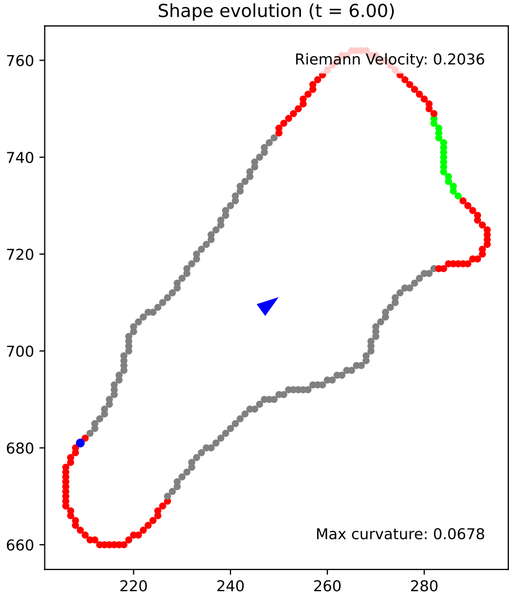

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

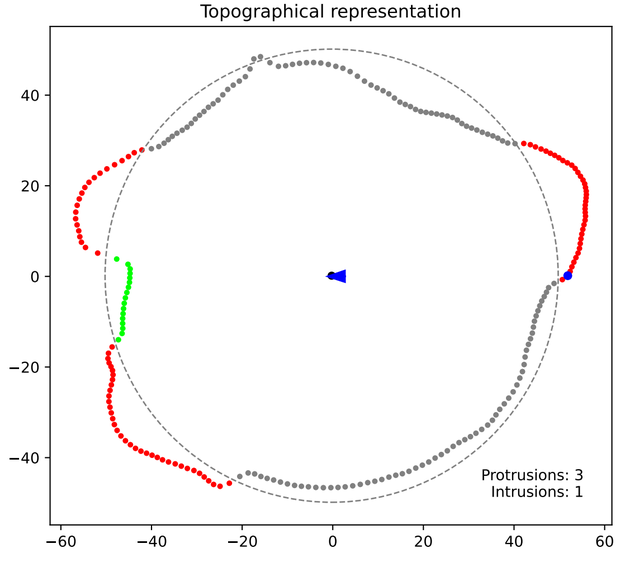

Shape evolution (t = 5.00)
Riemann Velocity: 0.2003
Max curvature: 0.1275
760
740
720
700
680
660
220
240
260
280

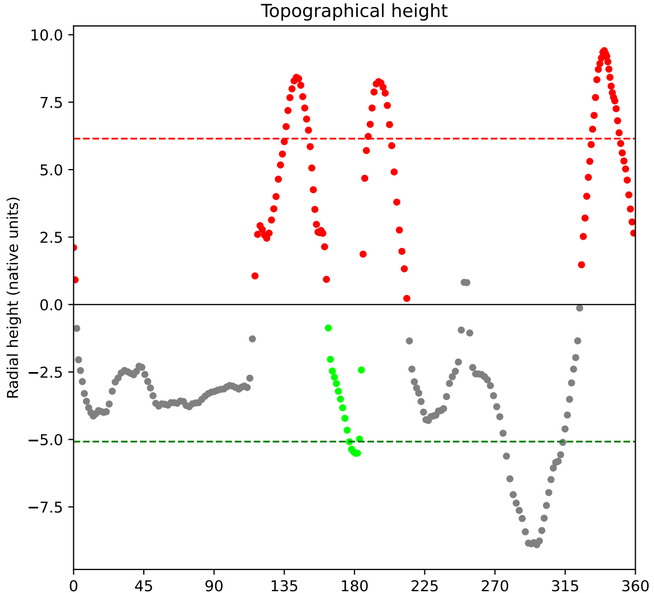

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

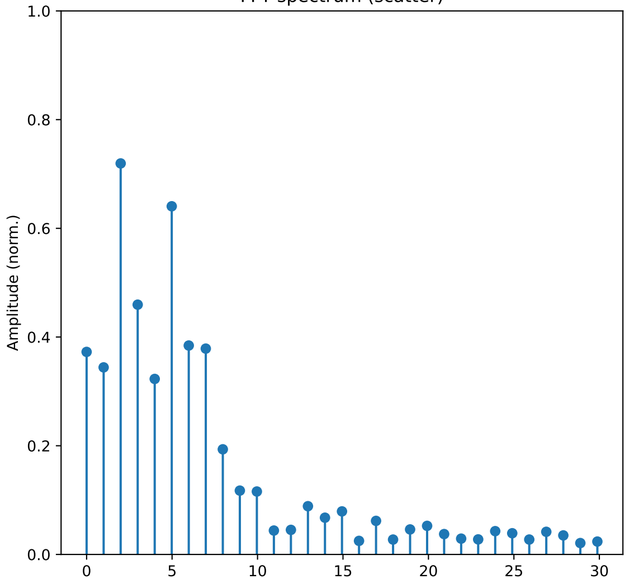

Topographical height
Radial height (native units)
Polar angle (°)
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
0
45
90
135
180
225
270
315
360

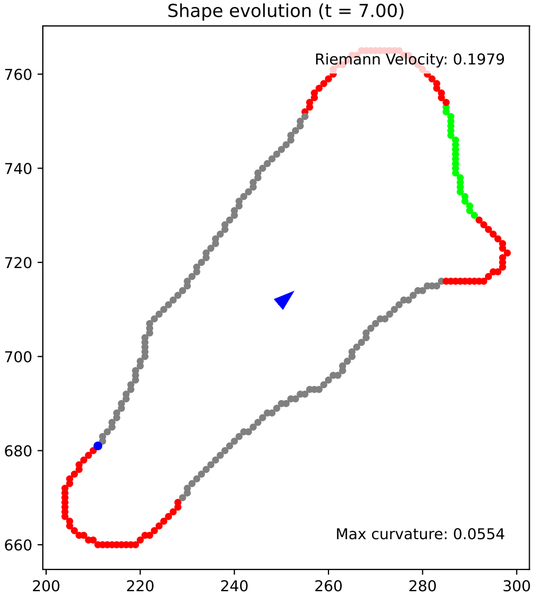

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

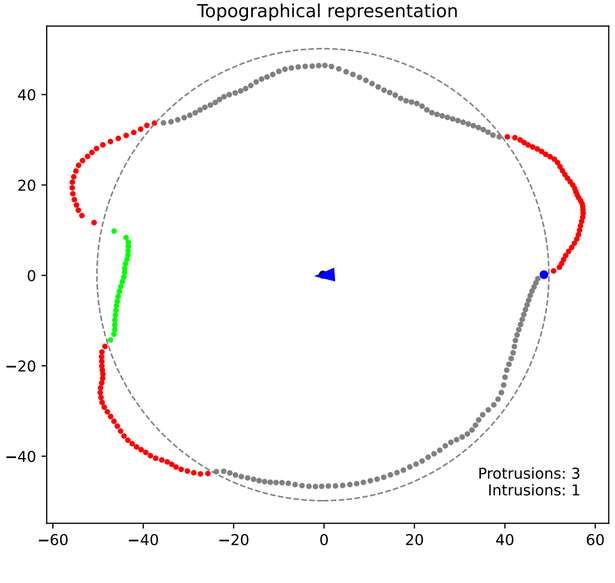

Shape evolution (t = 6.00)
Riemann Velocity: 0.2036
Max curvature: 0.0678
760
740
720
700
680
660
220
240
260
280

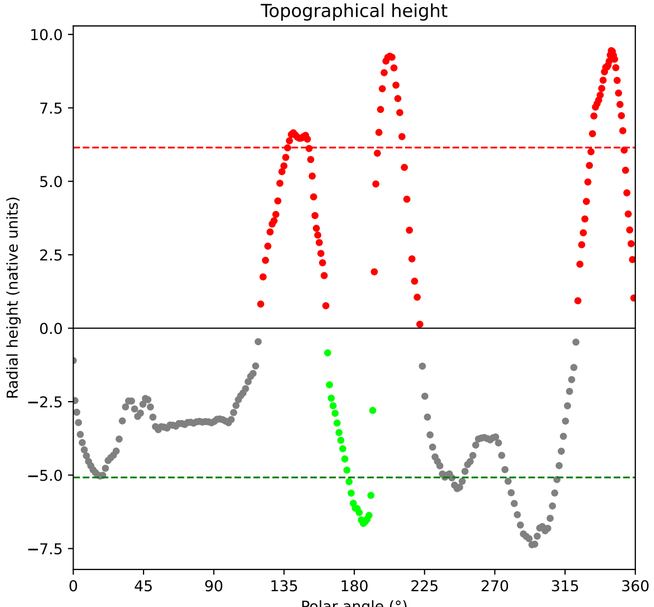

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

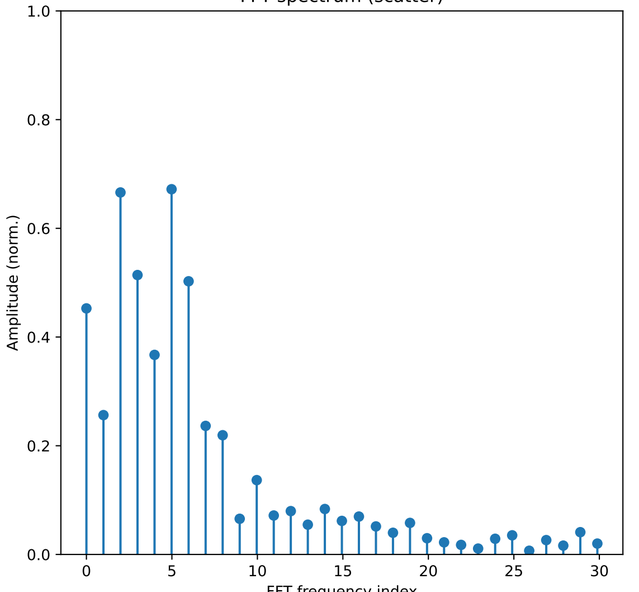

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

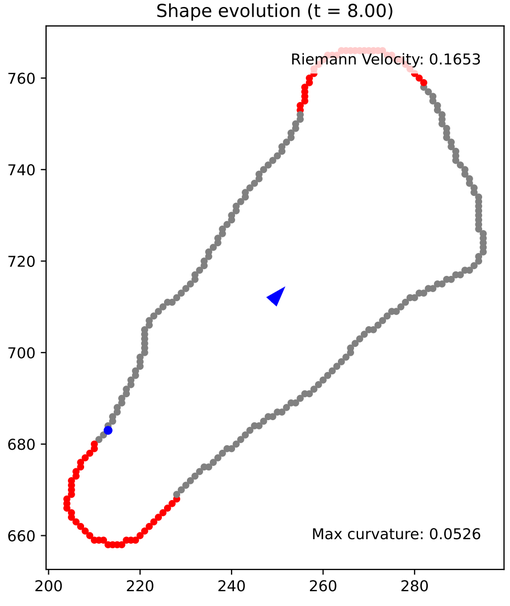

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

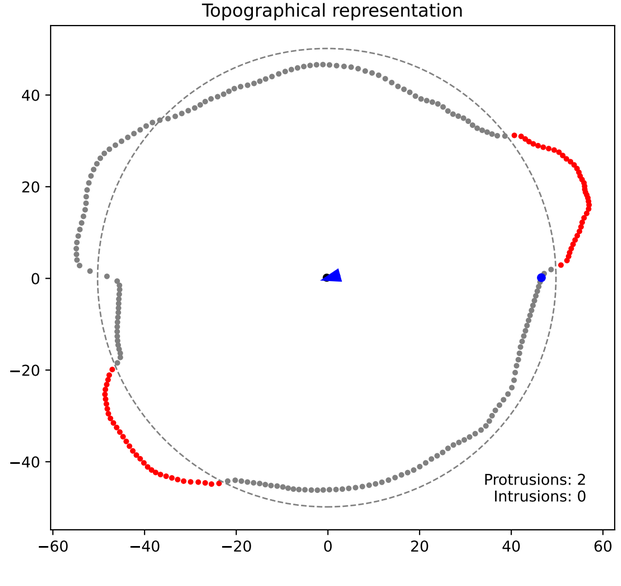

Shape evolution (t = 7.00)
Riemann Velocity: 0.1979
Max curvature: 0.0554
760
740
720
700
680
660
200
220
240
260
280
300

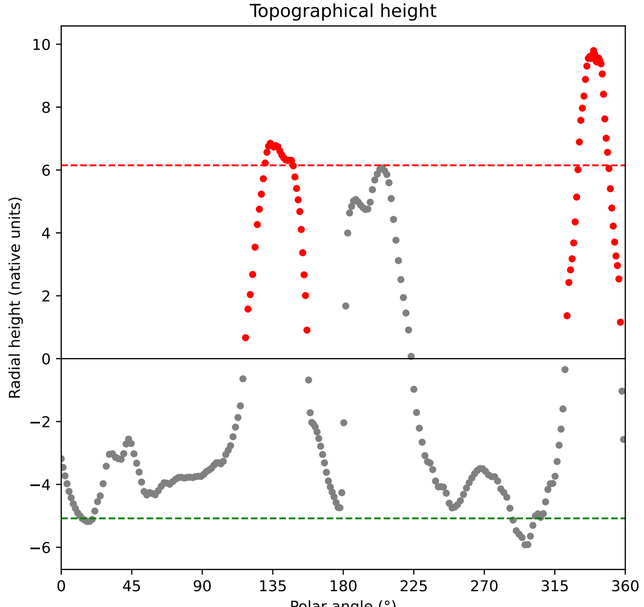

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

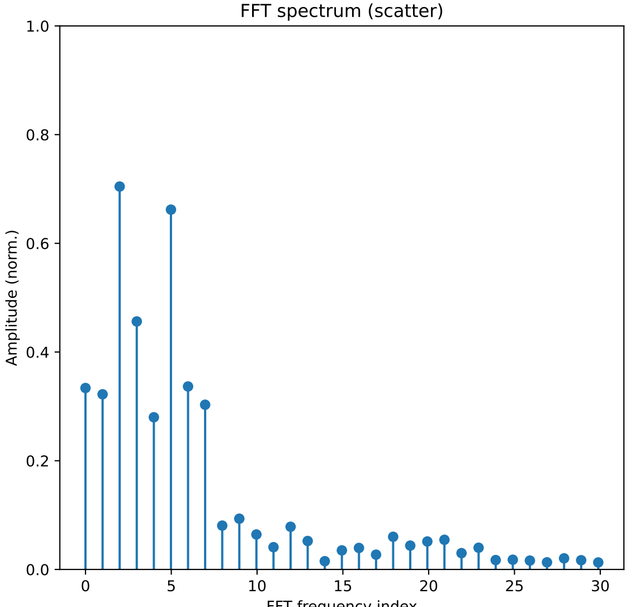

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

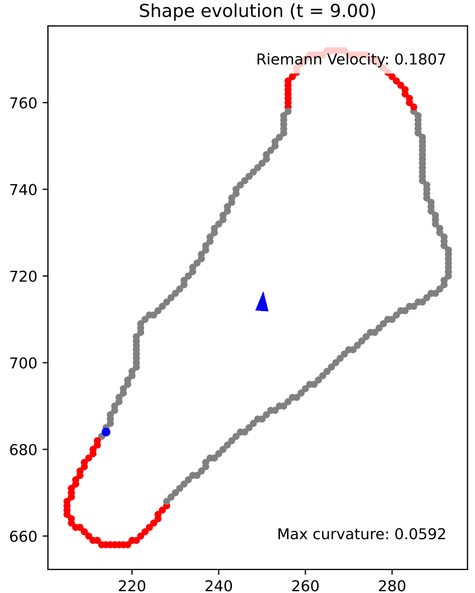

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

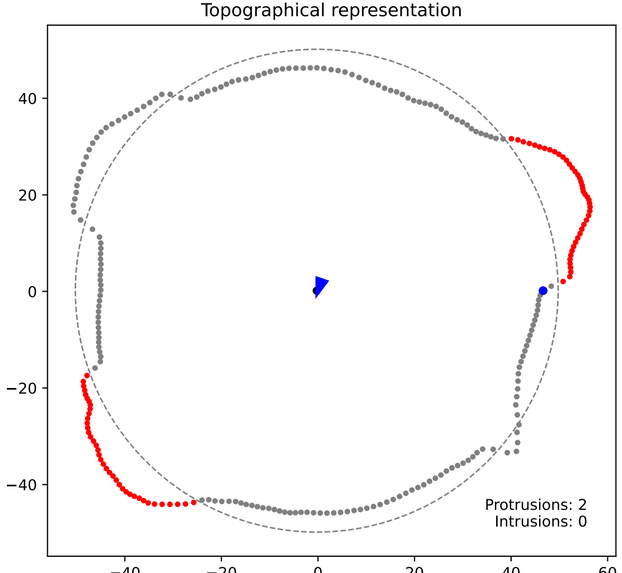

Shape evolution (t = 8.00)
Riemann Velocity: 0.1653
Max curvature: 0.0526
760
740
720
700
680
660
200
220
240
260
280

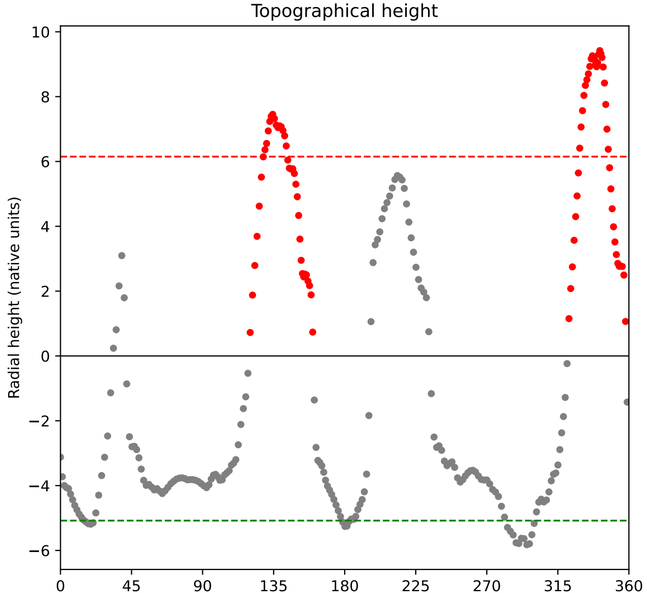

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

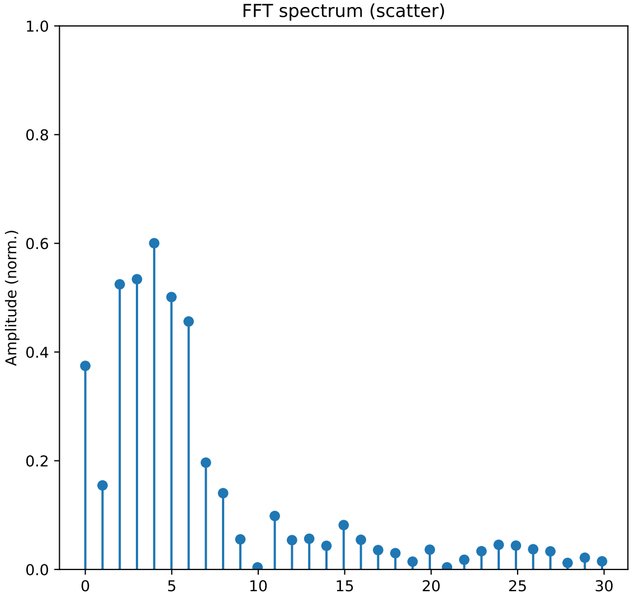

Topographical height
Radial height (native units)
Polar angle (°)
10
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

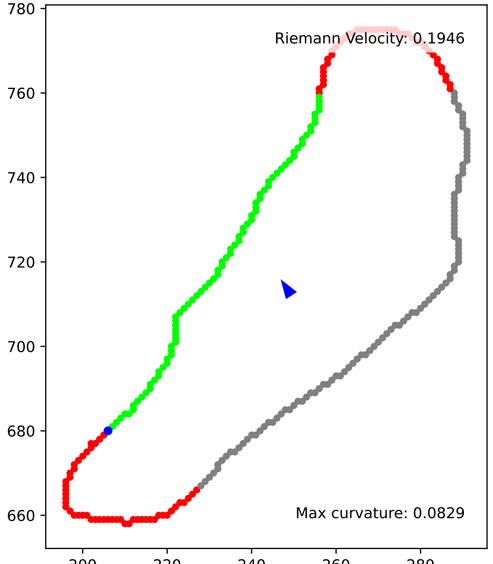

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

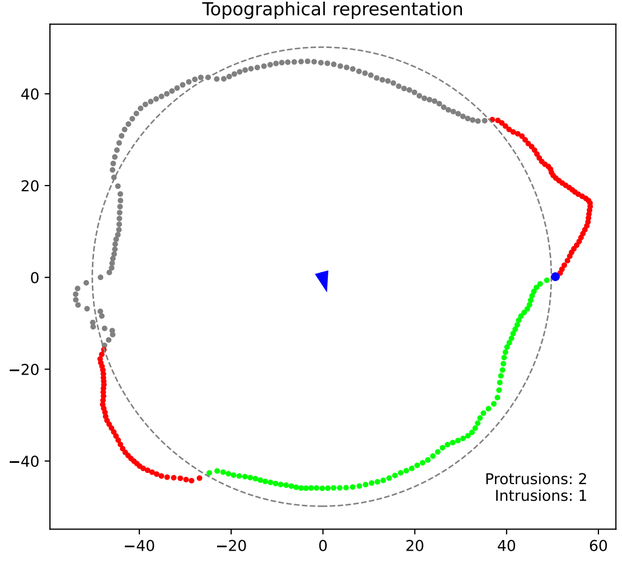

Shape evolution (t = 9.00)
Riemann Velocity: 0.1807
Max curvature: 0.0592
760
740
720
700
680
660
220
240
260
280

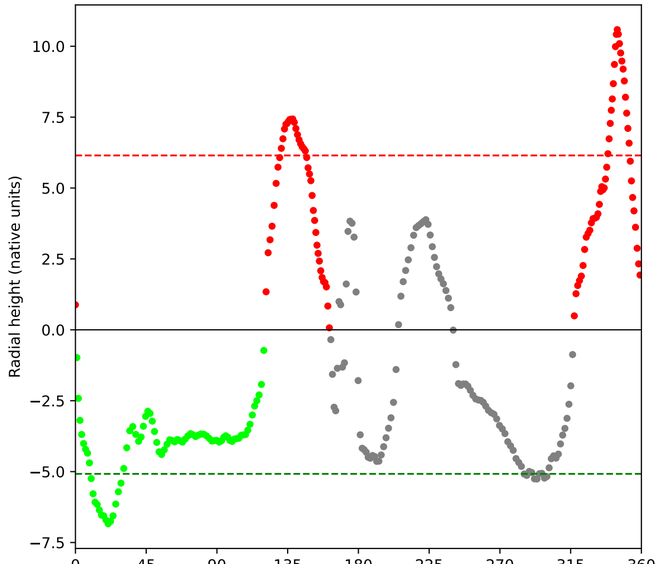

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

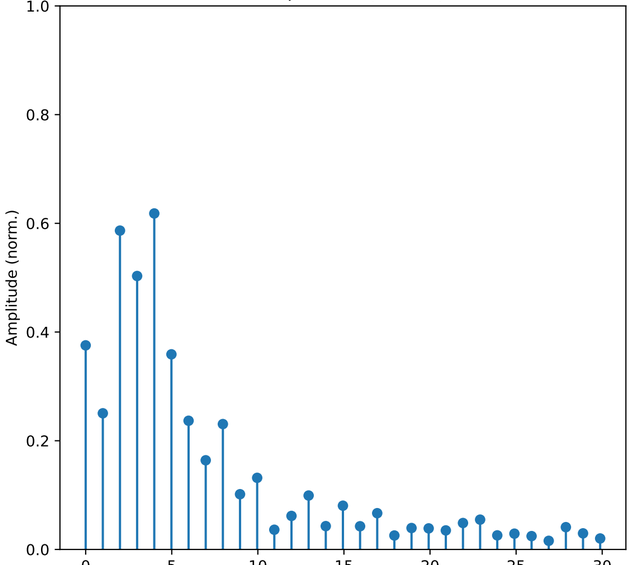

Topographical height
Radial height (native units)
Polar angle (°)
10
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

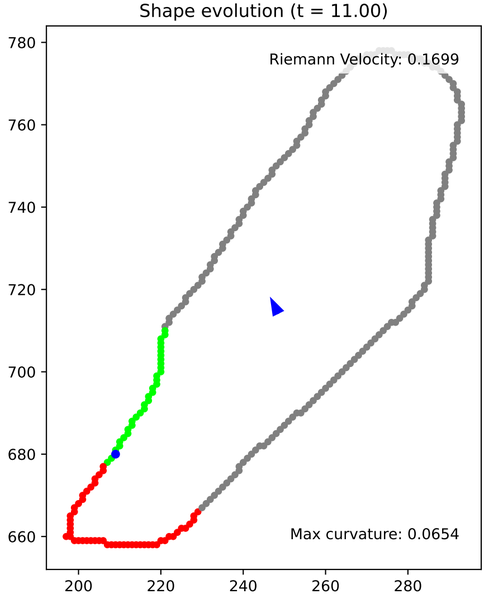

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

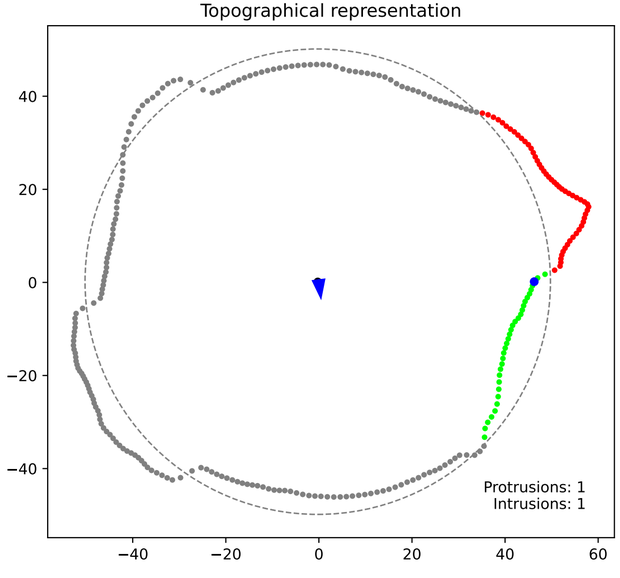

Shape evolution (t = 10.00)
Riemann Velocity: 0.1946
Max curvature: 0.0829
780
760
740
720
700
680
660
200
220
240
260
280

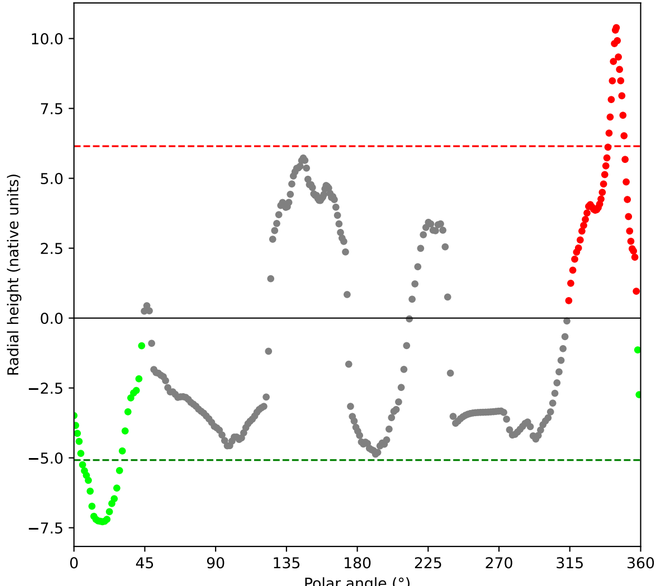

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−40
−20
0
20
40
60

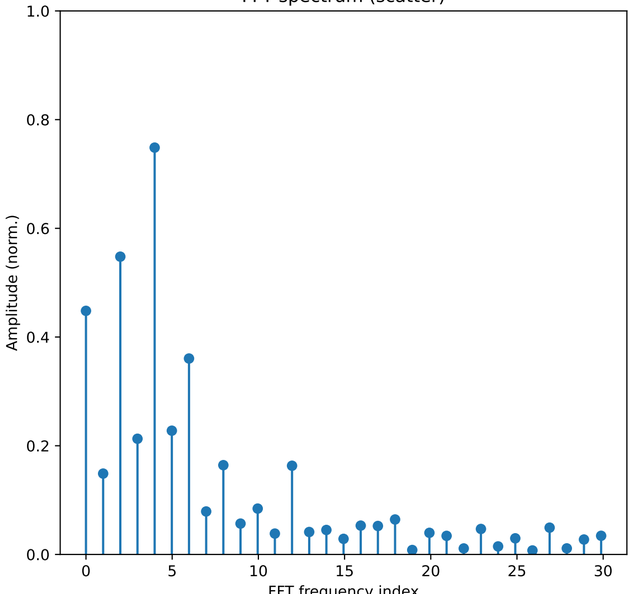

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

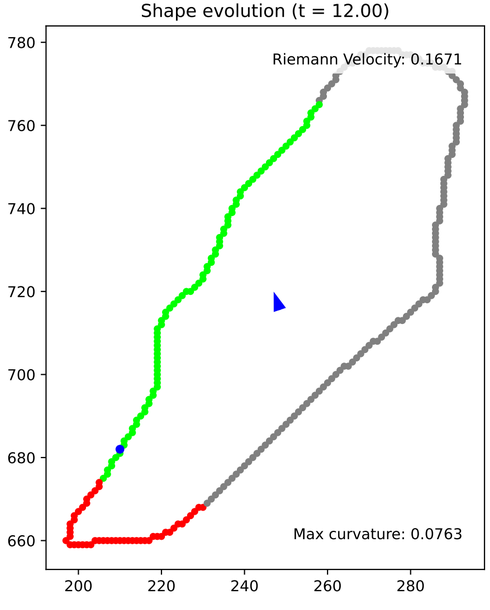

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

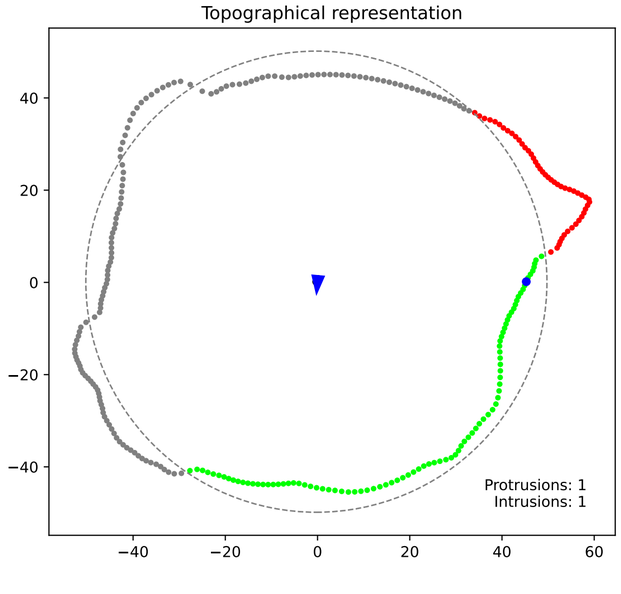

Shape evolution (t = 11.00)
Riemann Velocity: 0.1699
Max curvature: 0.0654
780
760
740
720
700
680
660
200
220
240
260
280

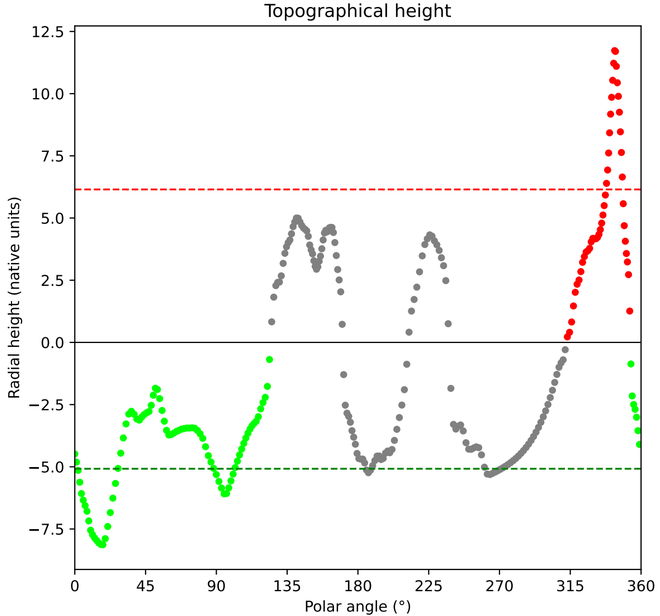

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−40
−20
0
20
40
60

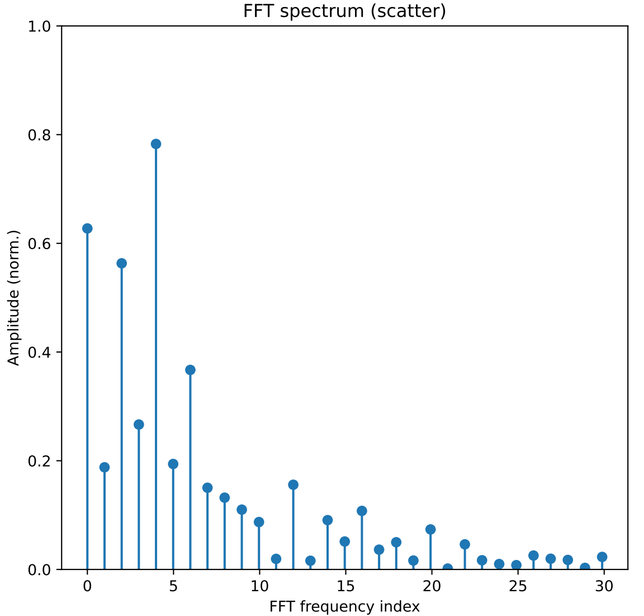

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

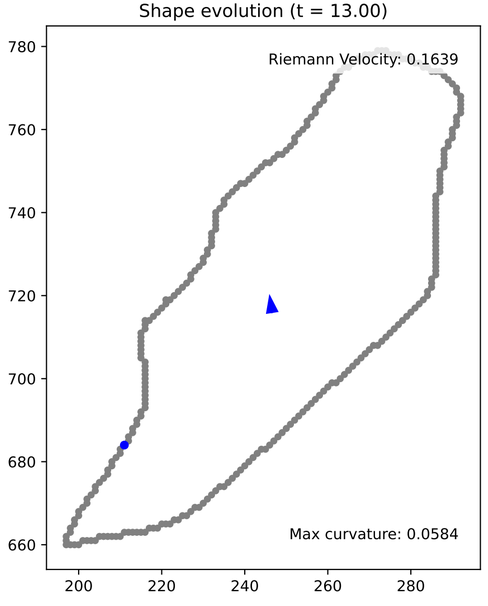

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

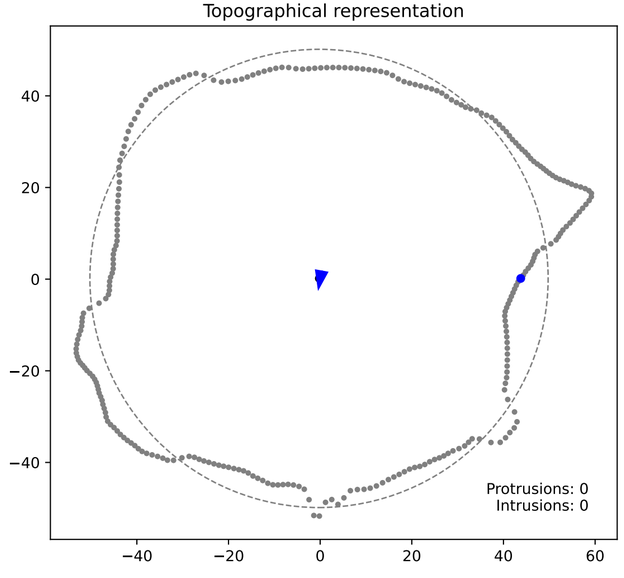

Shape evolution (t = 12.00)
Riemann Velocity: 0.1671
Max curvature: 0.0763
780
760
740
720
700
680
660
200
220
240
260
280

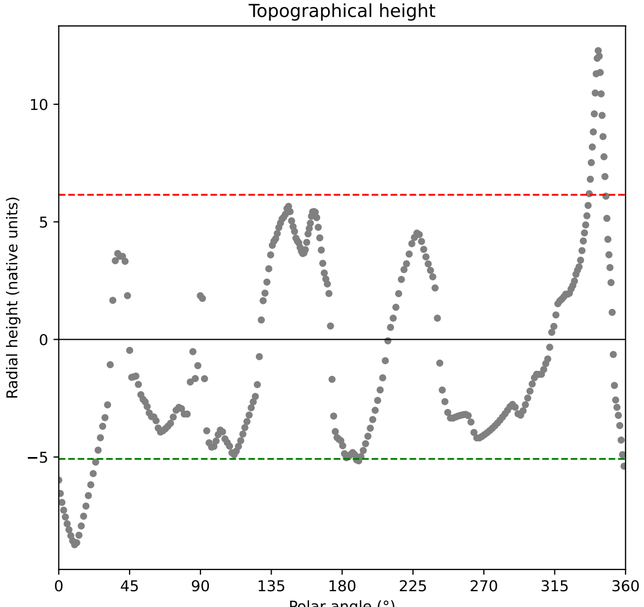

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−40
−20
0
20
40
60

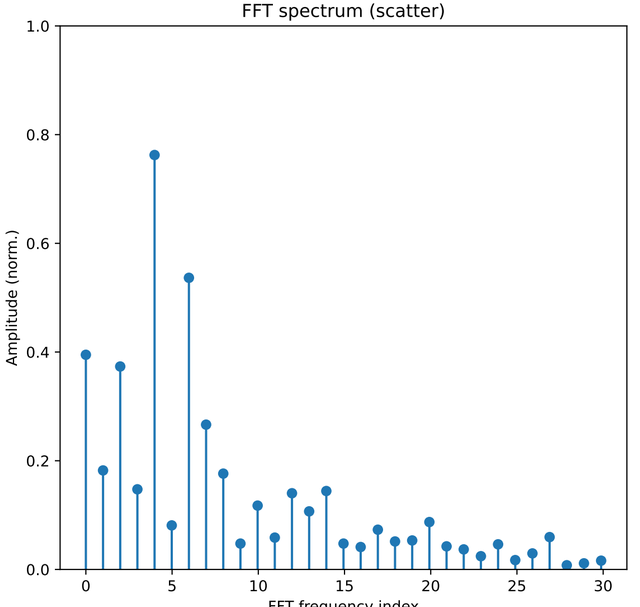

Topographical height
Radial height (native units)
Polar angle (°)
12.5
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

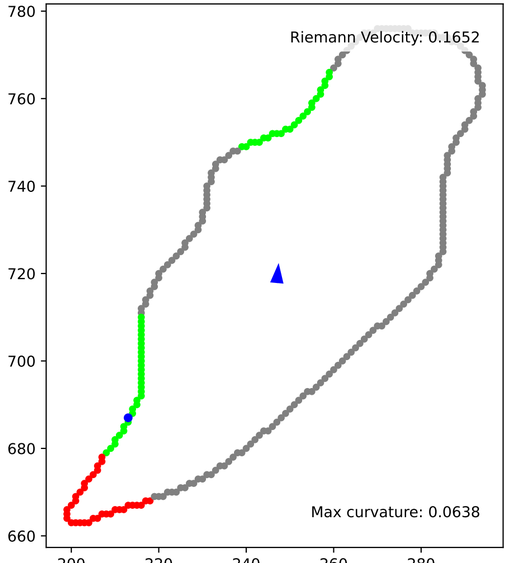

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

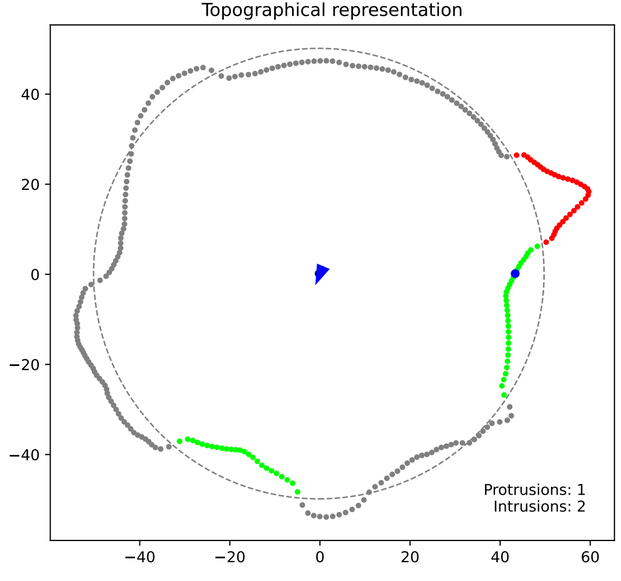

Shape evolution (t = 13.00)
Riemann Velocity: 0.1639
Max curvature: 0.0584
780
760
740
720
700
680
660
200
220
240
260
280

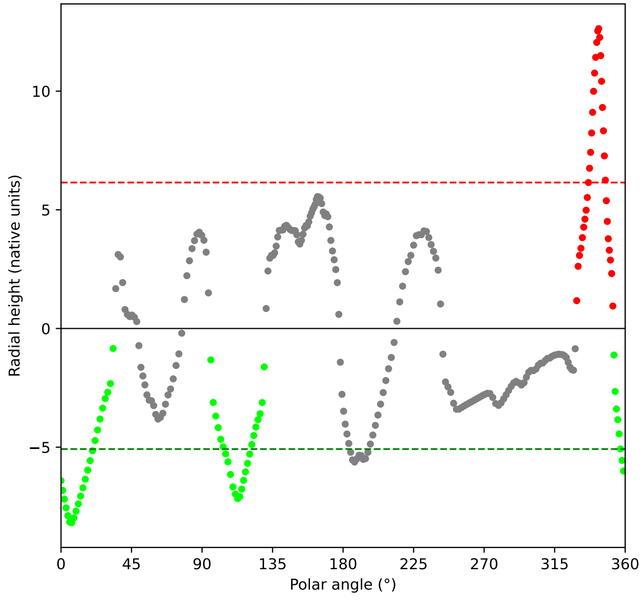

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

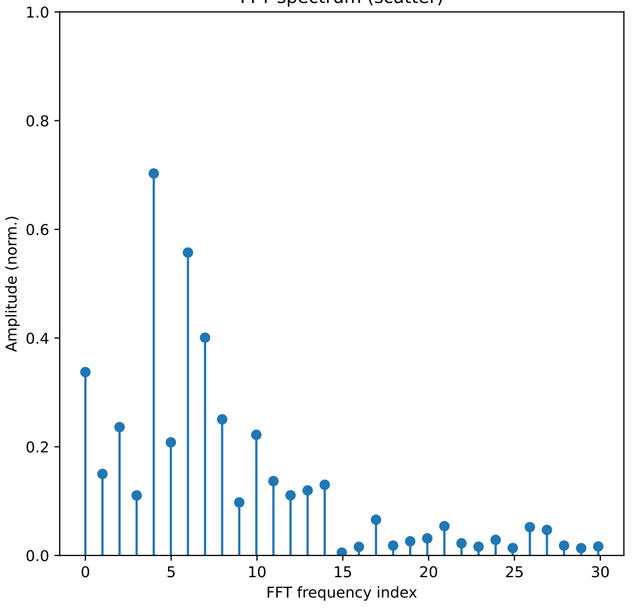

Topographical height
Radial height (native units)
Polar angle (°)
10
5
0
−5
0
45
90
135
180
225
270
315
360

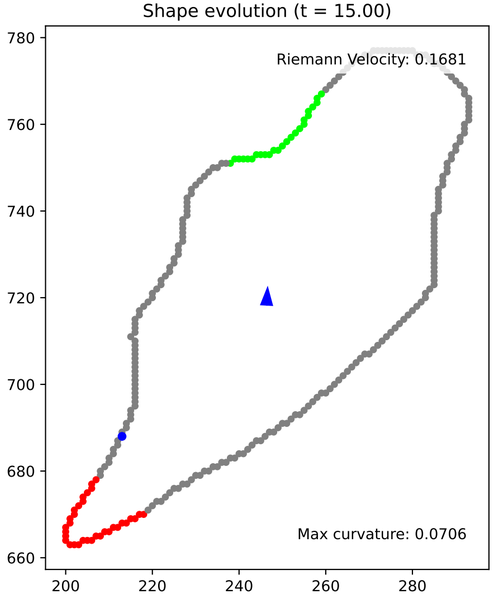

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

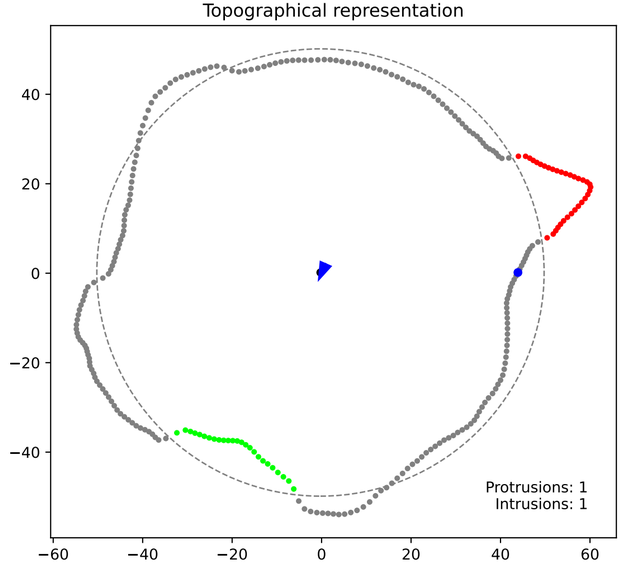

Shape evolution (t = 14.00)
Riemann Velocity: 0.1652
Max curvature: 0.0638
780
760
740
720
700
680
660
200
220
240
260
280

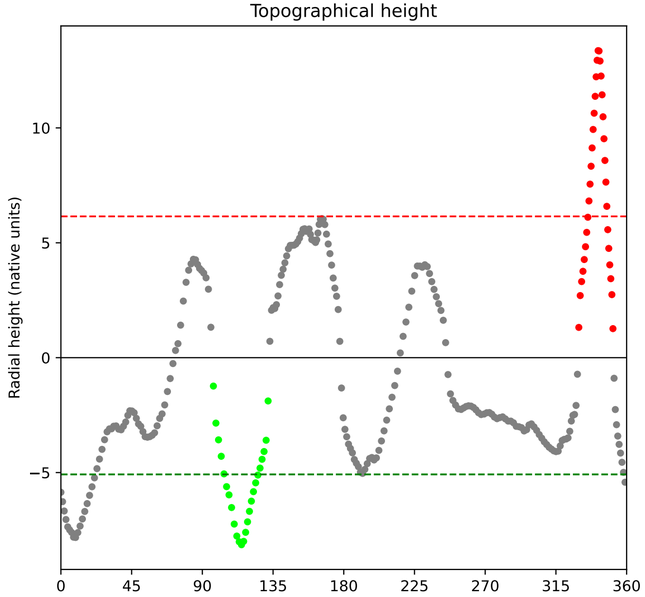

Topographical representation
Protrusions: 1
Intrusions: 2
40
20
0
−20
−40
−40
−20
0
20
40
60

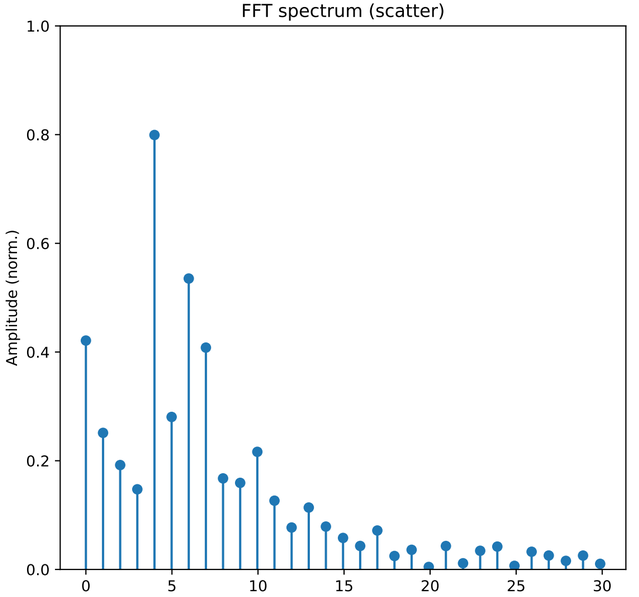

Topographical height
Radial height (native units)
Polar angle (°)
10
5
0
−5
0
45
90
135
180
225
270
315
360

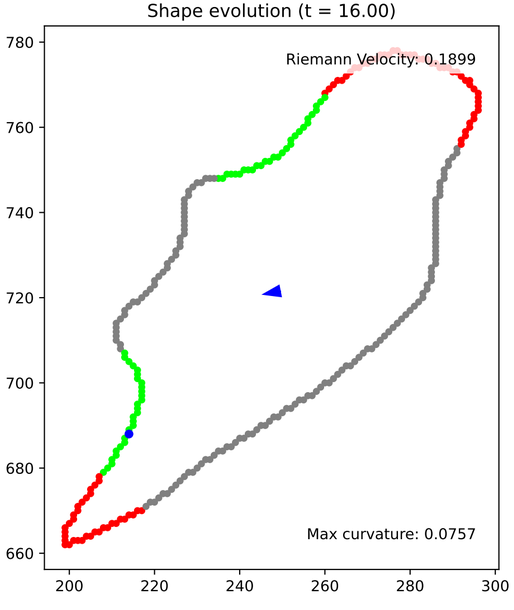

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

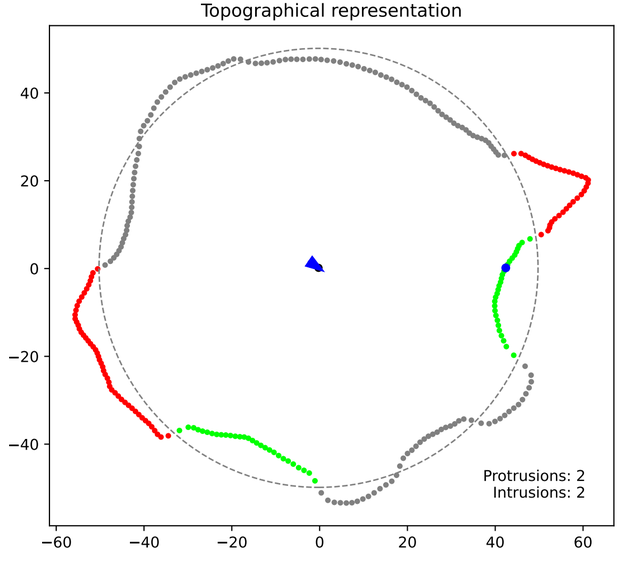

Shape evolution (t = 15.00)
Riemann Velocity: 0.1681
Max curvature: 0.0706
780
760
740
720
700
680
660
200
220
240
260
280

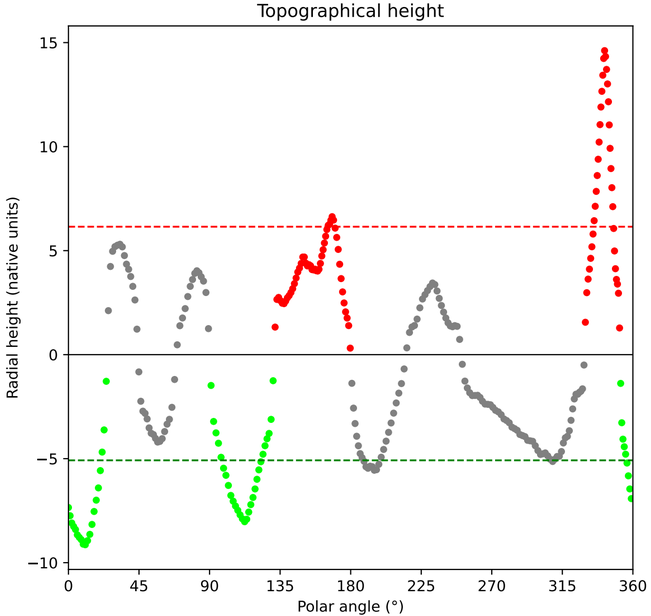

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

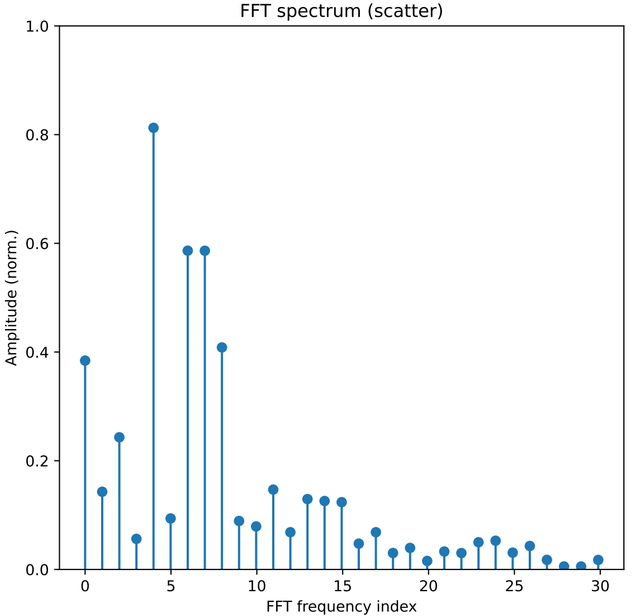

Topographical height
Radial height (native units)
Polar angle (°)
10
5
0
−5
0
45
90
135
180
225
270
315
360

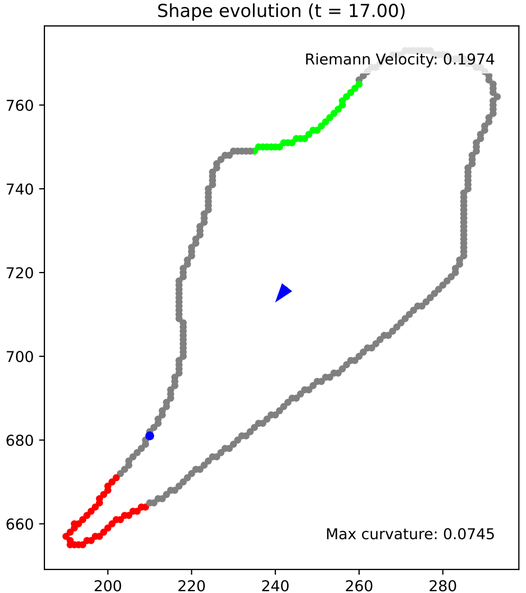

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

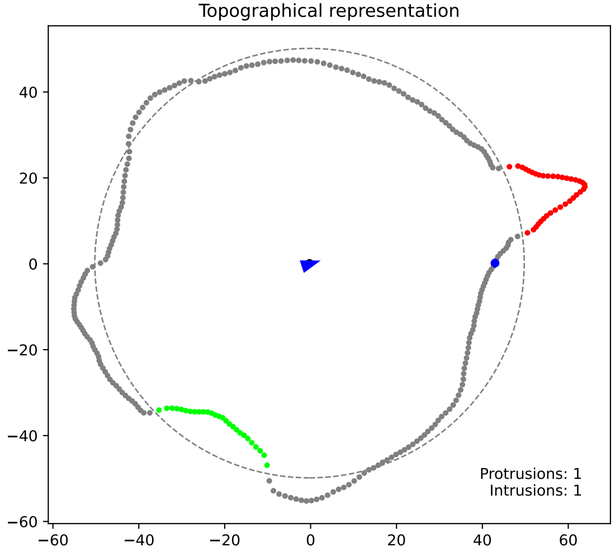

Shape evolution (t = 16.00)
Riemann Velocity: 0.1899
Max curvature: 0.0757
780
760
740
720
700
680
660
200
220
240
260
280
300

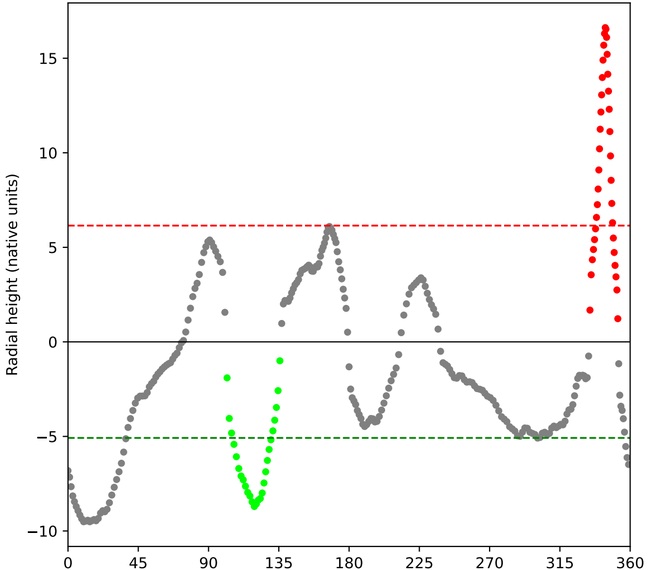

Topographical representation
Protrusions: 2
Intrusions: 2
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

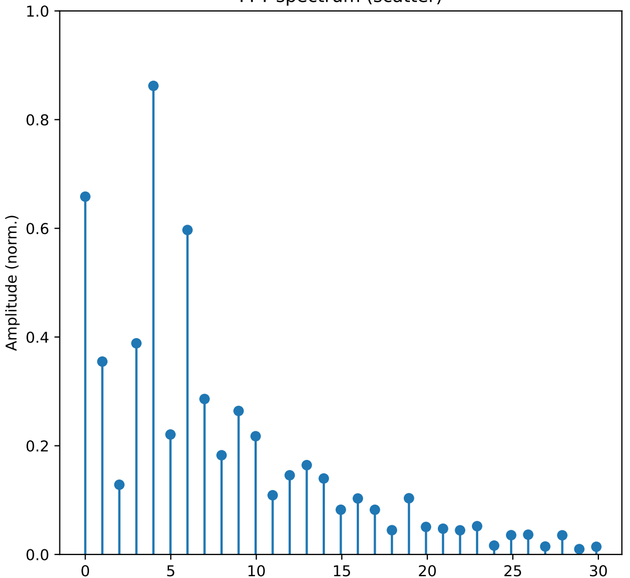

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

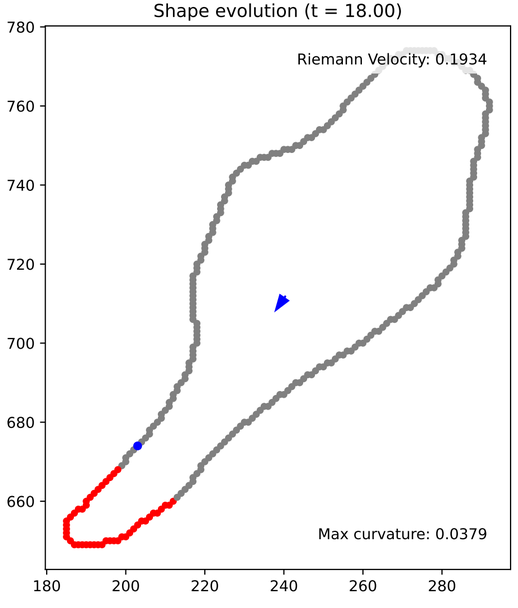

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

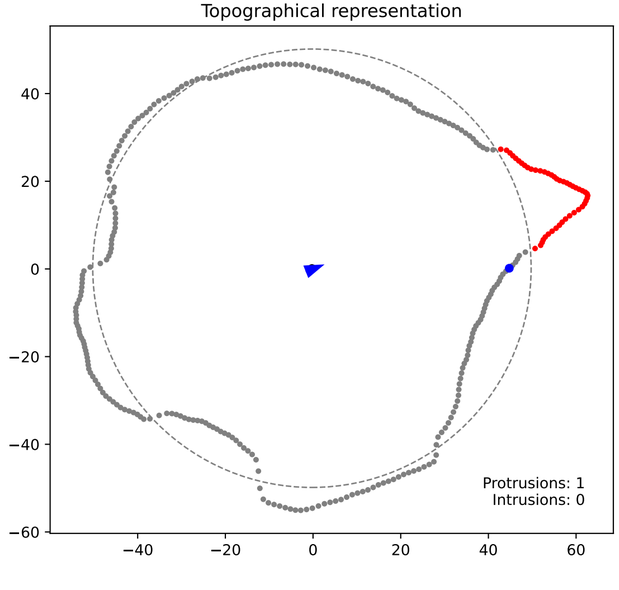

Shape evolution (t = 17.00)
Riemann Velocity: 0.1974
Max curvature: 0.0745
760
740
720
700
680
660
200
220
240
260
280

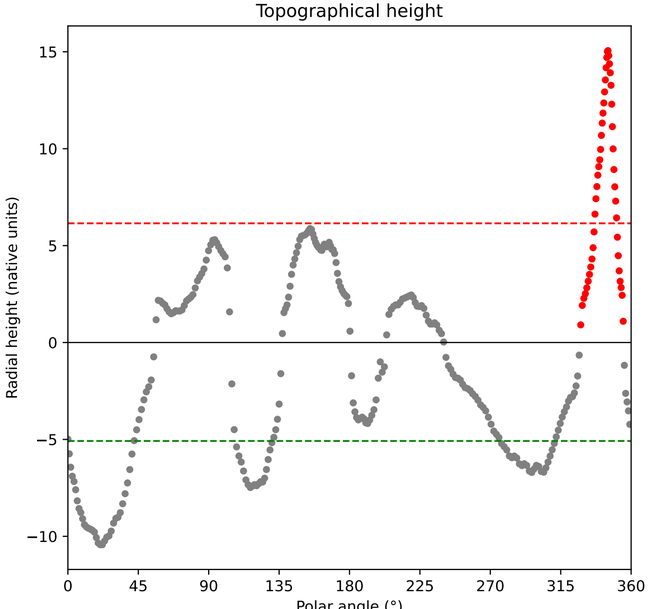

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

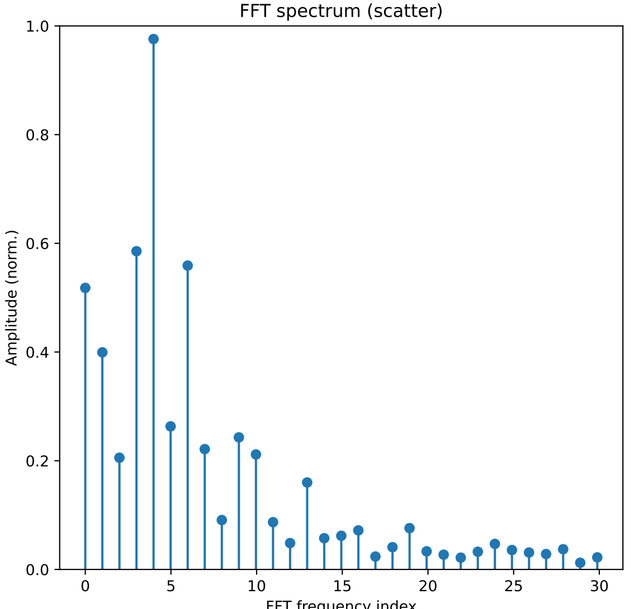

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

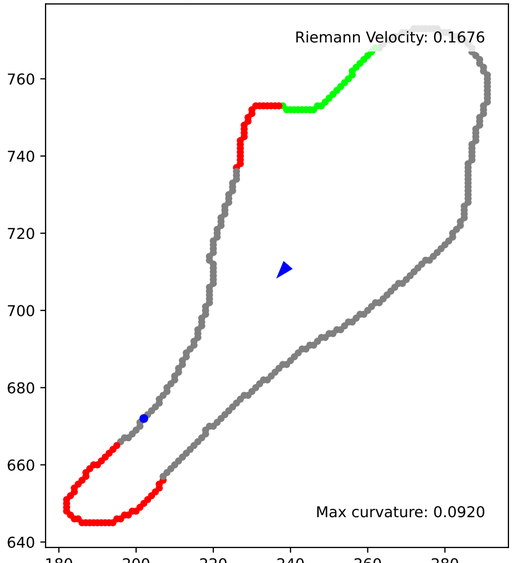

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

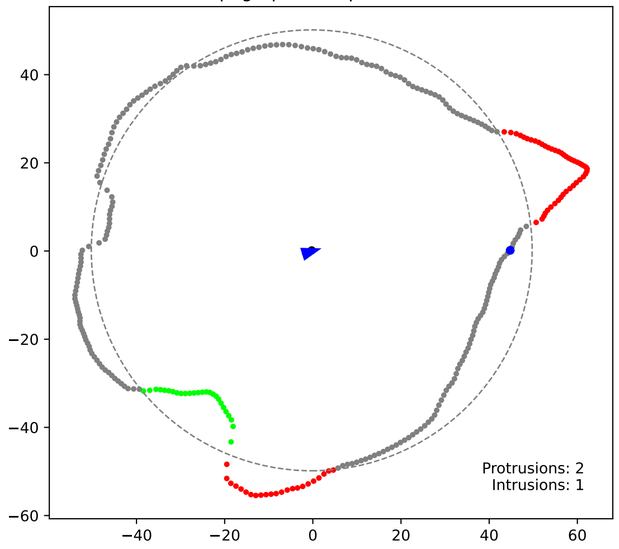

Shape evolution (t = 18.00)
Riemann Velocity: 0.1934
Max curvature: 0.0379
780
760
740
720
700
680
660
180
200
220
240
260
280

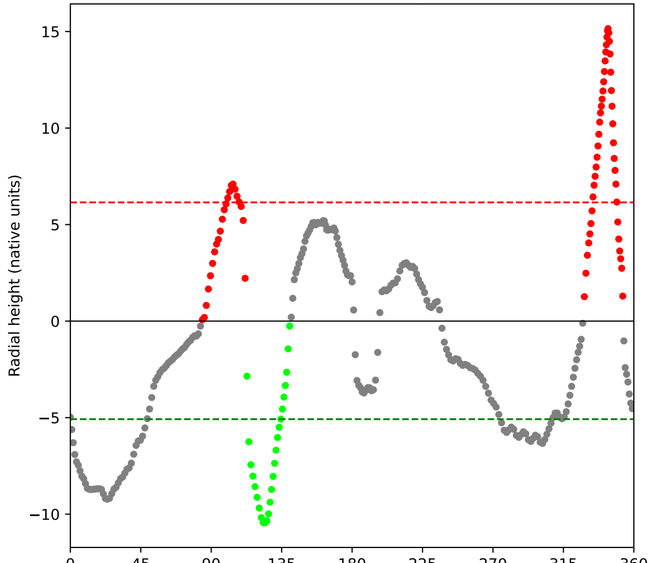

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

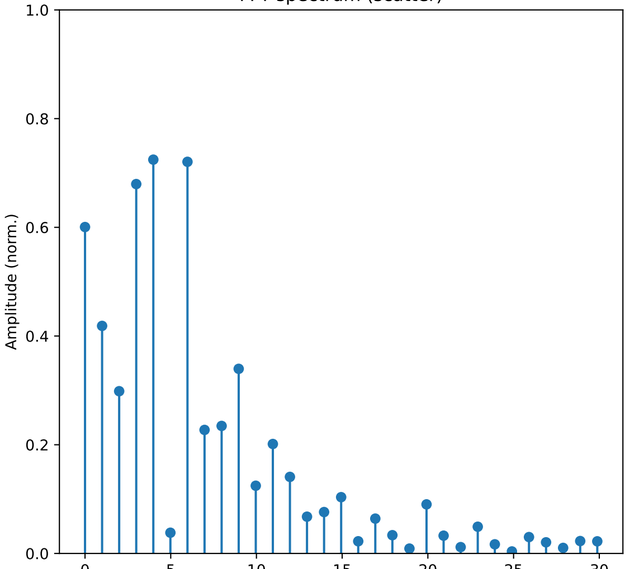

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

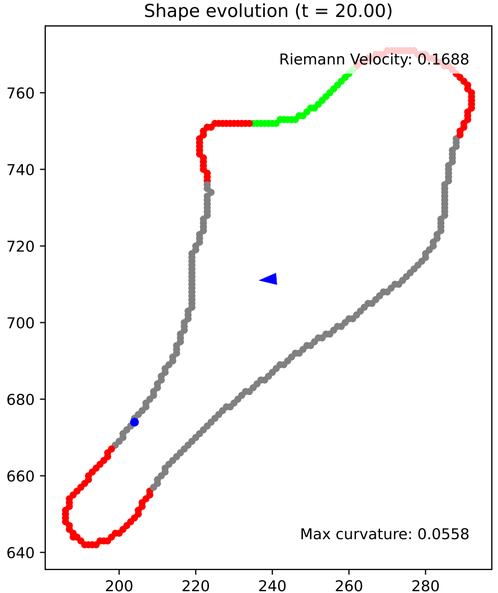

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

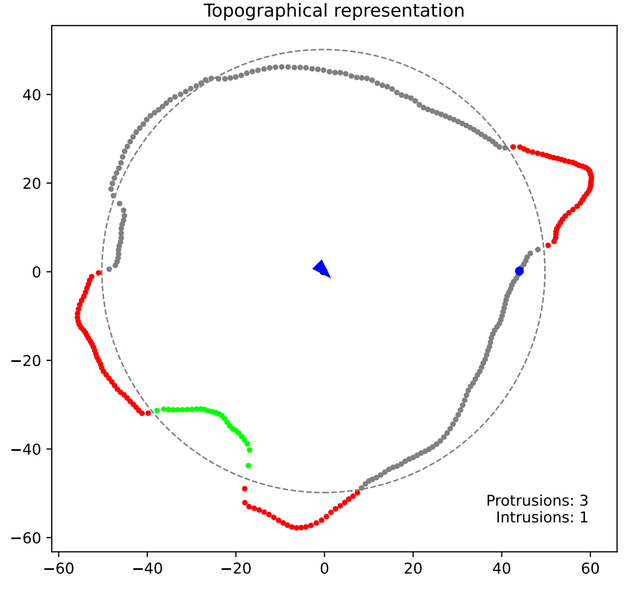

Shape evolution (t = 19.00)
Riemann Velocity: 0.1676
Max curvature: 0.0920
760
740
720
700
680
660
640
180
200
220
240
260
280

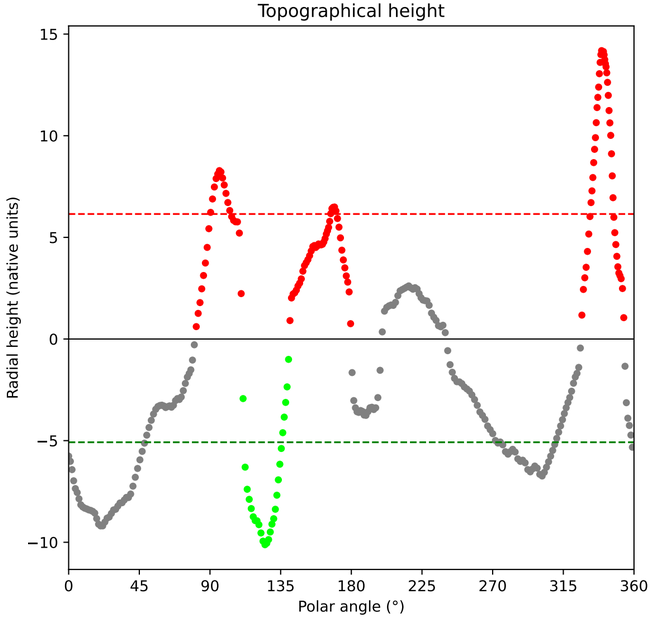

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

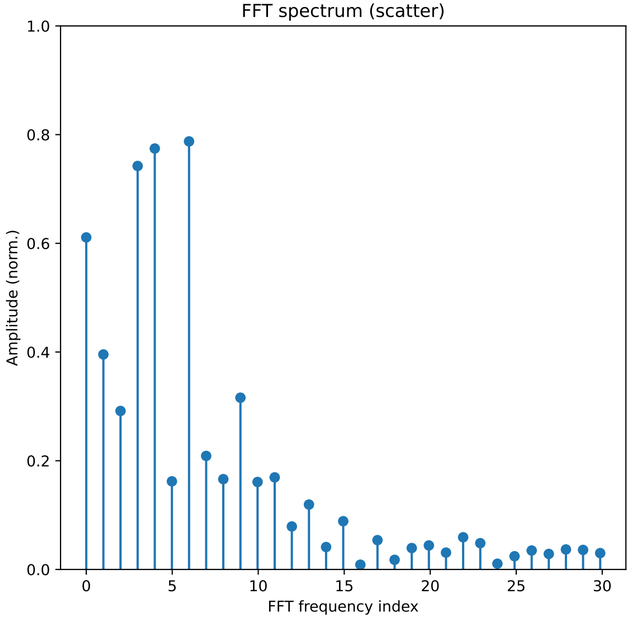

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

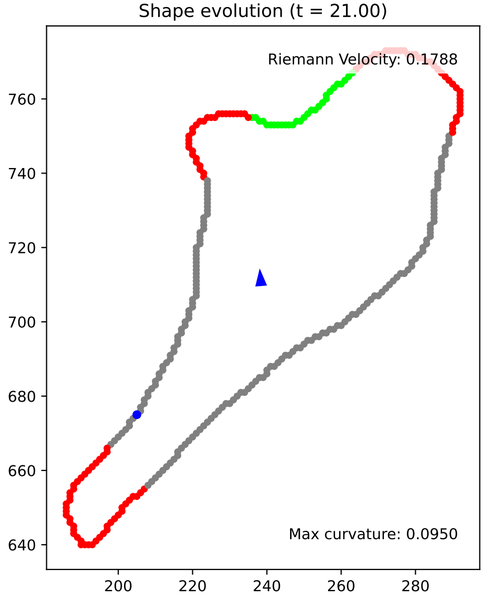

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

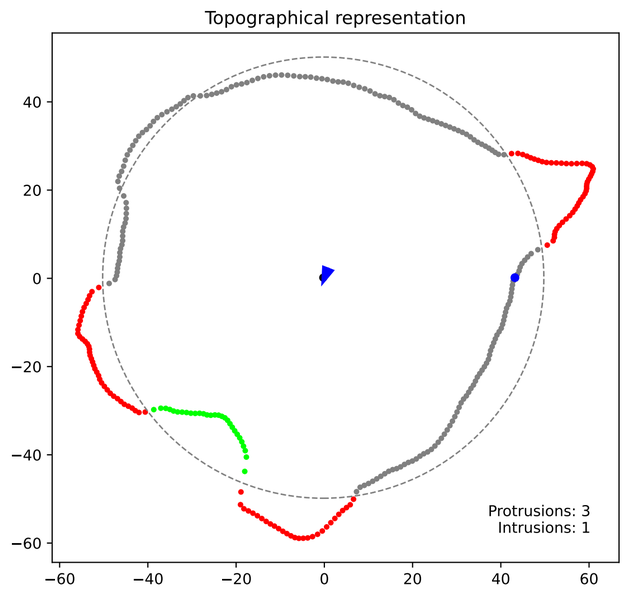

Shape evolution (t = 20.00)
Riemann Velocity: 0.1688
Max curvature: 0.0558
760
740
720
700
680
660
640
200
220
240
260
280

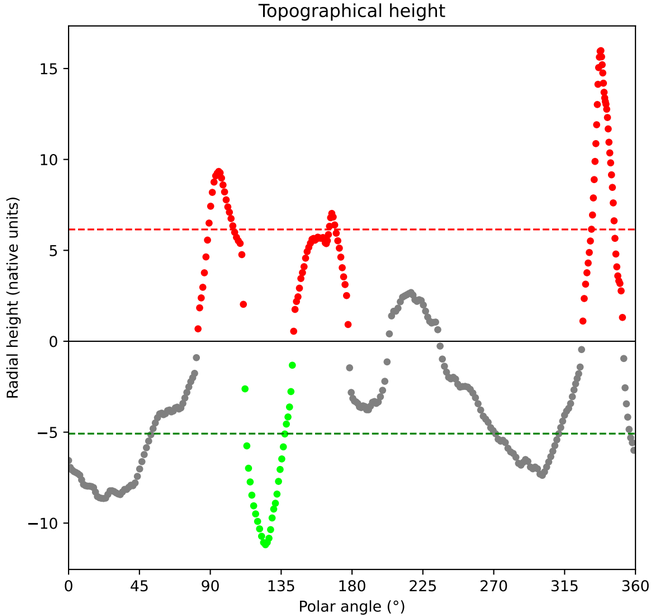

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

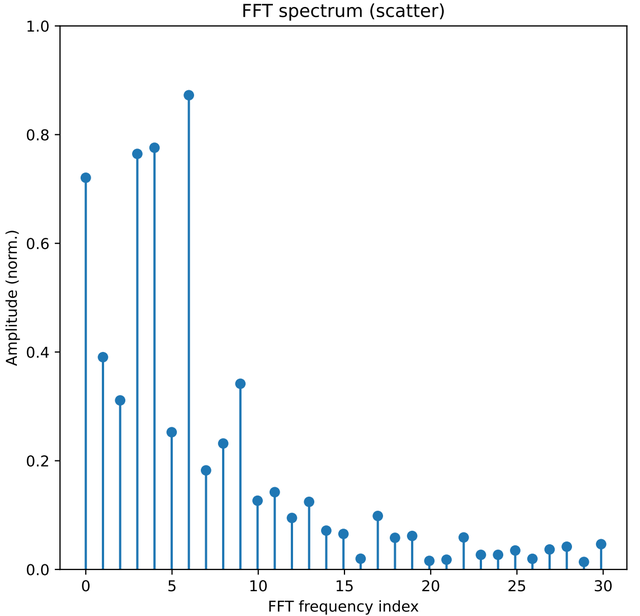

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

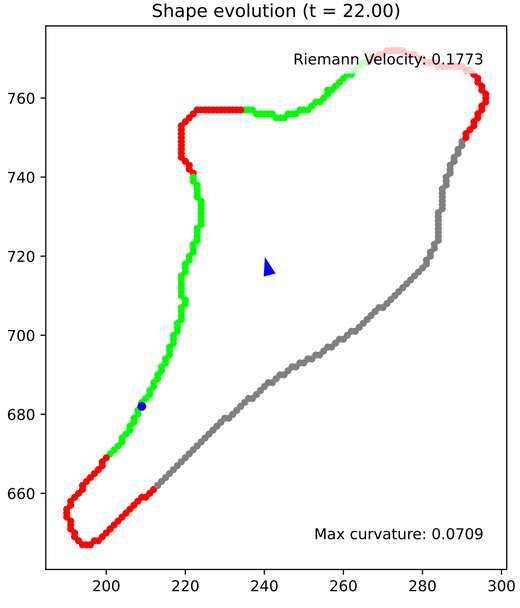

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

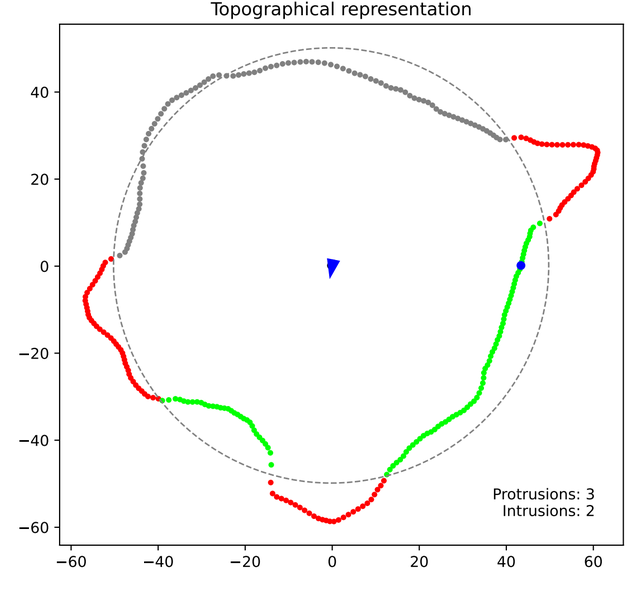

Shape evolution (t = 21.00)
Riemann Velocity: 0.1788
Max curvature: 0.0950
760
740
720
700
680
660
640
200
220
240
260
280

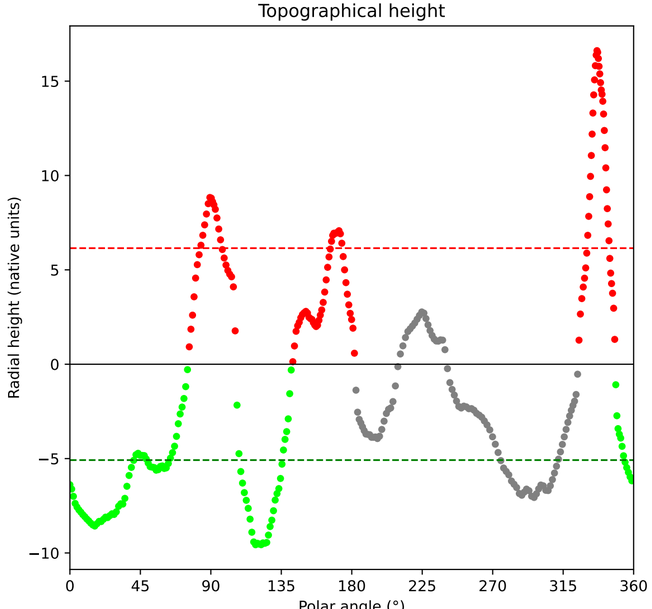

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

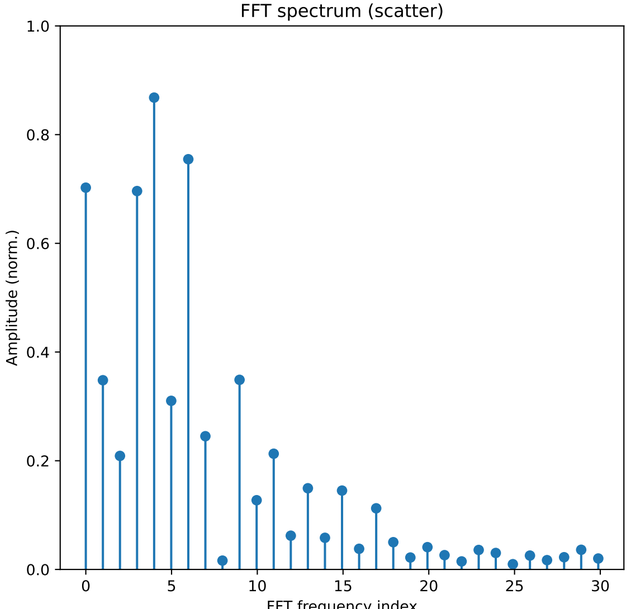

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

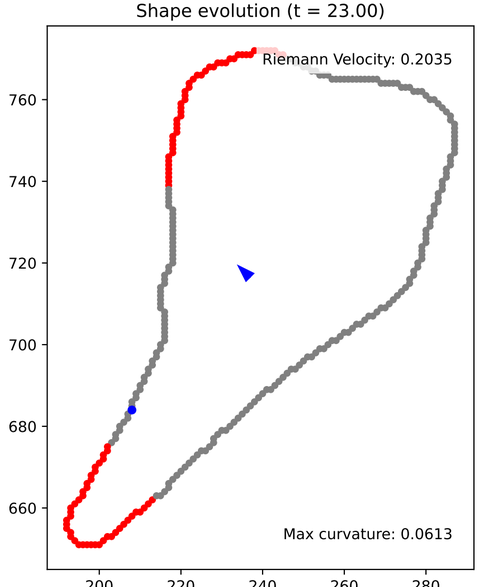

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

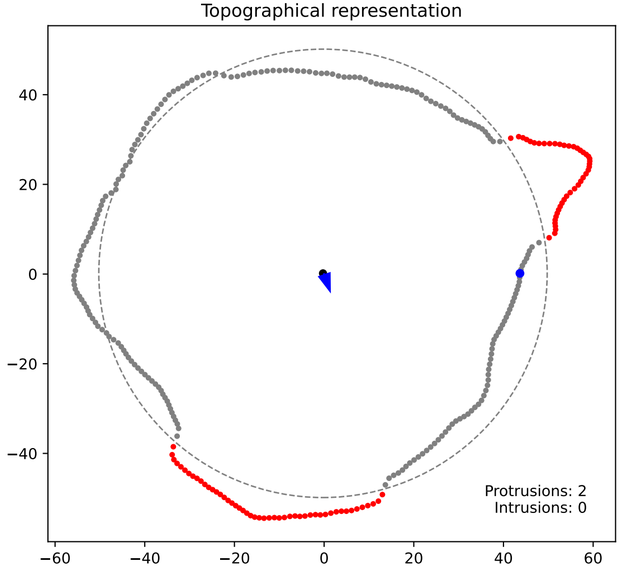

Shape evolution (t = 22.00)
Riemann Velocity: 0.1773
Max curvature: 0.0709
760
740
720
700
680
660
200
220
240
260
280
300

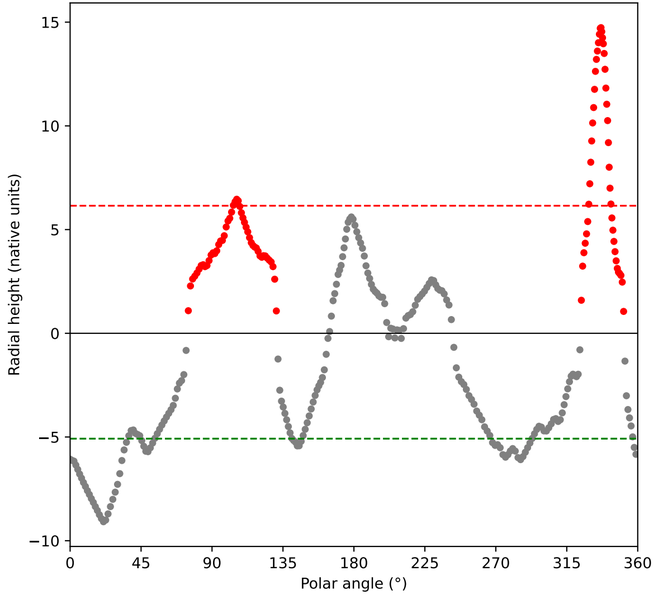

Topographical representation
Protrusions: 3
Intrusions: 2
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

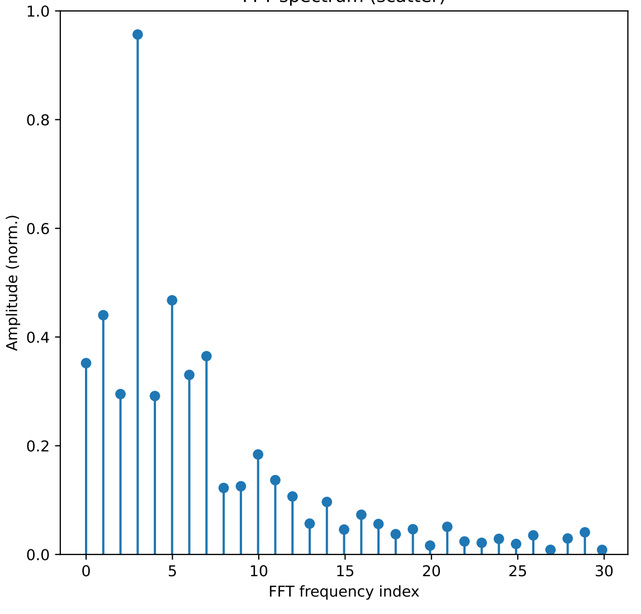

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

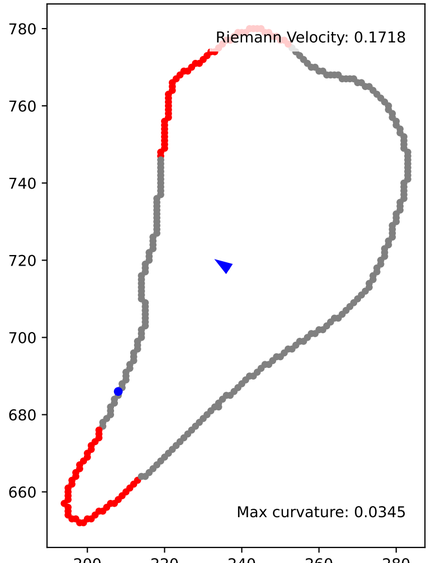

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

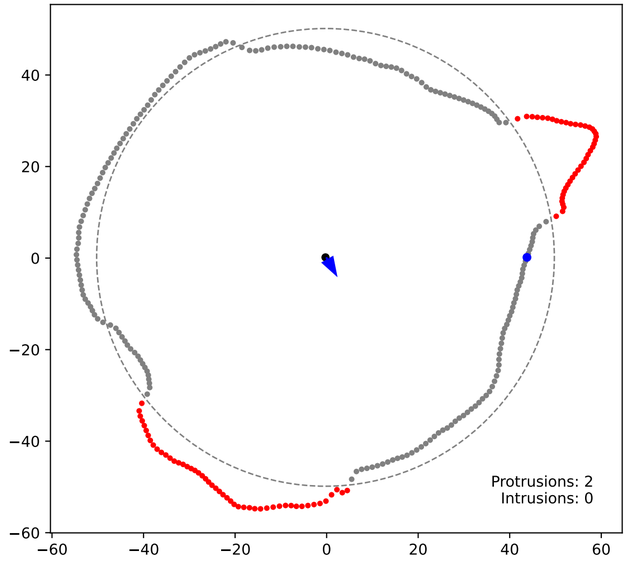

Shape evolution (t = 23.00)
Riemann Velocity: 0.2035
Max curvature: 0.0613
760
740
720
700
680
660
200
220
240
260
280

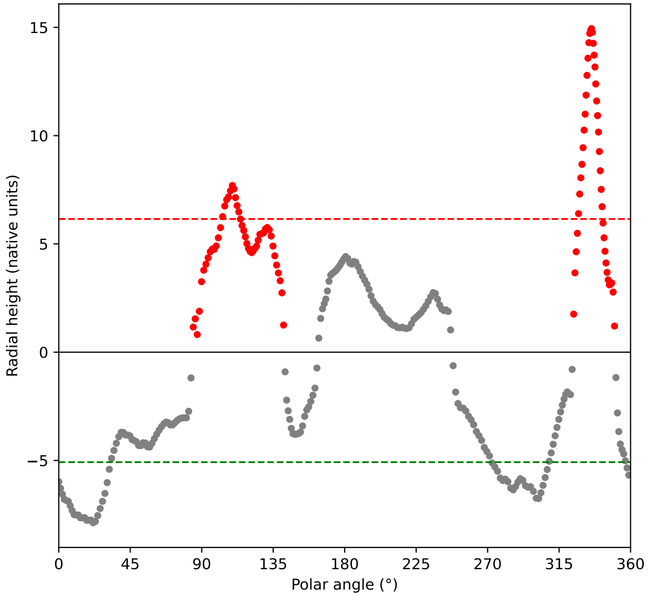

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

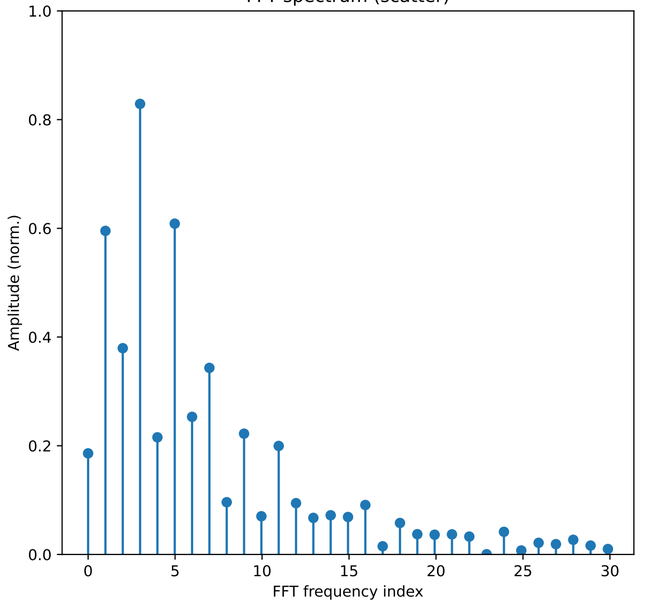

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

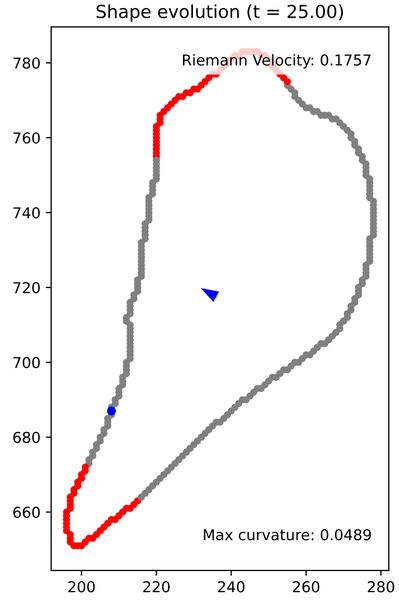

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

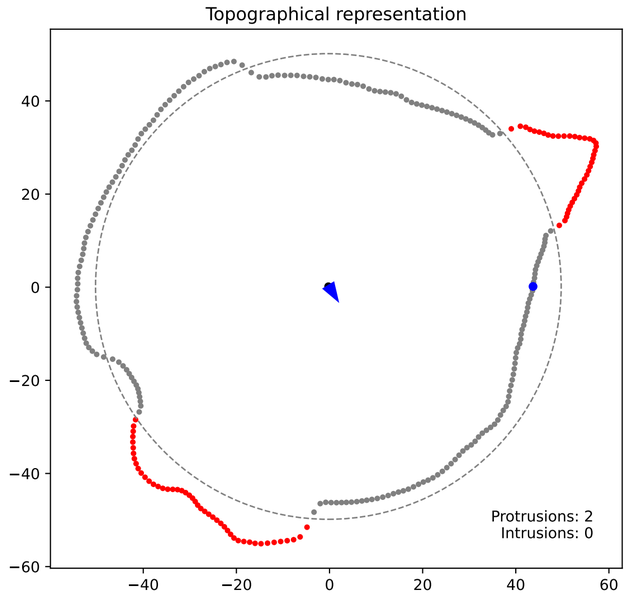

Shape evolution (t = 24.00)
Riemann Velocity: 0.1718
Max curvature: 0.0345
780
760
740
720
700
680
660
200
220
240
260
280

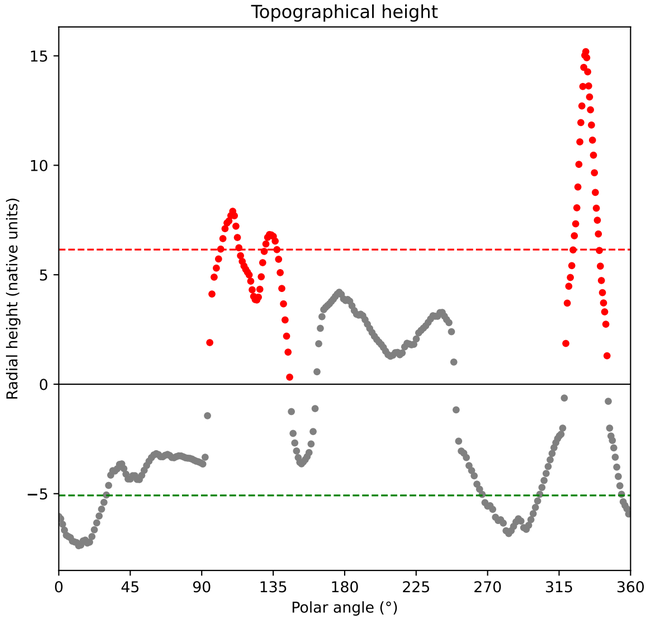

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

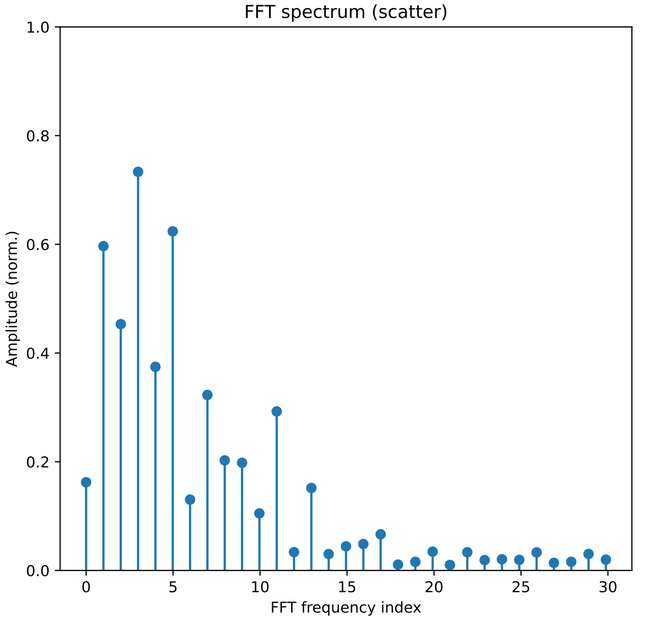

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
0
45
90
135
180
225
270
315
360

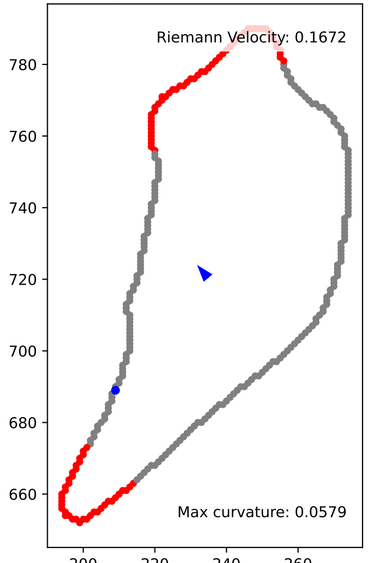

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

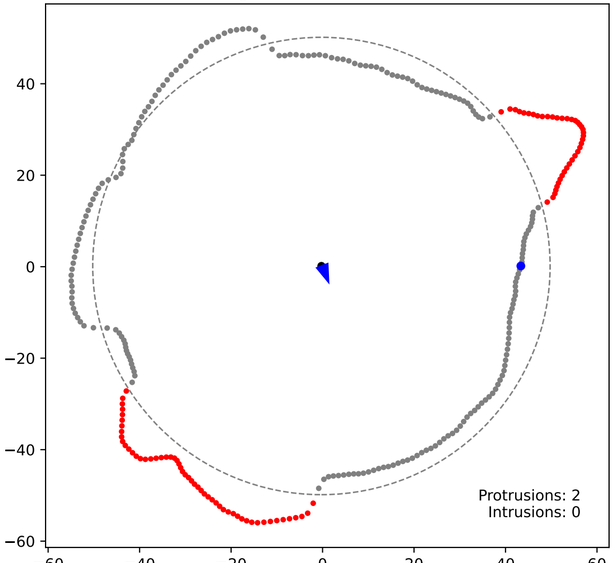

Shape evolution (t = 25.00)
Riemann Velocity: 0.1757
Max curvature: 0.0489
780
760
740
720
700
680
660
200
220
240
260
280

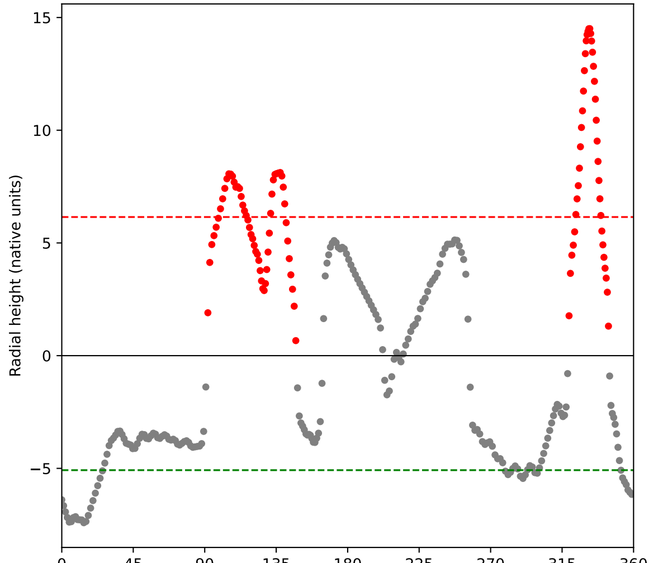

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

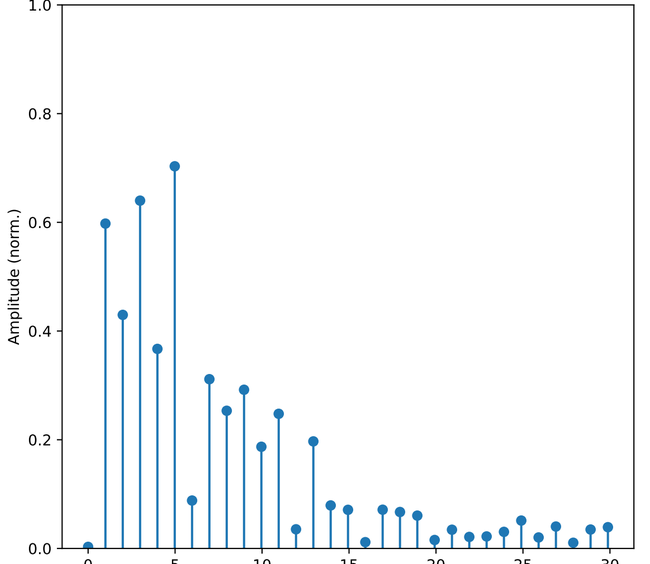

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
0
45
90
135
180
225
270
315
360

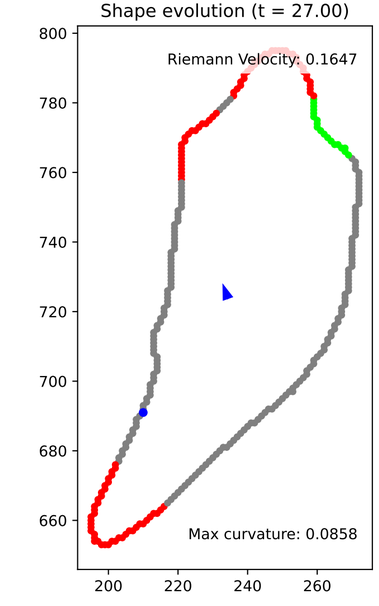

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

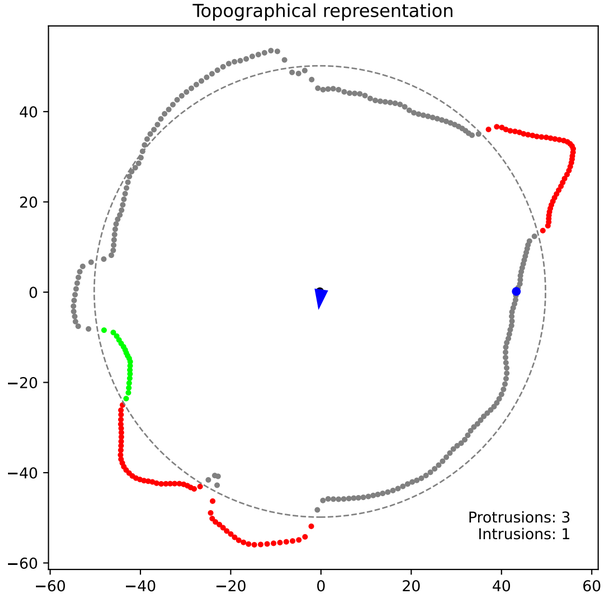

Shape evolution (t = 26.00)
Riemann Velocity: 0.1672
Max curvature: 0.0579
780
760
740
720
700
680
660
200
220
240
260

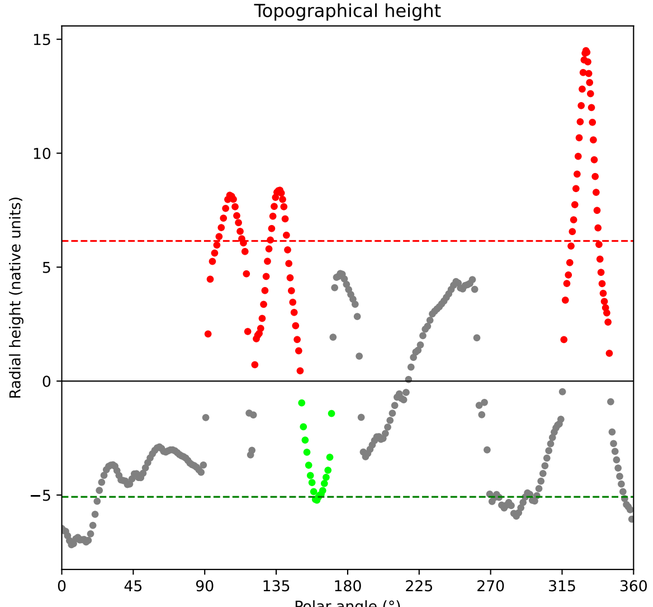

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

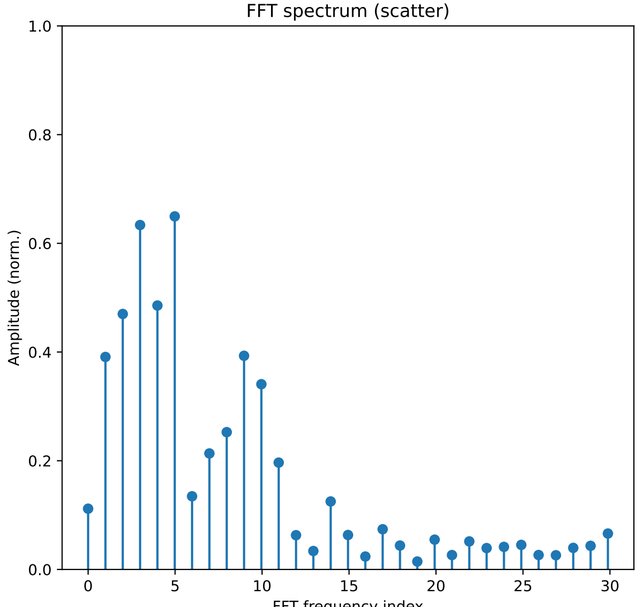

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
0
45
90
135
180
225
270
315
360

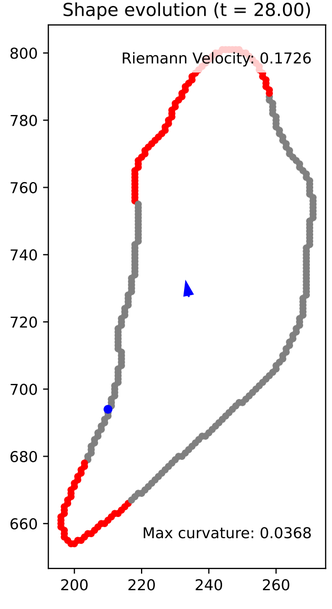

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

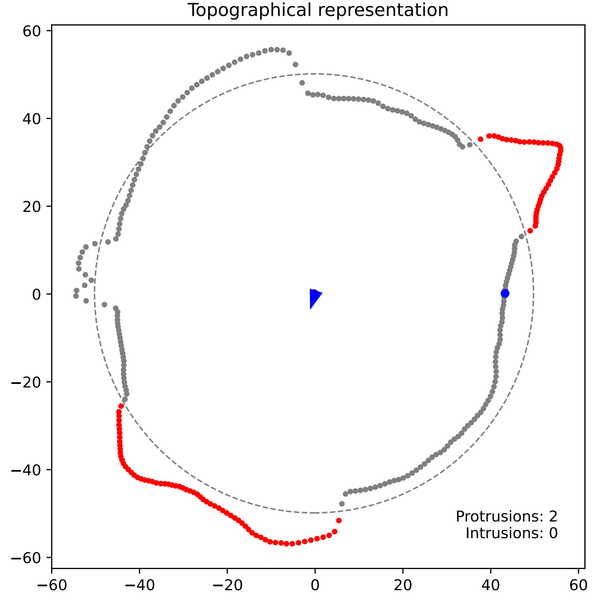

Shape evolution (t = 27.00)
Riemann Velocity: 0.1647
Max curvature: 0.0858

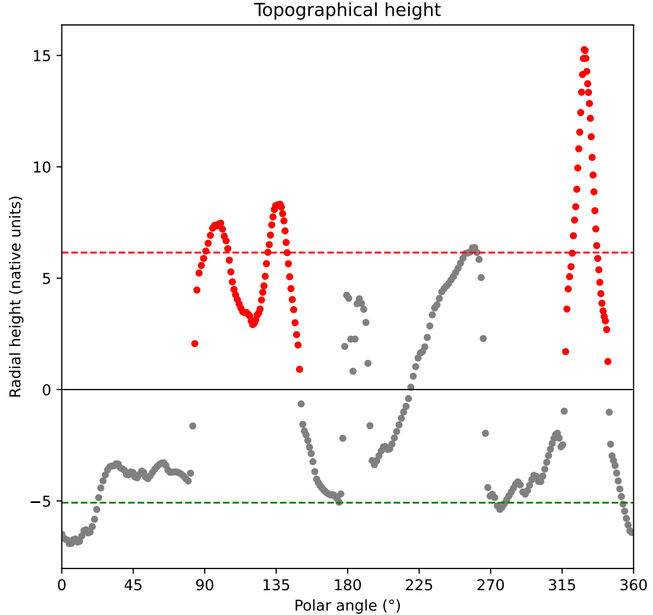

Topographical representation
Protrusions: 3
Intrusions: 1

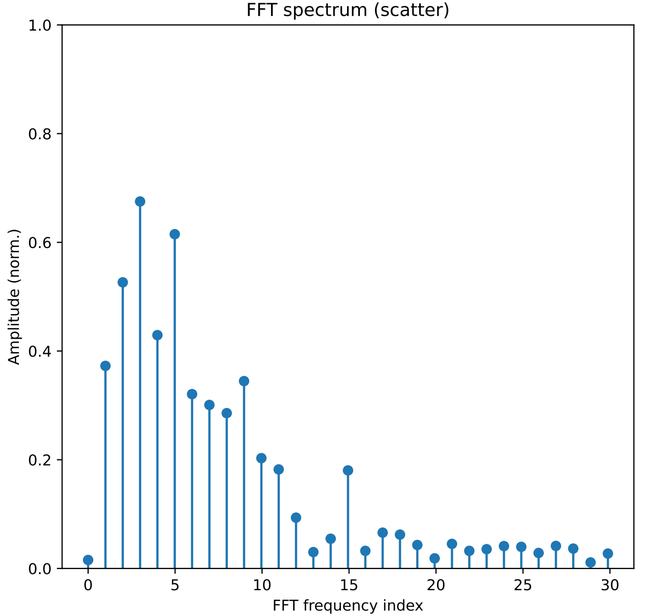

Topographical height
Radial height (native units)
Polar angle (°)

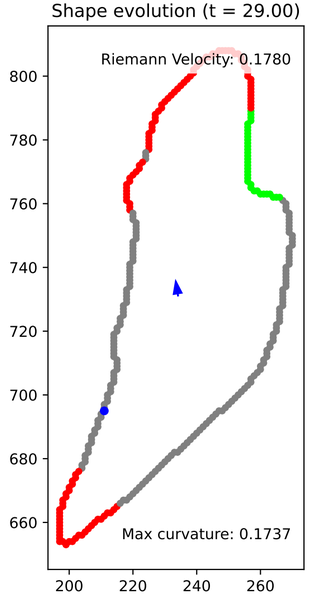

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index

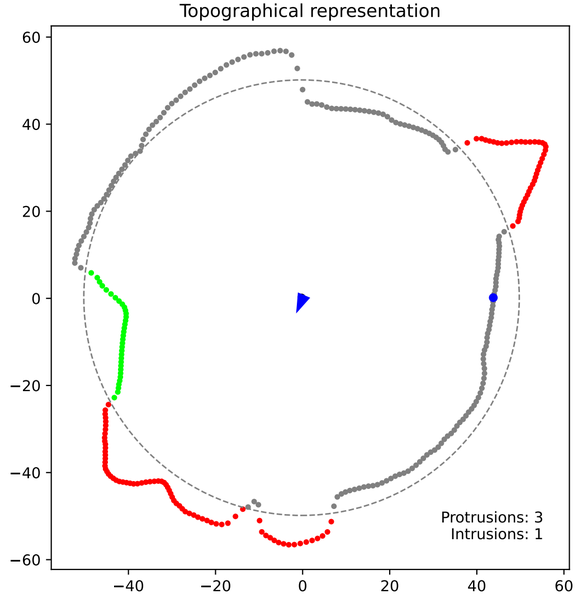

Shape evolution (t = 28.00)
Riemann Velocity: 0.1726
Max curvature: 0.0368
800
780
760
740
720
700
680
660
200
220
240
260

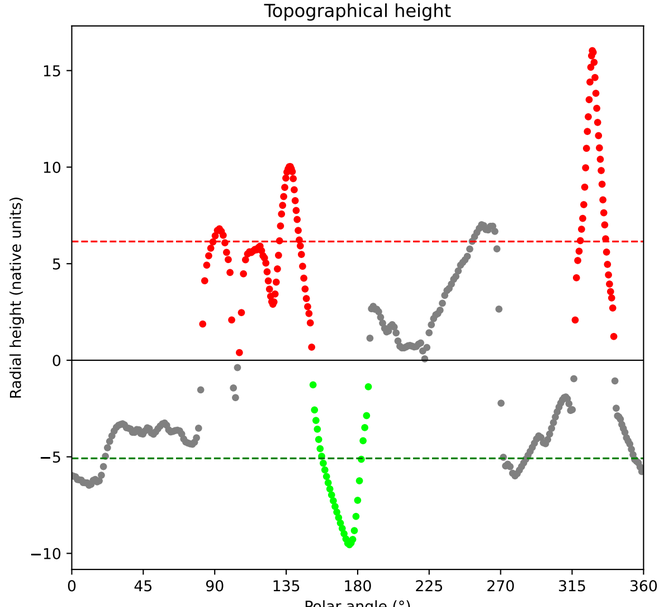

Topographical representation
Protrusions: 2
Intrusions: 0
60
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40
60

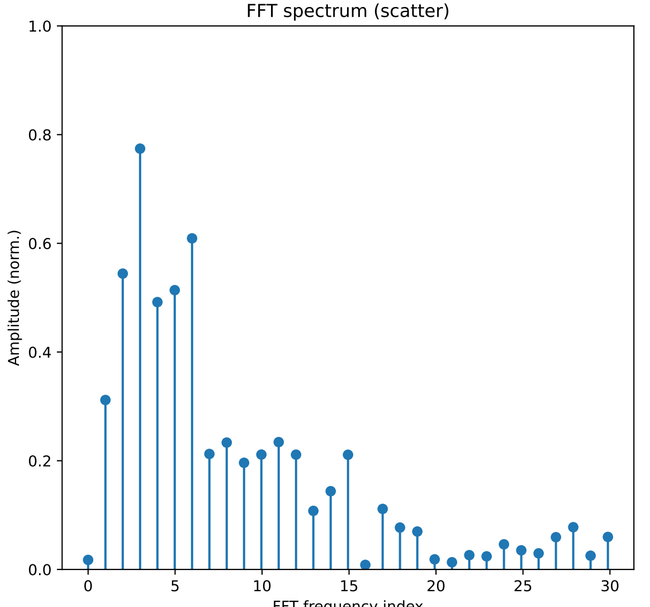

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
0
45
90
135
180
225
270
315
360

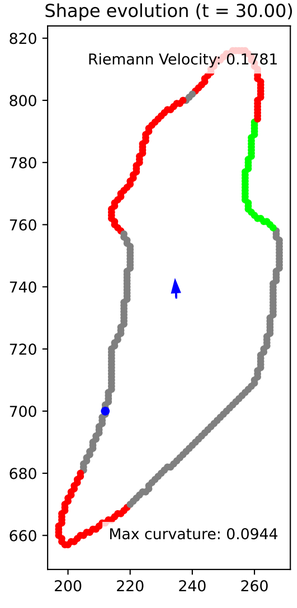

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

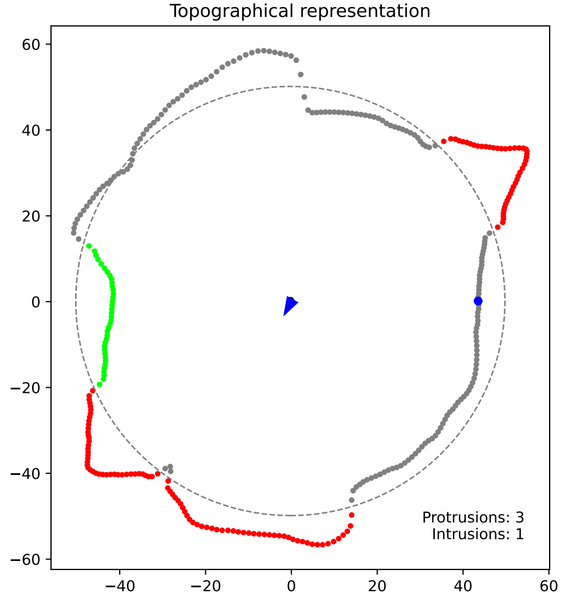

Shape evolution (t = 29.00)
Riemann Velocity: 0.1780
Max curvature: 0.1737
800
780
760
740
720
700
680
660
200
220
240
260

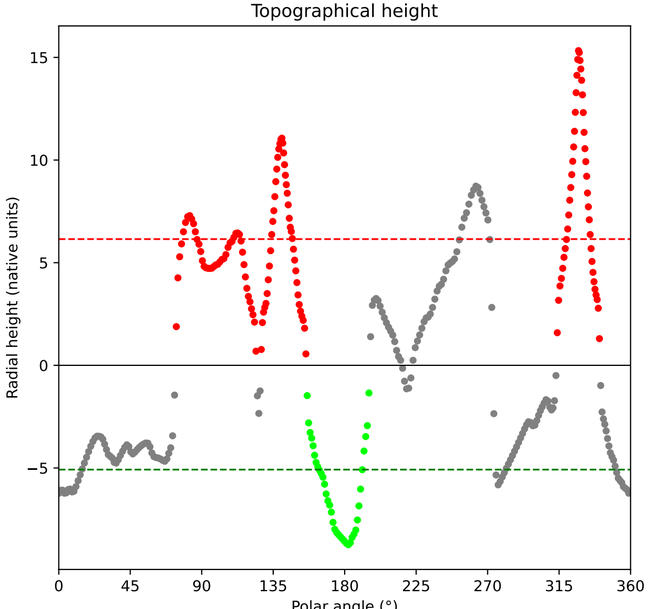

Topographical representation
Protrusions: 3
Intrusions: 1
60
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

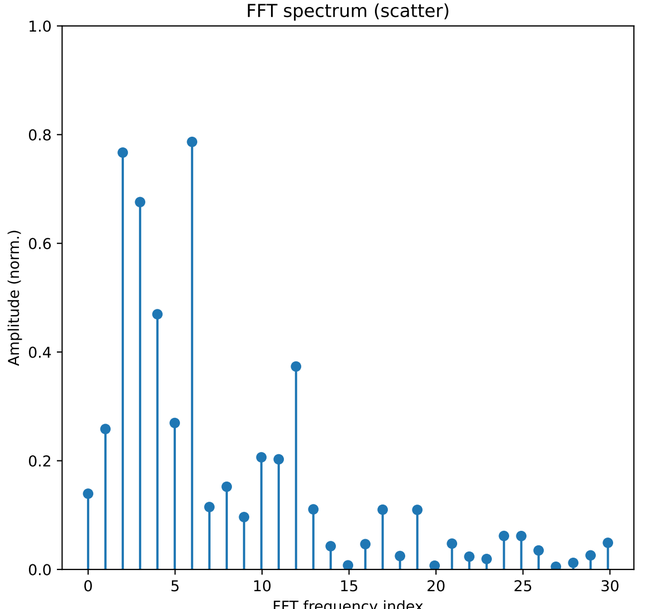

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

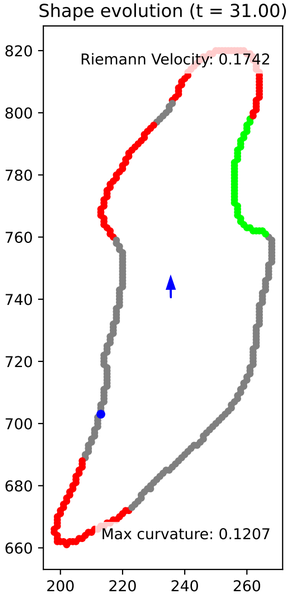

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

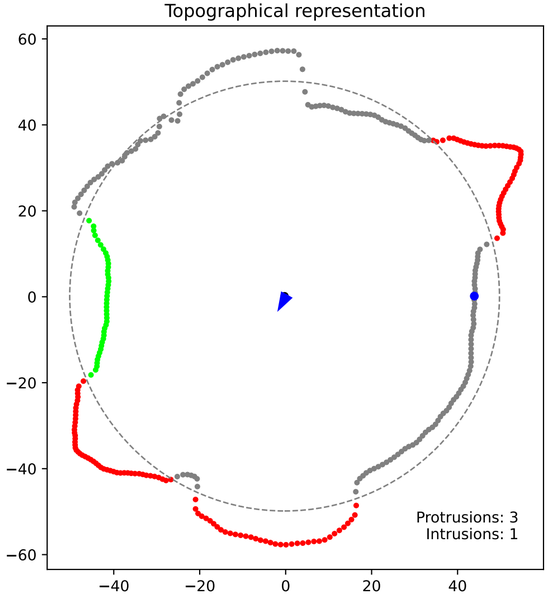

Shape evolution (t = 30.00)
Riemann Velocity: 0.1781
Max curvature: 0.0944
820
800
780
760
740
720
700
680
660
200
220
240
260

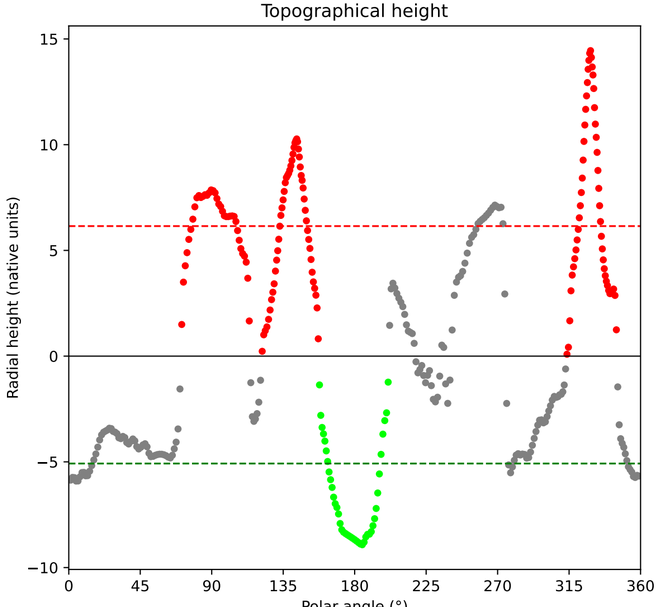

Topographical representation
Protrusions: 3
Intrusions: 1
60
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

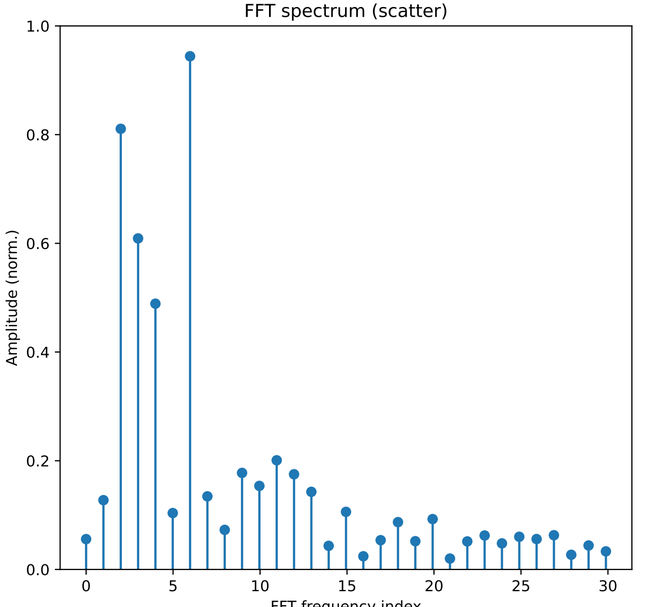

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
0
45
90
135
180
225
270
315
360

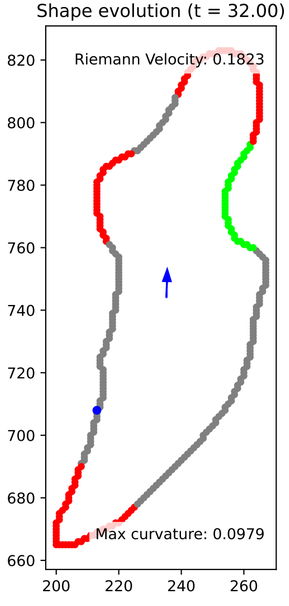

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

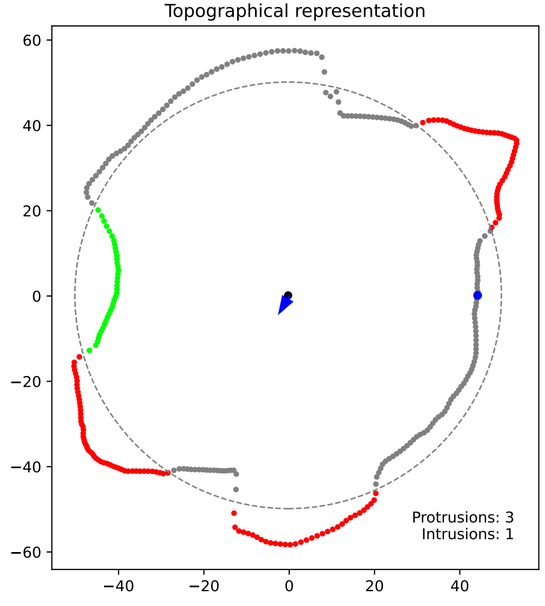

Shape evolution (t = 31.00)
Riemann Velocity: 0.1742
Max curvature: 0.1207
820
800
780
760
740
720
700
680
660
200
220
240
260

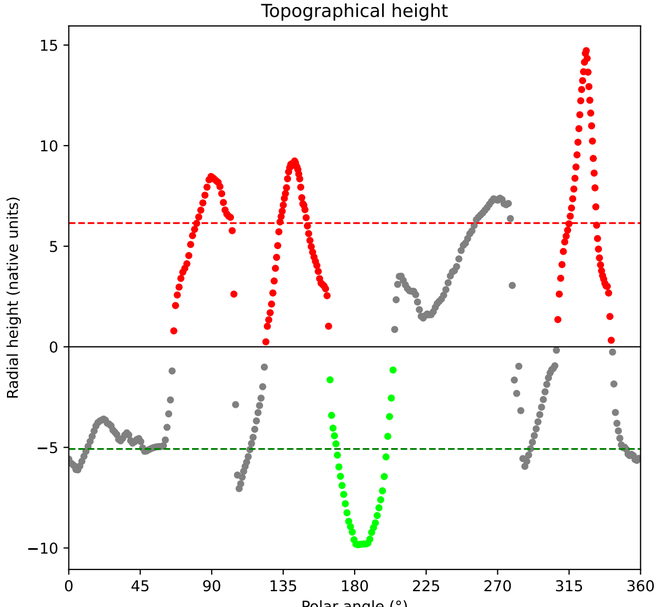

Topographical representation
Protrusions: 3
Intrusions: 1
60
40
20
0
−20
−40
−60
−40
−20
0
20
40

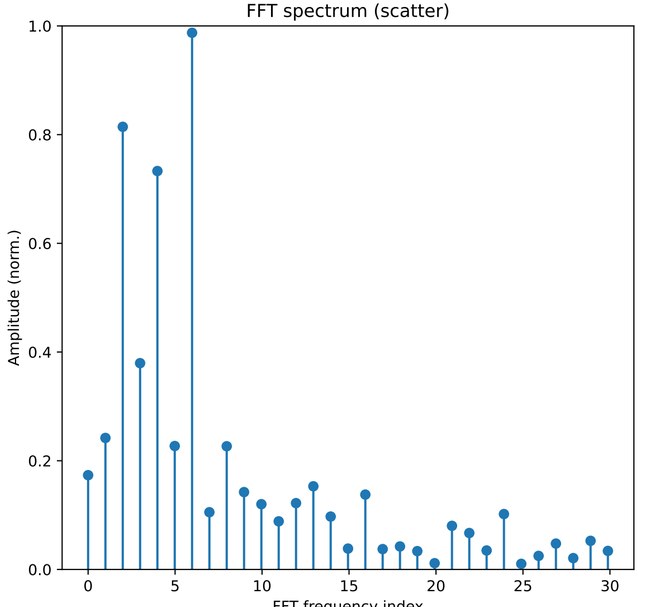

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

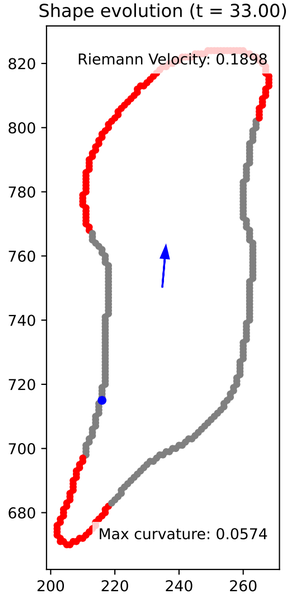

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

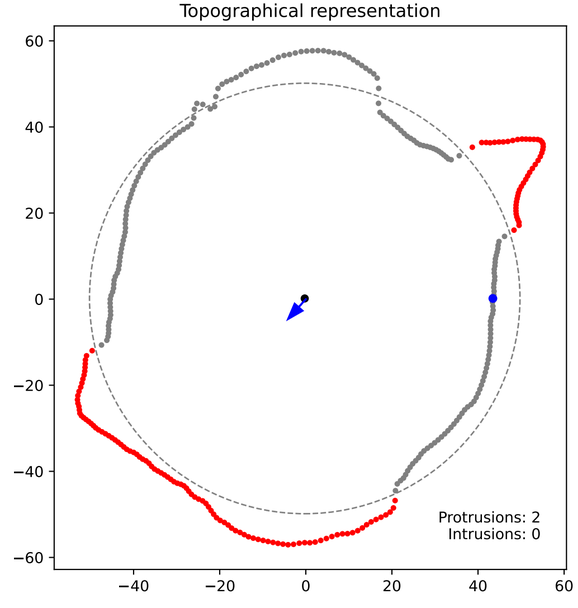

Shape evolution (t = 32.00)
Riemann Velocity: 0.1823
Max curvature: 0.0979
820
800
780
760
740
720
700
680
660
200
220
240
260

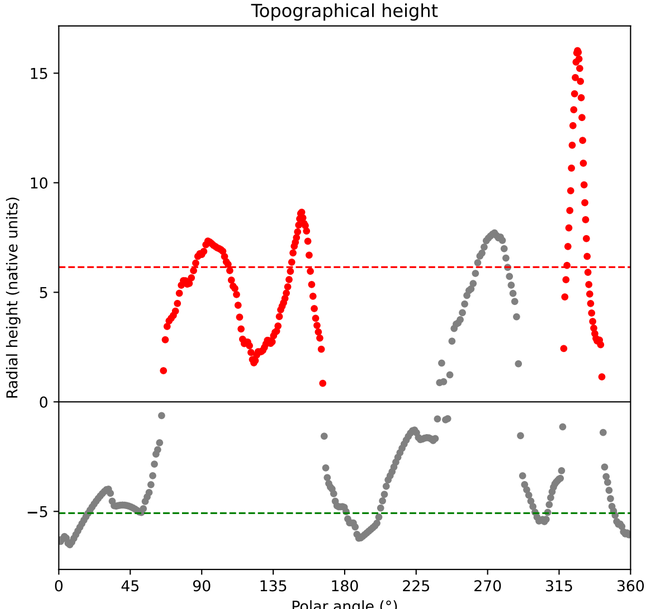

Topographical representation
Protrusions: 3
Intrusions: 1
60
40
20
0
−20
−40
−60
−40
−20
0
20
40

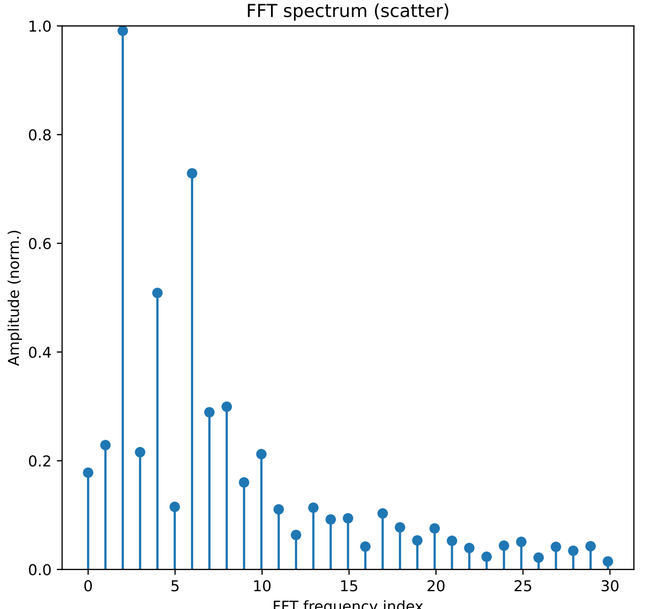

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
−10
0
45
90
135
180
225
270
315
360

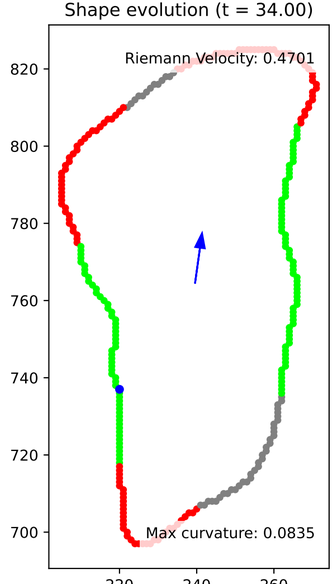

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

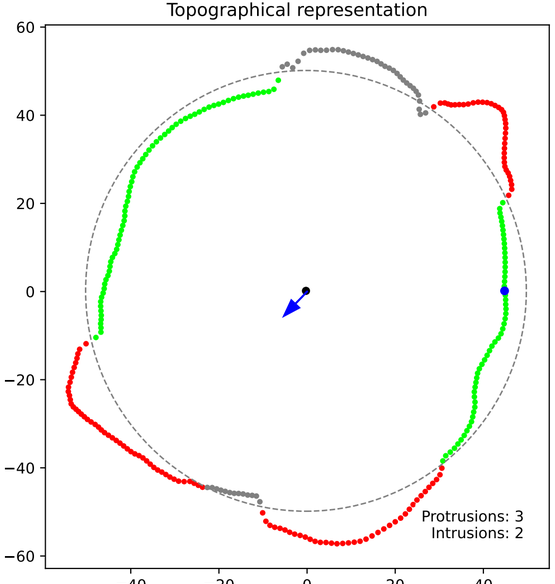

Shape evolution (t = 33.00)
Riemann Velocity: 0.1898
Max curvature: 0.0574
820
800
780
760
740
720
700
680
200
220
240
260

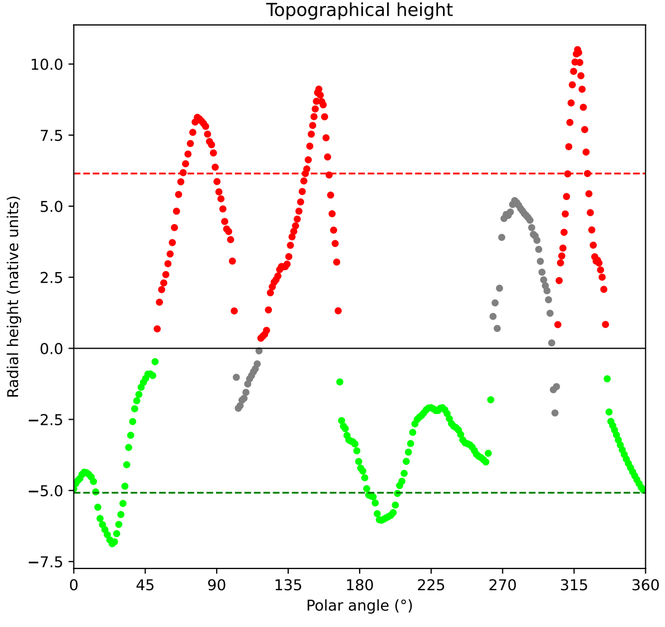

Topographical representation
Protrusions: 2
Intrusions: 0
60
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

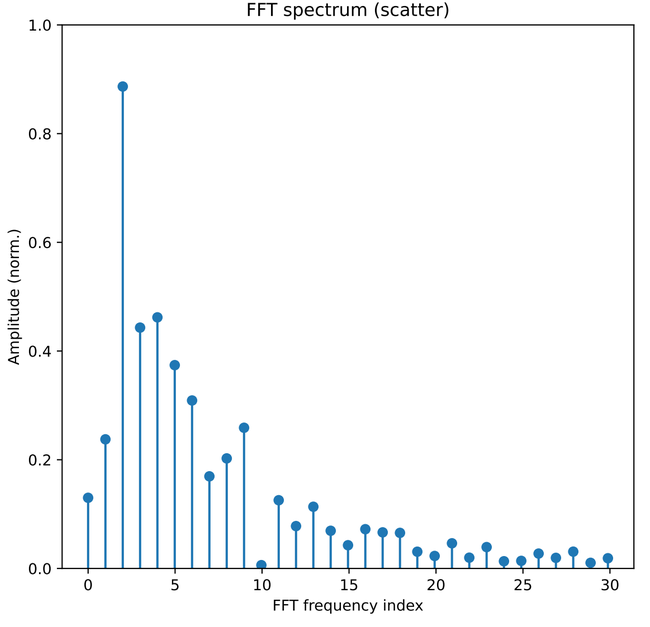

Topographical height
Radial height (native units)
Polar angle (°)
15
10
5
0
−5
0
45
90
135
180
225
270
315
360

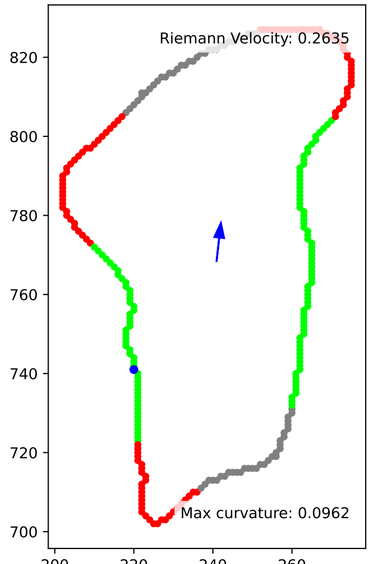

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

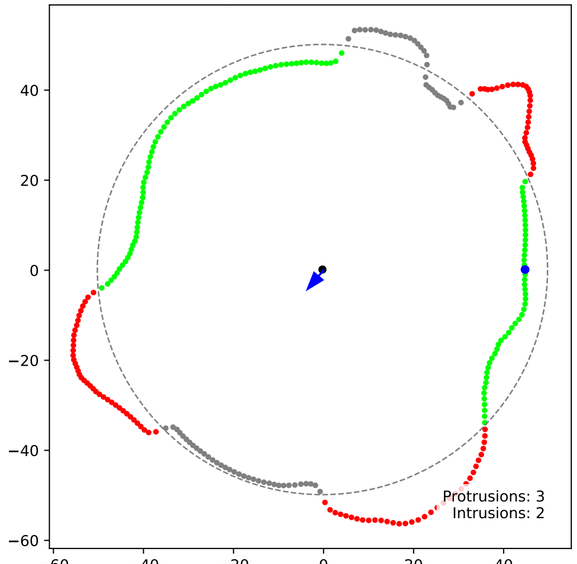

Shape evolution (t = 34.00)
Riemann Velocity: 0.4701
Max curvature: 0.0835
820
800
780
760
740
720
700
220
240
260

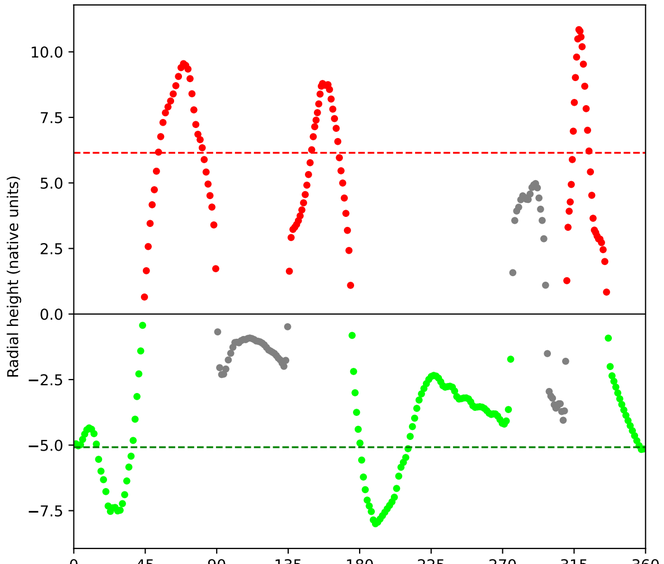

Topographical representation
Protrusions: 3
Intrusions: 2
60
40
20
0
−20
−40
−60
−40
−20
0
20
40

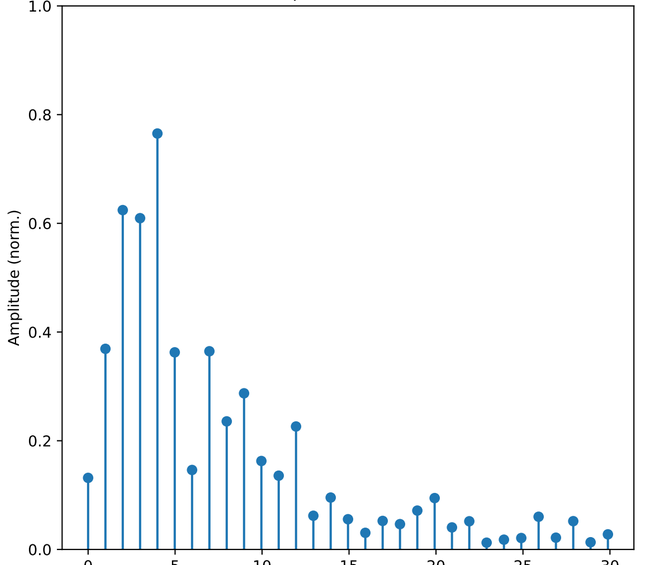

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

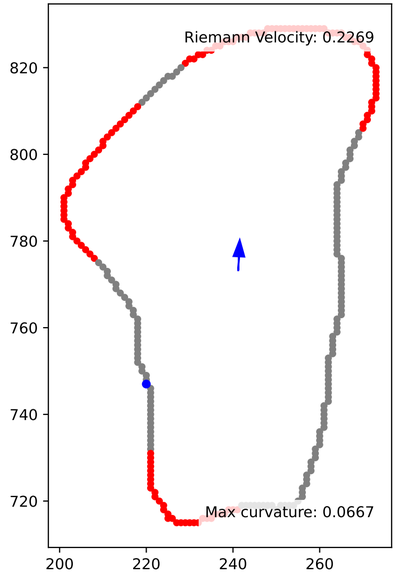

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

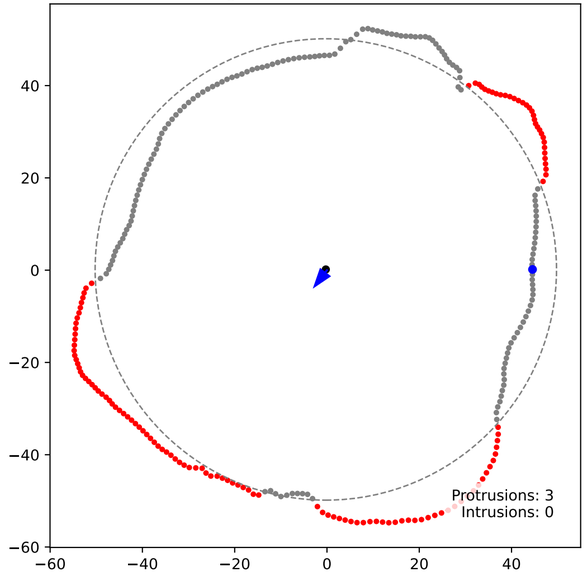

Shape evolution (t = 35.00)
Riemann Velocity: 0.2635
Max curvature: 0.0962
820
800
780
760
740
720
700
200
220
240
260

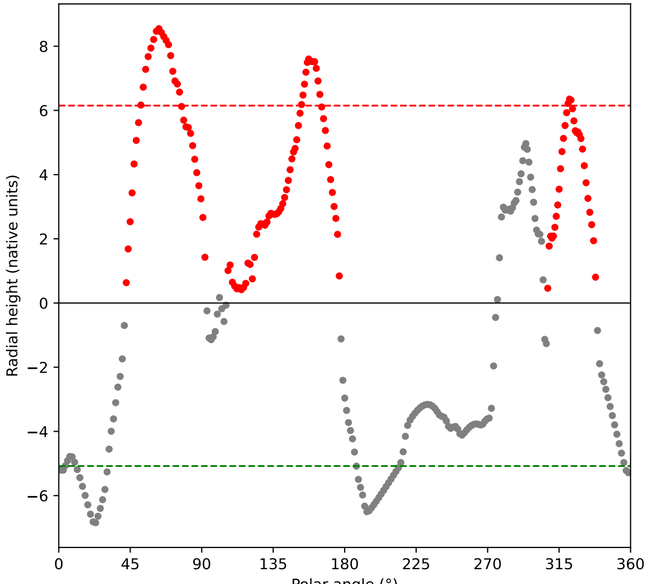

Topographical representation
Protrusions: 3
Intrusions: 2
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40

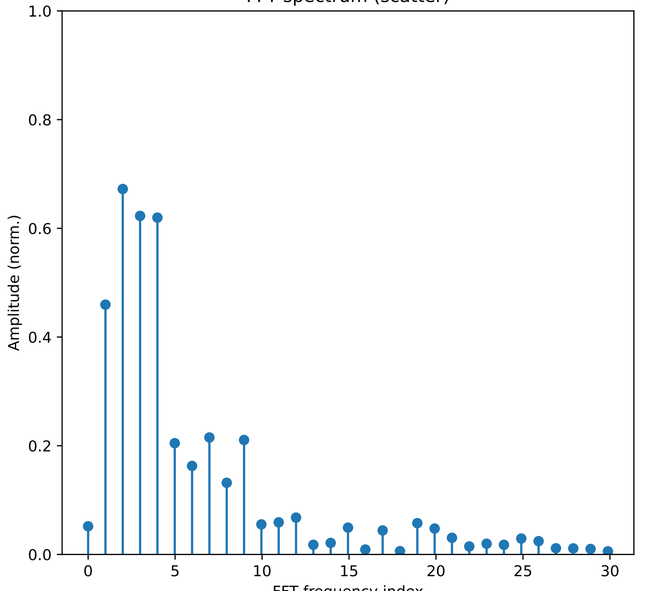

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

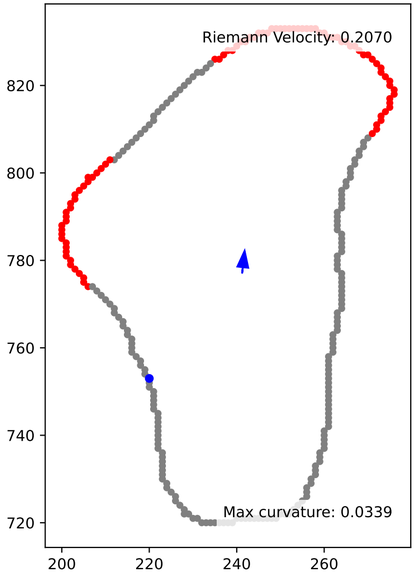

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

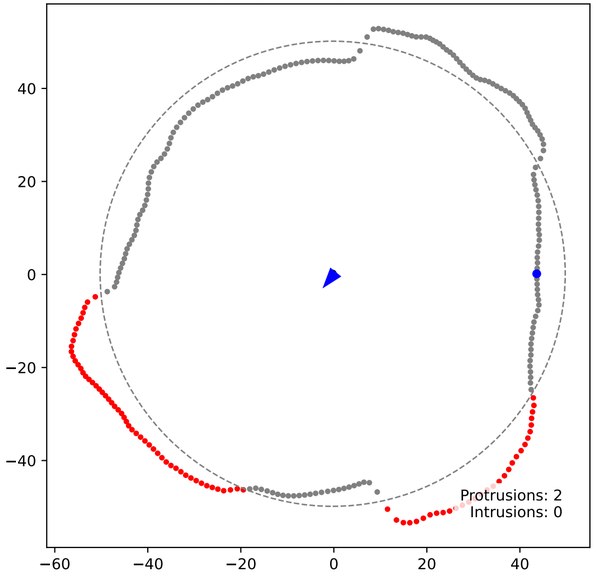

Shape evolution (t = 36.00)
Riemann Velocity: 0.2269
Max curvature: 0.0667
820
800
780
760
740
720
200
220
240
260

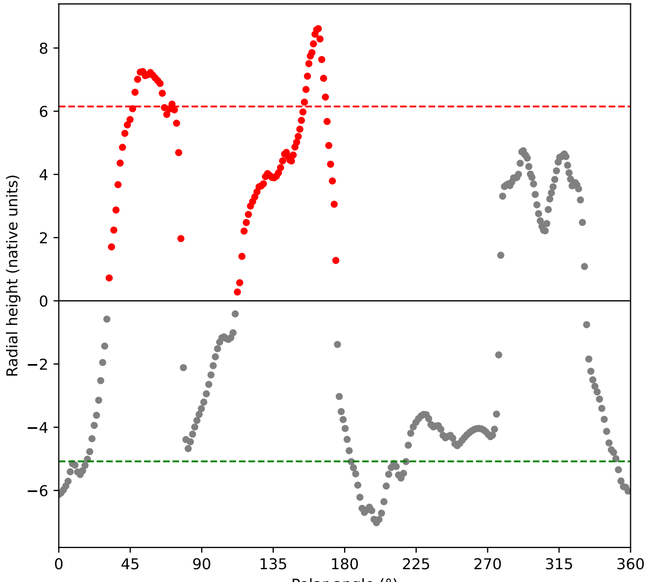

Topographical representation
Protrusions: 3
Intrusions: 0
40
20
0
−20
−40
−60
−60
−40
−20
0
20
40

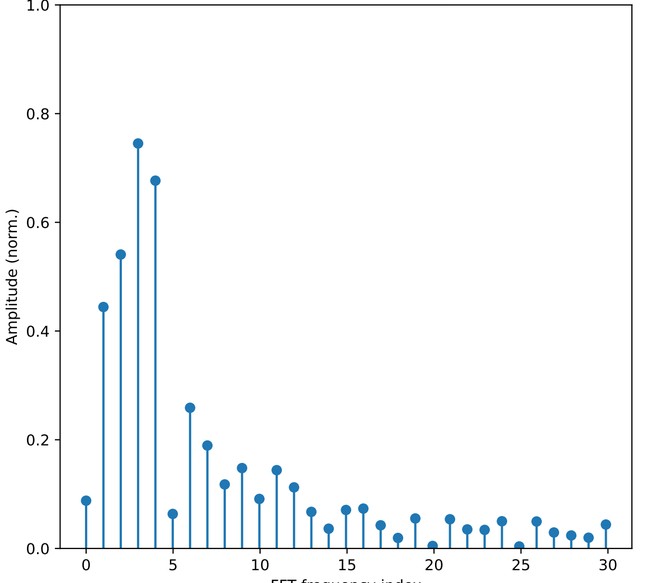

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

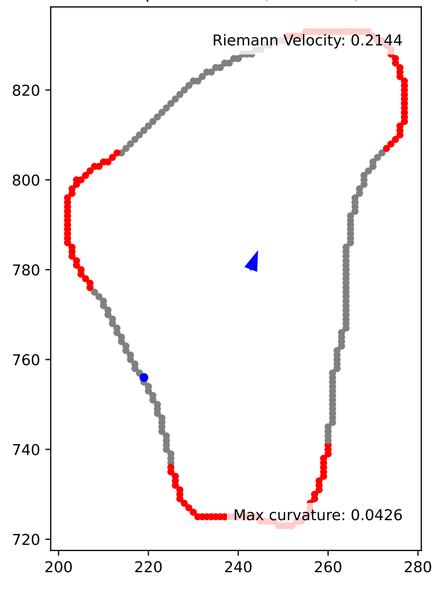

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

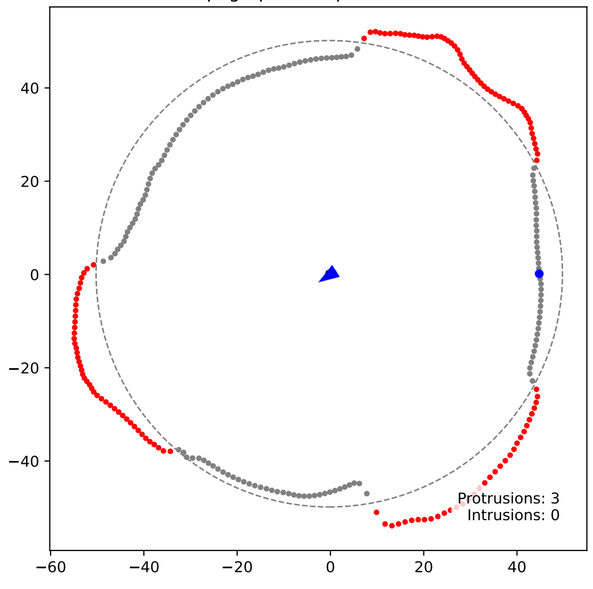

Shape evolution (t = 37.00)
Riemann Velocity: 0.2070
Max curvature: 0.0339
820
800
780
760
740
720
200
220
240
260

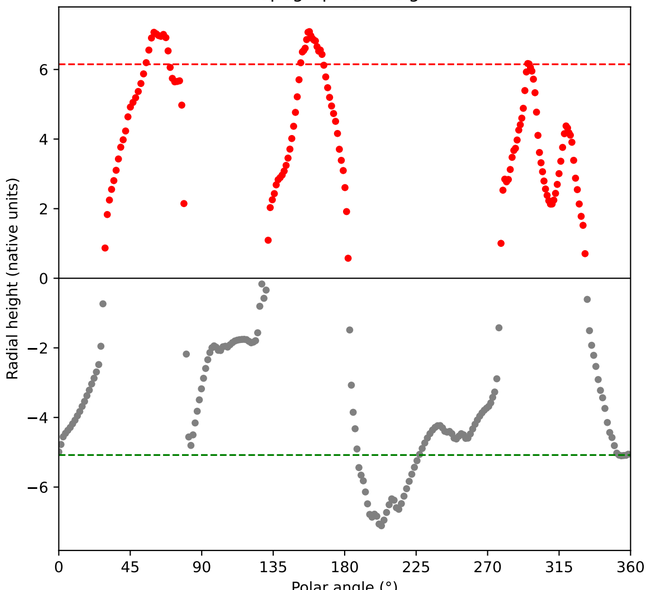

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

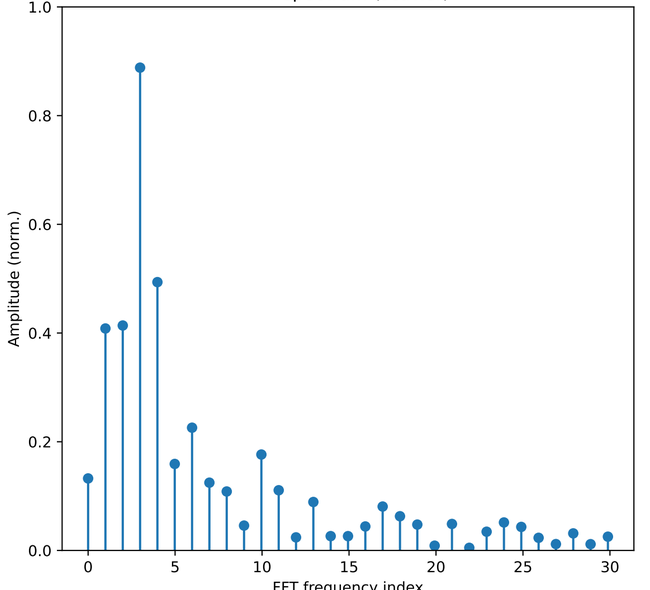

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

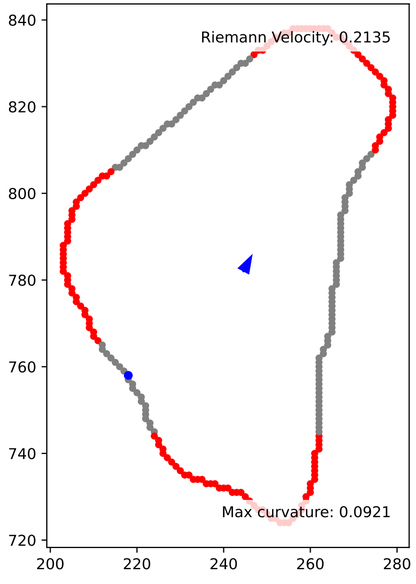

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

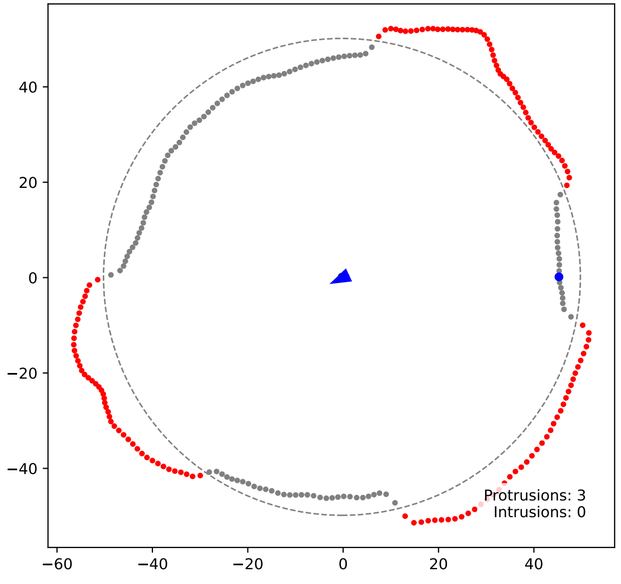

Shape evolution (t = 38.00)
Riemann Velocity: 0.2144
Max curvature: 0.0426
820
800
780
760
740
720
200
220
240
260
280

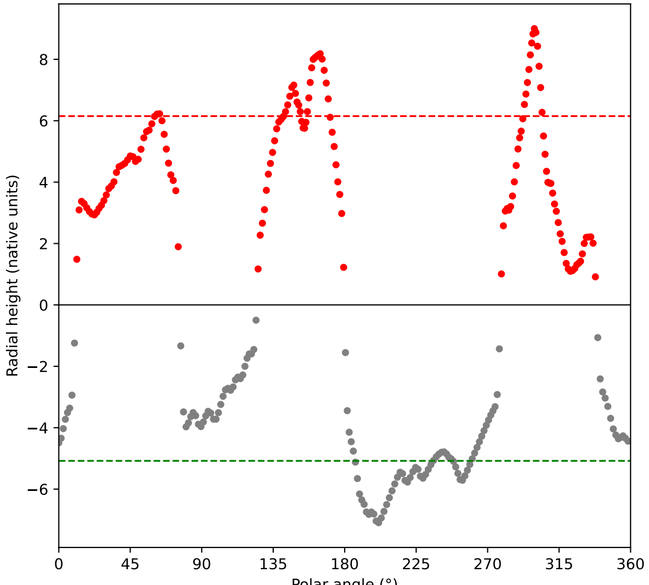

Topographical representation
Protrusions: 3
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

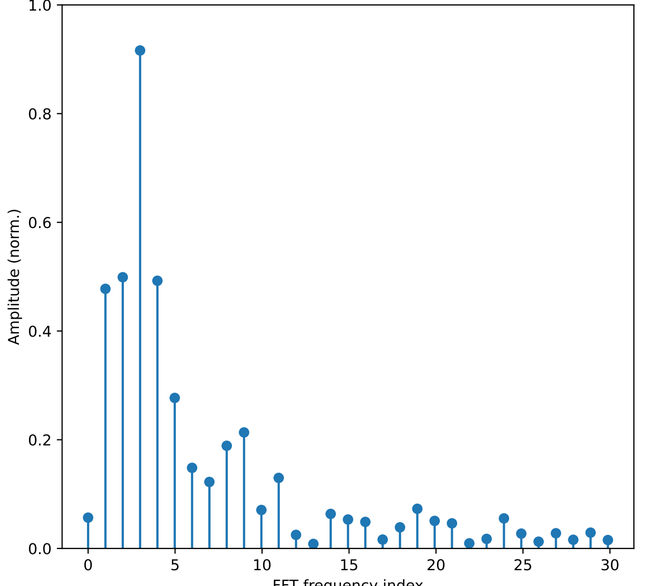

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

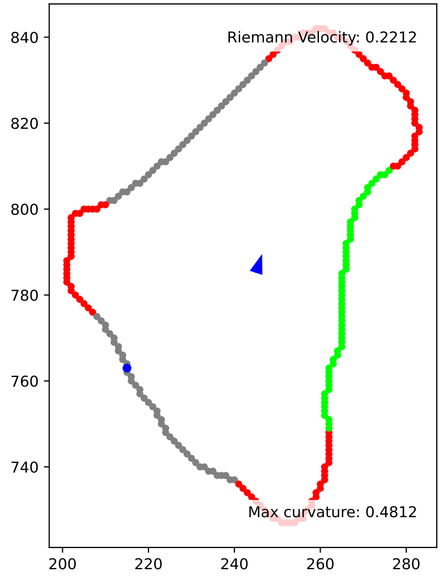

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

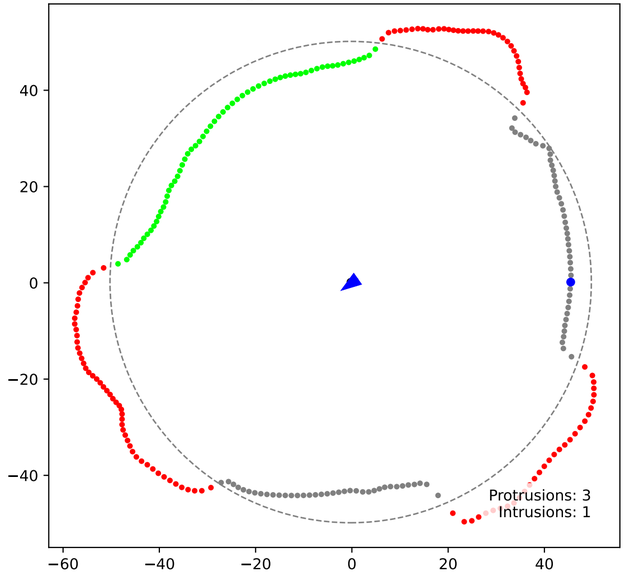

Shape evolution (t = 39.00)
Riemann Velocity: 0.2135
Max curvature: 0.0921
840
820
800
780
760
740
720
200
220
240
260
280

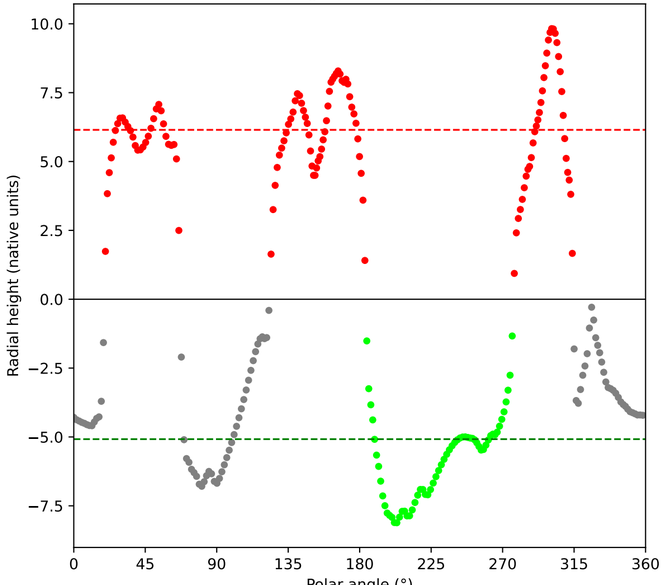

Topographical representation
Protrusions: 3
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

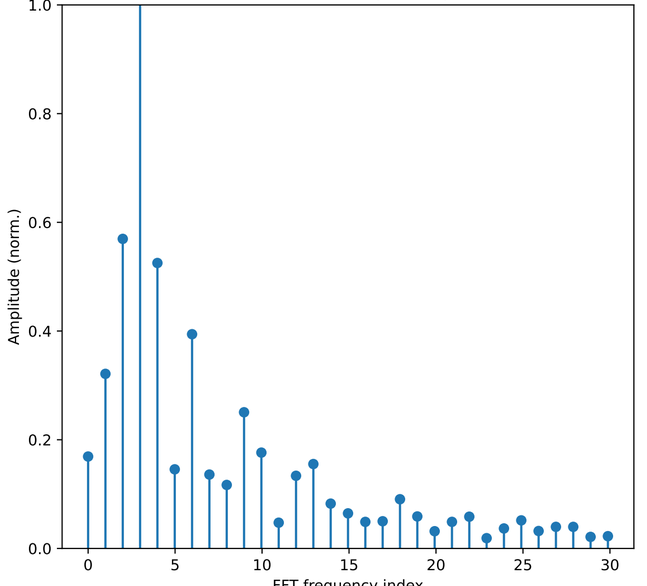

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

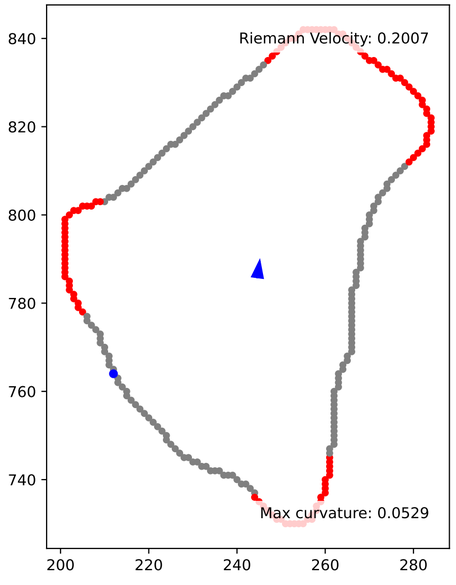

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

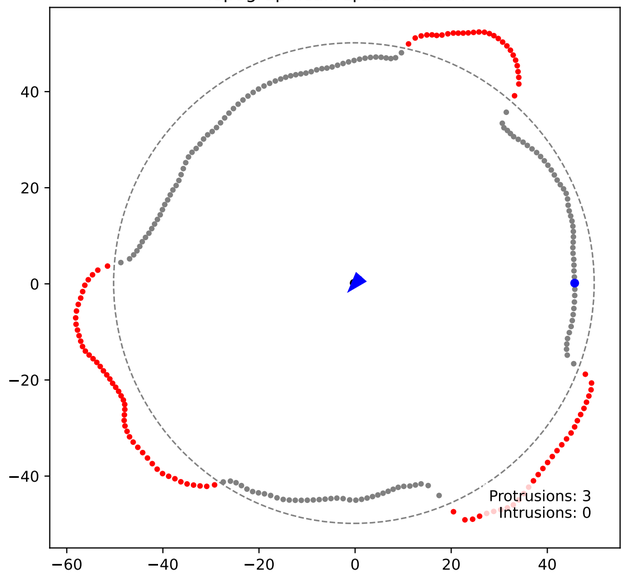

Shape evolution (t = 40.00)
Riemann Velocity: 0.2212
Max curvature: 0.4812
840
820
800
780
760
740
200
220
240
260
280

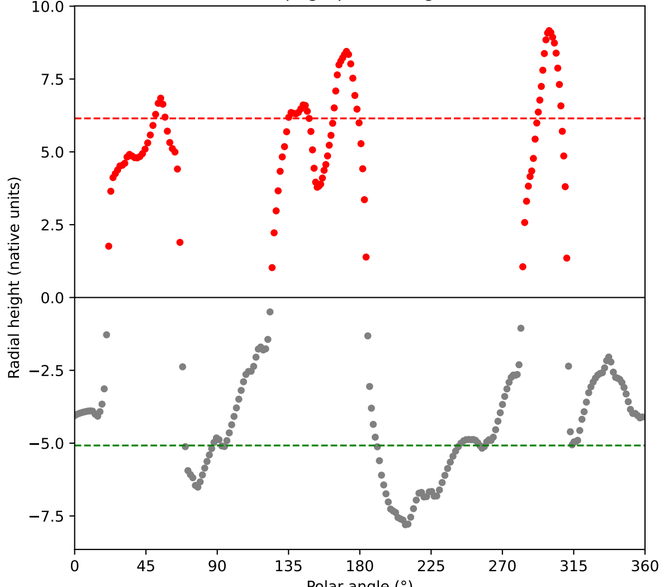

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

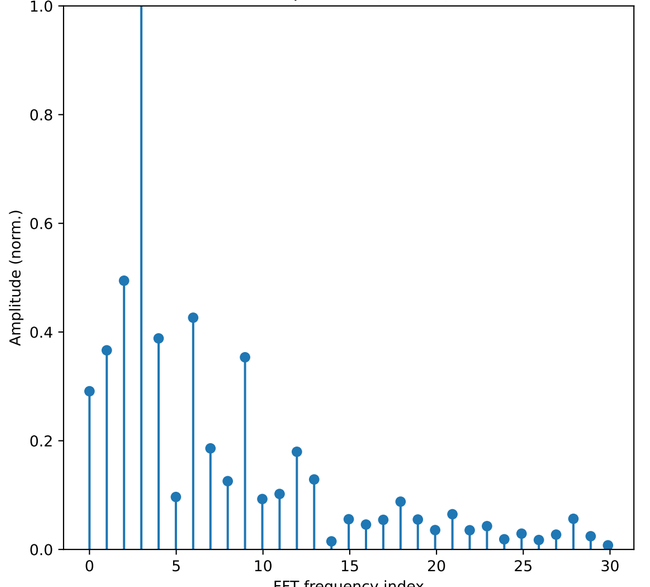

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

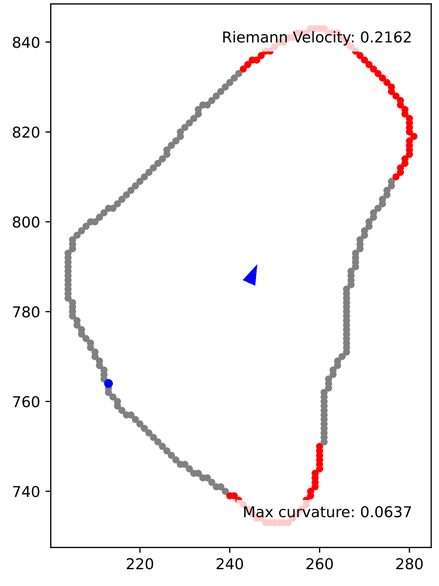

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

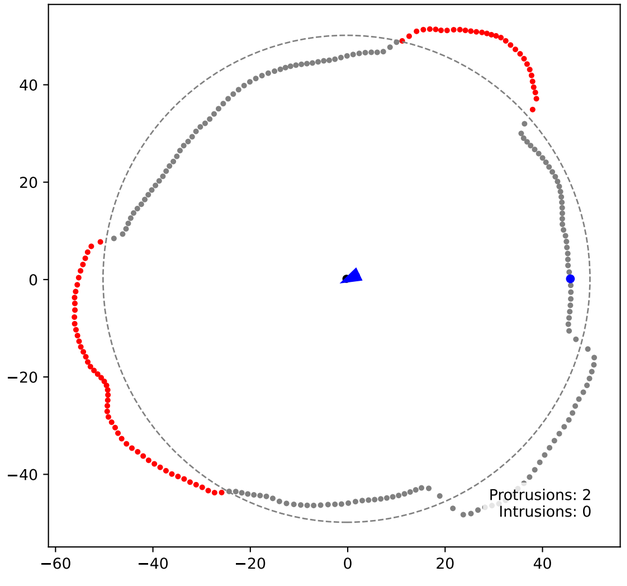

Shape evolution (t = 41.00)
Riemann Velocity: 0.2007
Max curvature: 0.0529
840
820
800
780
760
740
200
220
240
260
280

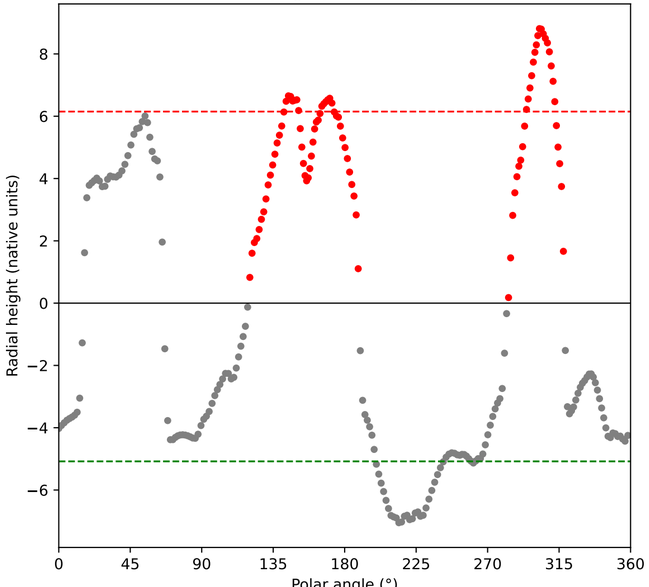

Topographical representation
Protrusions: 3
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

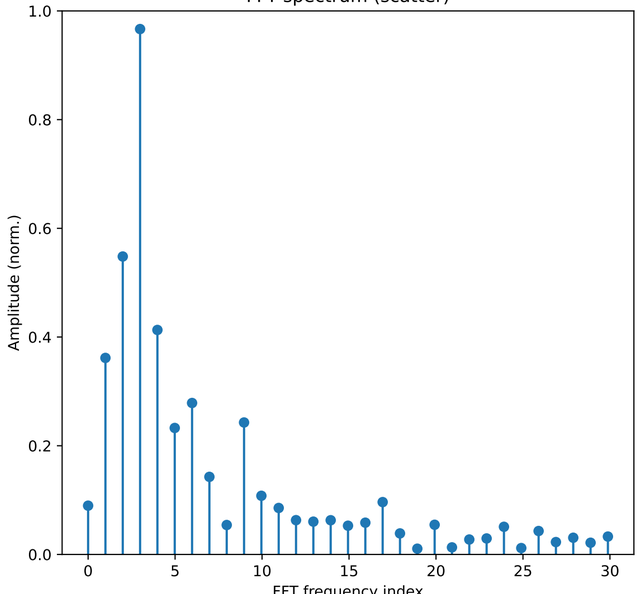

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

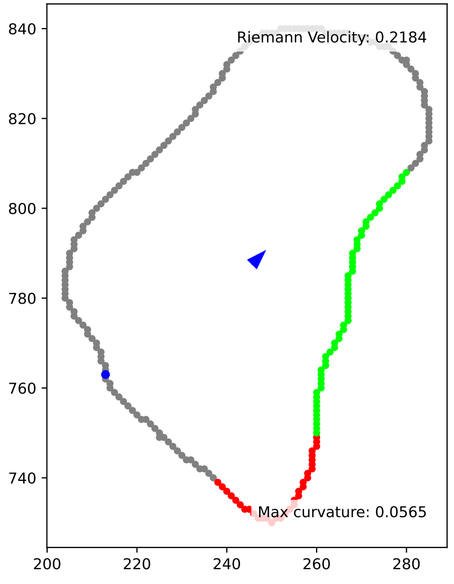

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

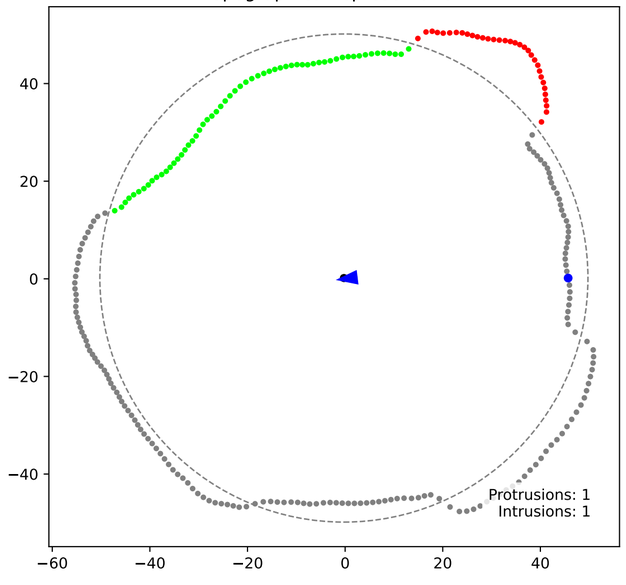

Shape evolution (t = 42.00)
Riemann Velocity: 0.2162
Max curvature: 0.0637
840
820
800
780
760
740
220
240
260
280

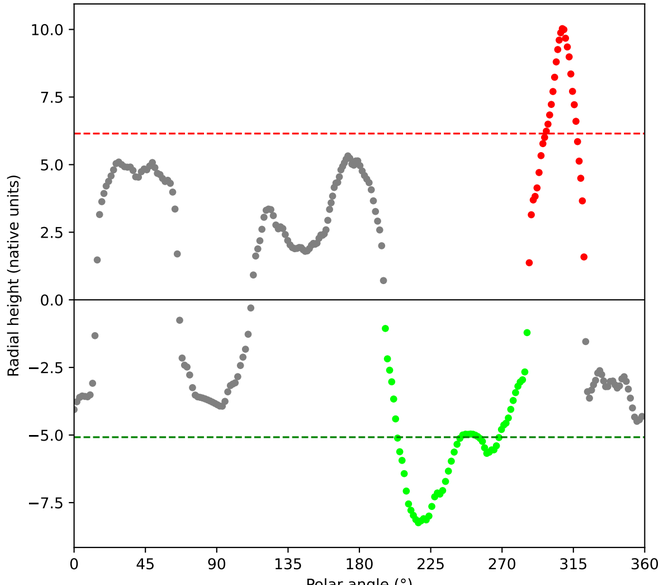

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

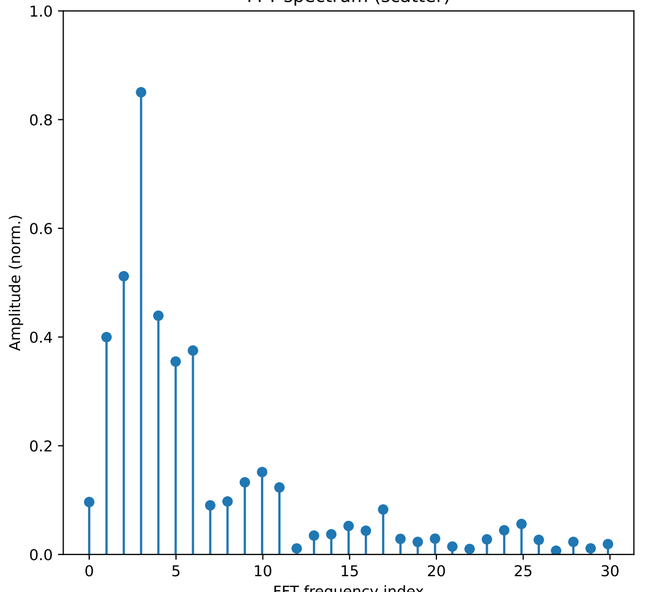

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

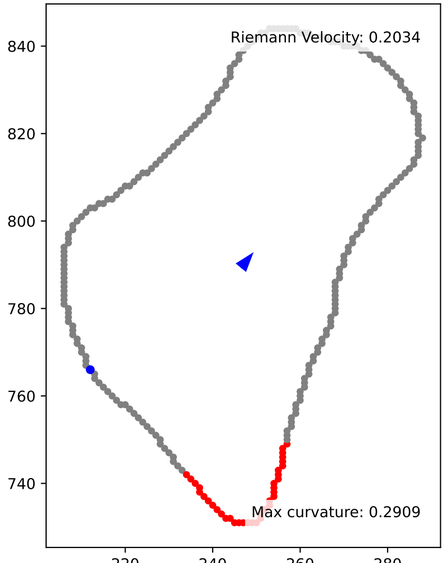

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

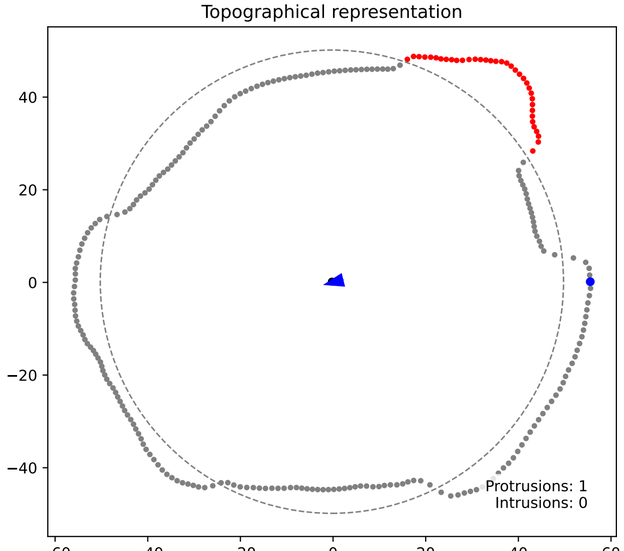

Shape evolution (t = 43.00)
Riemann Velocity: 0.2184
Max curvature: 0.0565
840
820
800
780
760
740
200
220
240
260
280

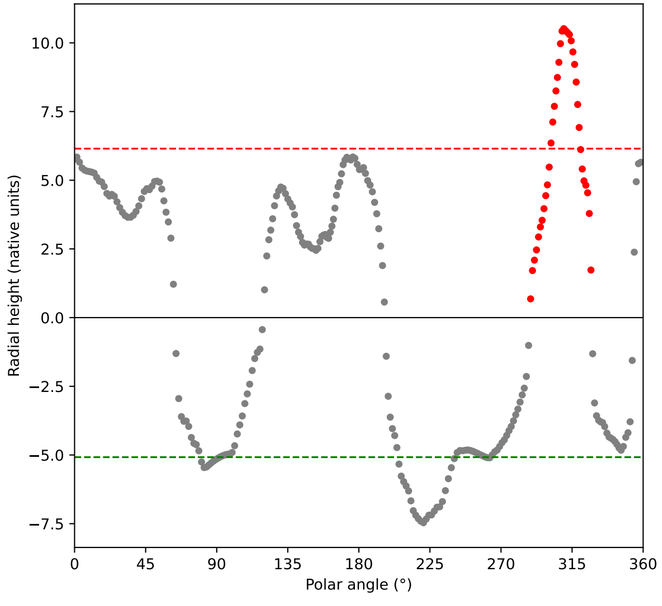

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

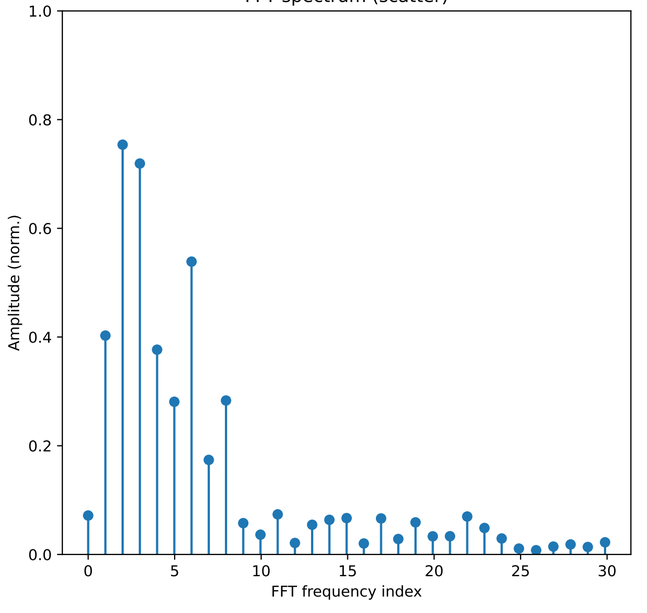

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

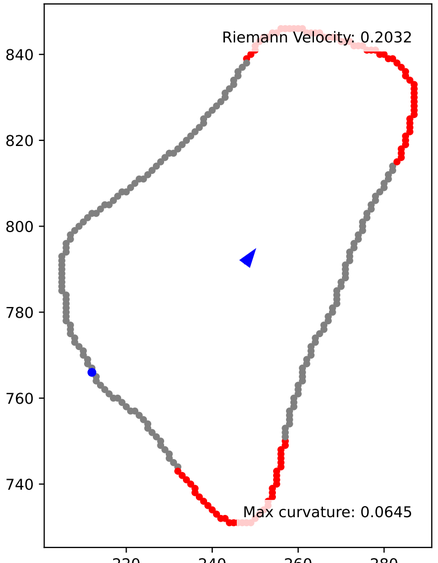

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

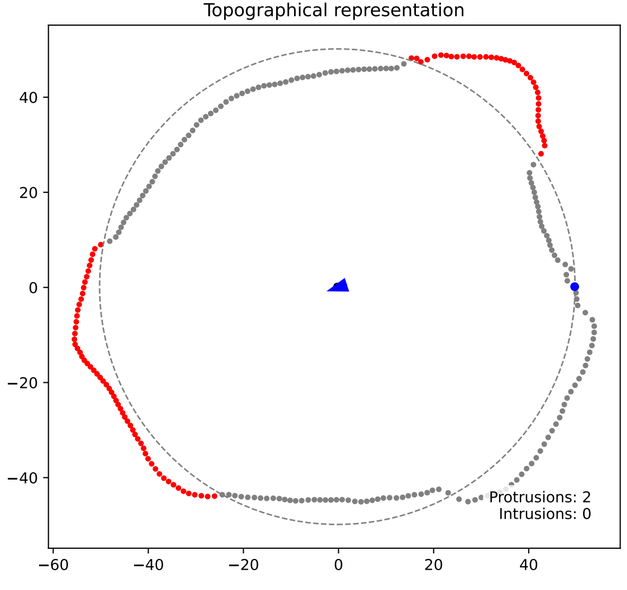

Shape evolution (t = 44.00)
Riemann Velocity: 0.2034
Max curvature: 0.2909
840
820
800
780
760
740
220
240
260
280

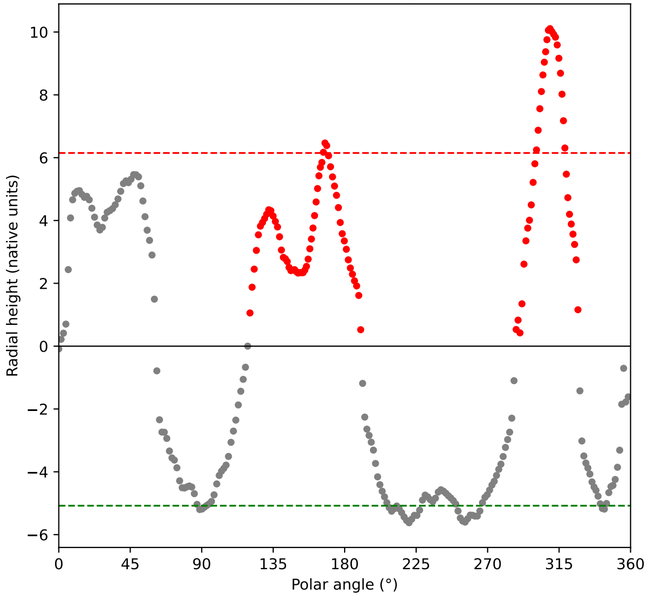

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

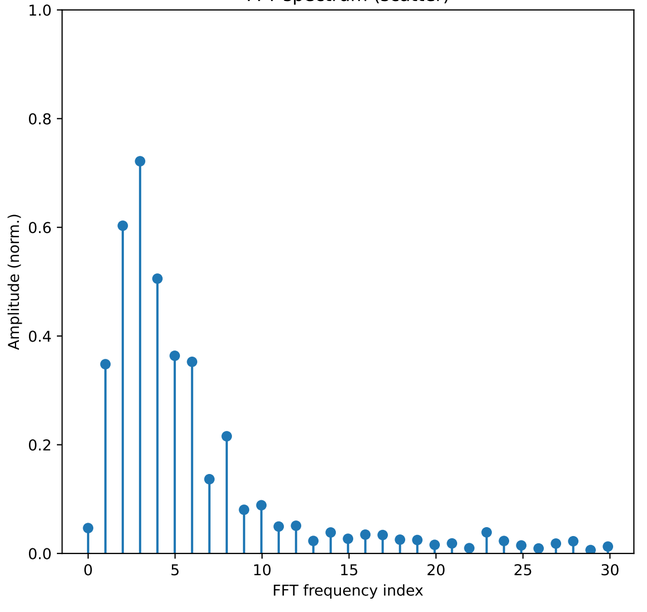

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

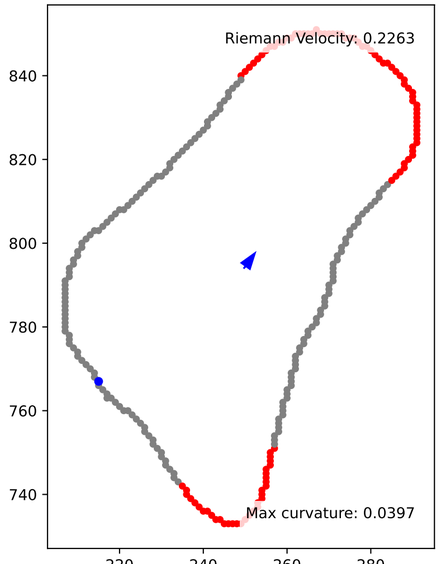

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

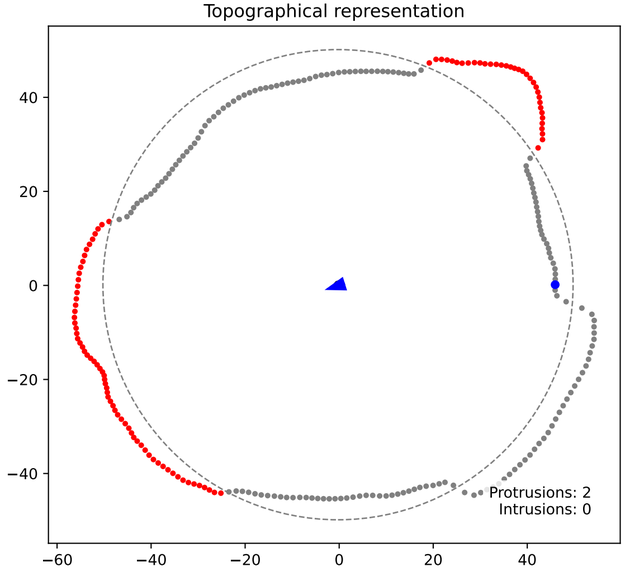

Shape evolution (t = 45.00)
Riemann Velocity: 0.2032
Max curvature: 0.0645
840
820
800
780
760
740
220
240
260
280

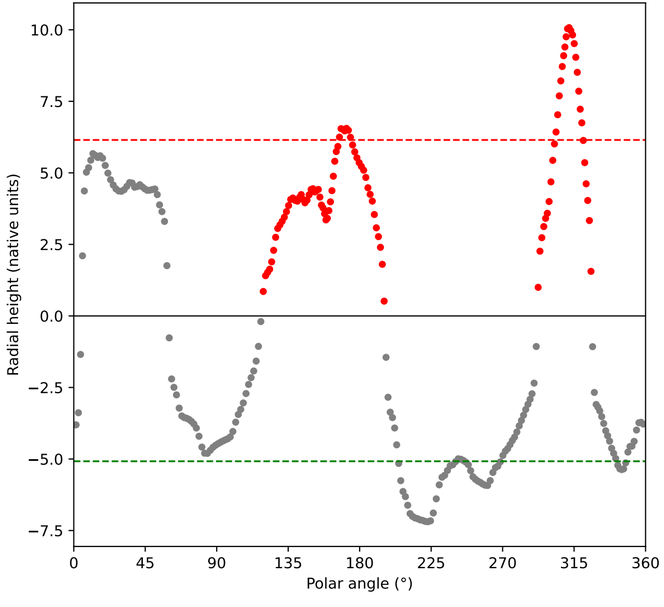

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

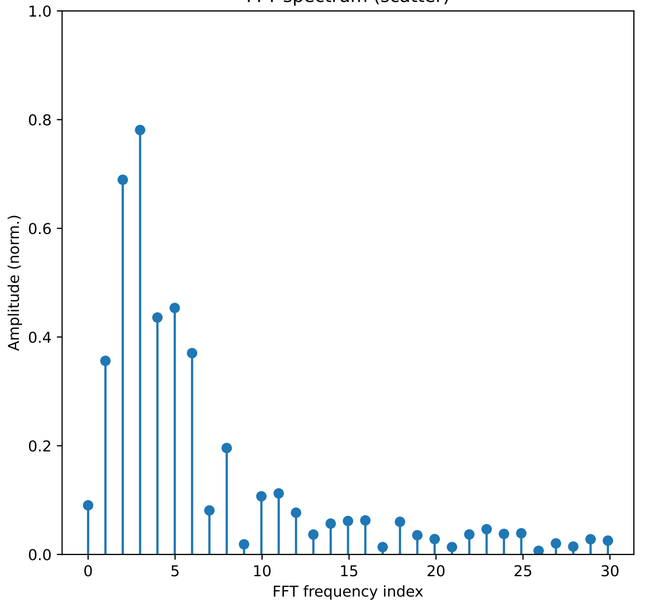

Topographical height
Radial height (native units)
Polar angle (°)
10
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

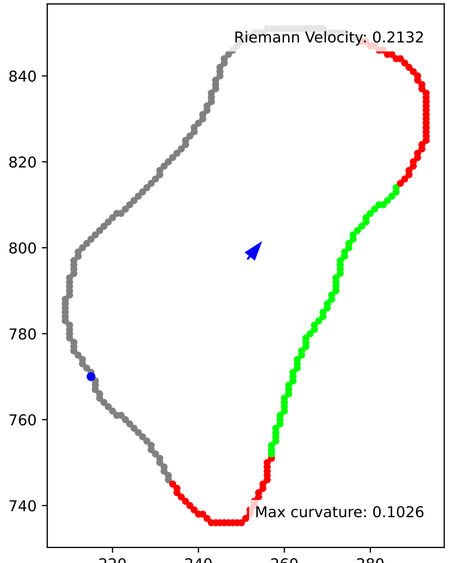

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

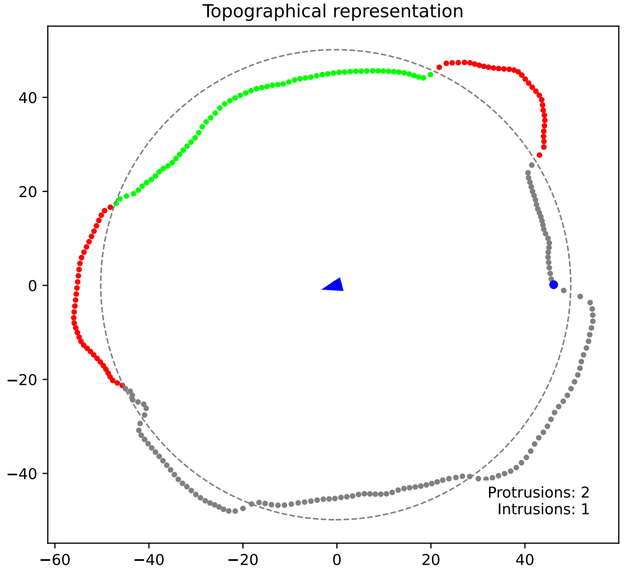

Shape evolution (t = 46.00)
Riemann Velocity: 0.2263
Max curvature: 0.0397
840
820
800
780
760
740
220
240
260
280

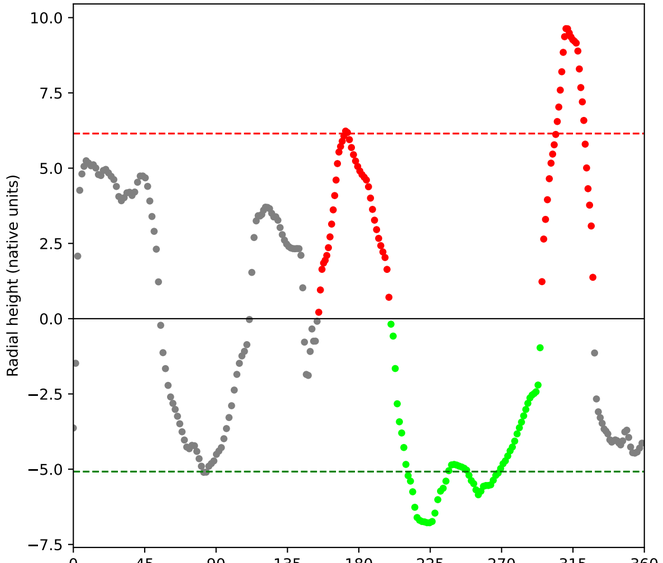

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

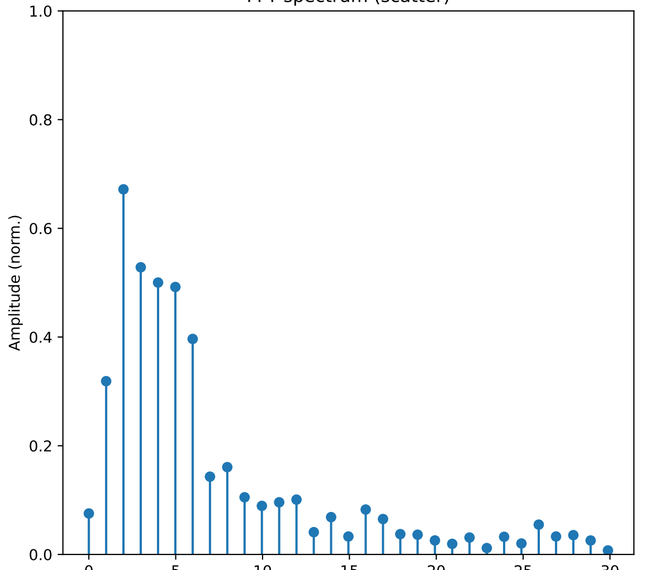

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

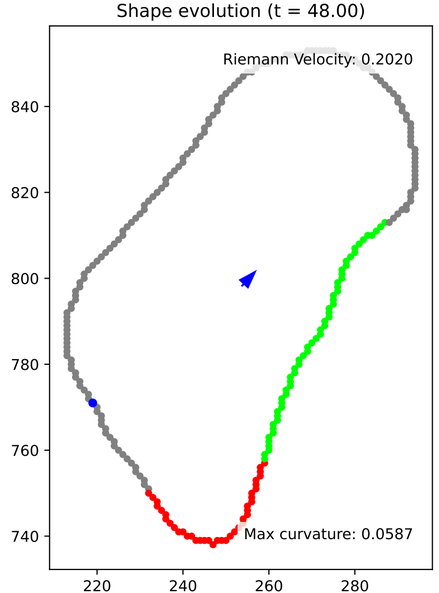

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

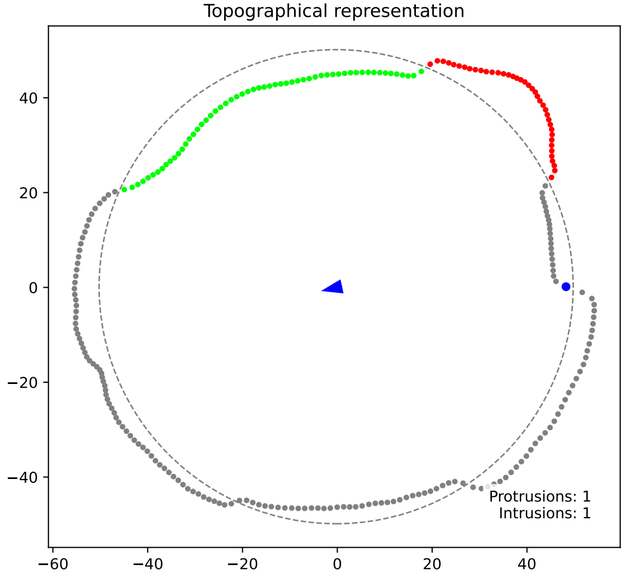

Shape evolution (t = 47.00)
Riemann Velocity: 0.2132
Max curvature: 0.1026
840
820
800
780
760
740
220
240
260
280

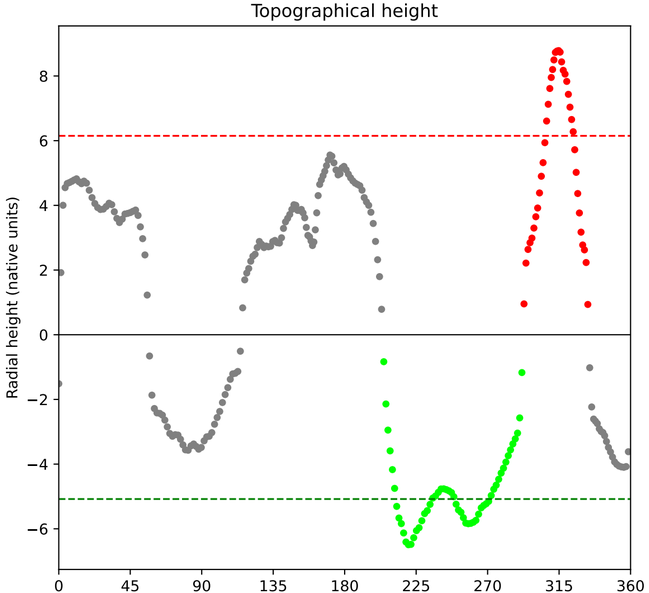

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

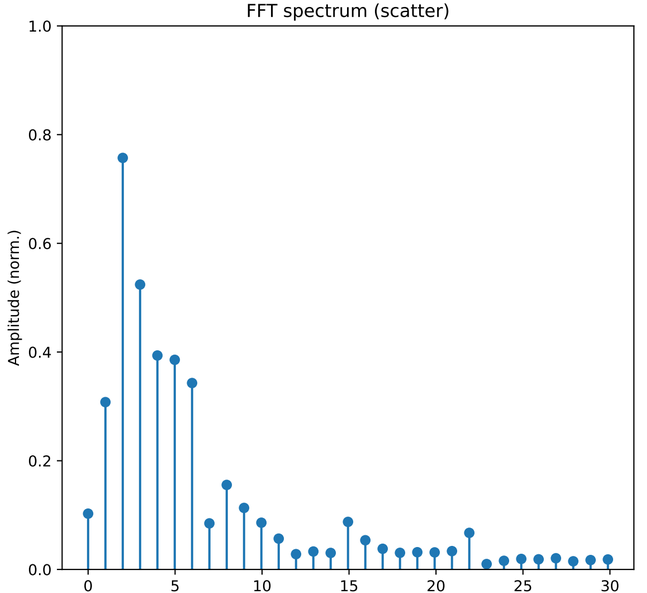

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
0
45
90
135
180
225
270
315
360

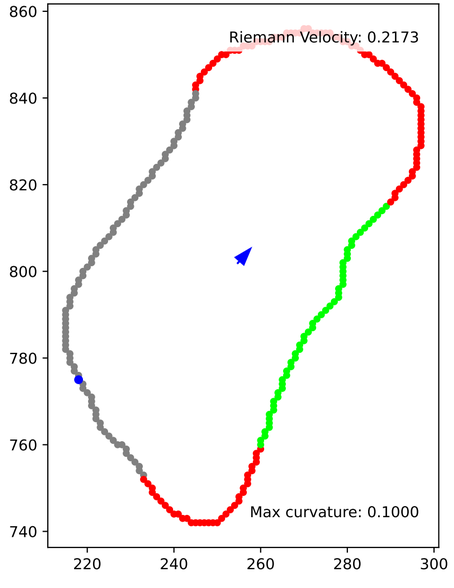

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

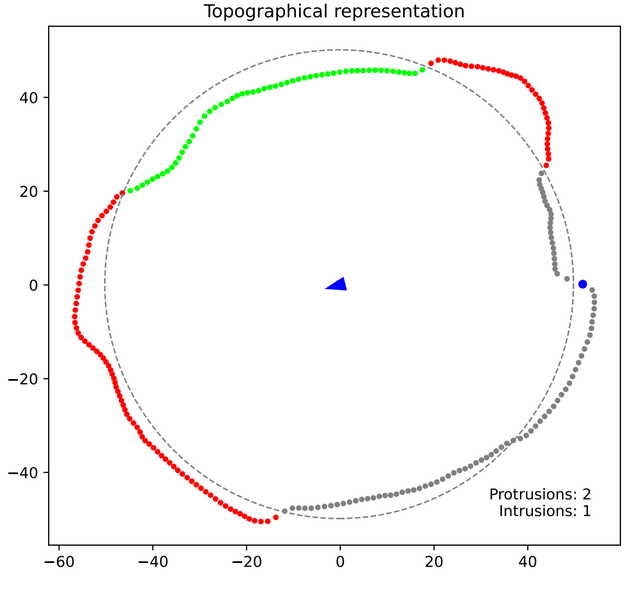

Shape evolution (t = 48.00)
Riemann Velocity: 0.2020
Max curvature: 0.0587
840
820
800
780
760
740
220
240
260
280

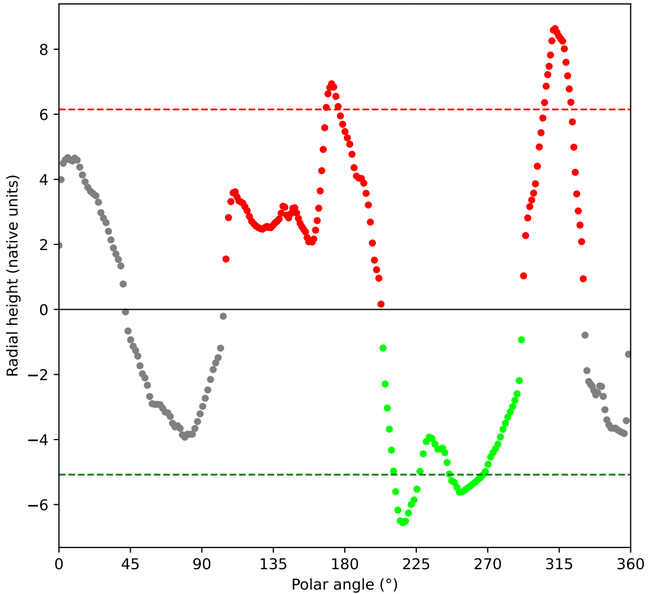

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

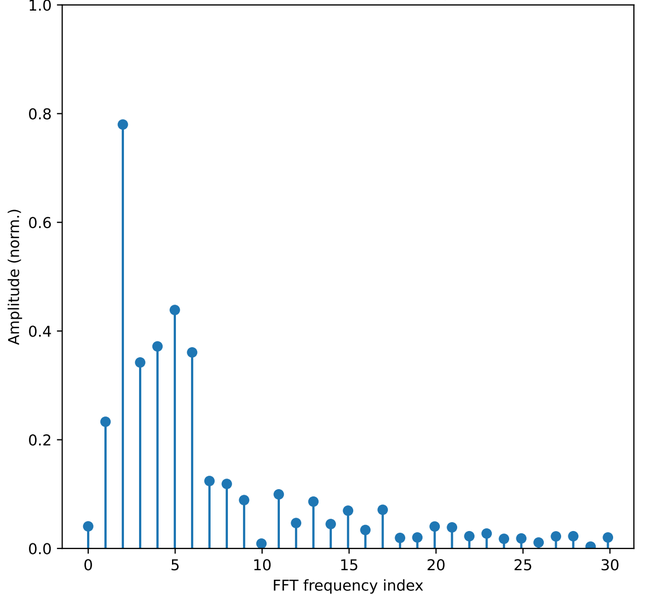

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

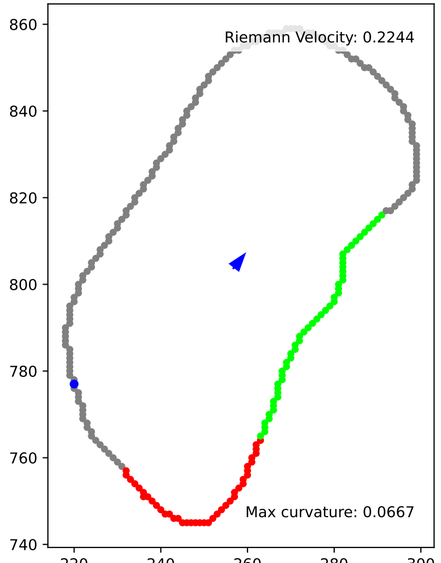

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

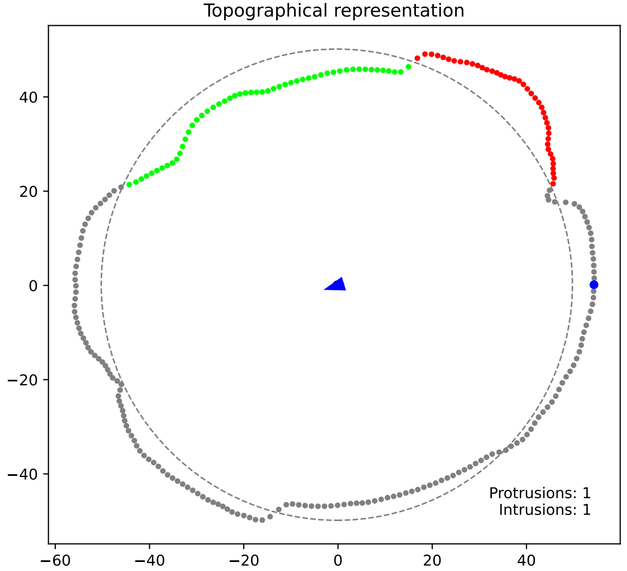

Shape evolution (t = 49.00)
Riemann Velocity: 0.2173
Max curvature: 0.1000
860
840
820
800
780
760
740
220
240
260
280
300

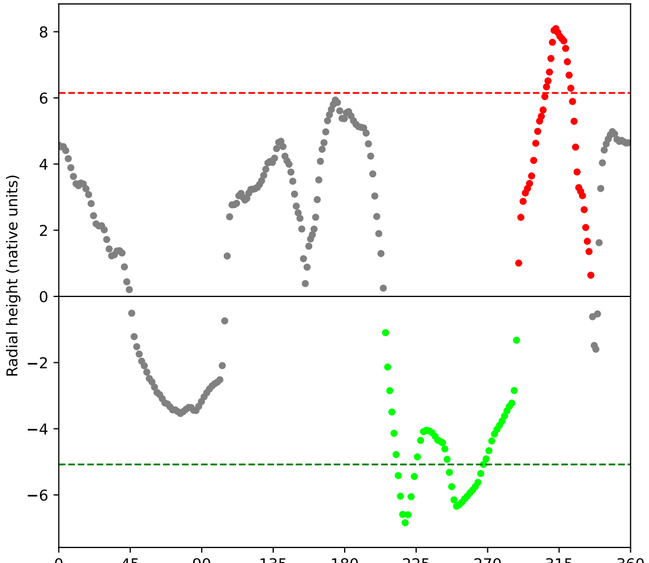

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

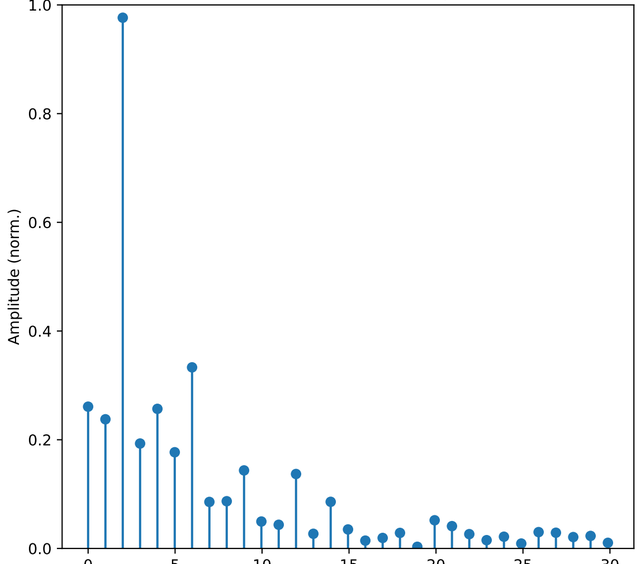

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

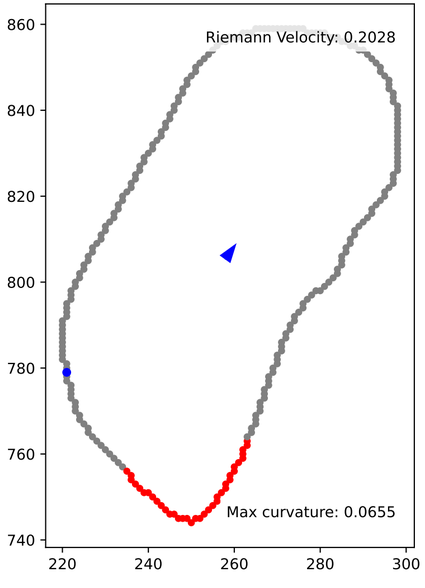

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

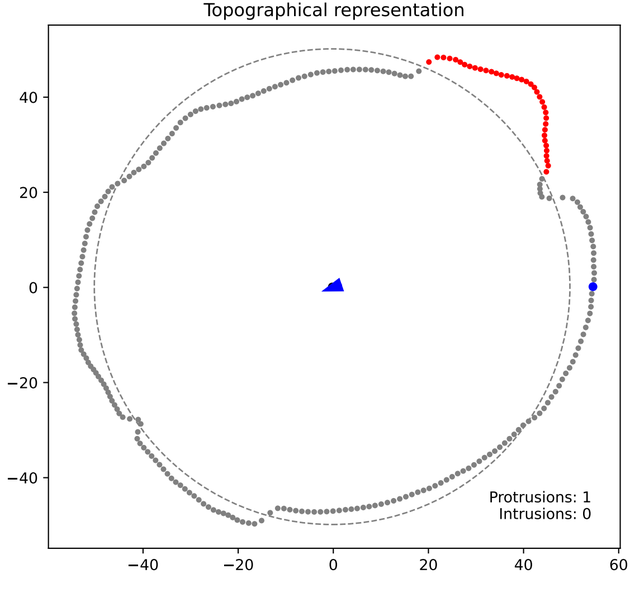

Shape evolution (t = 50.00)
Riemann Velocity: 0.2244
Max curvature: 0.0667
860
840
820
800
780
760
740
220
240
260
280
300

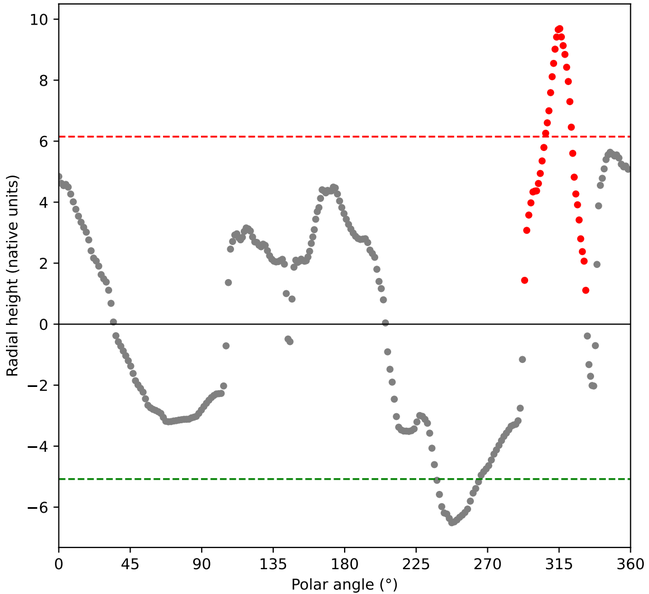

Topographical representation
Protrusions: 1
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

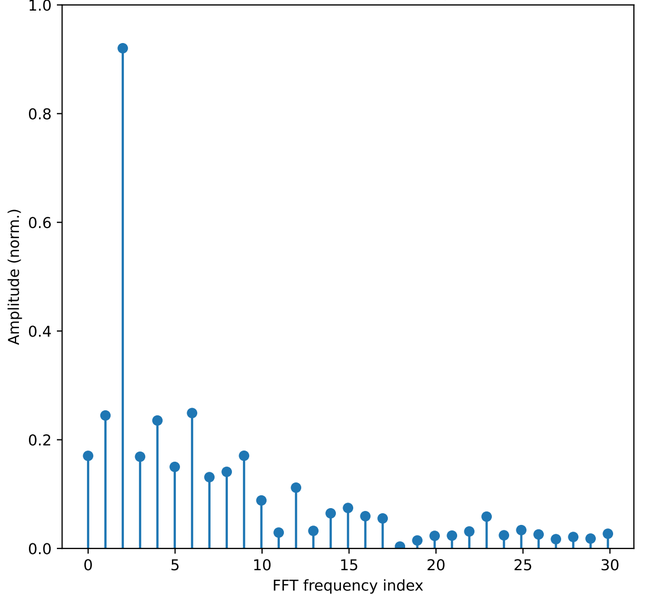

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

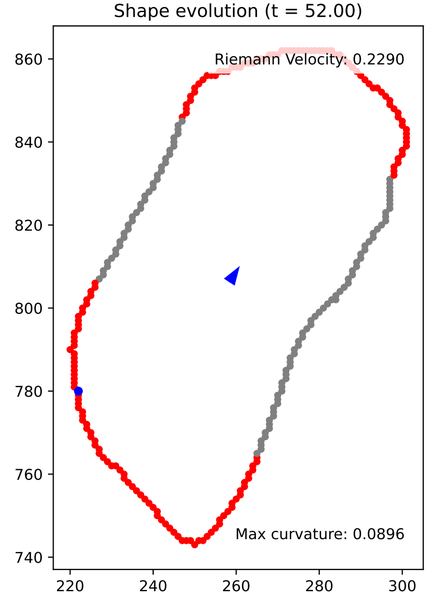

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

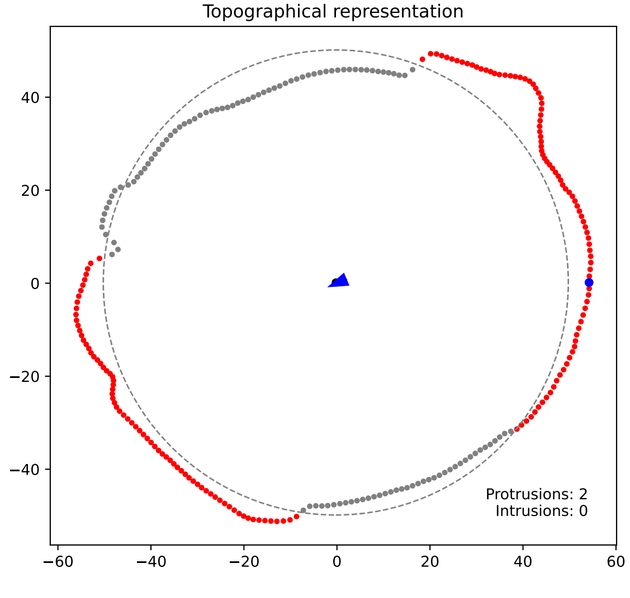

Shape evolution (t = 51.00)
Riemann Velocity: 0.2028
Max curvature: 0.0655
860
840
820
800
780
760
740
220
240
260
280
300

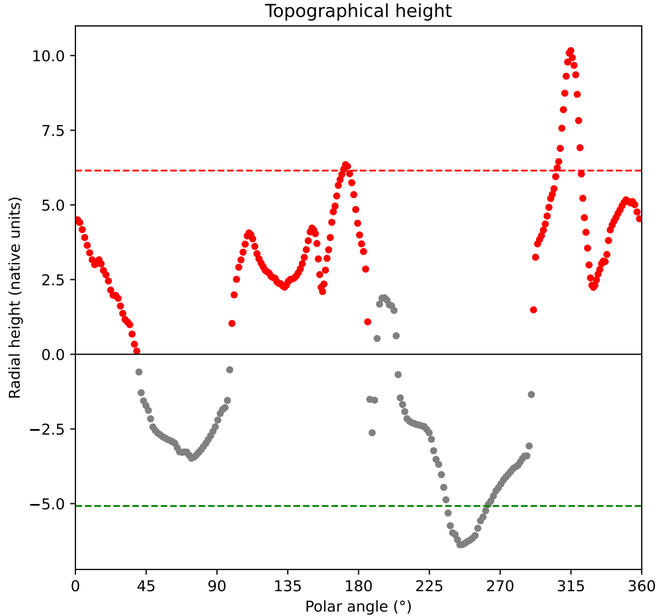

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

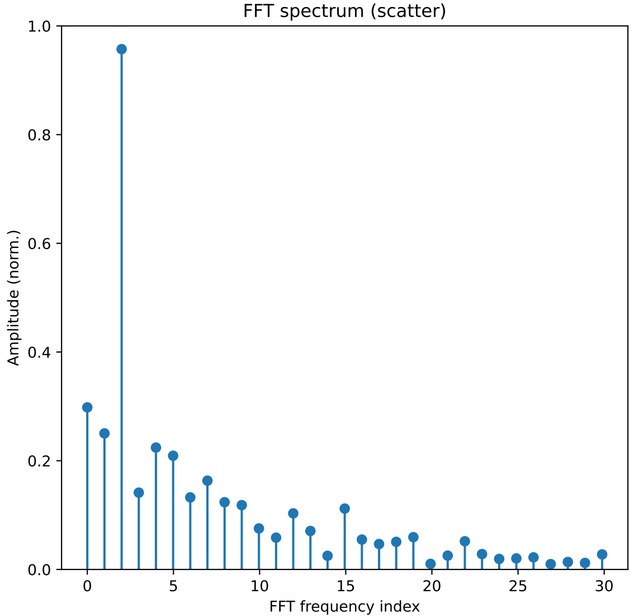

Topographical height
Radial height (native units)
Polar angle (°)
10
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

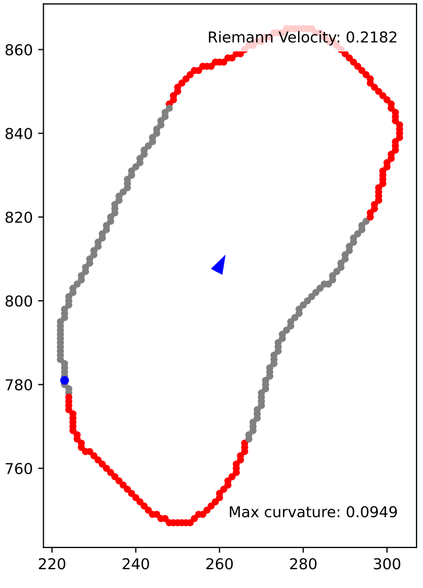

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

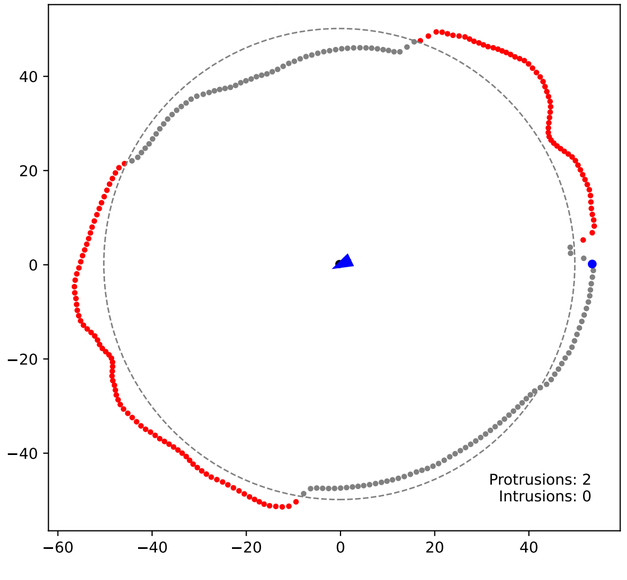

Shape evolution (t = 52.00)
Riemann Velocity: 0.2290
Max curvature: 0.0896
860
840
820
800
780
760
740
220
240
260
280
300

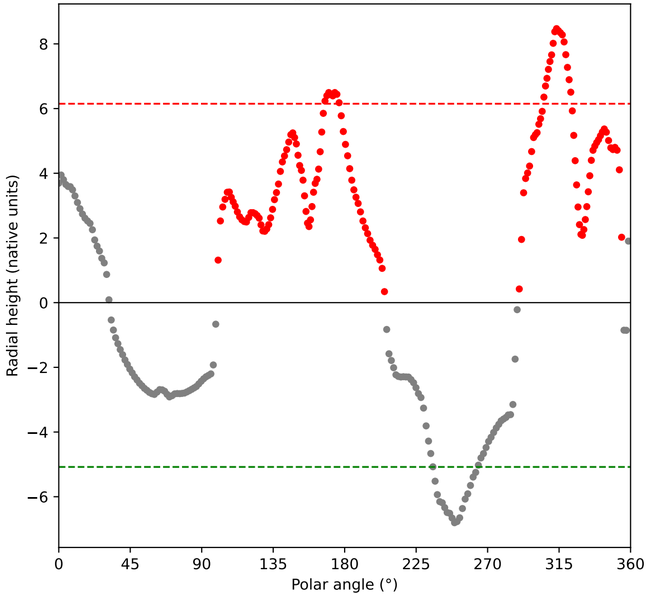

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40
60

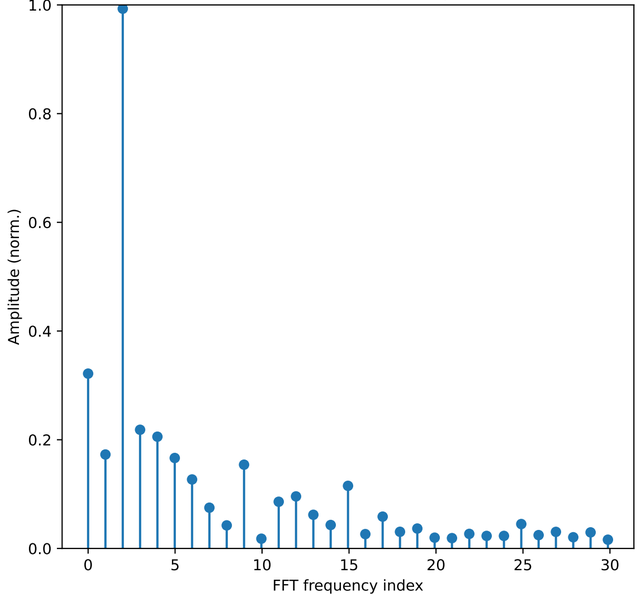

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
0
45
90
135
180
225
270
315
360

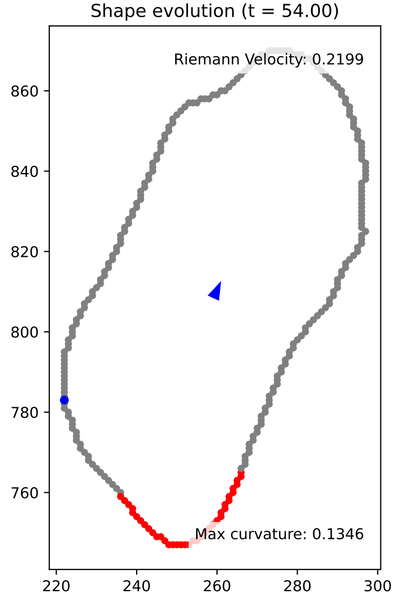

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

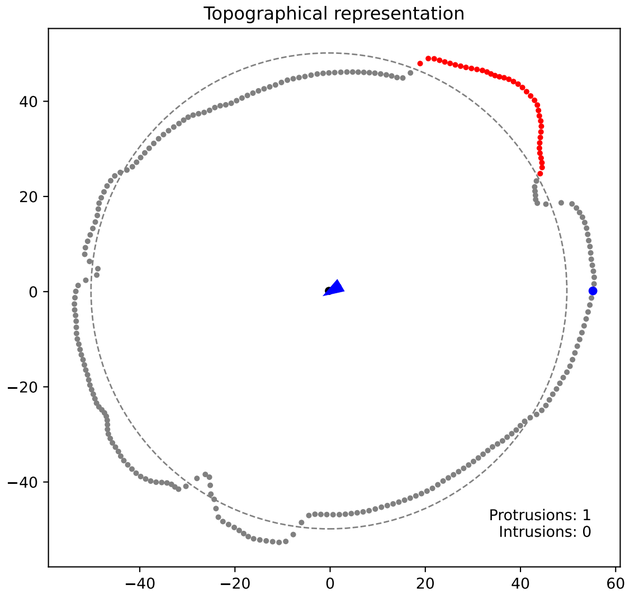

Shape evolution (t = 53.00)
Riemann Velocity: 0.2182
Max curvature: 0.0949
860
840
820
800
780
760
220
240
260
280
300

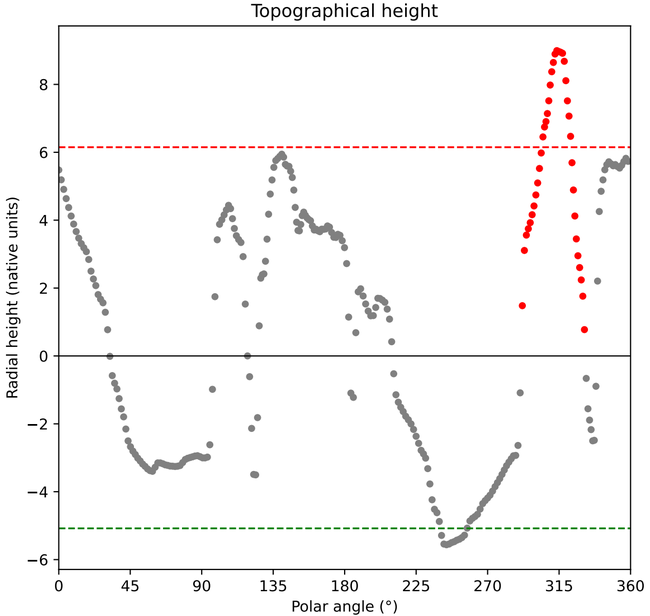

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

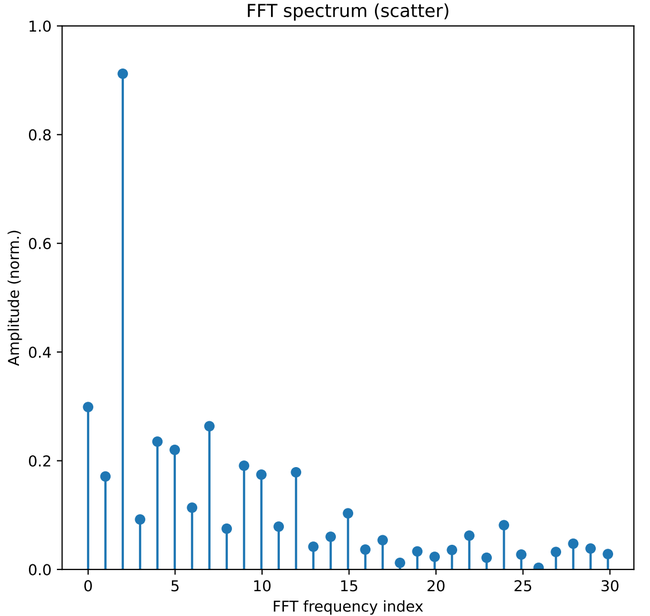

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

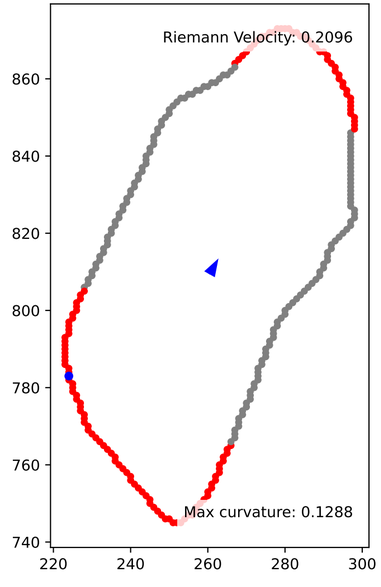

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

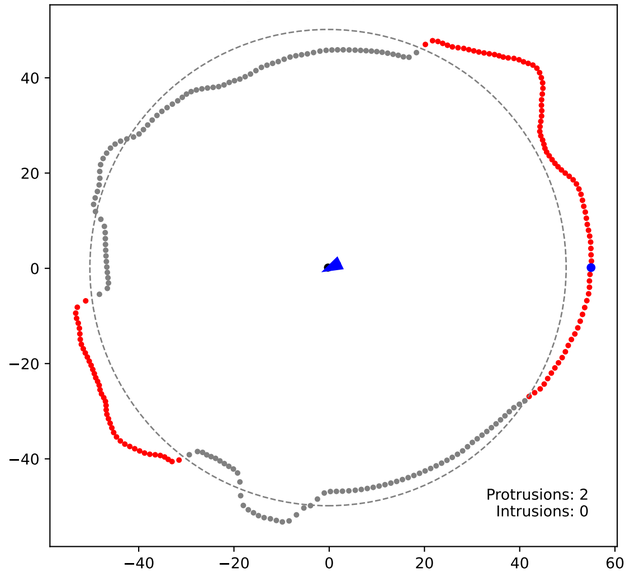

Shape evolution (t = 54.00)
Riemann Velocity: 0.2199
Max curvature: 0.1346
860
840
820
800
780
760
220
240
260
280
300

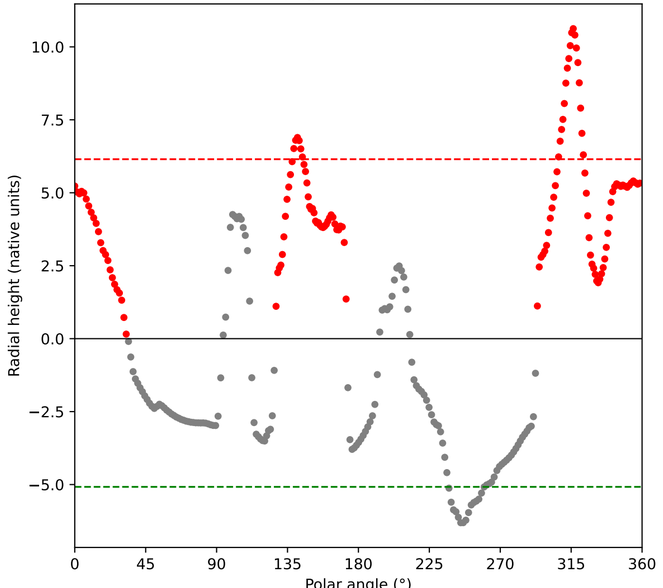

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

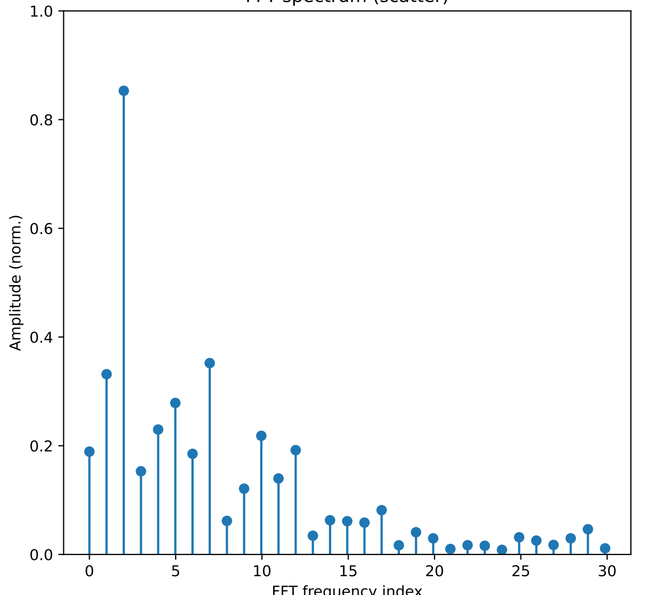

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

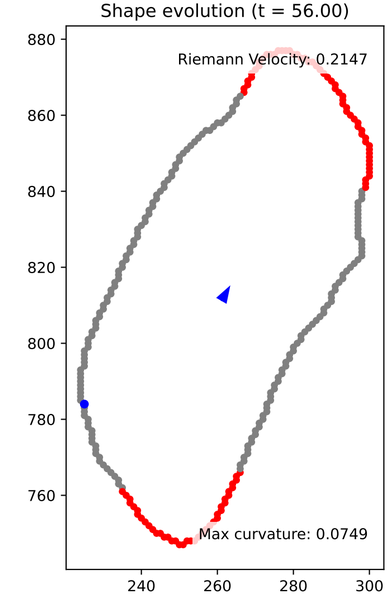

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

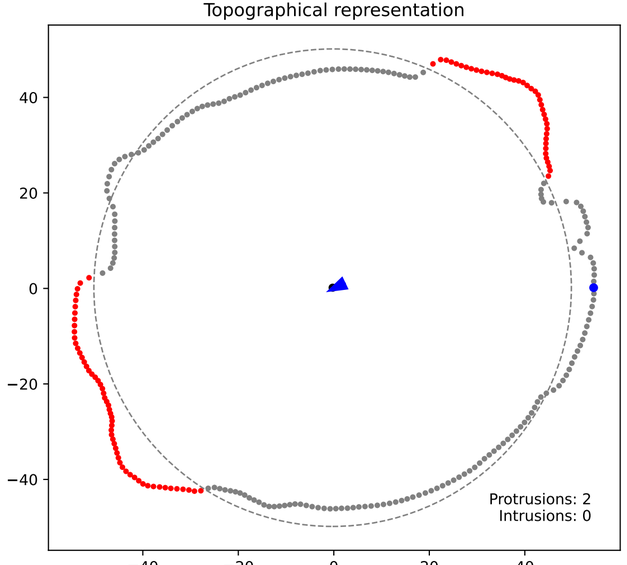

Shape evolution (t = 55.00)
Riemann Velocity: 0.2096
Max curvature: 0.1288
860
840
820
800
780
760
740
220
240
260
280
300

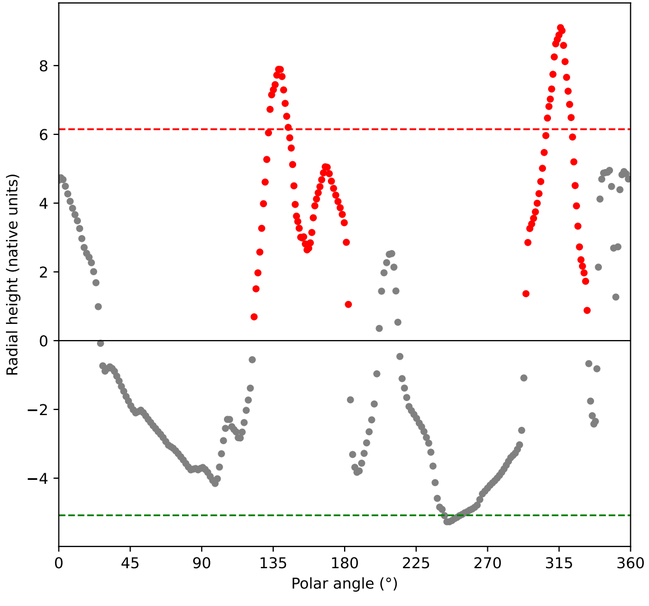

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

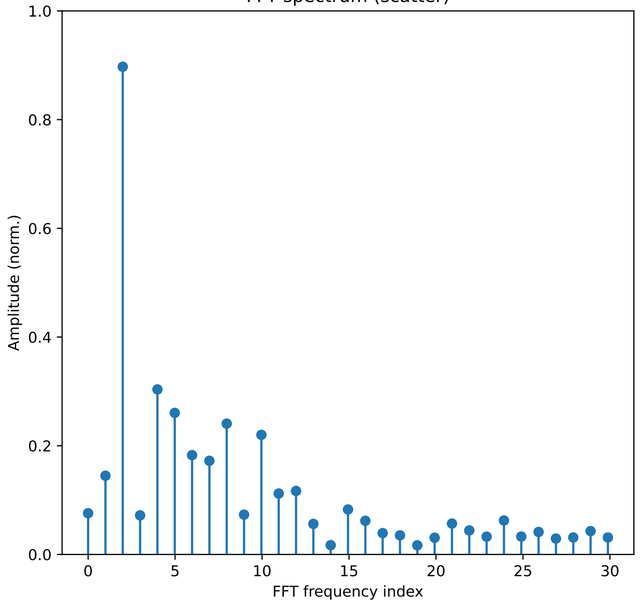

Topographical height
Radial height (native units)
Polar angle (°)
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
0
45
90
135
180
225
270
315
360

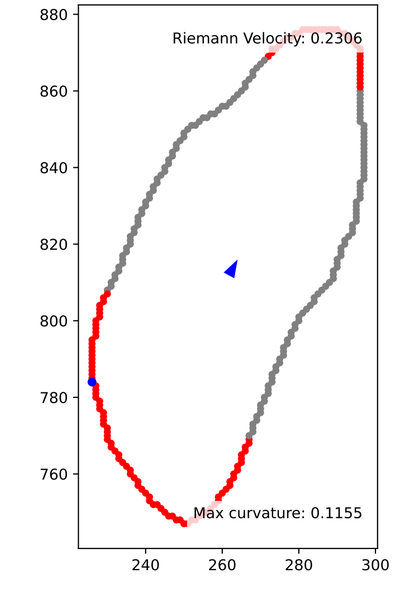

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

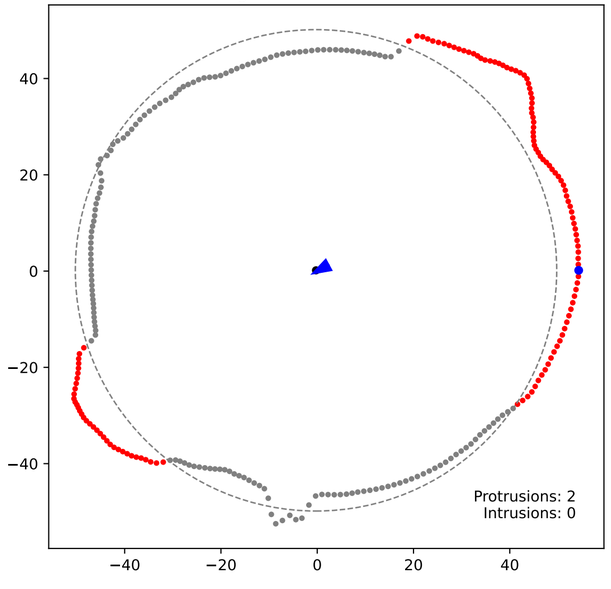

Shape evolution (t = 56.00)
Riemann Velocity: 0.2147
Max curvature: 0.0749
880
860
840
820
800
780
760
240
260
280
300

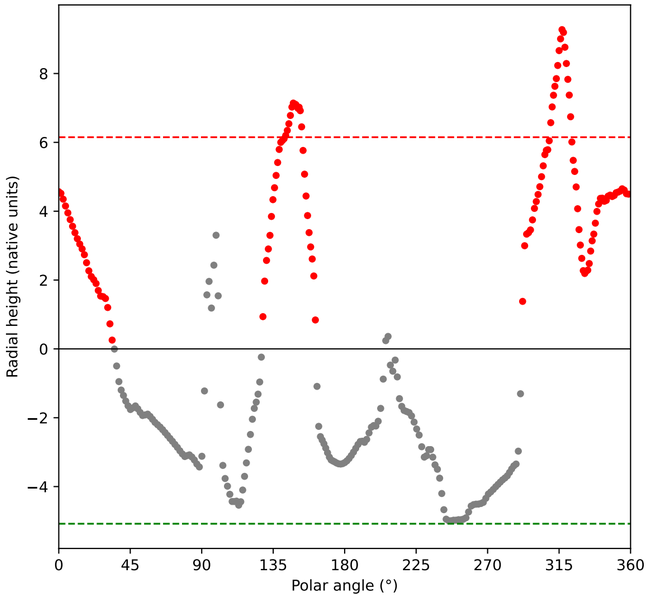

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

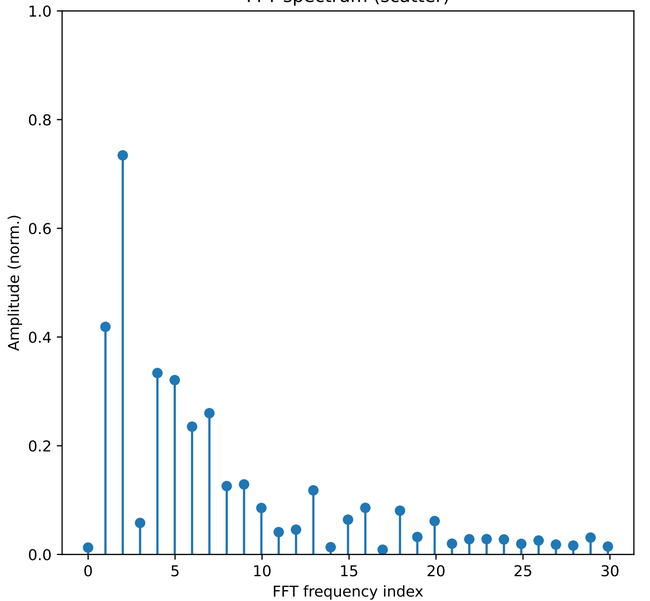

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

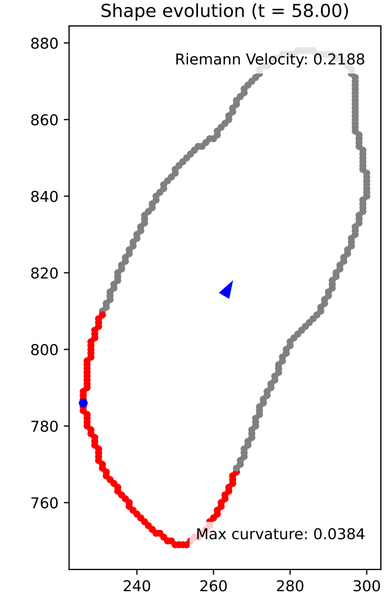

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

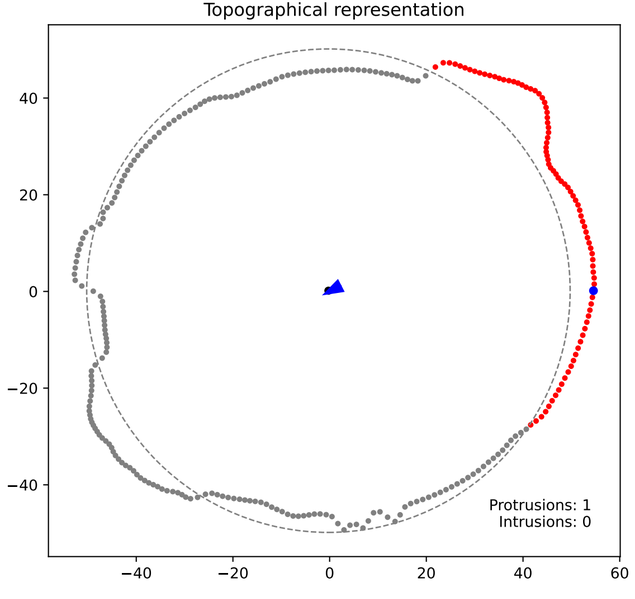

Shape evolution (t = 57.00)
Riemann Velocity: 0.2306
Max curvature: 0.1155

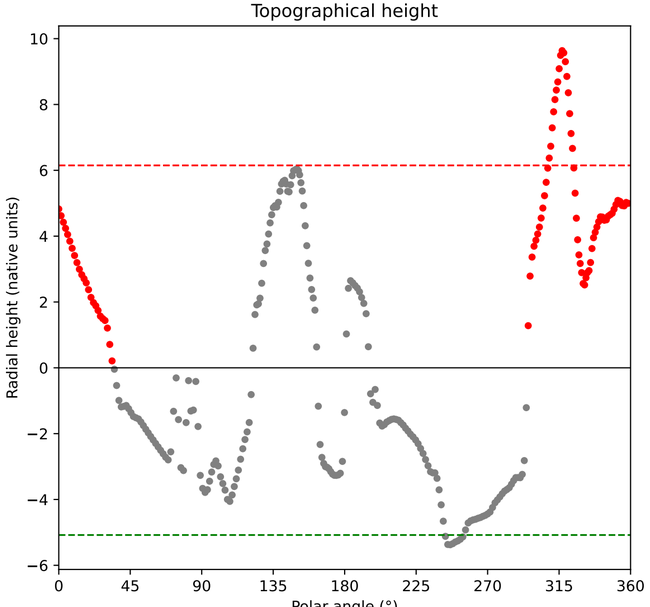

Topographical representation
Protrusions: 2
Intrusions: 0

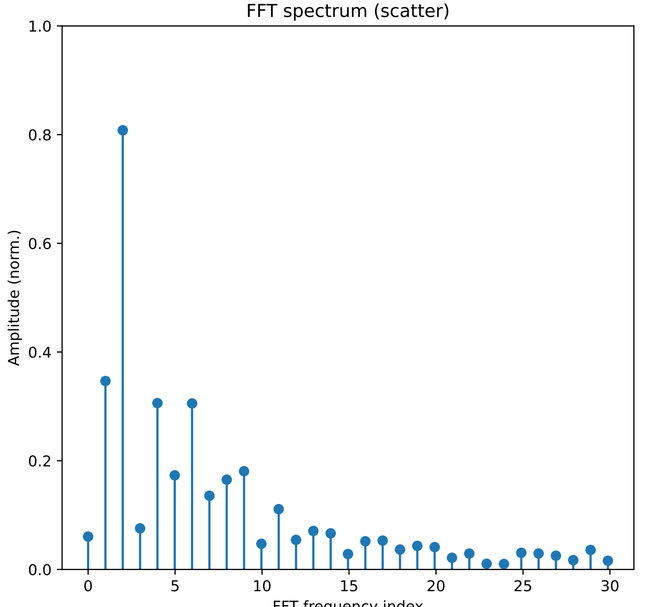

Topographical height
Radial height (native units)
Polar angle (°)

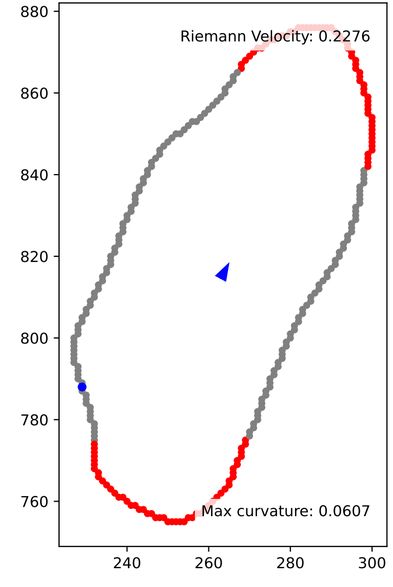

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index

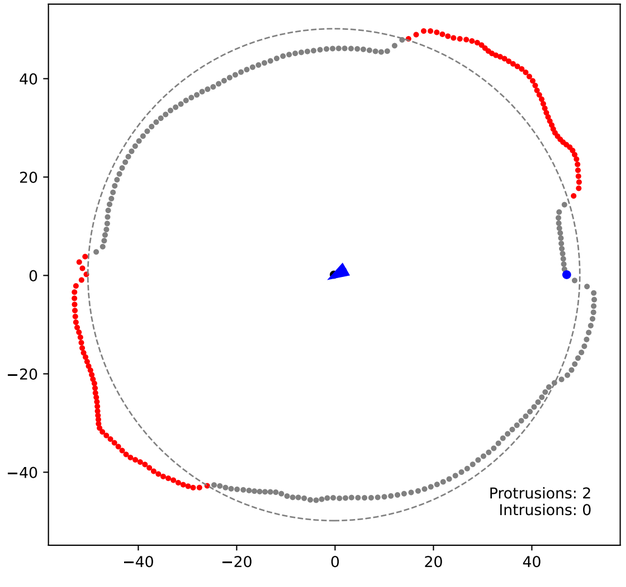

Shape evolution (t = 58.00)
Riemann Velocity: 0.2188
Max curvature: 0.0384
880
860
840
820
800
780
760
240
260
280
300

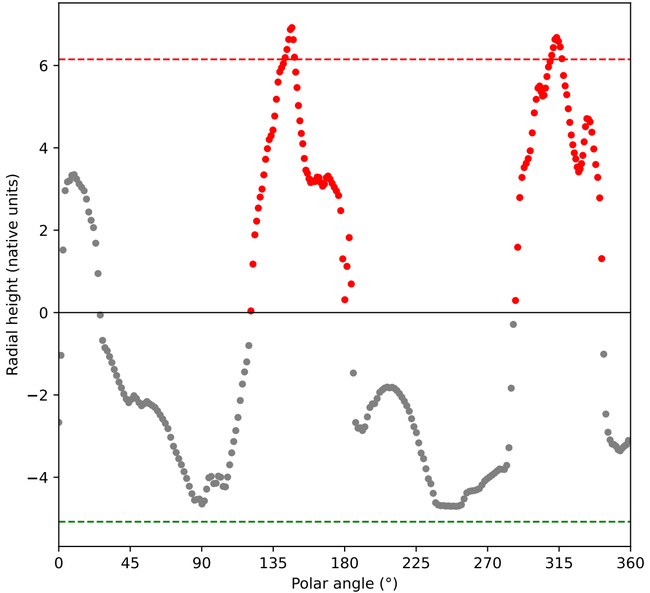

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

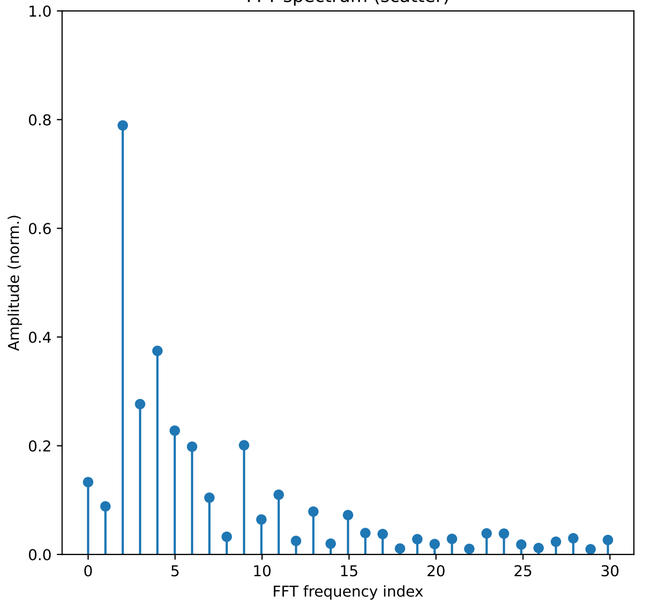

Topographical height
Radial height (native units)
Polar angle (°)
10
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

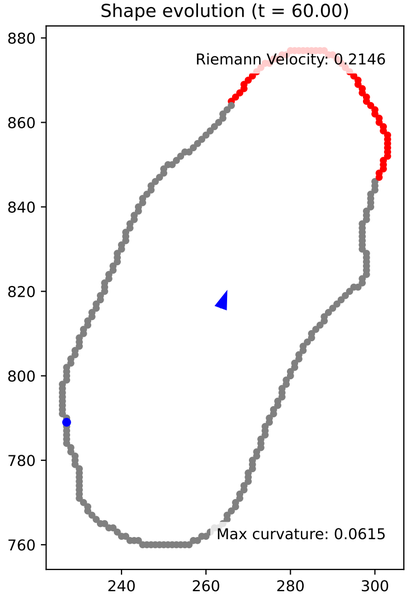

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

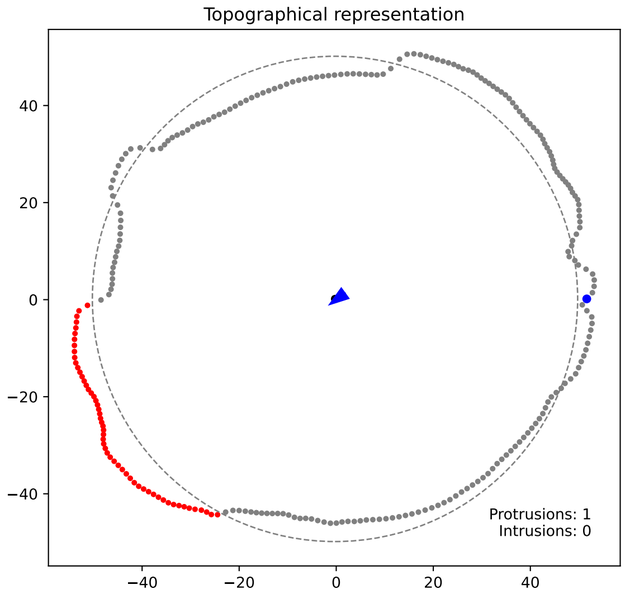

Shape evolution (t = 59.00)
Riemann Velocity: 0.2276
Max curvature: 0.0607
880
860
840
820
800
780
760
240
260
280
300

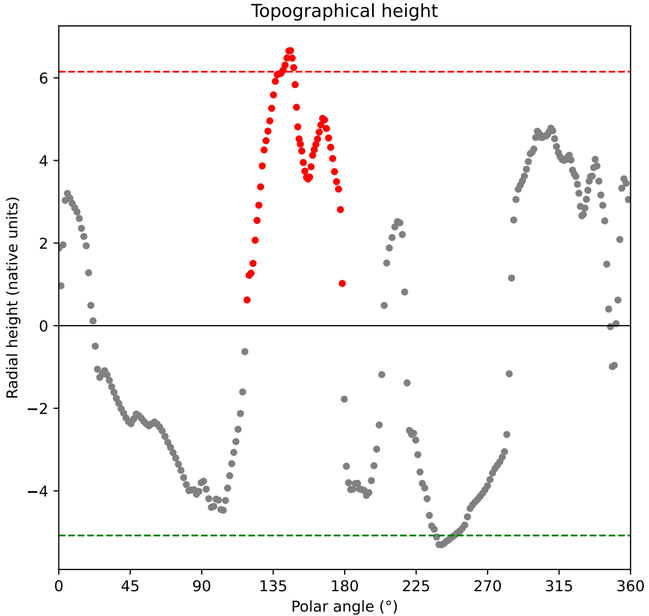

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

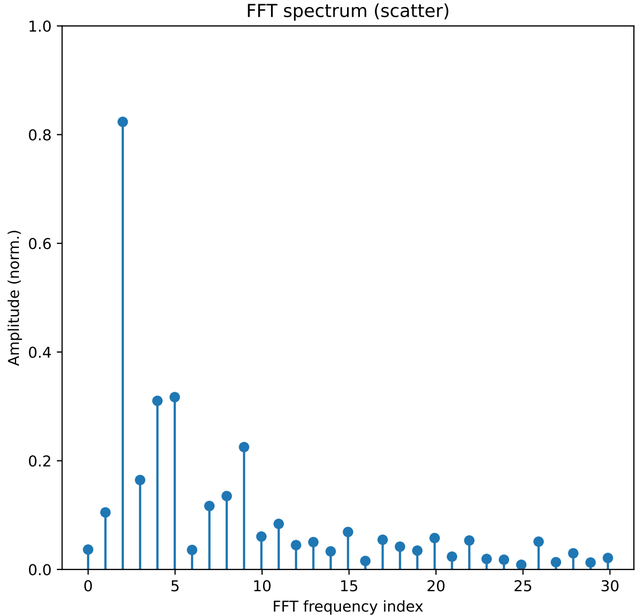

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

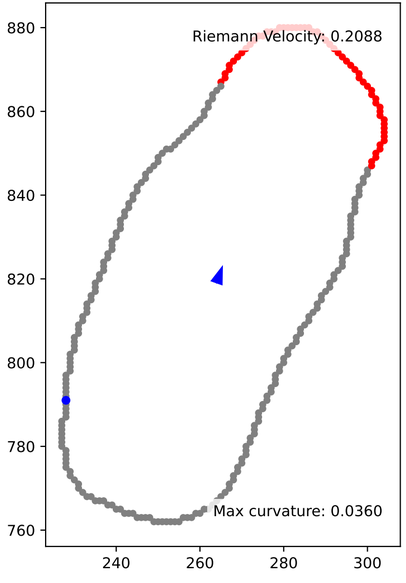

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

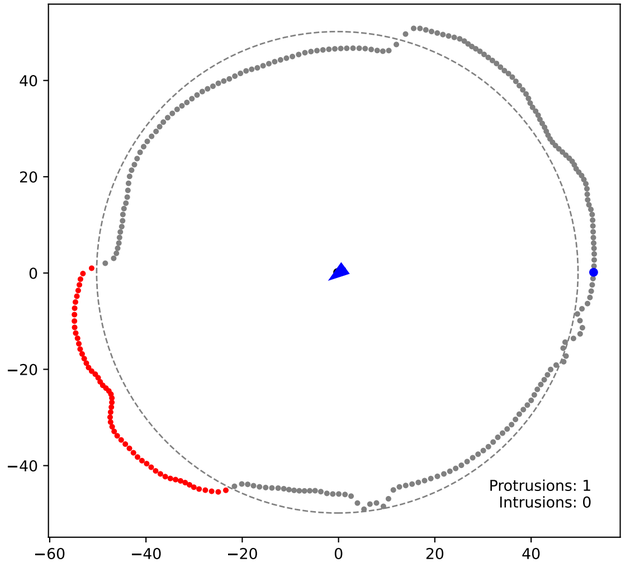

Shape evolution (t = 60.00)
Riemann Velocity: 0.2146
Max curvature: 0.0615
880
860
840
820
800
780
760
240
260
280
300

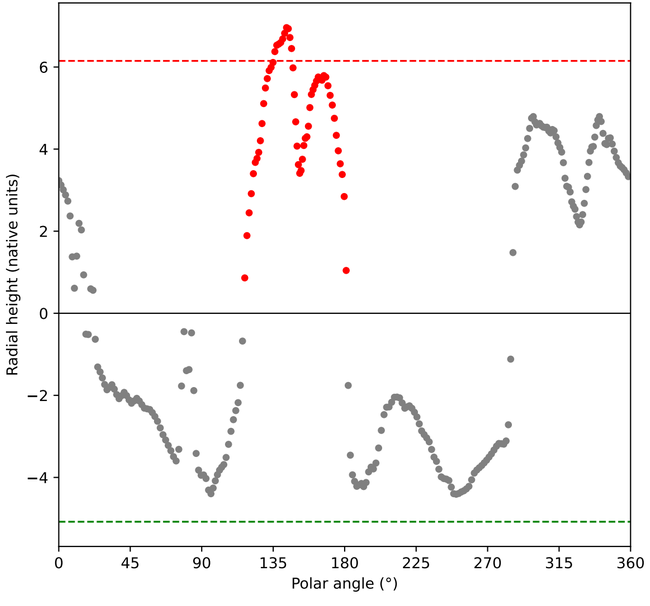

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

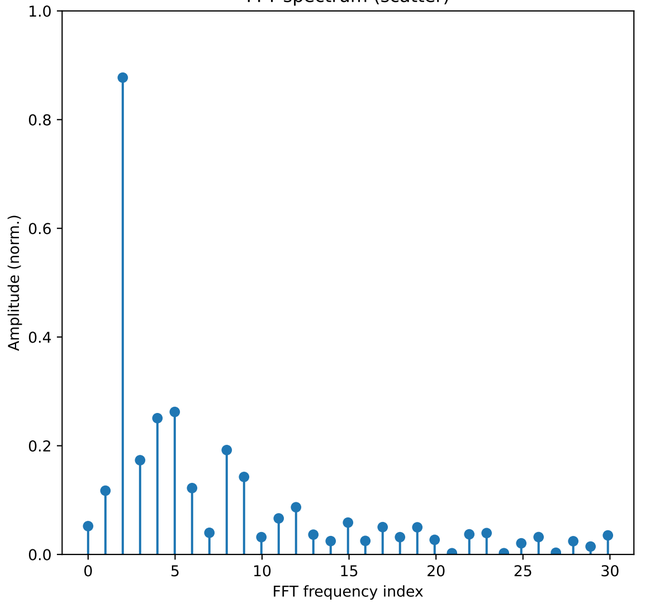

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

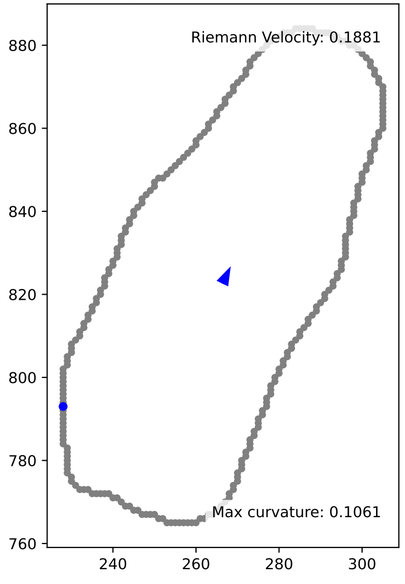

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

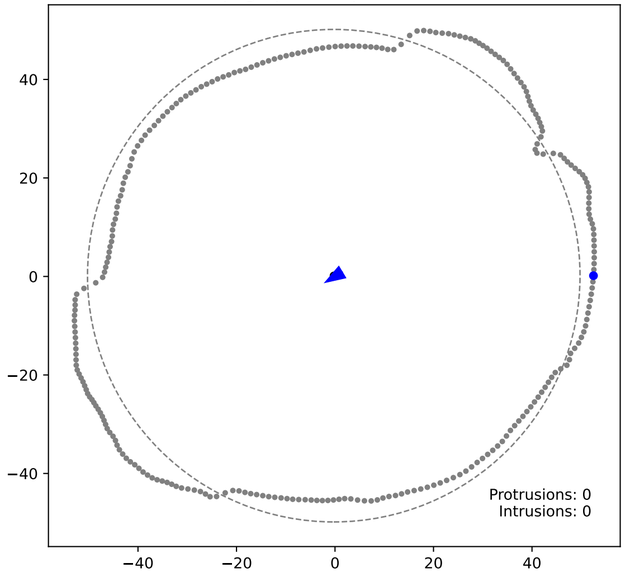

Shape evolution (t = 61.00)
Riemann Velocity: 0.2088
Max curvature: 0.0360
880
860
840
820
800
780
760
240
260
280
300

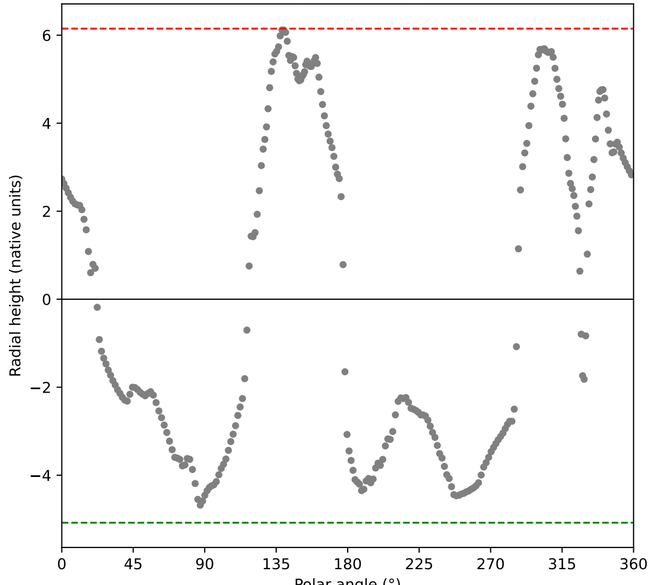

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

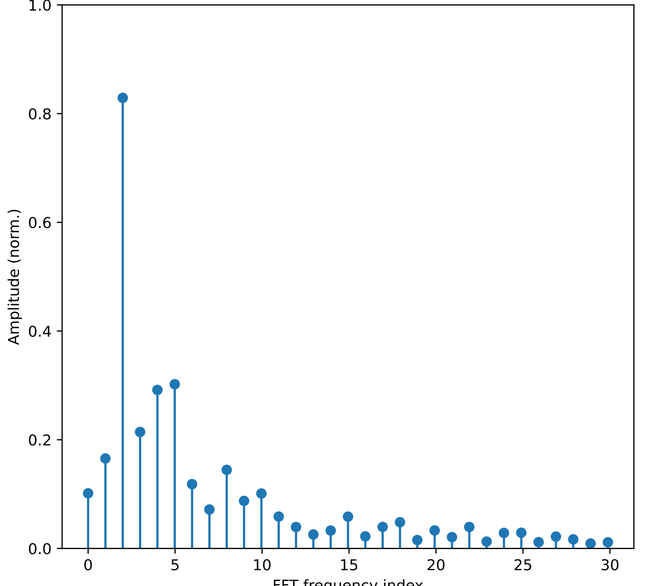

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

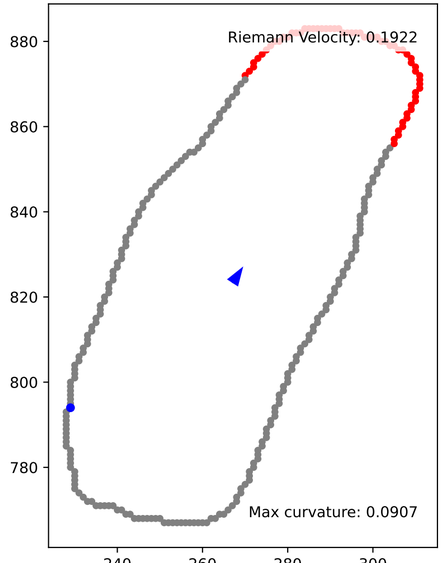

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

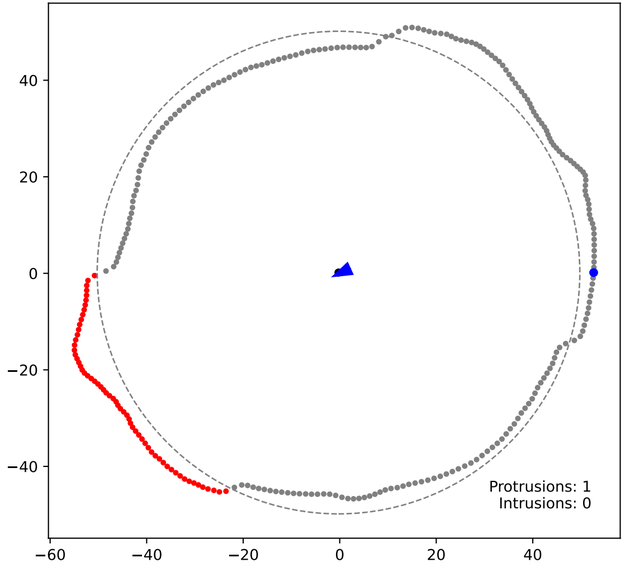

Shape evolution (t = 62.00)
Riemann Velocity: 0.1881
Max curvature: 0.1061
880
860
840
820
800
780
760
240
260
280
300

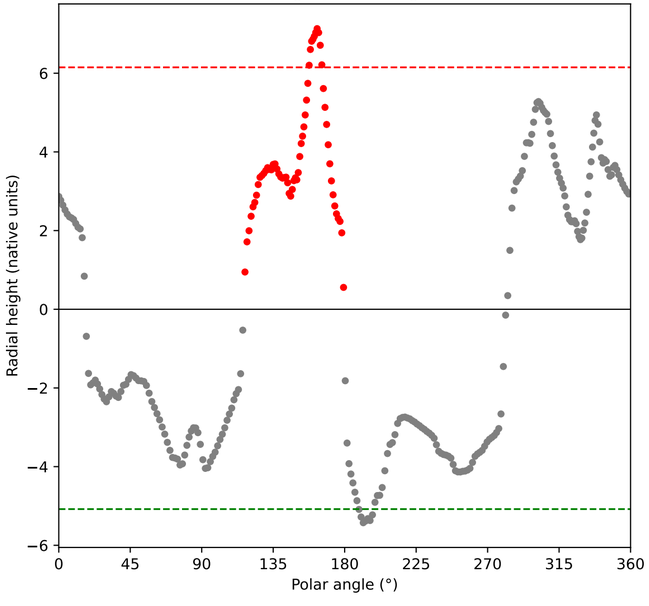

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

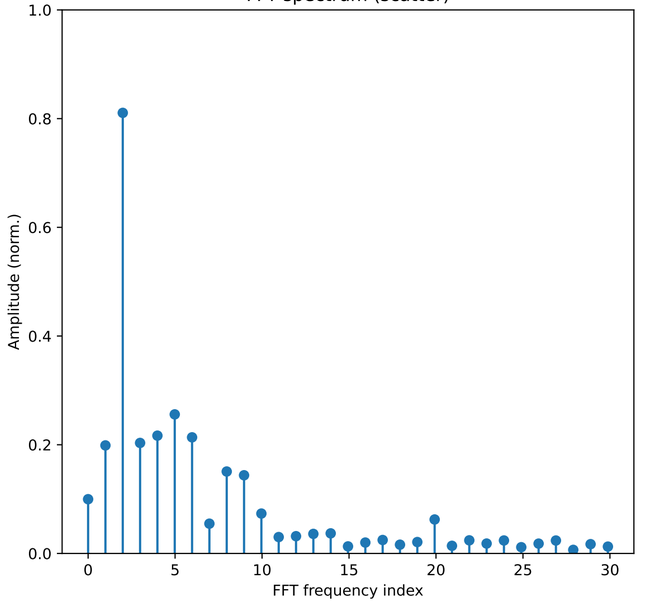

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

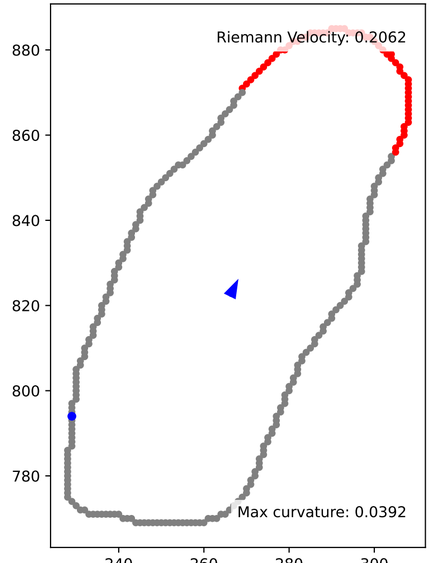

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

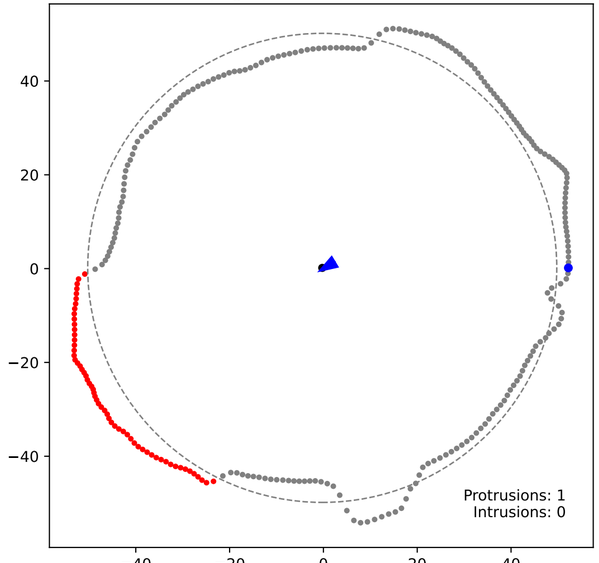

Shape evolution (t = 63.00)
Riemann Velocity: 0.1922
Max curvature: 0.0907
880
860
840
820
800
780
240
260
280
300

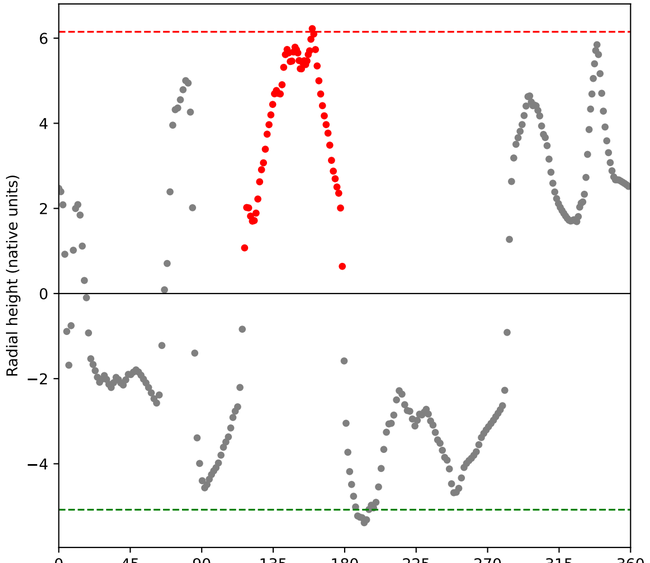

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−60
−40
−20
0
20
40

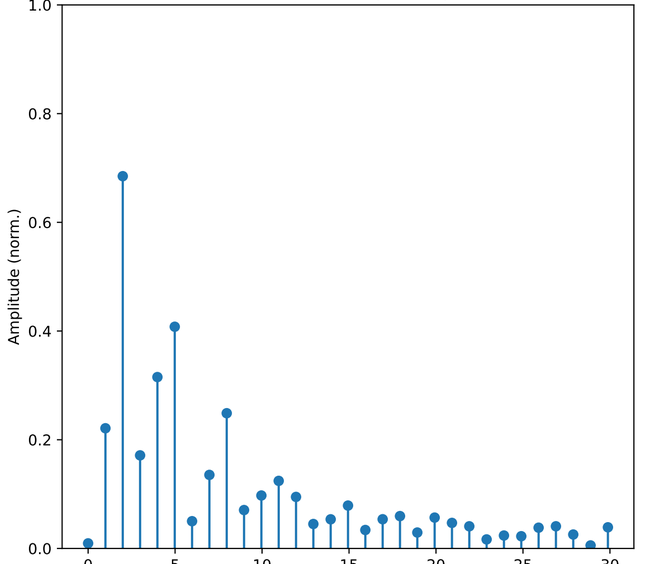

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

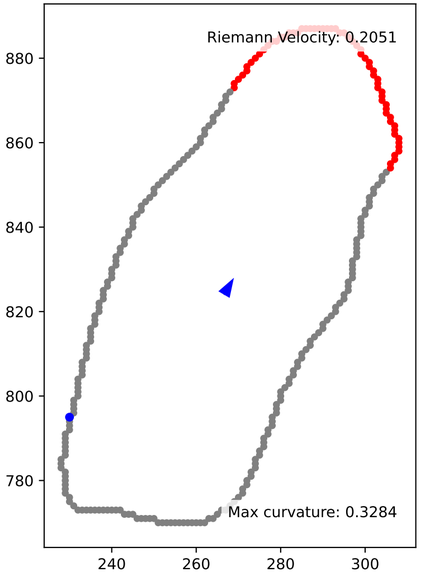

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

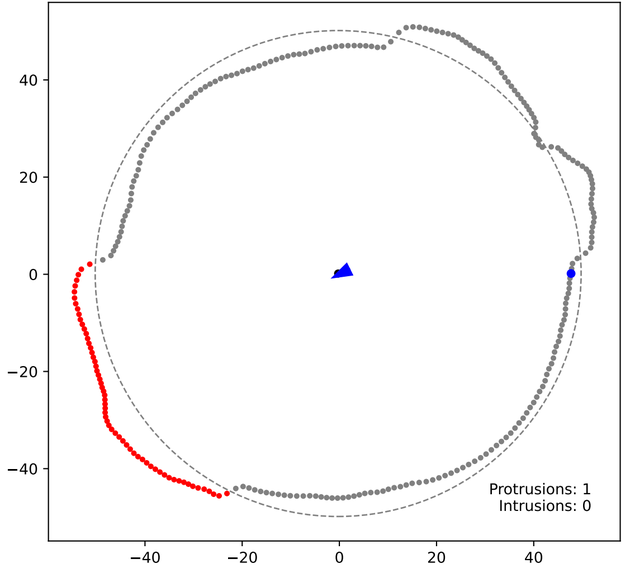

Shape evolution (t = 64.00)
Riemann Velocity: 0.2062
Max curvature: 0.0392
880
860
840
820
800
780
240
260
280
300

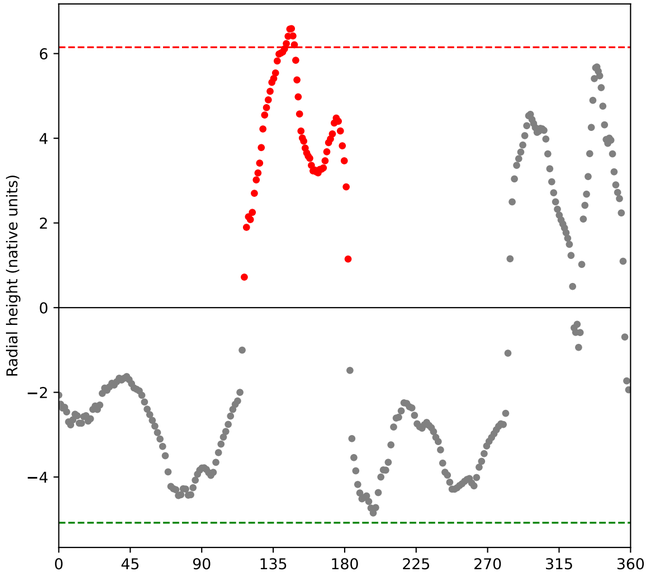

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

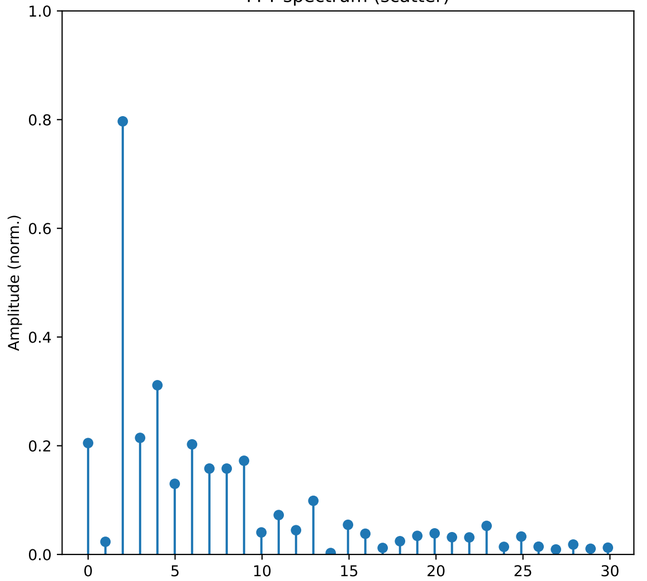

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

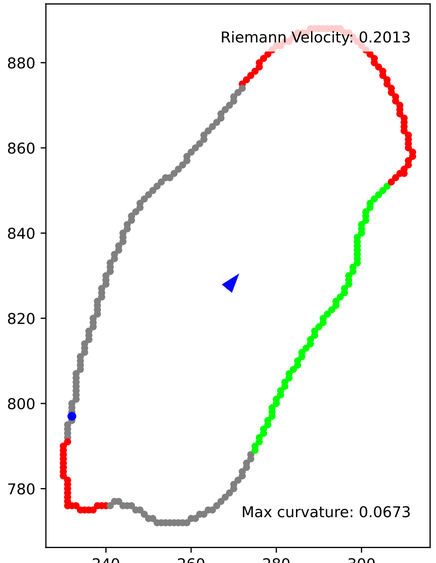

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

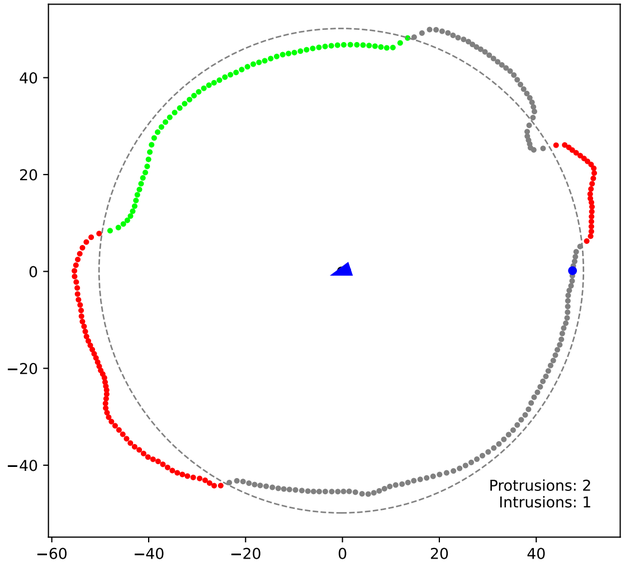

Shape evolution (t = 65.00)
Riemann Velocity: 0.2051
Max curvature: 0.3284
880
860
840
820
800
780
240
260
280
300

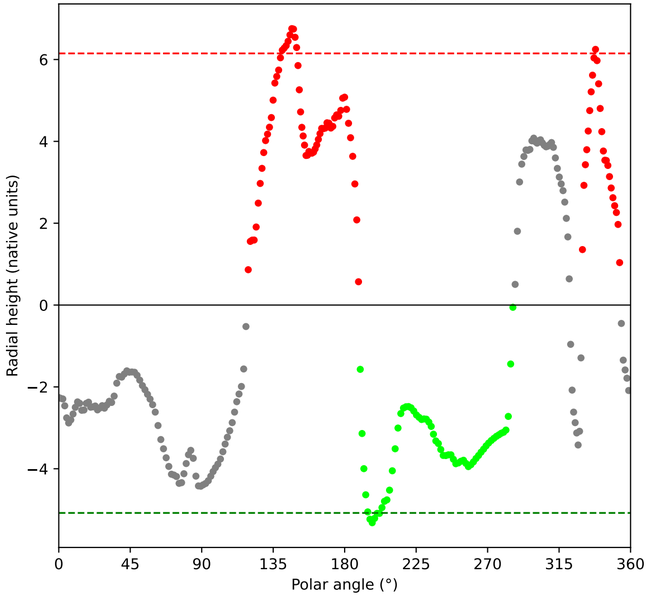

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

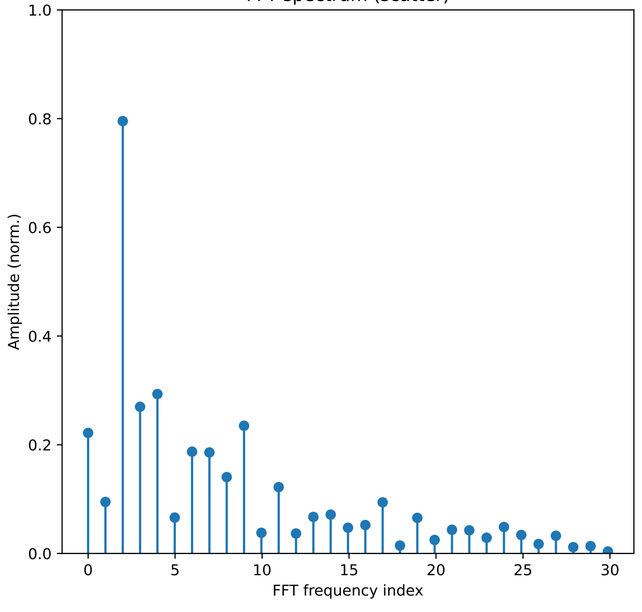

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

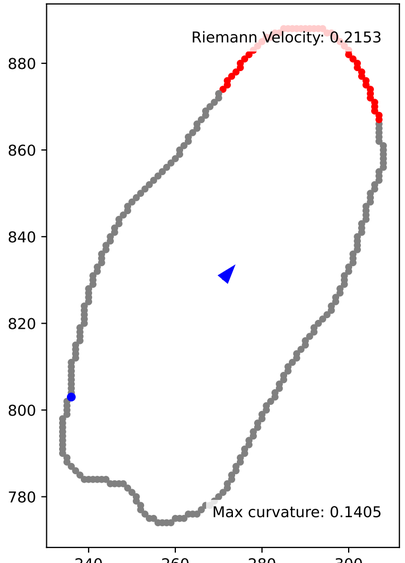

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

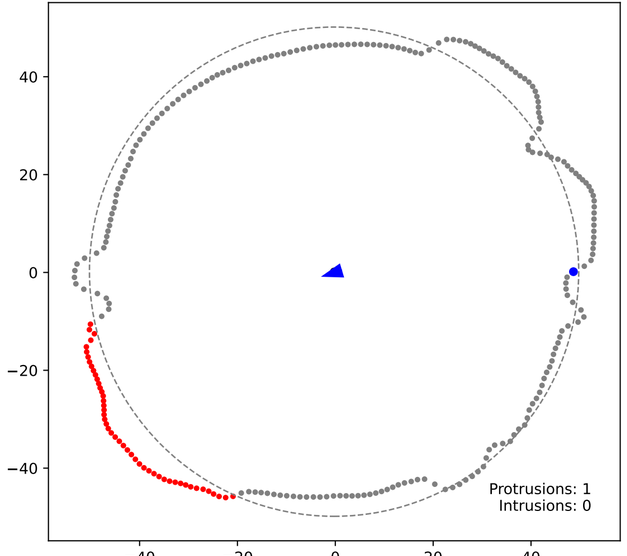

Shape evolution (t = 66.00)
Riemann Velocity: 0.2013
Max curvature: 0.0673
880
860
840
820
800
780
240
260
280
300

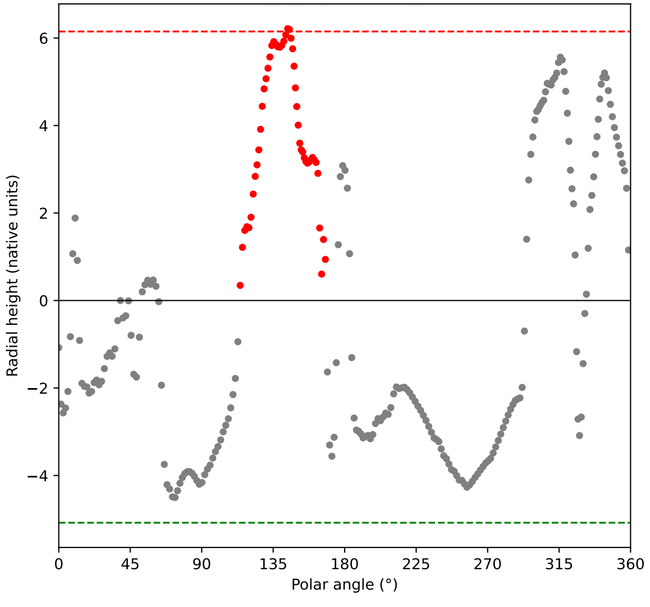

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−60
−40
−20
0
20
40

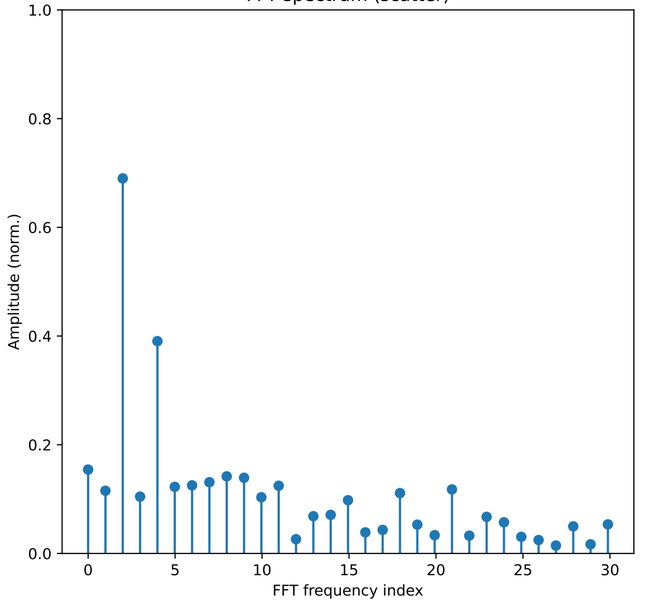

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

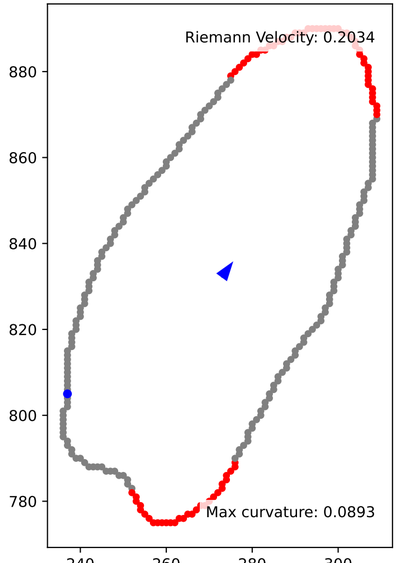

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

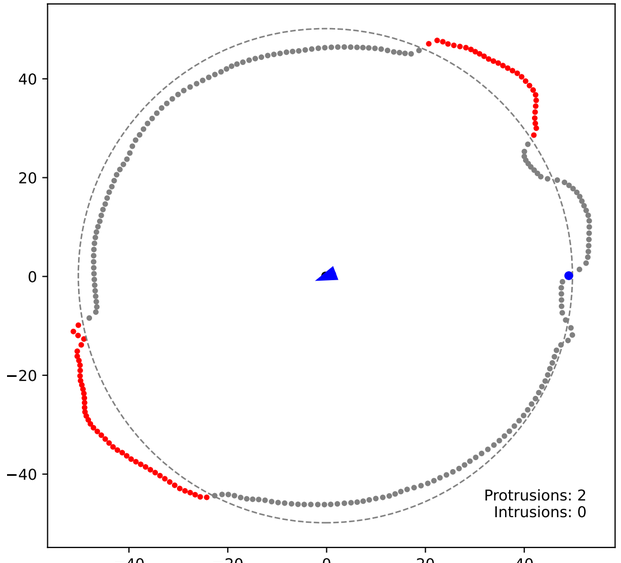

Shape evolution (t = 67.00)
Riemann Velocity: 0.2153
Max curvature: 0.1405
880
860
840
820
800
780
240
260
280
300

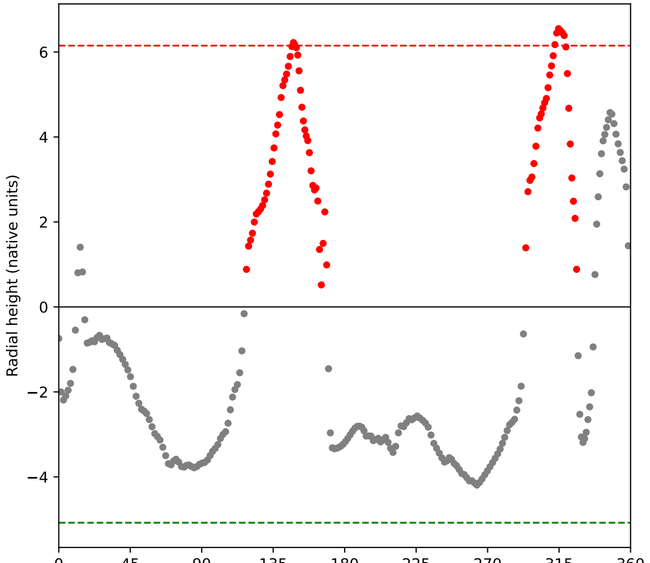

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

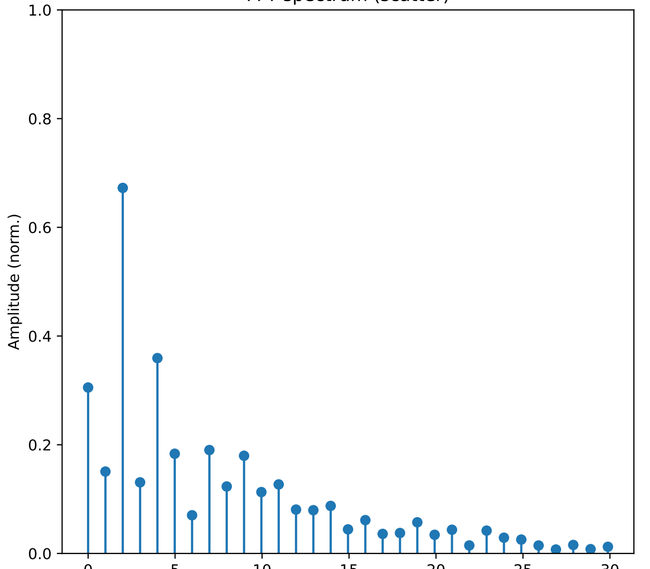

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

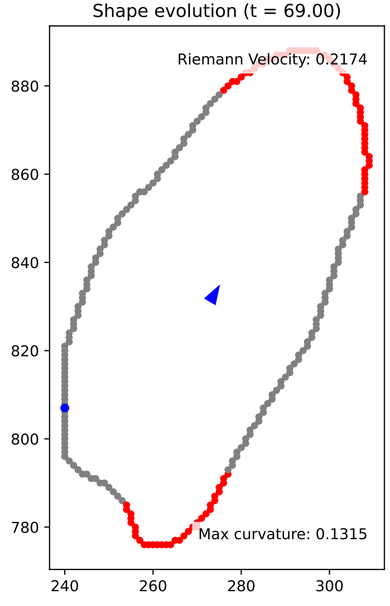

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

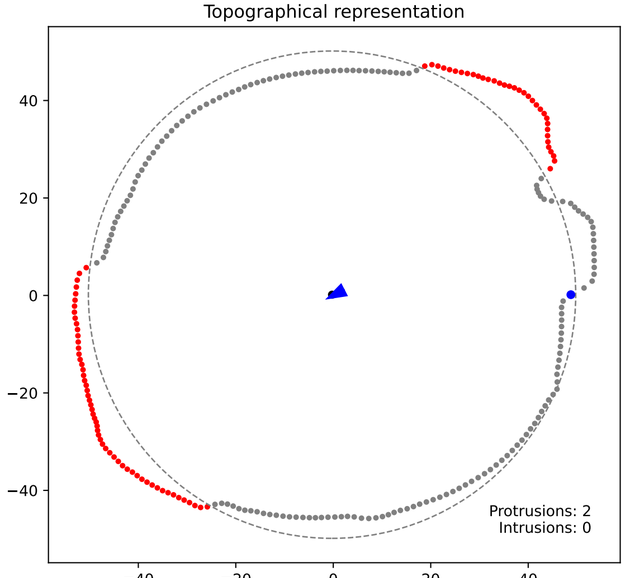

Shape evolution (t = 68.00)
Riemann Velocity: 0.2034
Max curvature: 0.0893
880
860
840
820
800
780
240
260
280
300

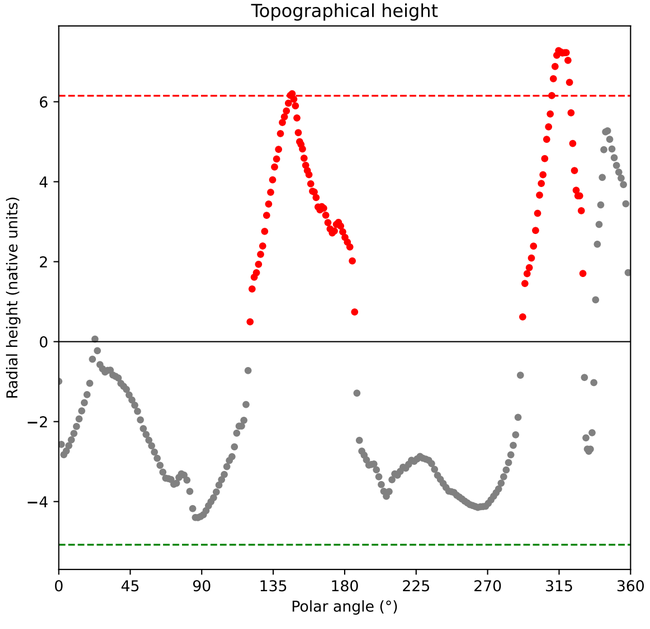

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

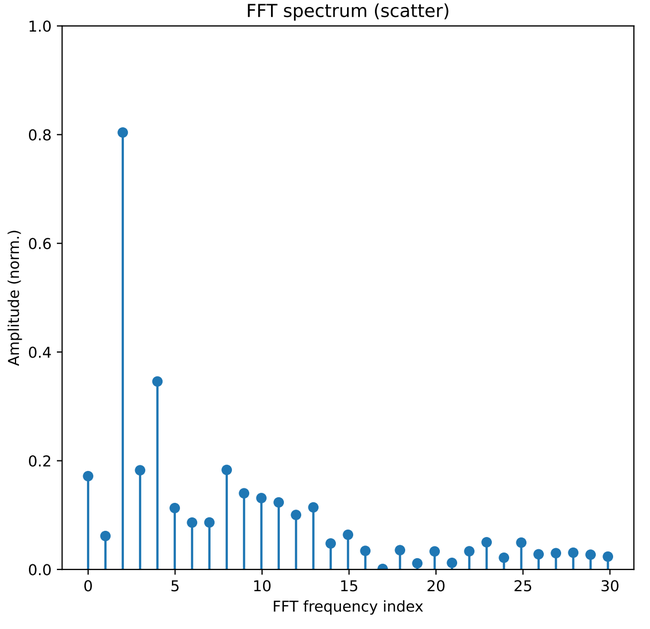

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

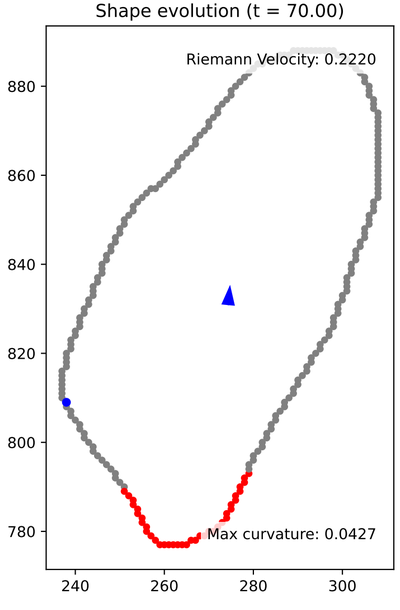

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

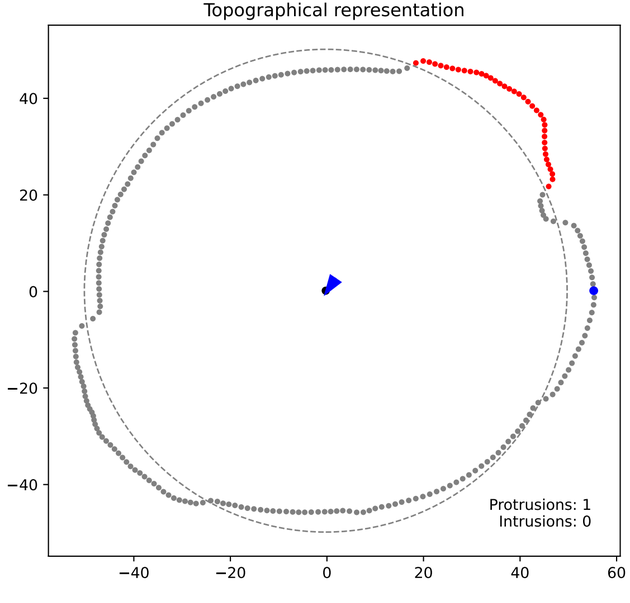

Shape evolution (t = 69.00)
Riemann Velocity: 0.2174
Max curvature: 0.1315
880
860
840
820
800
780
240
260
280
300

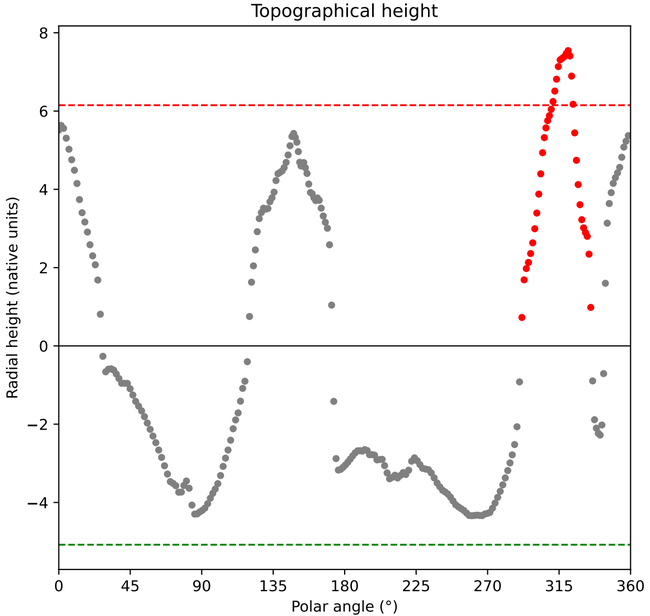

Topographical representation
Protrusions: 2
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

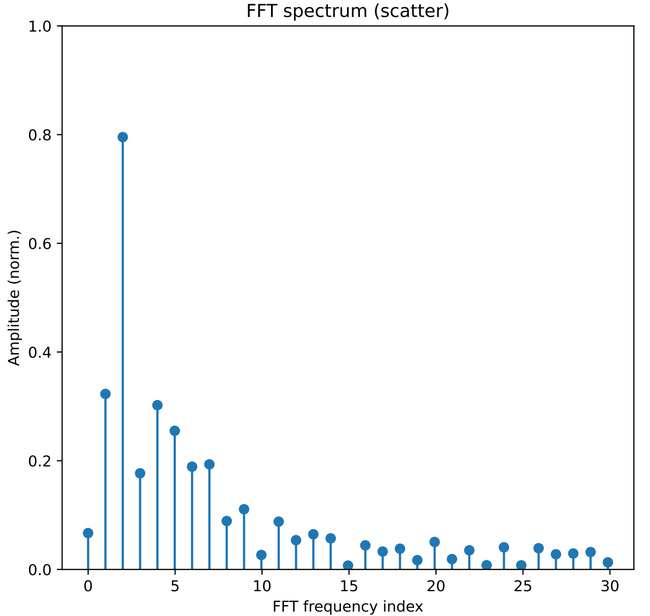

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

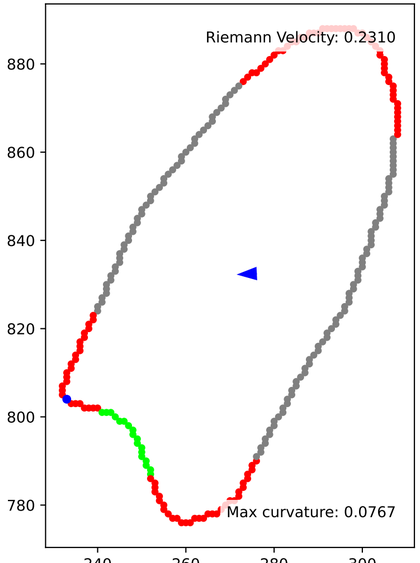

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

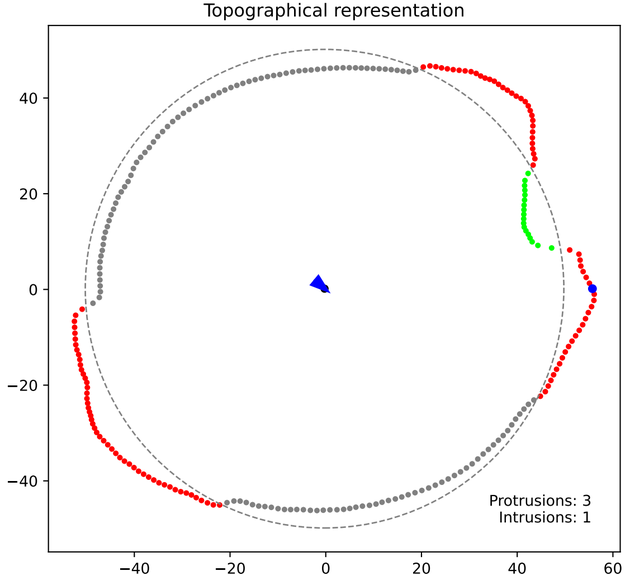

Shape evolution (t = 70.00)
Riemann Velocity: 0.2220
Max curvature: 0.0427
880
860
840
820
800
780
240
260
280
300

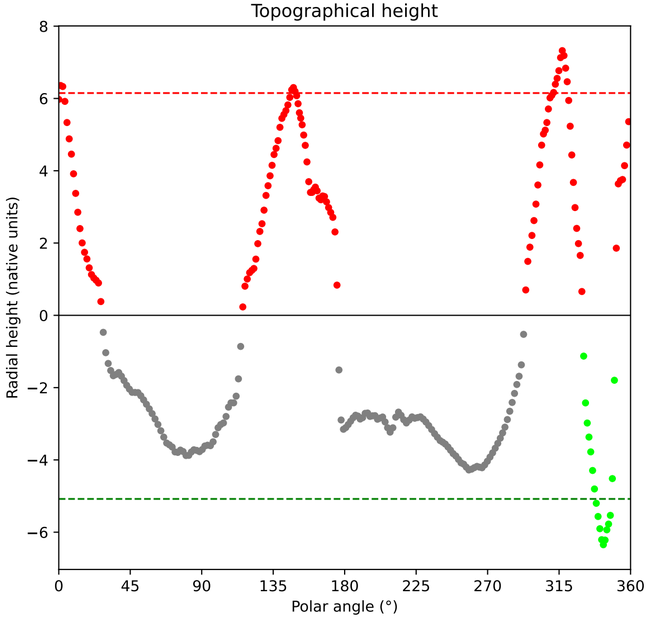

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

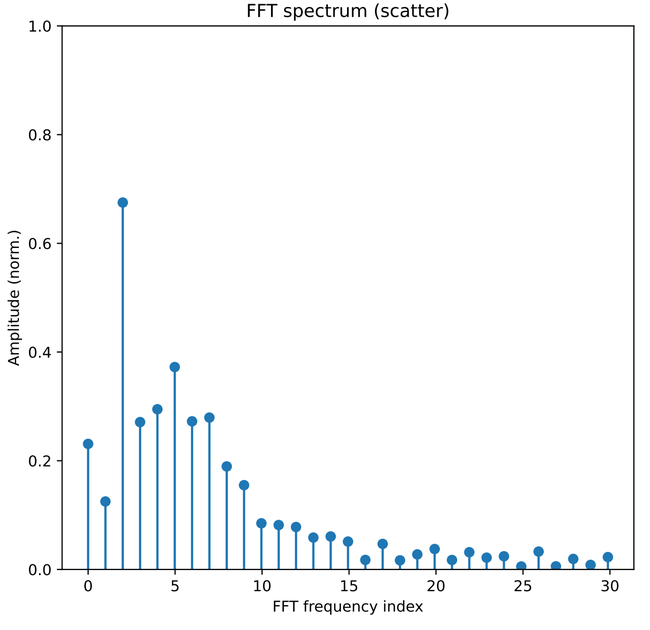

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

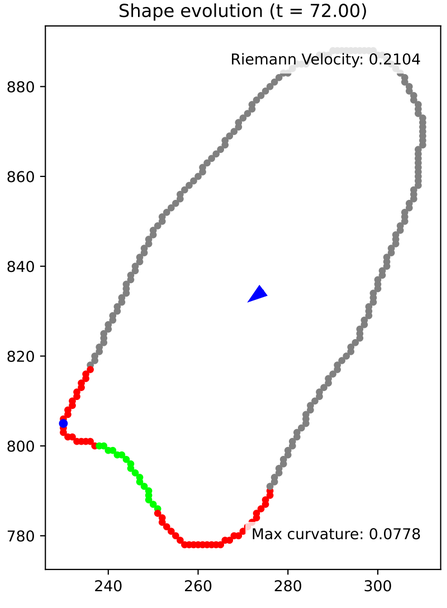

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

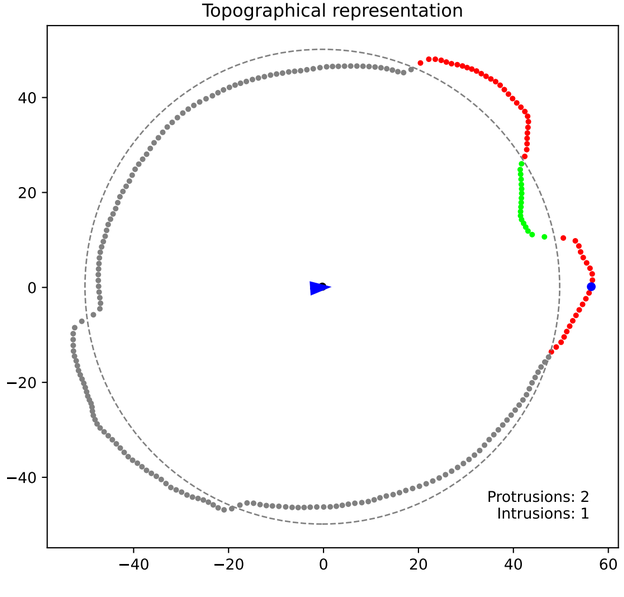

Shape evolution (t = 71.00)
Riemann Velocity: 0.2310
Max curvature: 0.0767
880
860
840
820
800
780
240
260
280
300

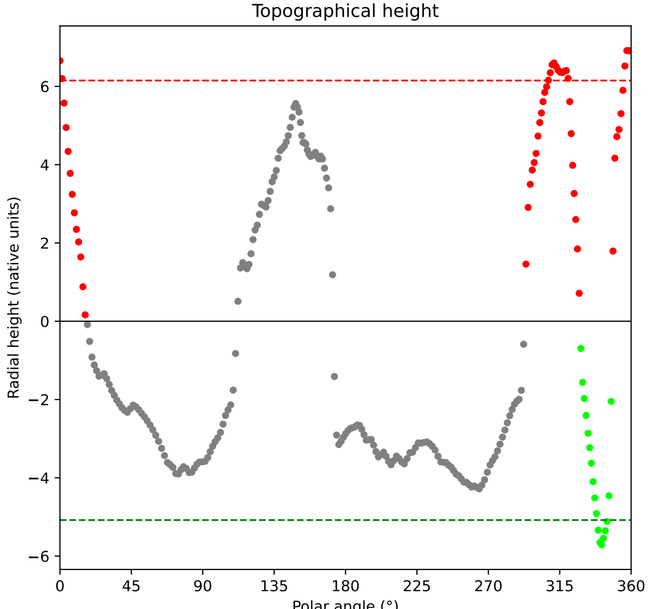

Topographical representation
Protrusions: 3
Intrusions: 1
40
20
0
−20
−40
−40
−20
0
20
40
60

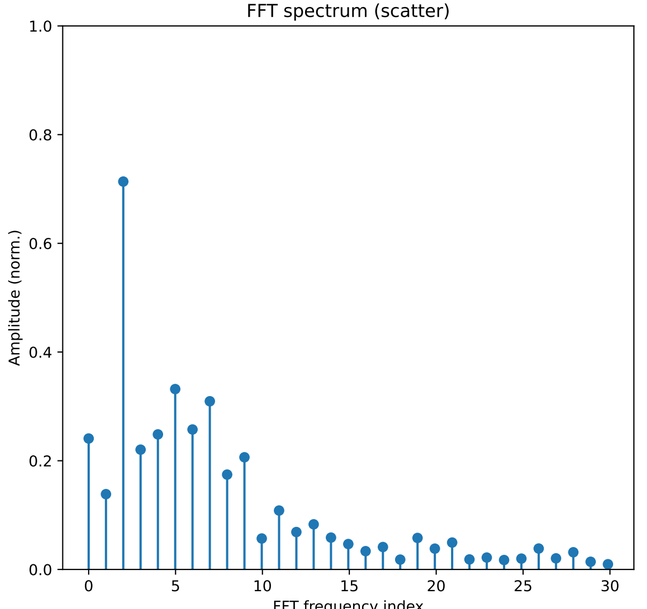

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

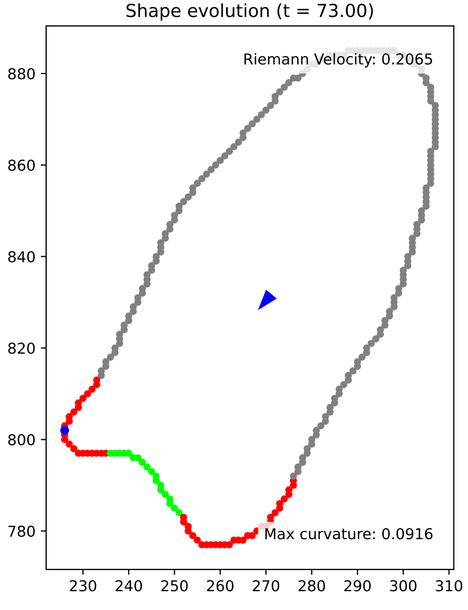

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

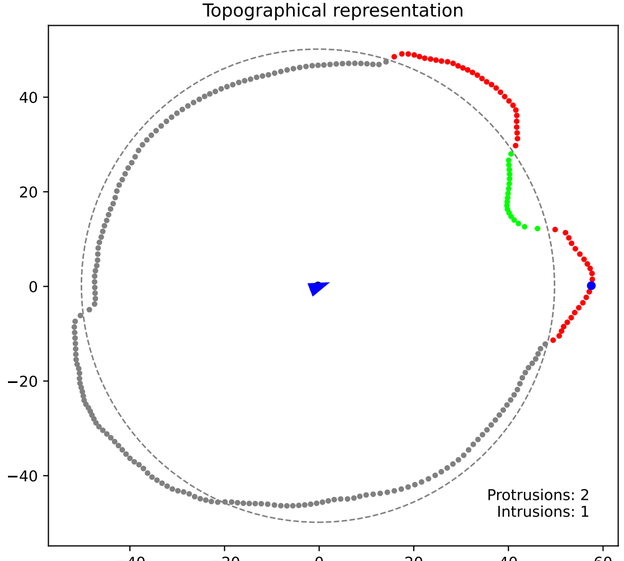

Shape evolution (t = 72.00)
Riemann Velocity: 0.2104
Max curvature: 0.0778
880
860
840
820
800
780
240
260
280
300

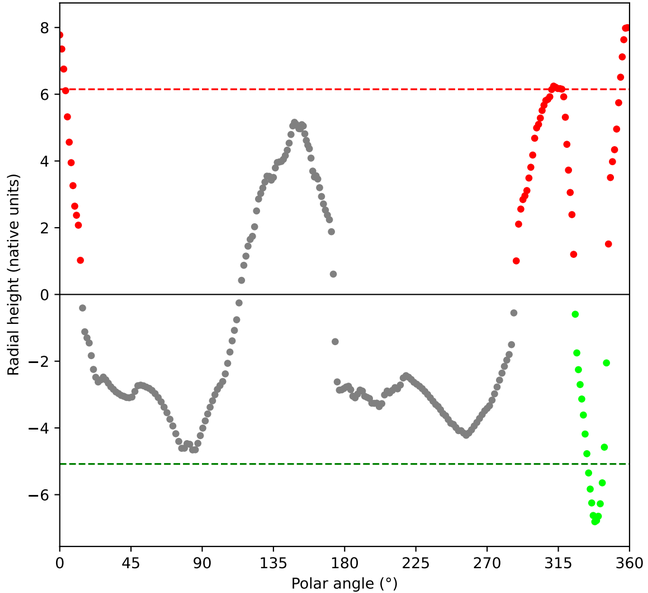

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−40
−20
0
20
40
60

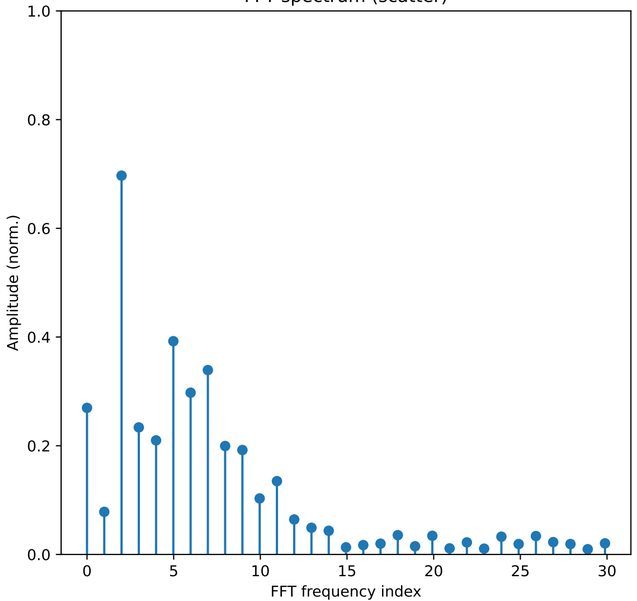

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

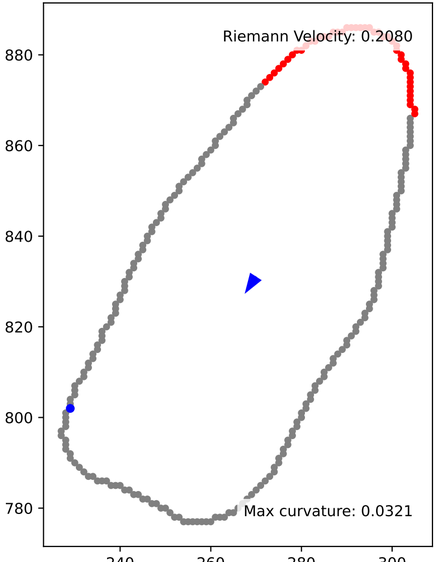

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

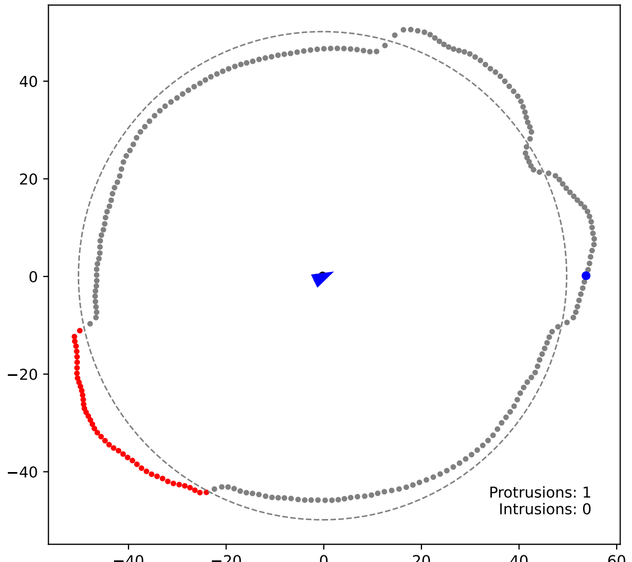

Shape evolution (t = 73.00)
Riemann Velocity: 0.2065
Max curvature: 0.0916
880
860
840
820
800
780
230
240
250
260
270
280
290
300
310

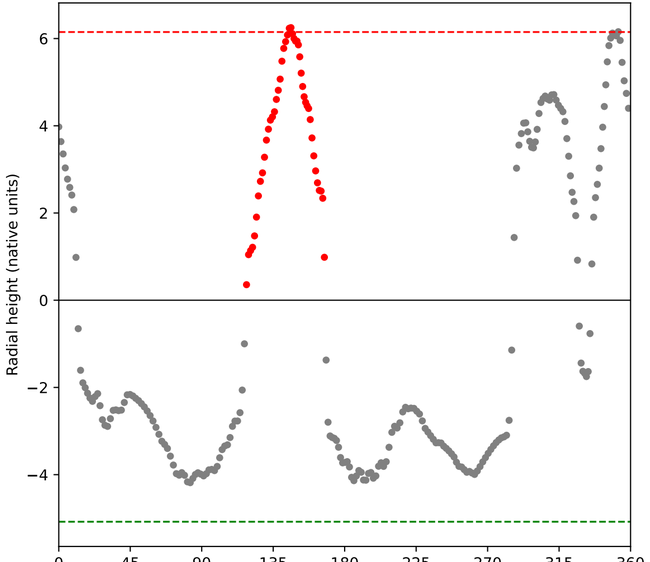

Topographical representation
Protrusions: 2
Intrusions: 1
40
20
0
−20
−40
−40
−20
0
20
40
60

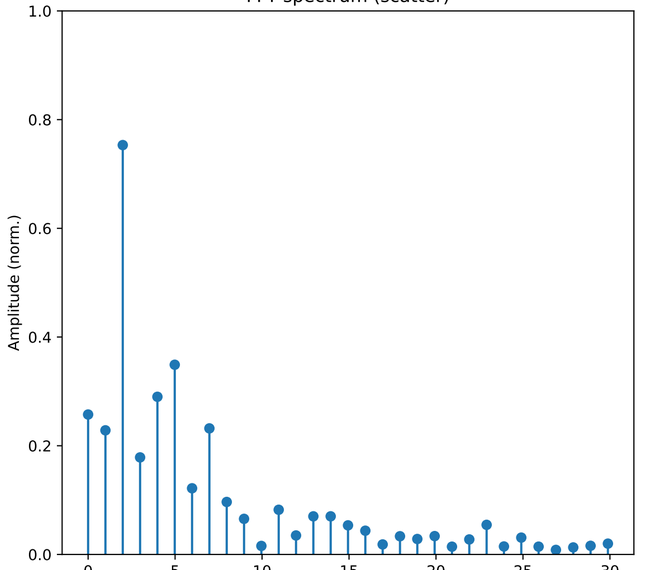

Topographical height
Radial height (native units)
Polar angle (°)
8
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

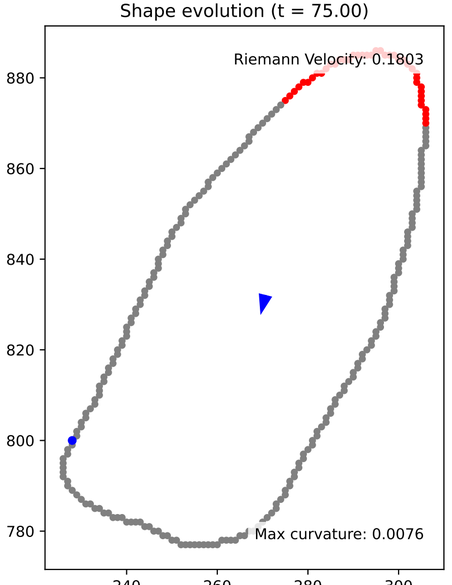

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

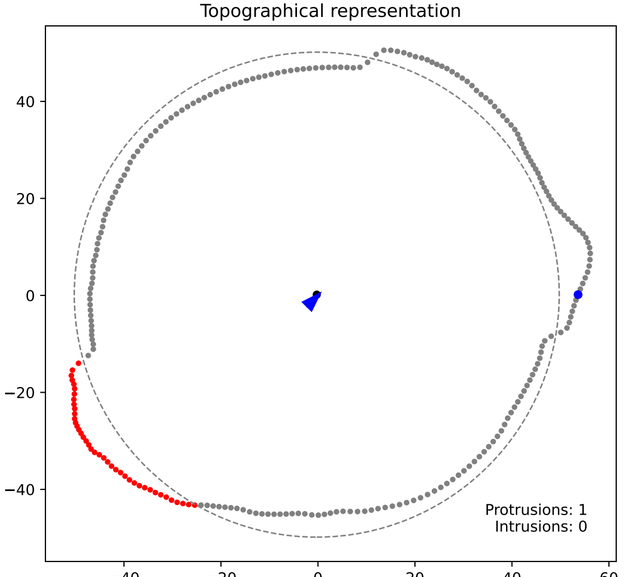

Shape evolution (t = 74.00)
Riemann Velocity: 0.2080
Max curvature: 0.0321
880
860
840
820
800
780
240
260
280
300

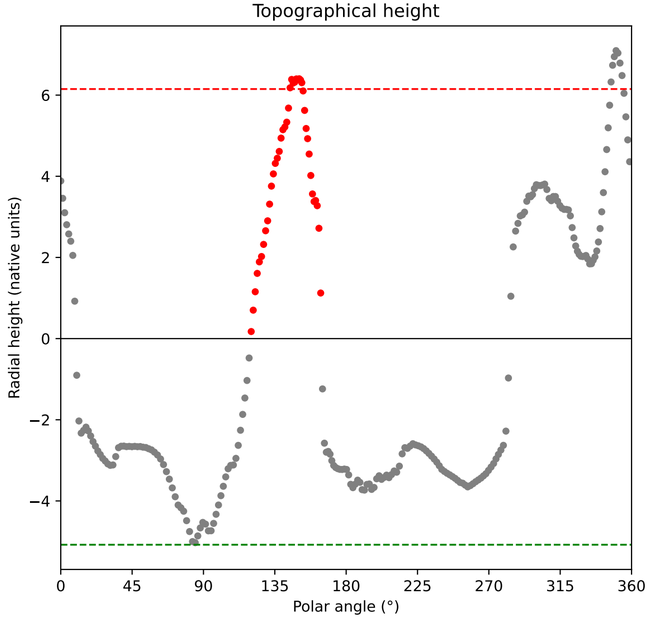

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

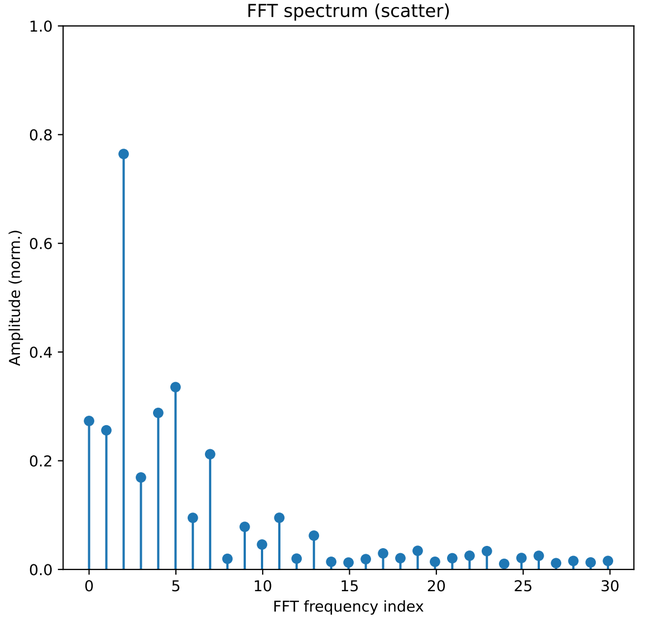

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

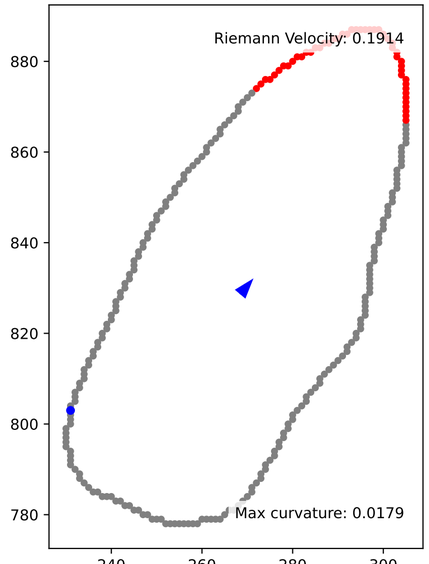

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

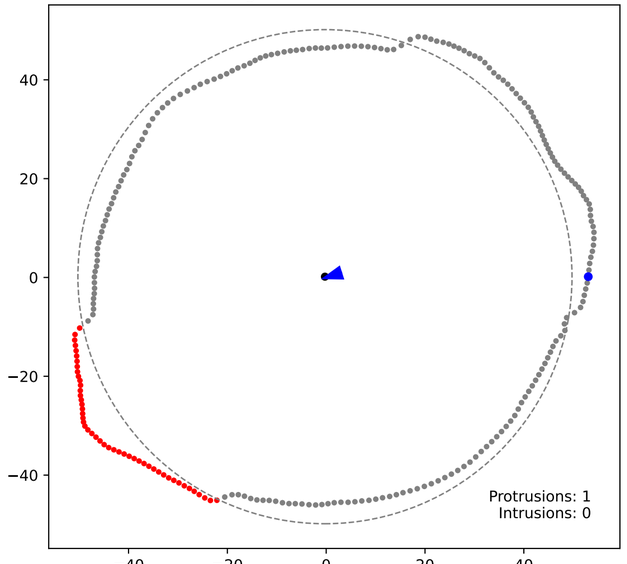

Shape evolution (t = 75.00)
Riemann Velocity: 0.1803
Max curvature: 0.0076
880
860
840
820
800
780
240
260
280
300

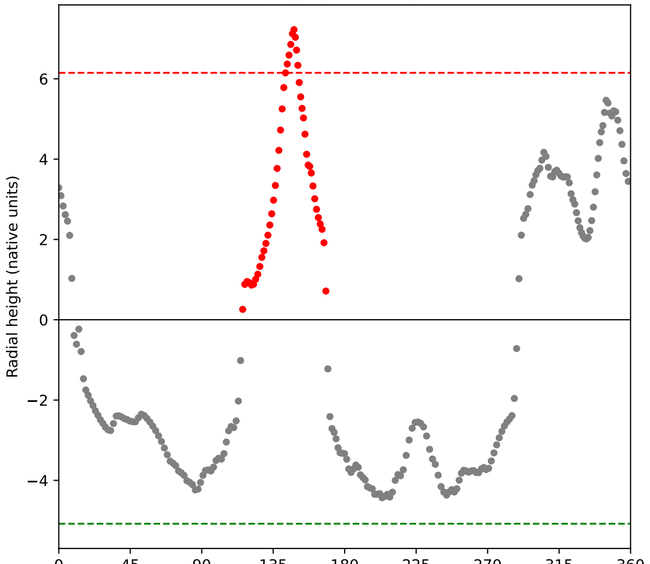

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

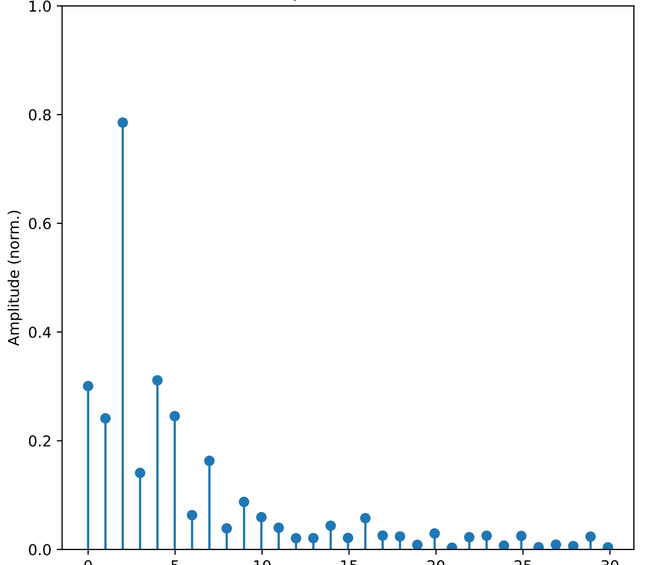

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

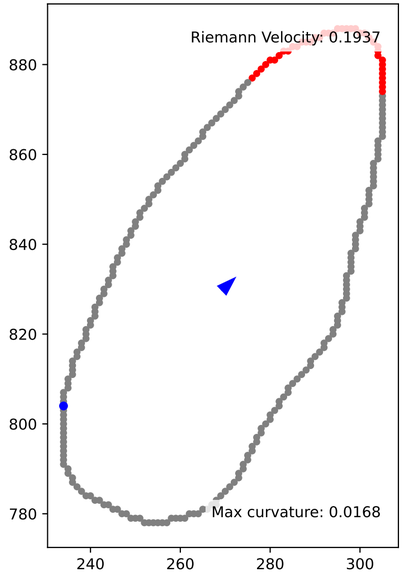

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

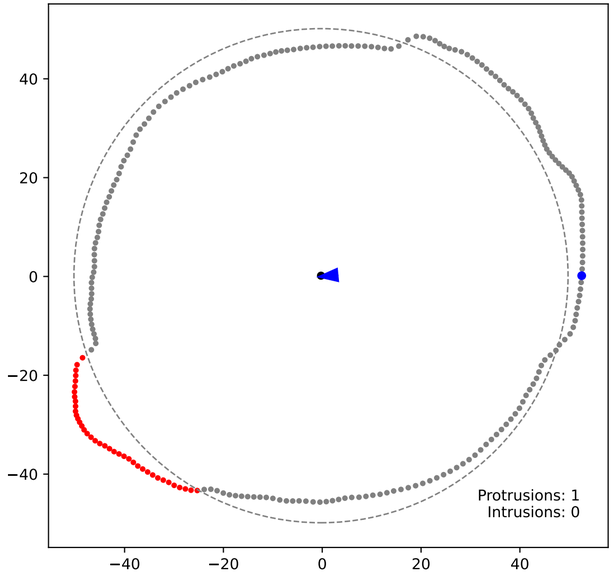

Shape evolution (t = 76.00)
Riemann Velocity: 0.1914
Max curvature: 0.0179
880
860
840
820
800
780
240
260
280
300

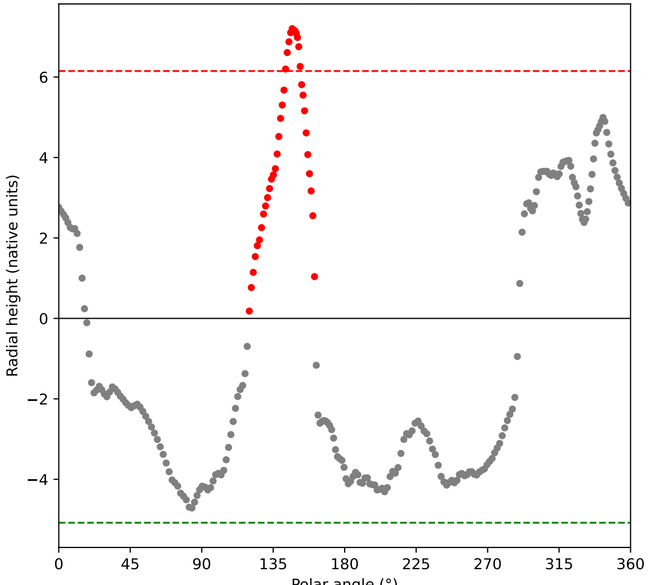

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

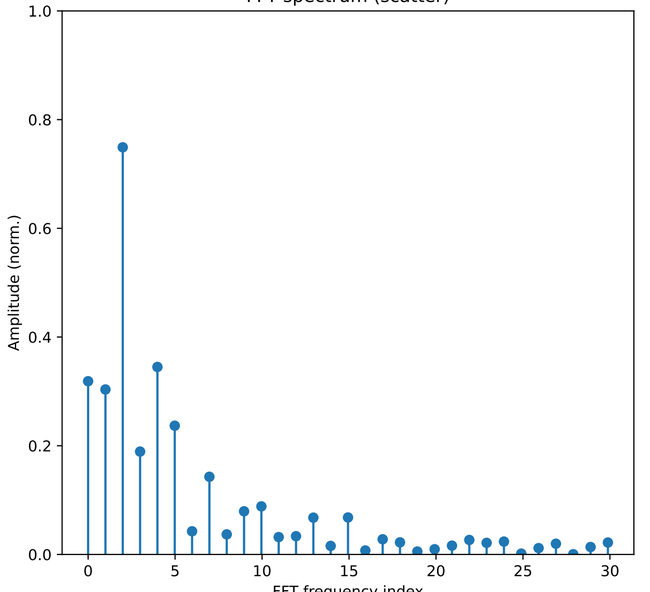

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

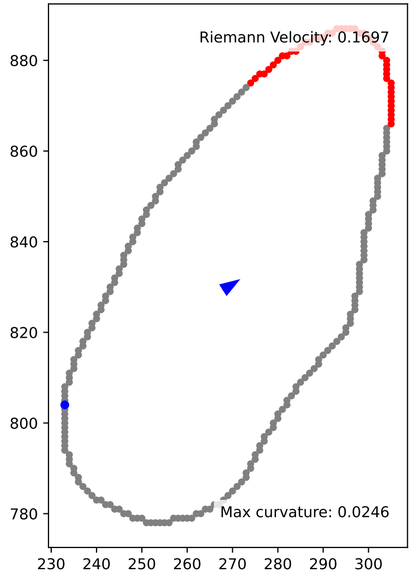

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

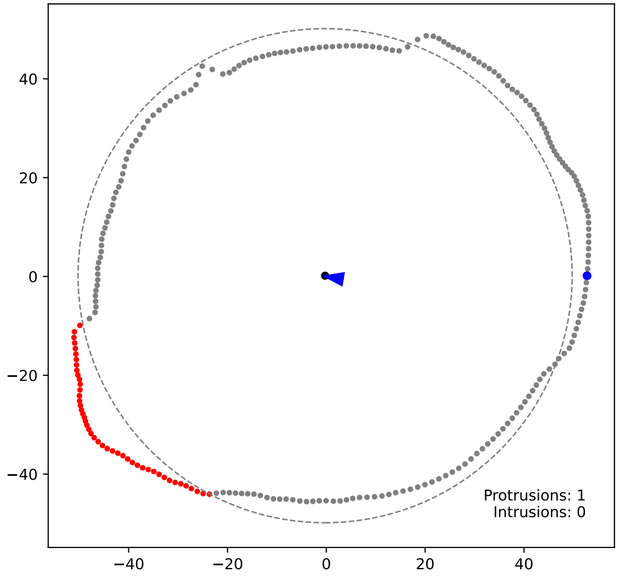

Shape evolution (t = 77.00)
Riemann Velocity: 0.1937
Max curvature: 0.0168
880
860
840
820
800
780
240
260
280
300

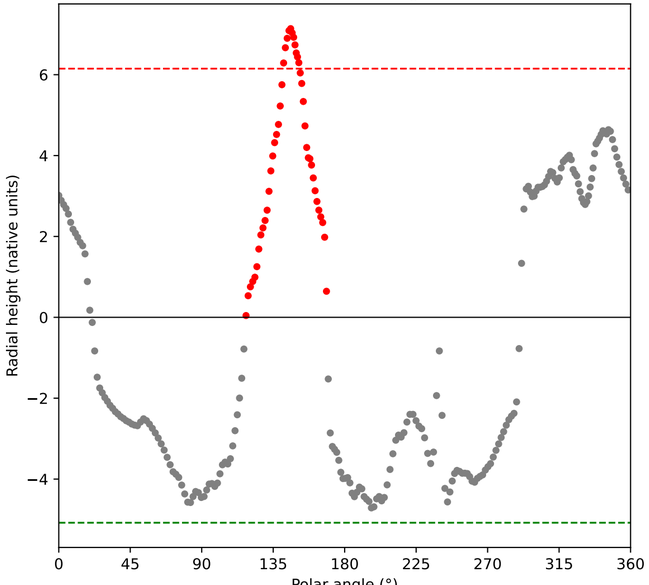

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

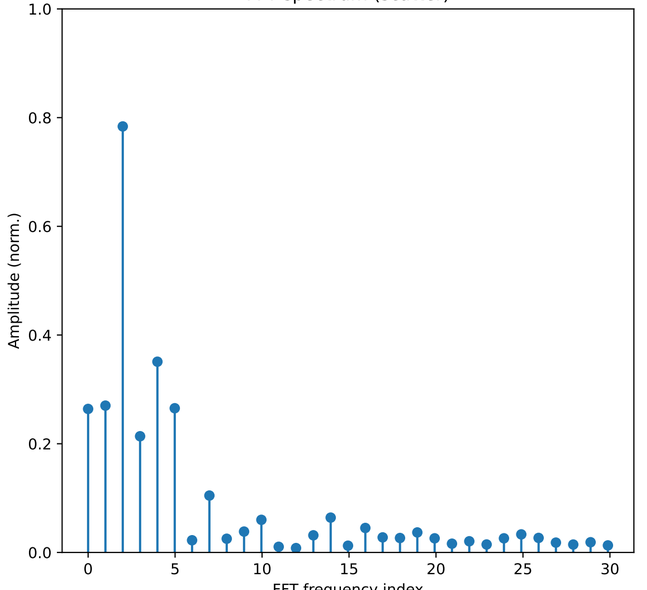

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

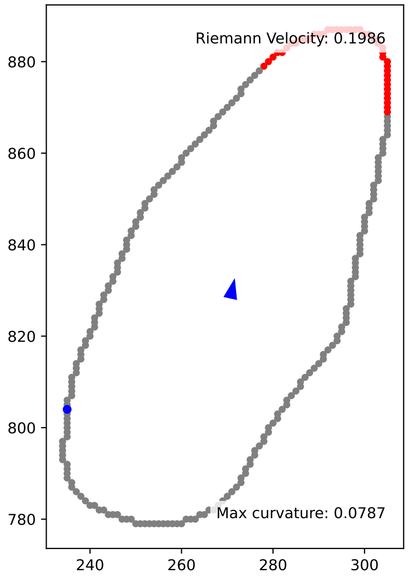

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

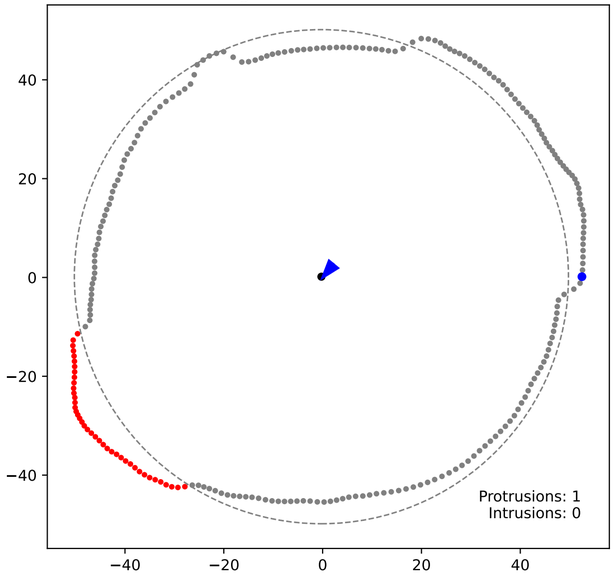

Shape evolution (t = 78.00)
Riemann Velocity: 0.1697
Max curvature: 0.0246
880
860
840
820
800
780
230
240
250
260
270
280
290
300

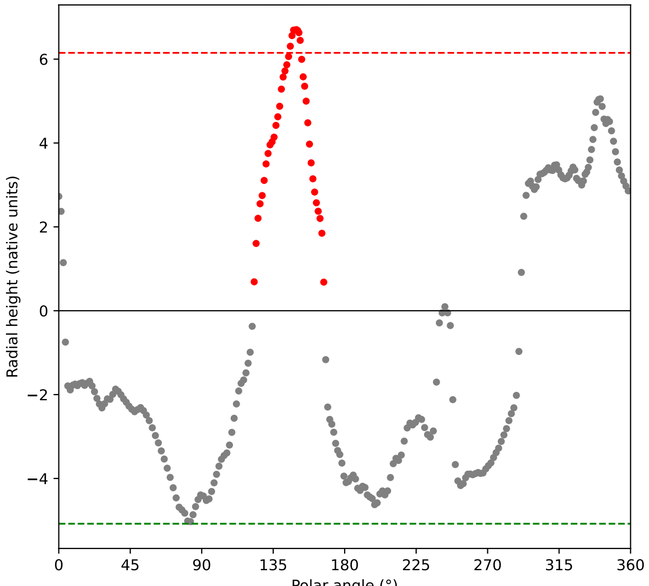

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

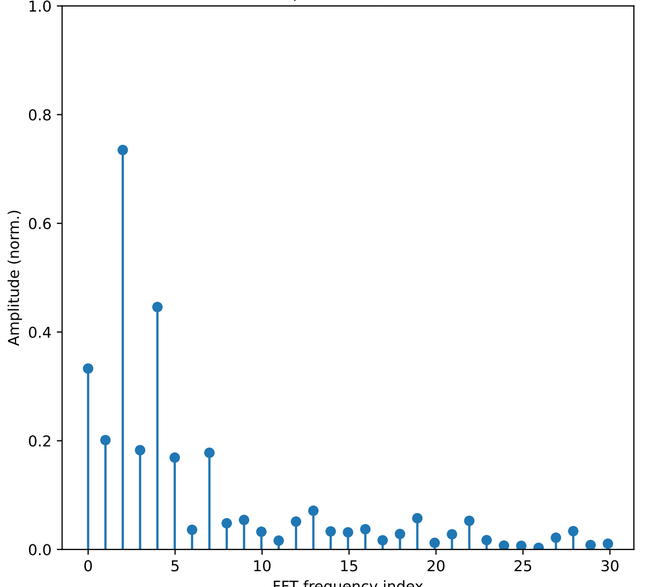

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

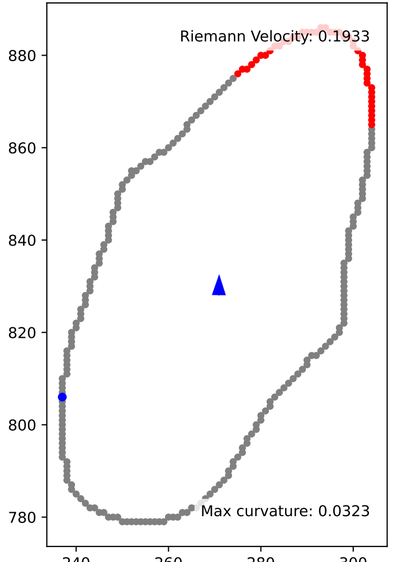

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

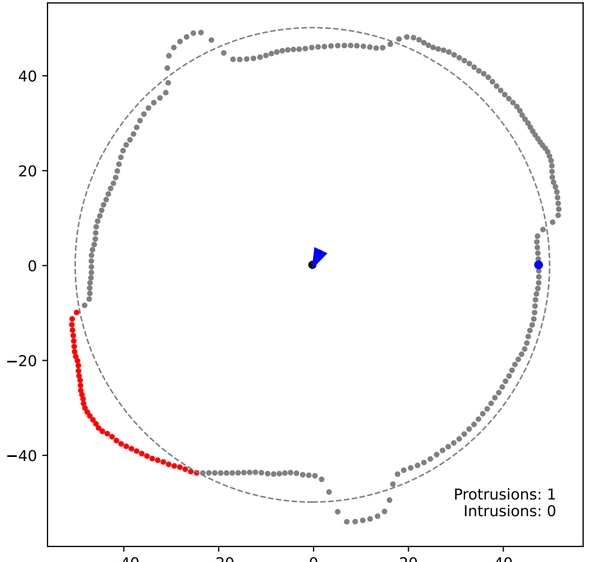

Shape evolution (t = 79.00)
Riemann Velocity: 0.1986
Max curvature: 0.0787
880
860
840
820
800
780
240
260
280
300

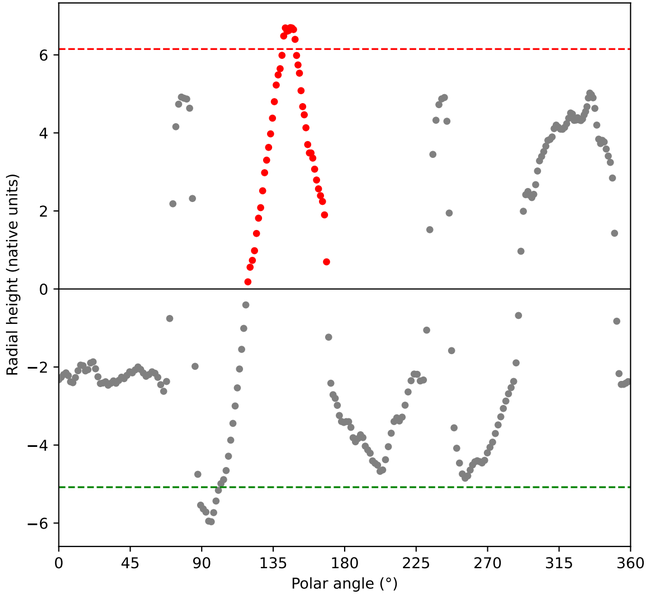

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

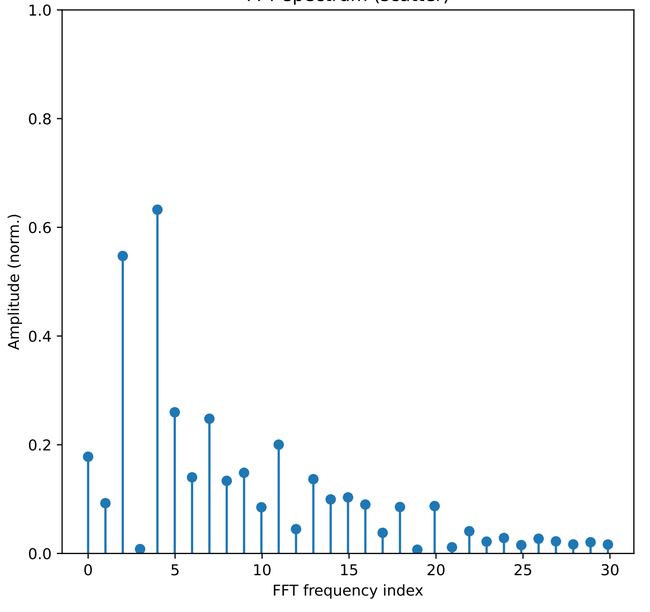

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

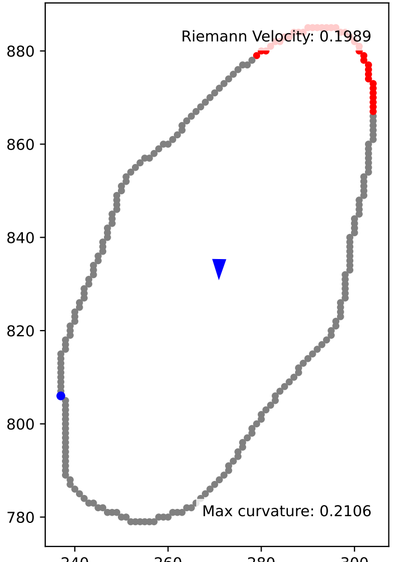

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

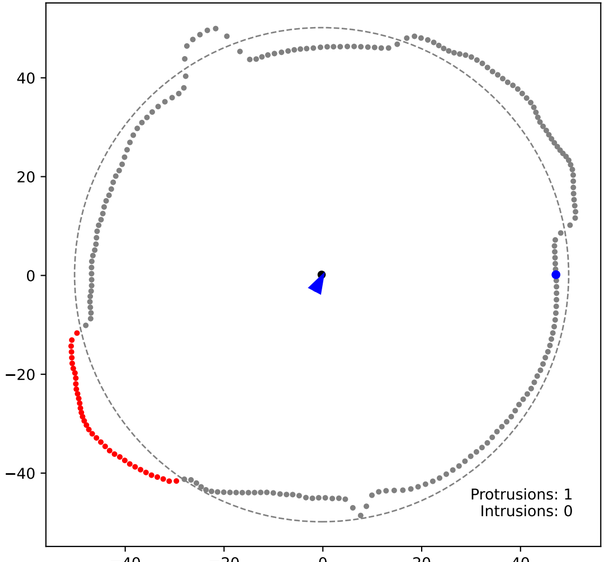

Shape evolution (t = 80.00)
Riemann Velocity: 0.1933
Max curvature: 0.0323
880
860
840
820
800
780
240
260
280
300

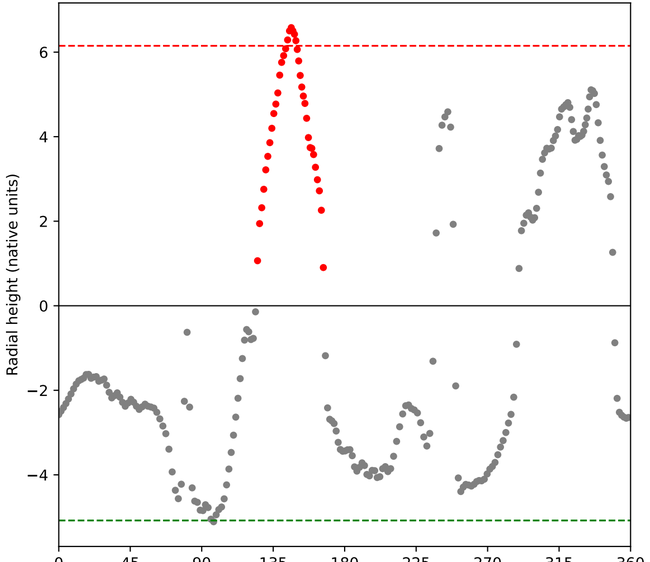

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

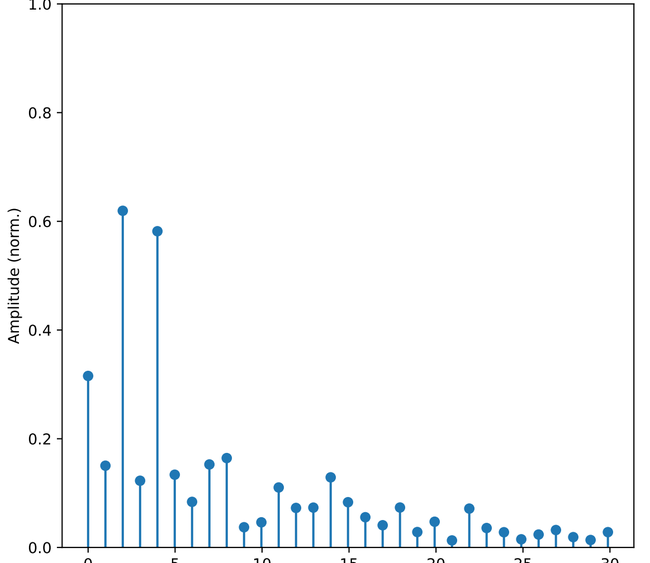

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
−6
0
45
90
135
180
225
270
315
360

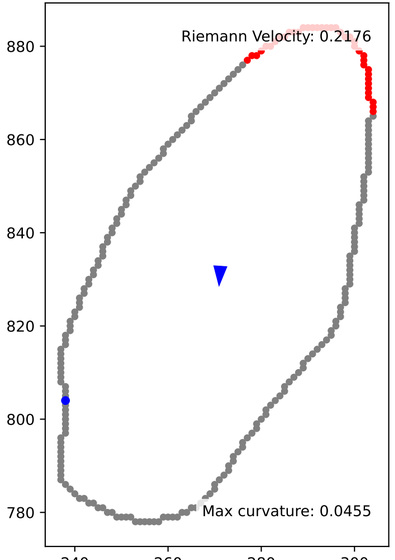

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

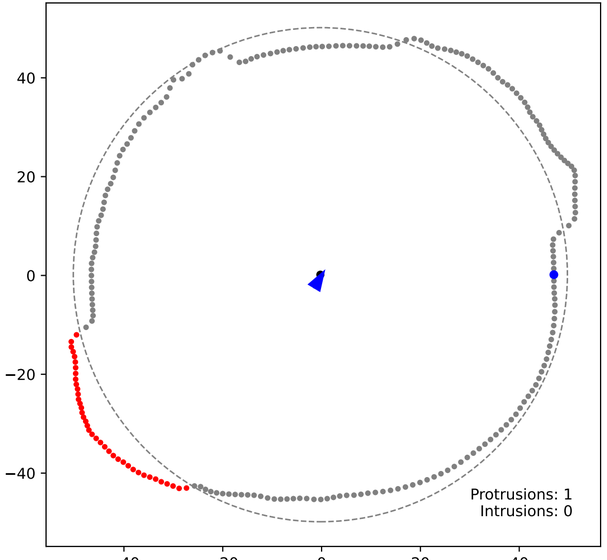

Shape evolution (t = 81.00)
Riemann Velocity: 0.1989
Max curvature: 0.2106
880
860
840
820
800
780
240
260
280
300

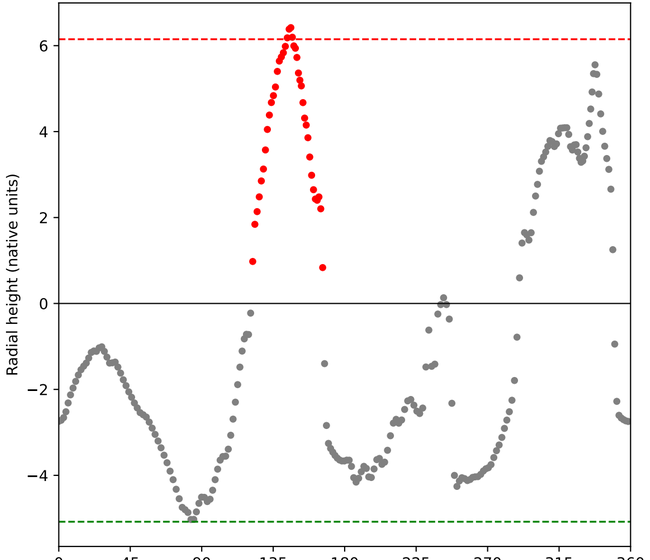

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

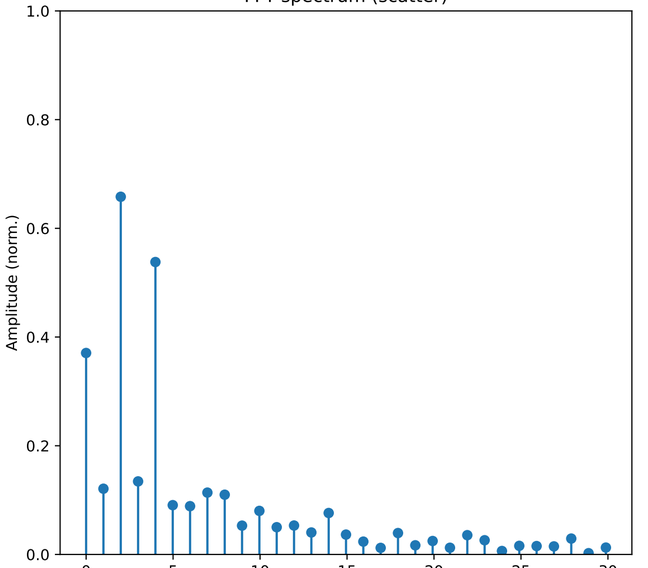

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

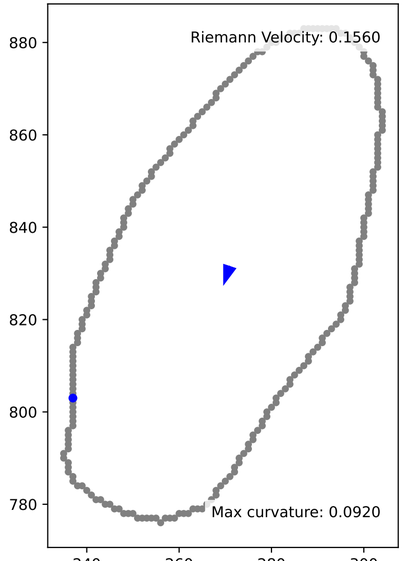

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

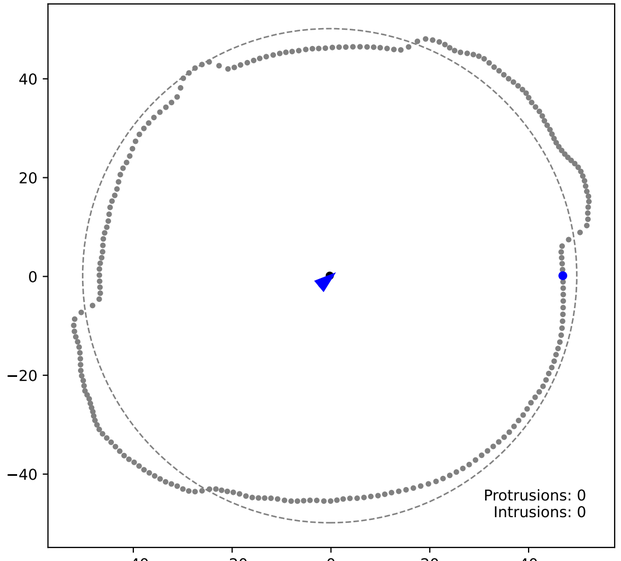

Shape evolution (t = 82.00)
Riemann Velocity: 0.2176
Max curvature: 0.0455
880
860
840
820
800
780
240
260
280
300

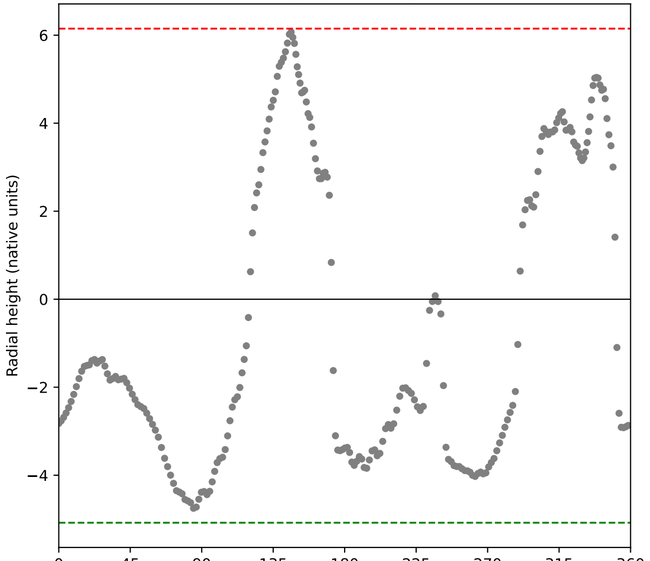

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

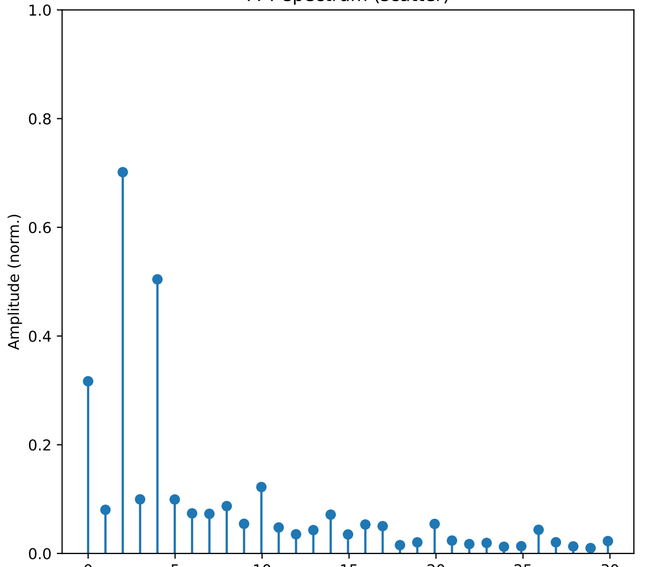

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

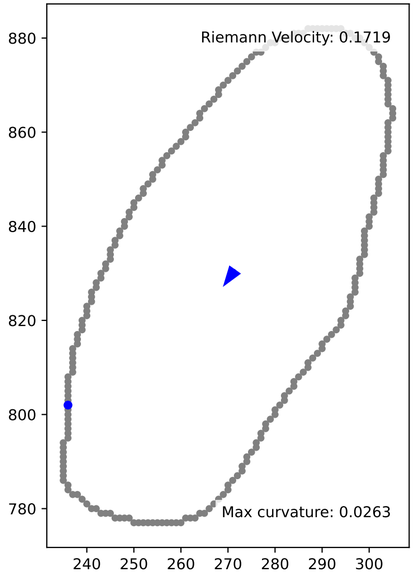

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

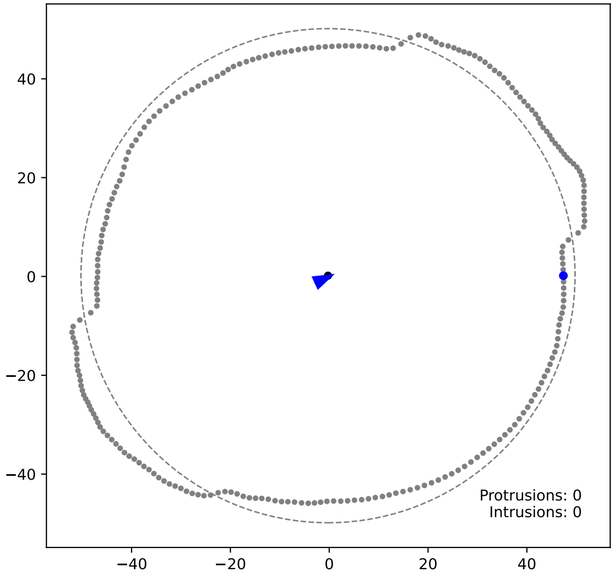

Shape evolution (t = 83.00)
Riemann Velocity: 0.1560
Max curvature: 0.0920
880
860
840
820
800
780
240
260
280
300

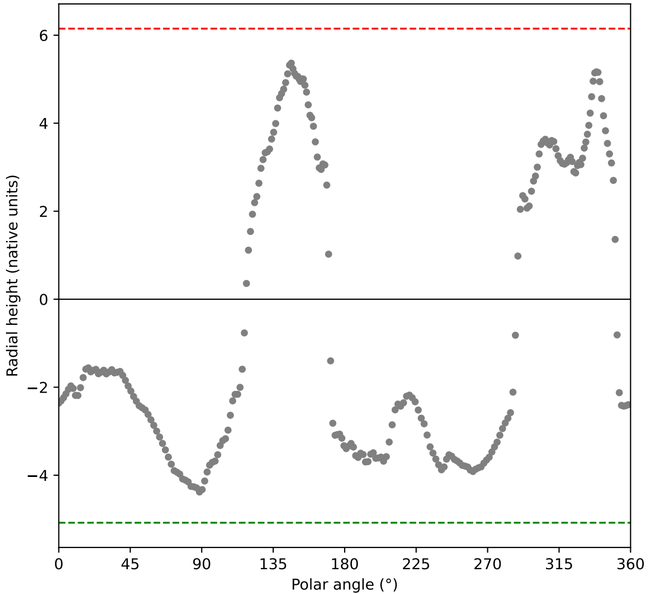

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

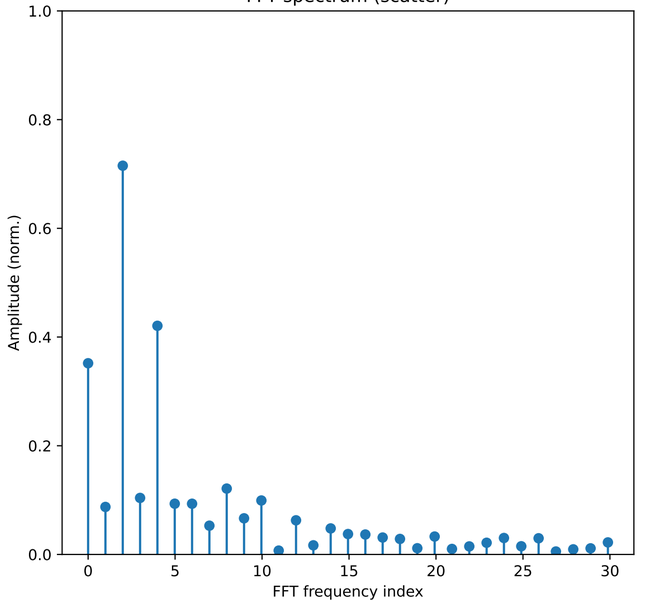

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

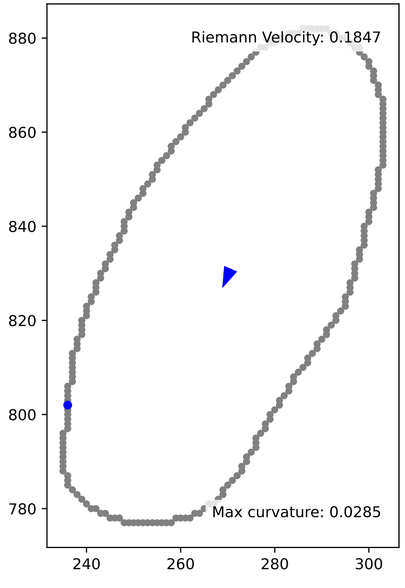

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

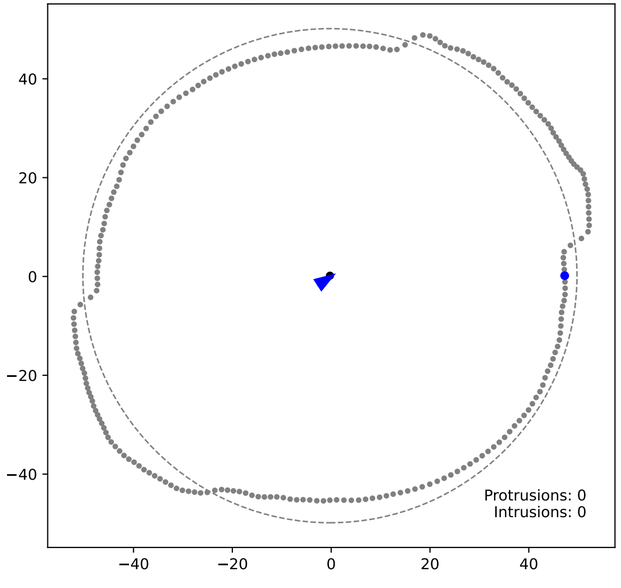

Shape evolution (t = 84.00)
Riemann Velocity: 0.1719
Max curvature: 0.0263
880
860
840
820
800
780
240
250
260
270
280
290
300

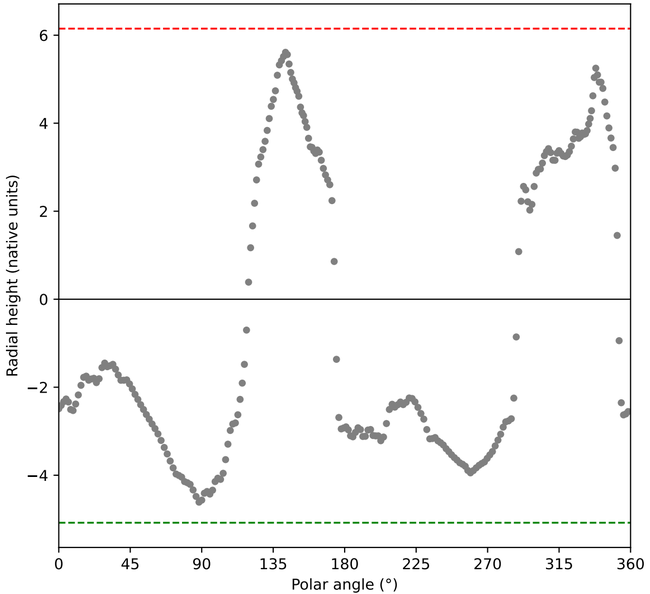

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

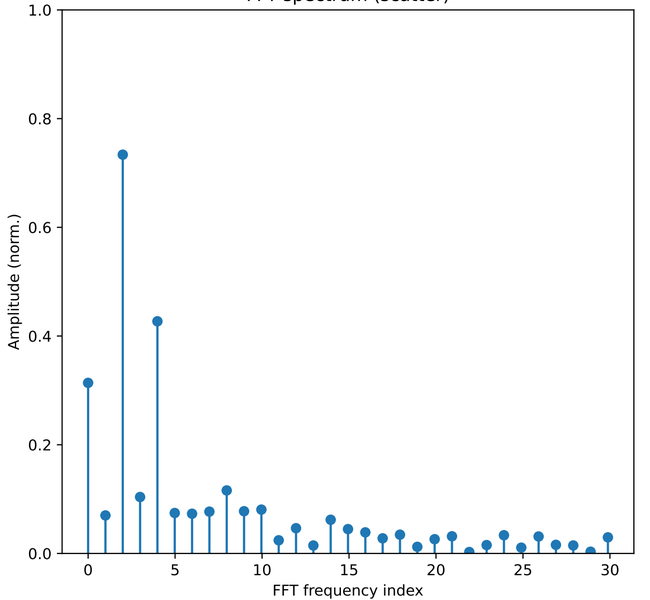

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

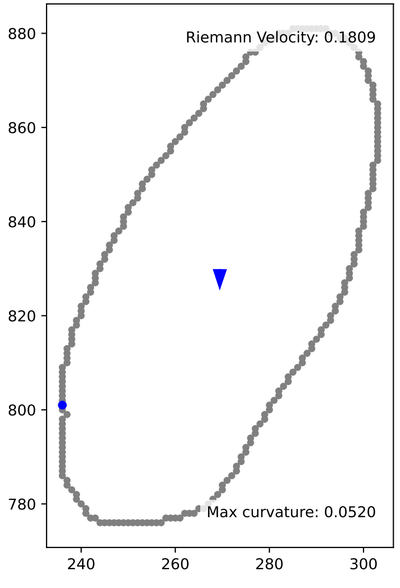

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

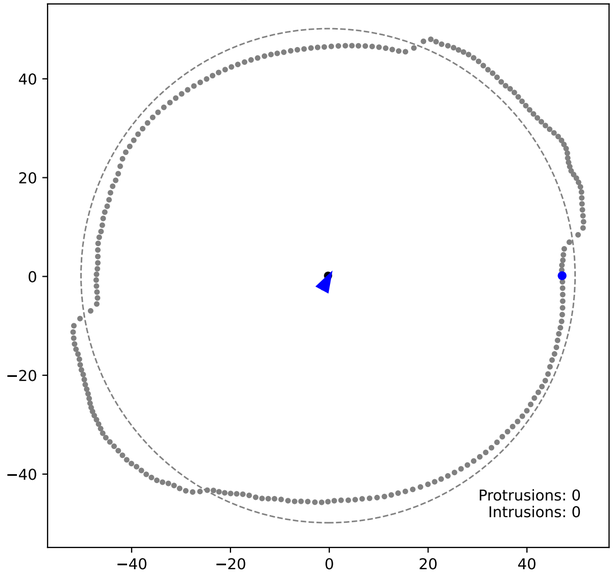

Shape evolution (t = 85.00)
Riemann Velocity: 0.1847
Max curvature: 0.0285
880
860
840
820
800
780
240
260
280
300

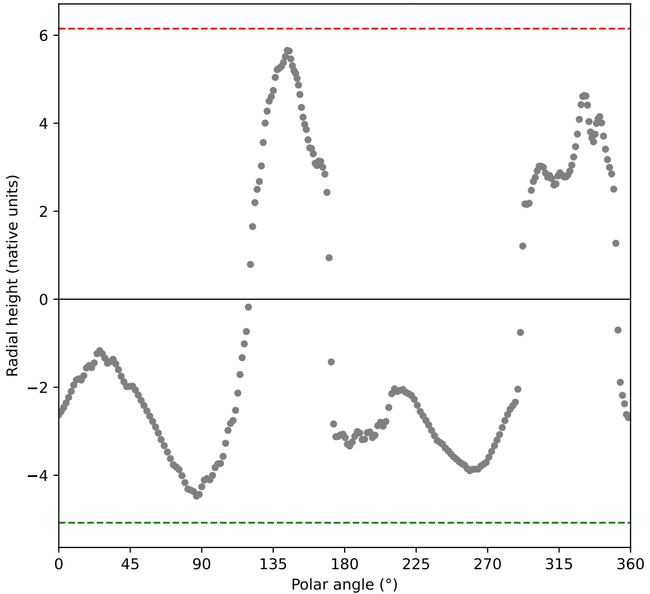

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

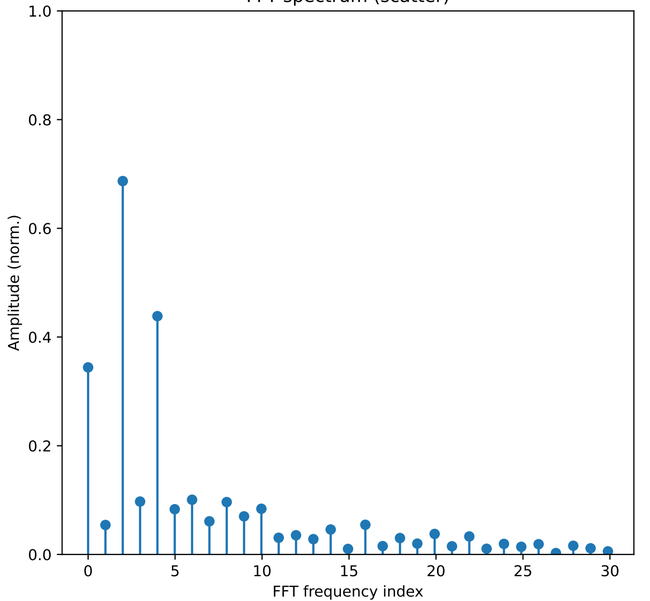

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

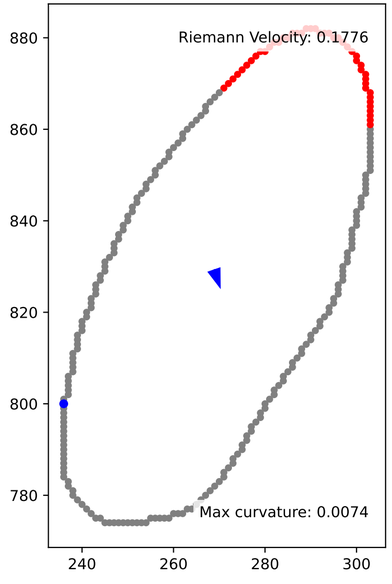

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

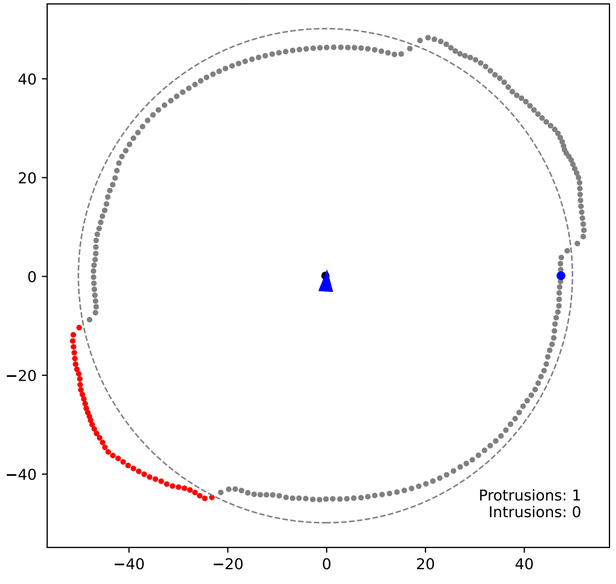

Shape evolution (t = 86.00)
Riemann Velocity: 0.1809
Max curvature: 0.0520
880
860
840
820
800
780
240
260
280
300

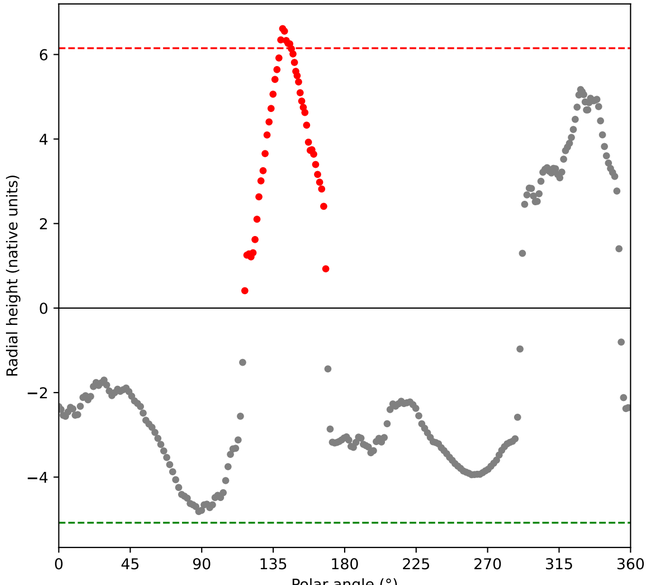

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

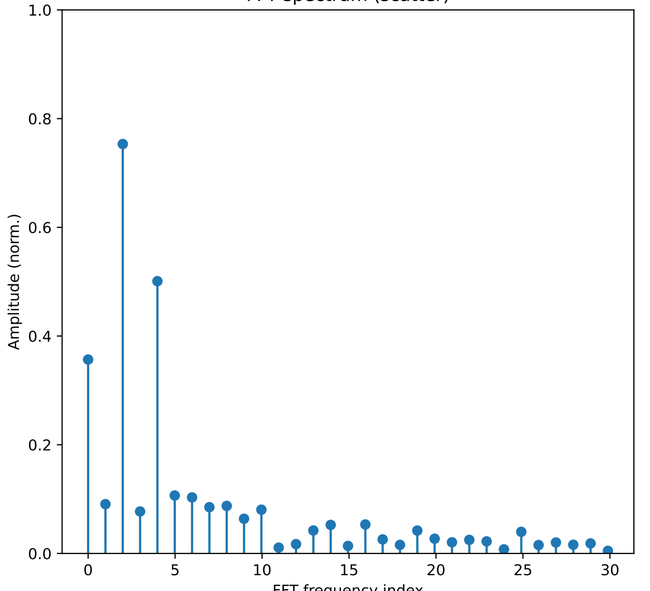

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

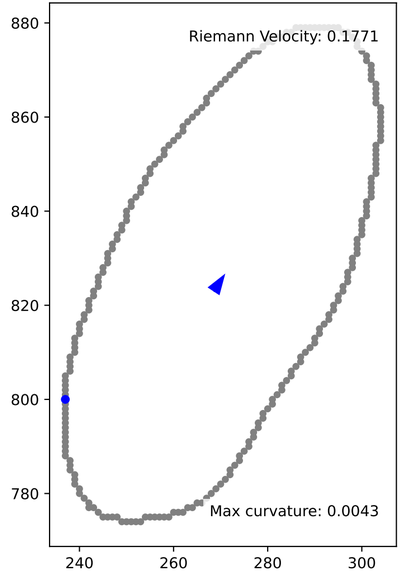

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

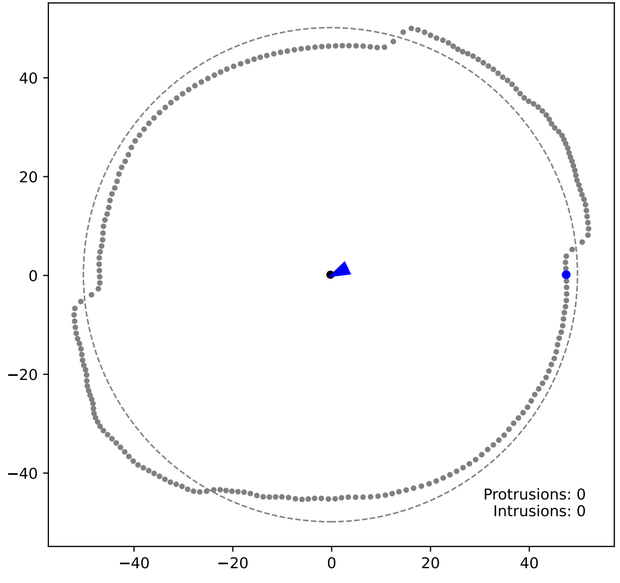

Shape evolution (t = 87.00)
Riemann Velocity: 0.1776
Max curvature: 0.0074
880
860
840
820
800
780
240
260
280
300

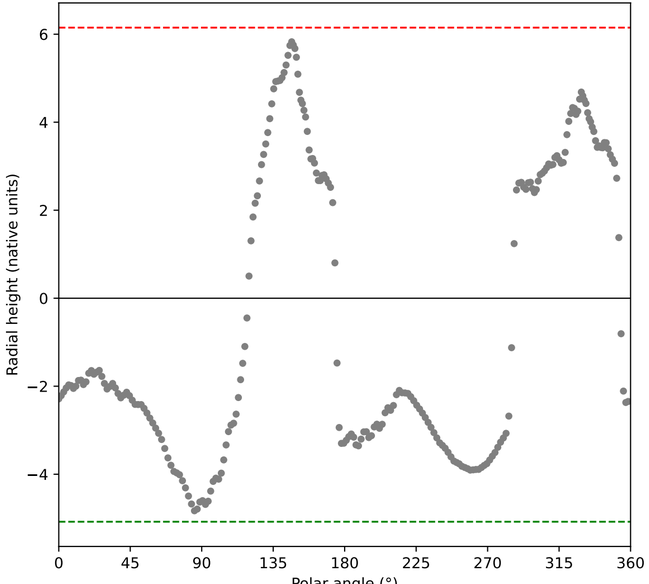

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

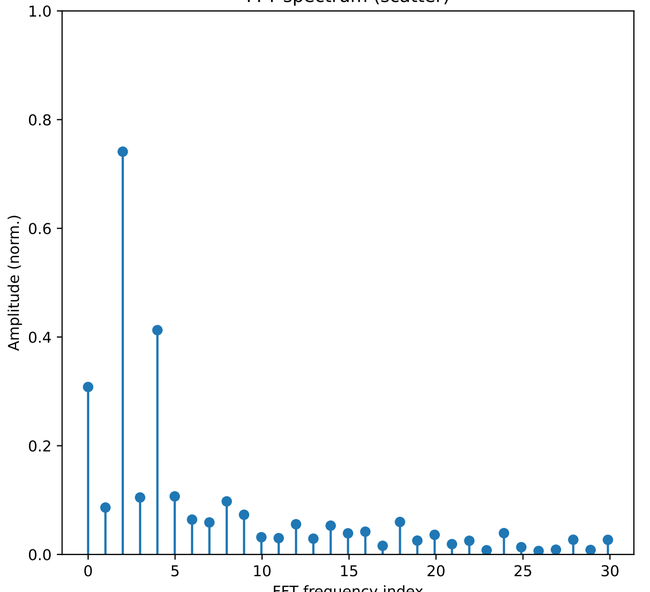

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

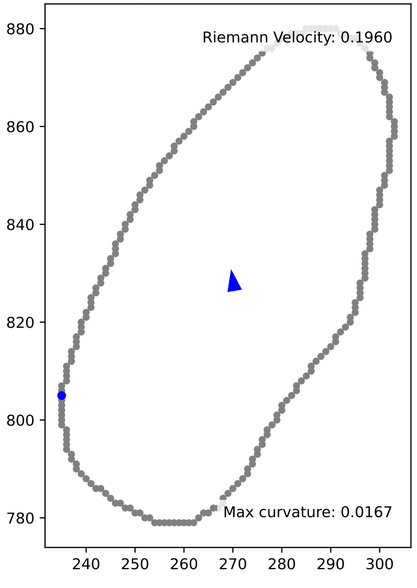

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

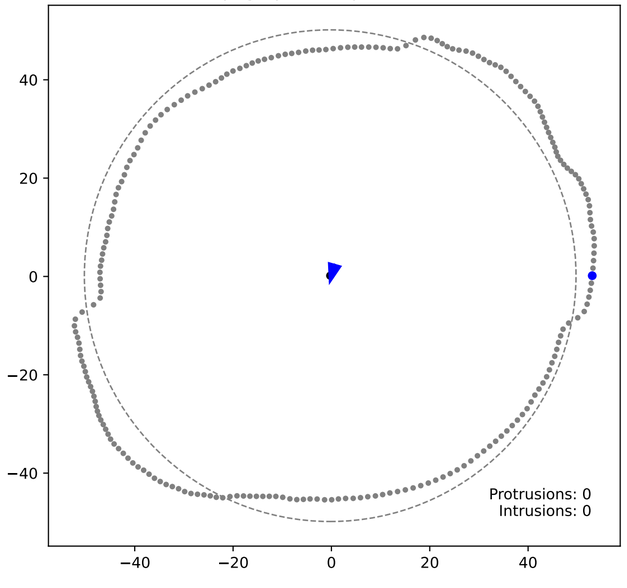

Shape evolution (t = 88.00)
Riemann Velocity: 0.1771
Max curvature: 0.0043
880
860
840
820
800
780
240
260
280
300

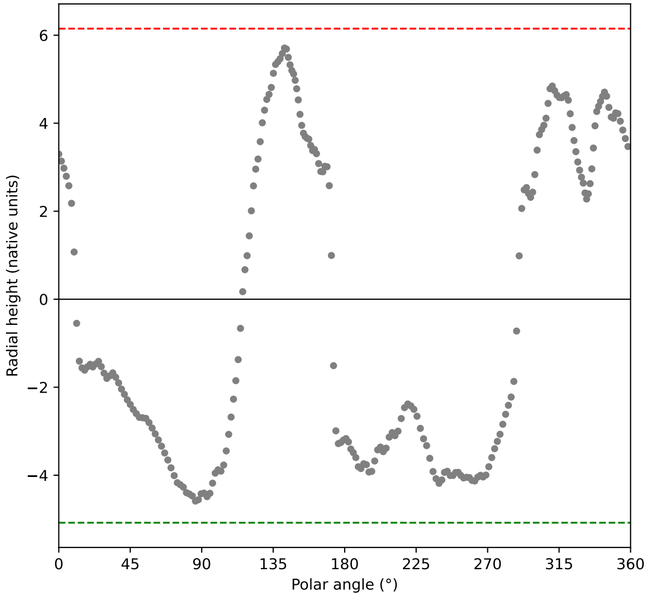

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

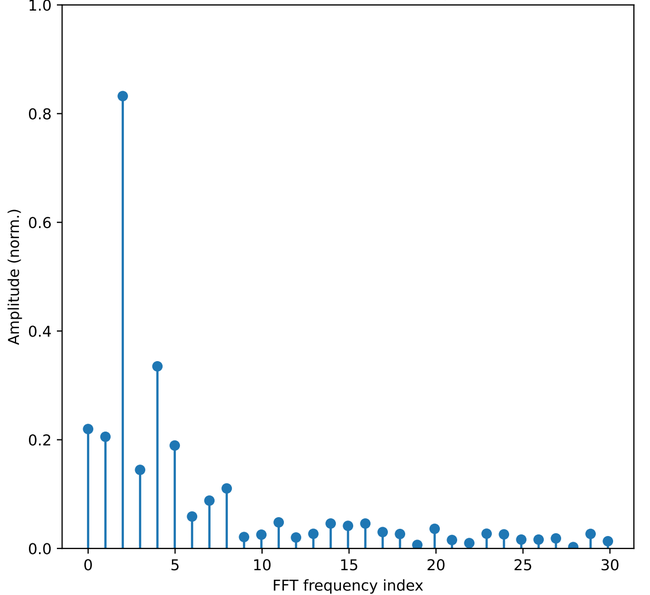

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

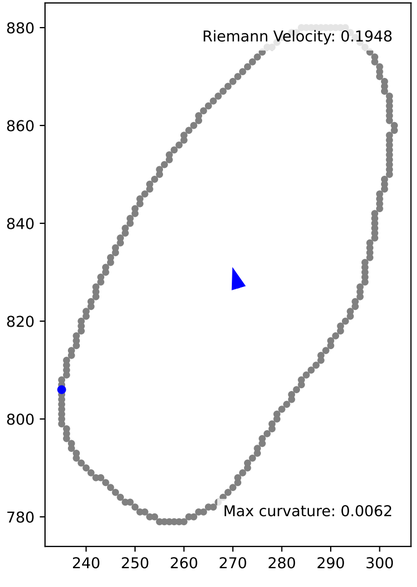

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

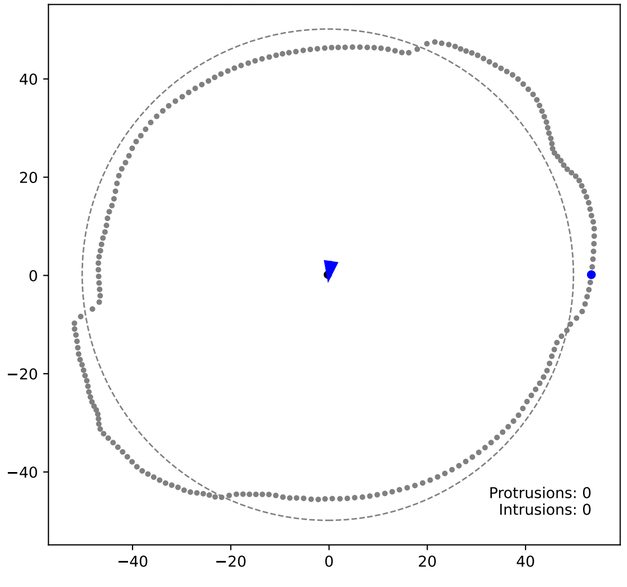

Shape evolution (t = 89.00)
Riemann Velocity: 0.1960
Max curvature: 0.0167
880
860
840
820
800
780
240
250
260
270
280
290
300

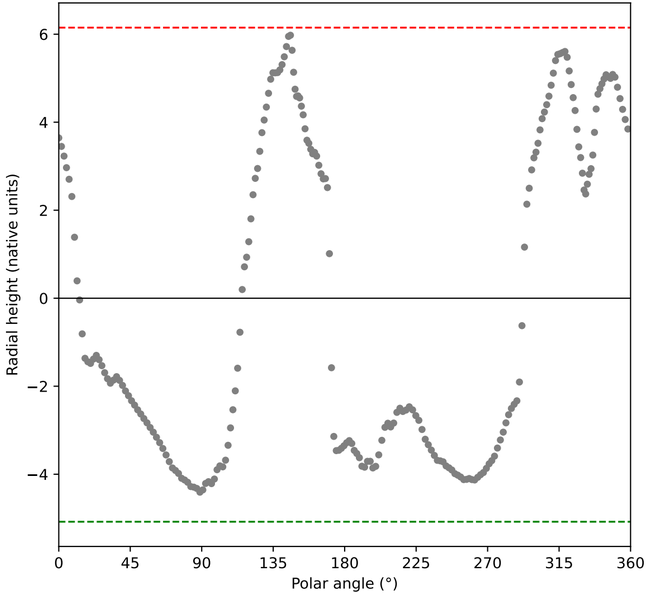

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

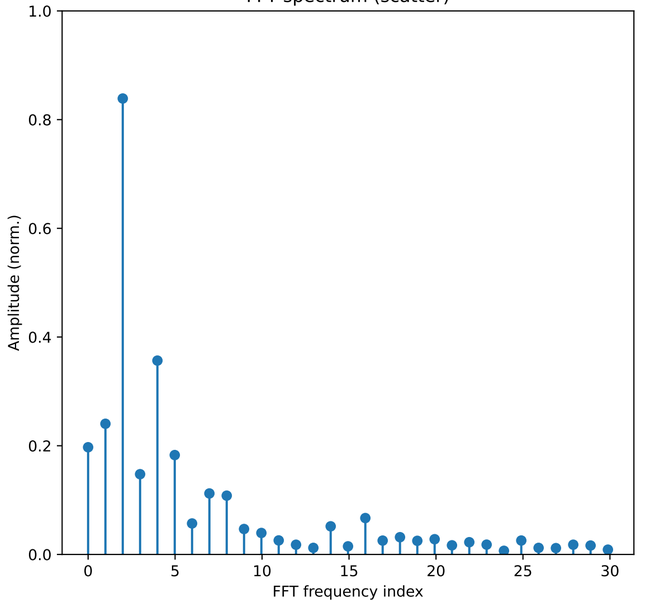

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

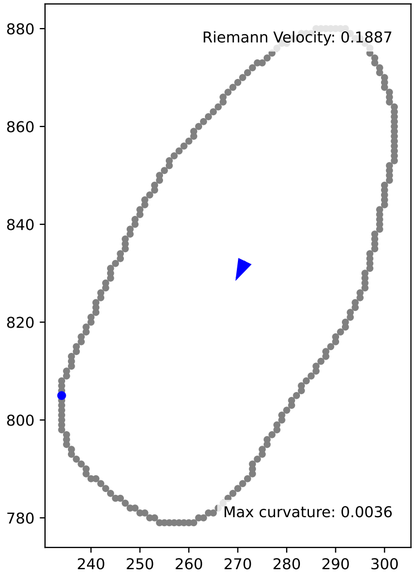

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

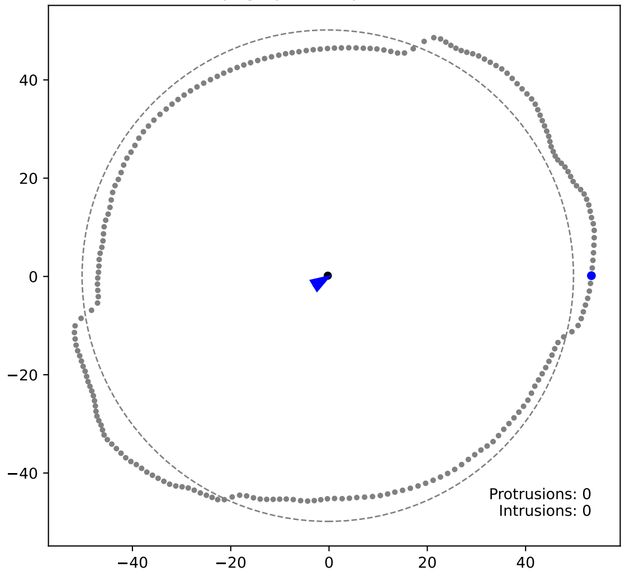

Shape evolution (t = 90.00)
Riemann Velocity: 0.1948
Max curvature: 0.0062
880
860
840
820
800
780
240
250
260
270
280
290
300

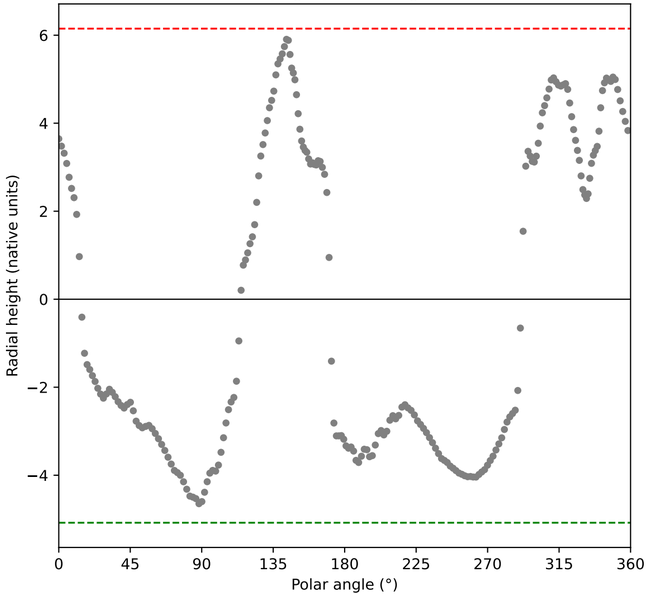

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

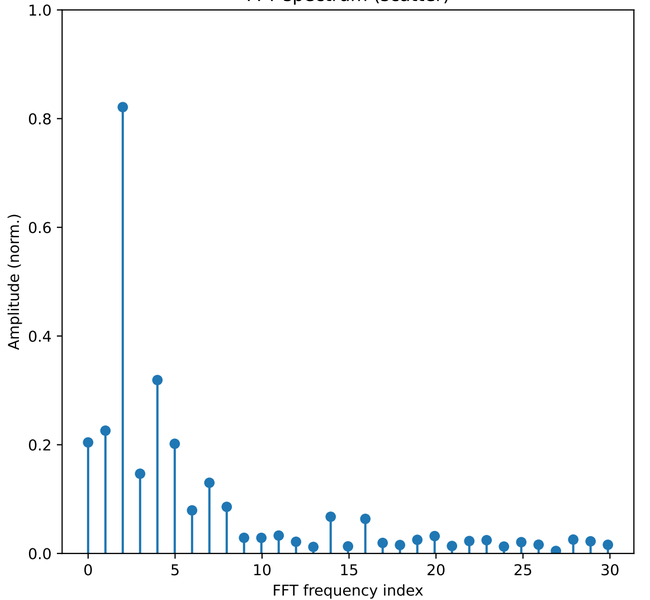

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

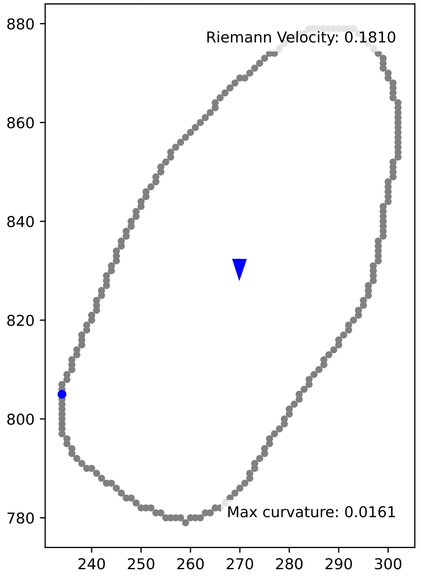

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

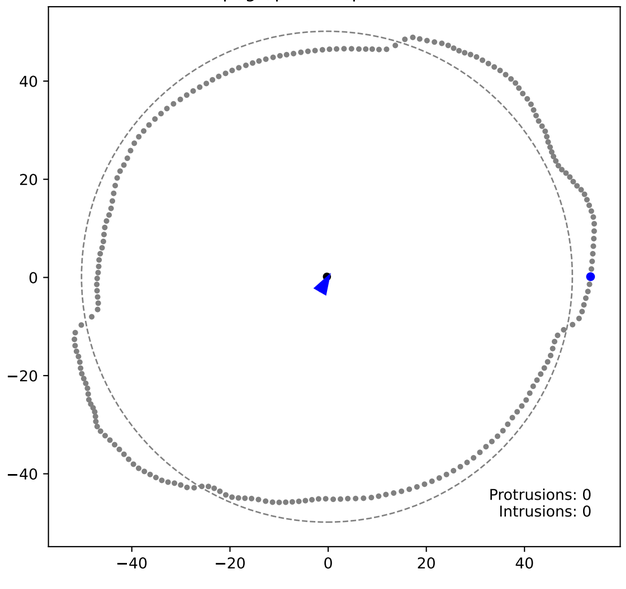

Shape evolution (t = 91.00)
Riemann Velocity: 0.1887
Max curvature: 0.0036
880
860
840
820
800
780
240
250
260
270
280
290
300

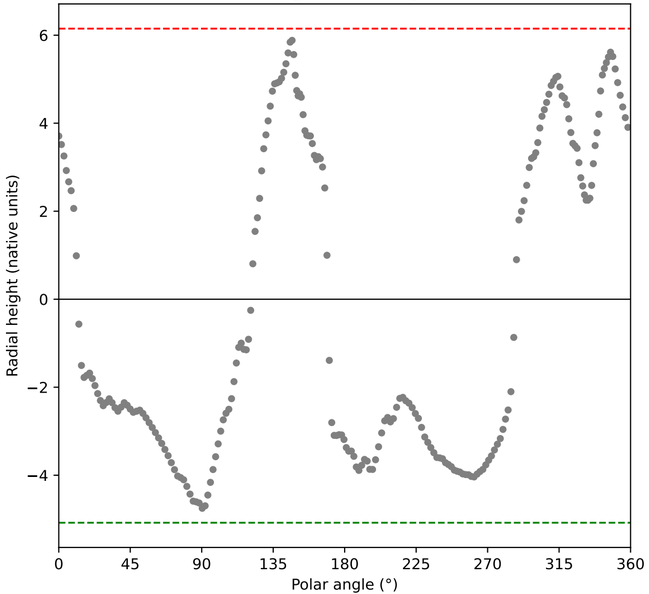

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

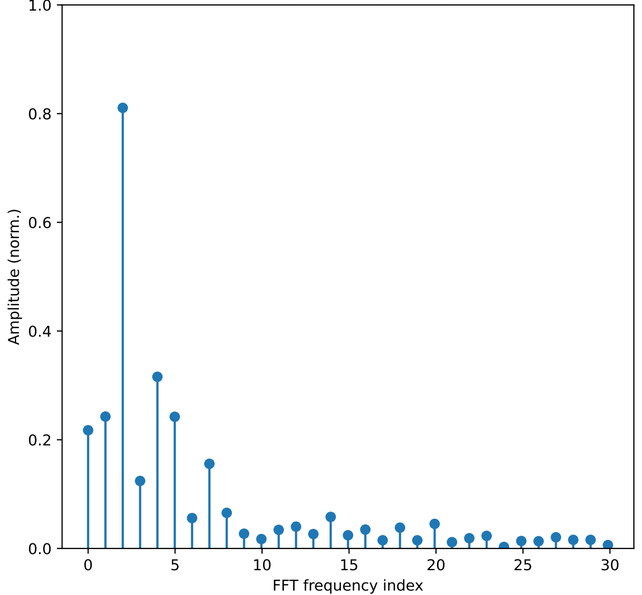

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

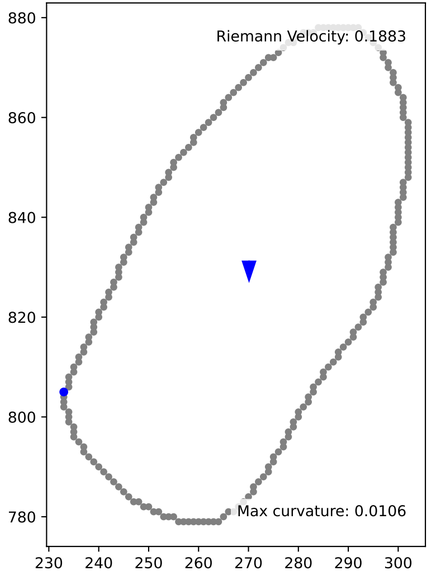

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

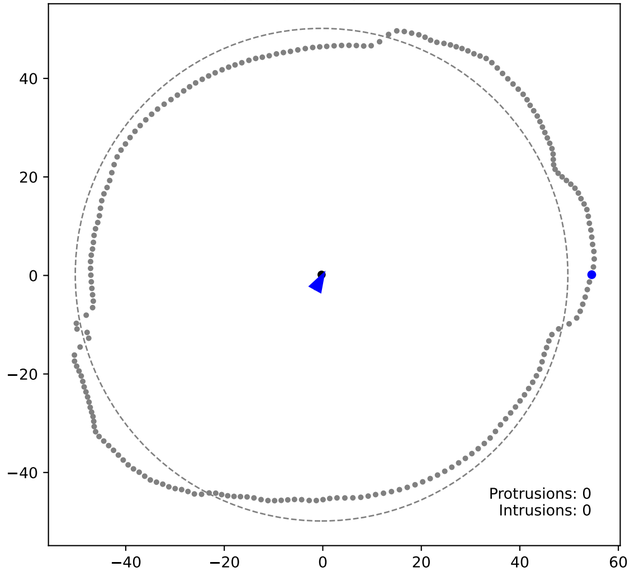

Shape evolution (t = 92.00)
Riemann Velocity: 0.1810
Max curvature: 0.0161
880
860
840
820
800
780
240
250
260
270
280
290
300

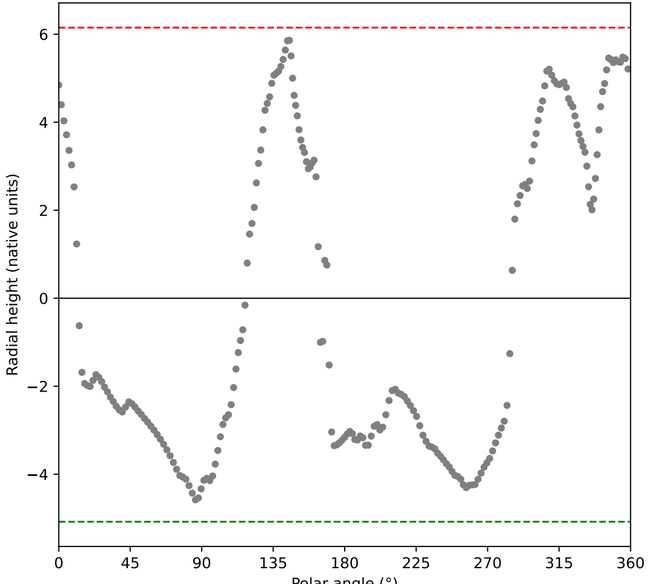

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

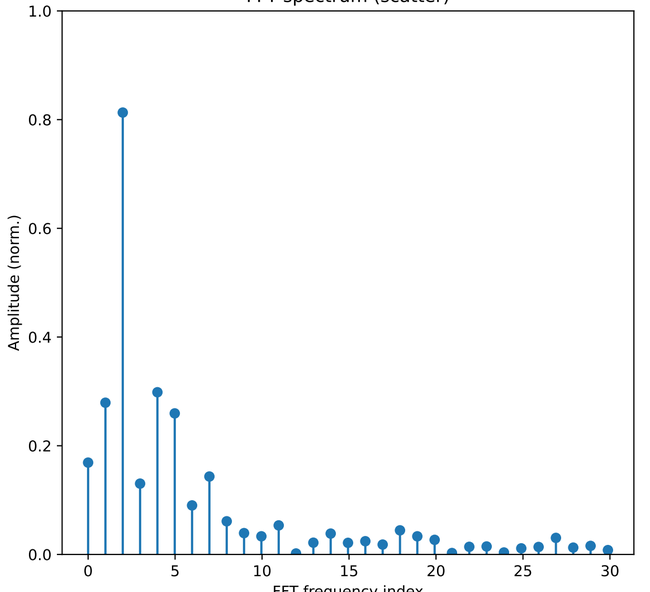

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

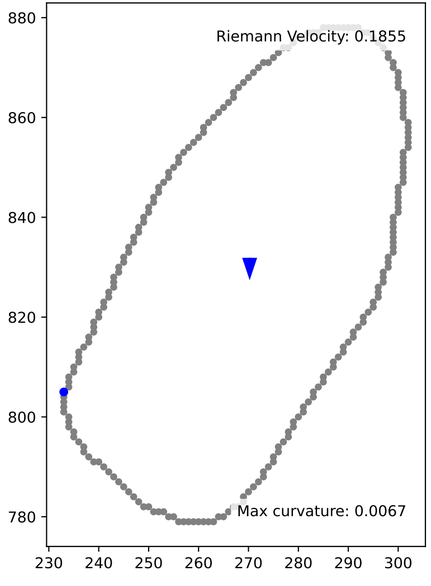

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

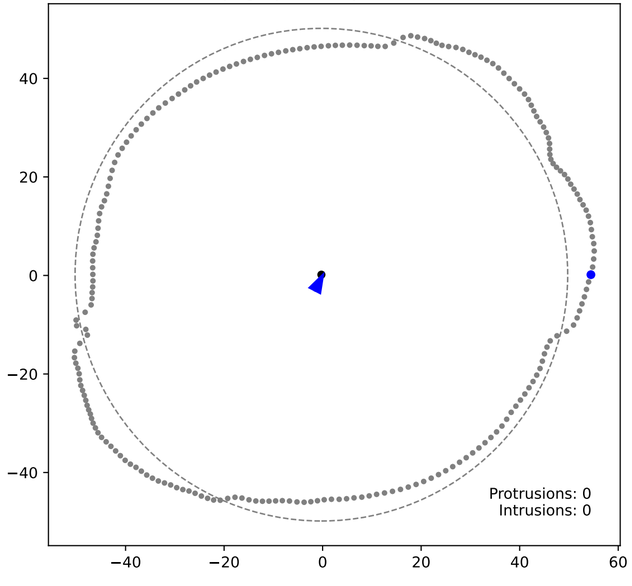

Shape evolution (t = 93.00)
Riemann Velocity: 0.1883
Max curvature: 0.0106
880
860
840
820
800
780
230
240
250
260
270
280
290
300

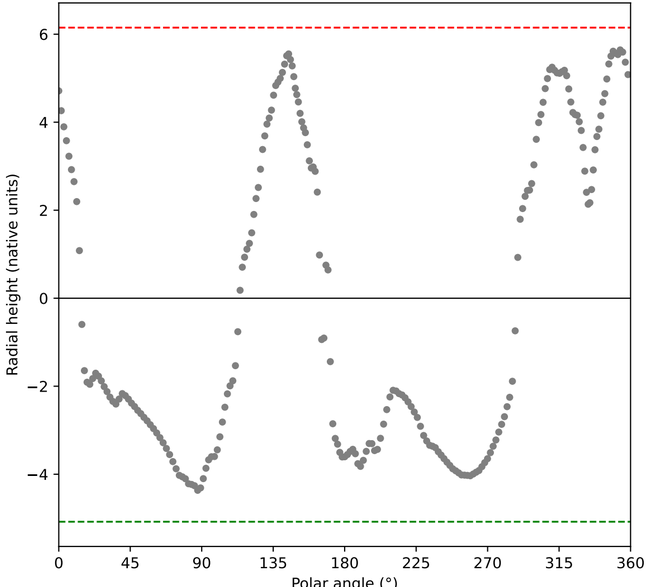

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

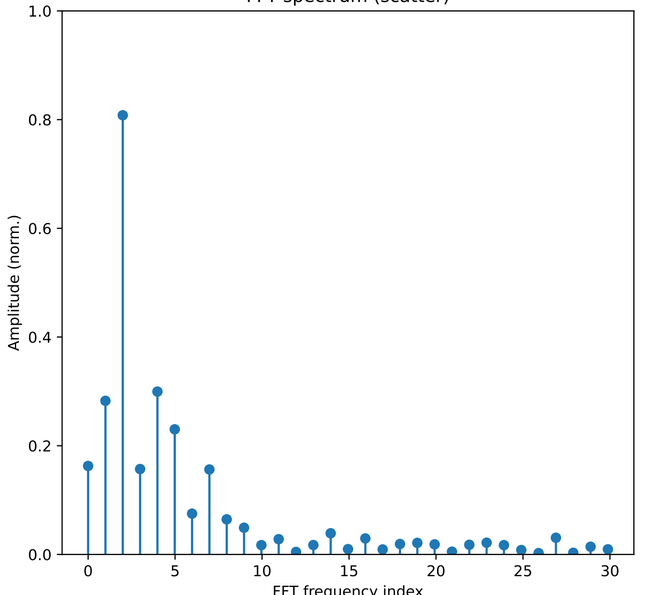

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

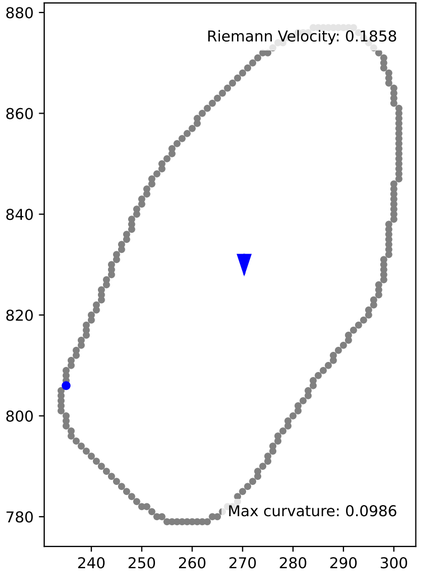

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

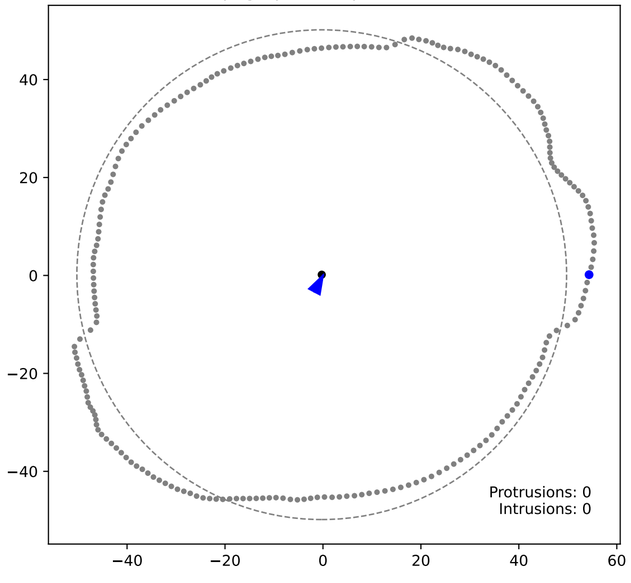

Shape evolution (t = 94.00)
Riemann Velocity: 0.1855
Max curvature: 0.0067
880
860
840
820
800
780
230
240
250
260
270
280
290
300

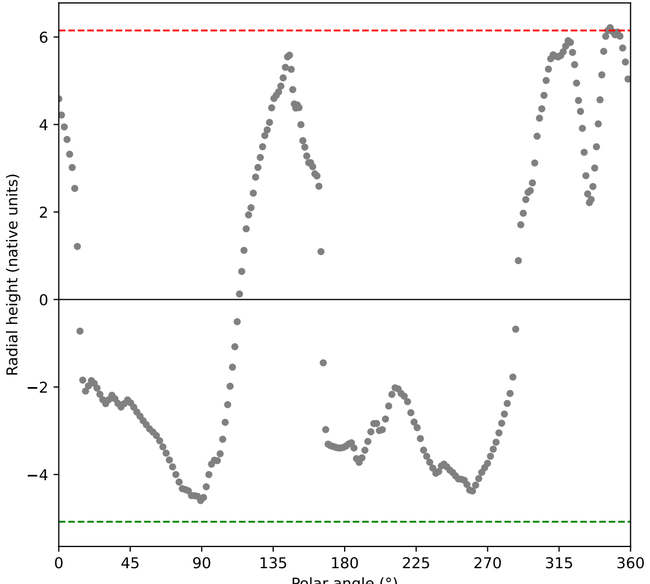

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

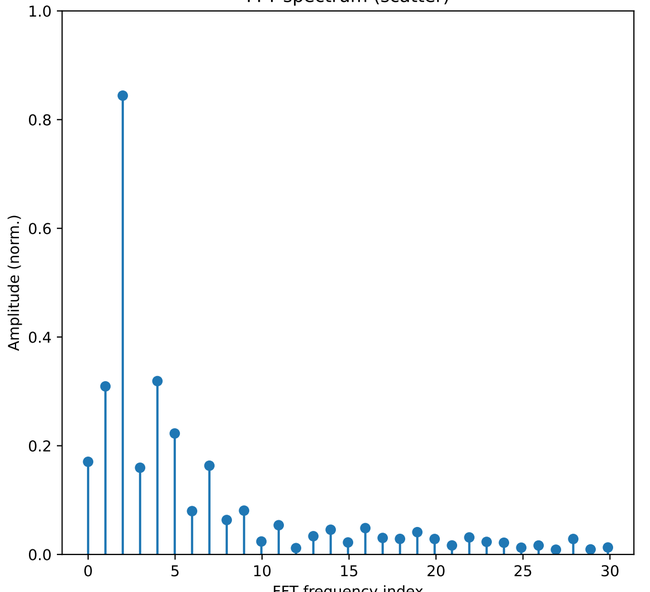

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

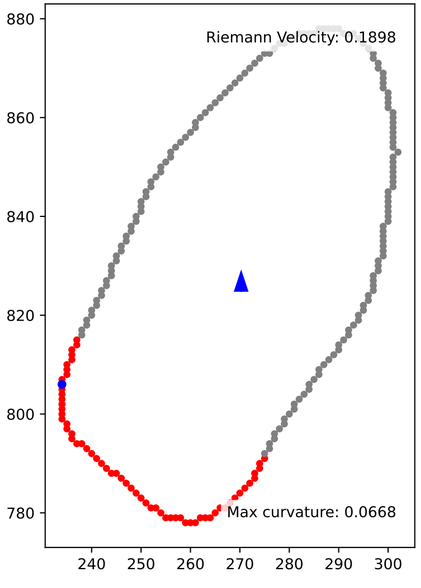

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

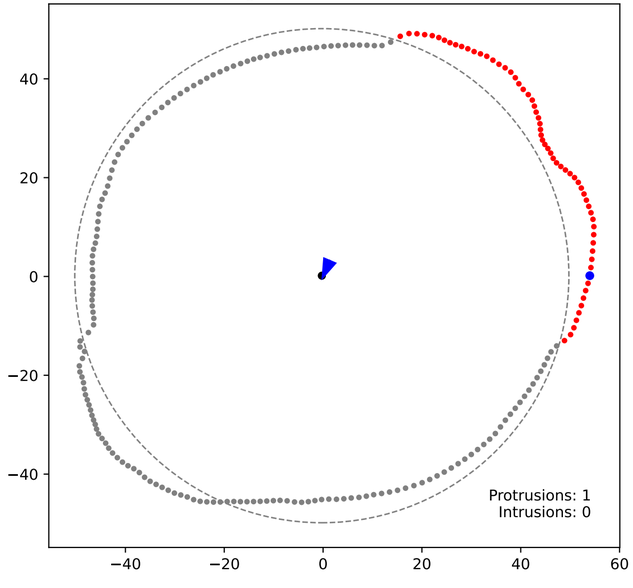

Shape evolution (t = 95.00)
Riemann Velocity: 0.1858
Max curvature: 0.0986
880
860
840
820
800
780
240
250
260
270
280
290
300

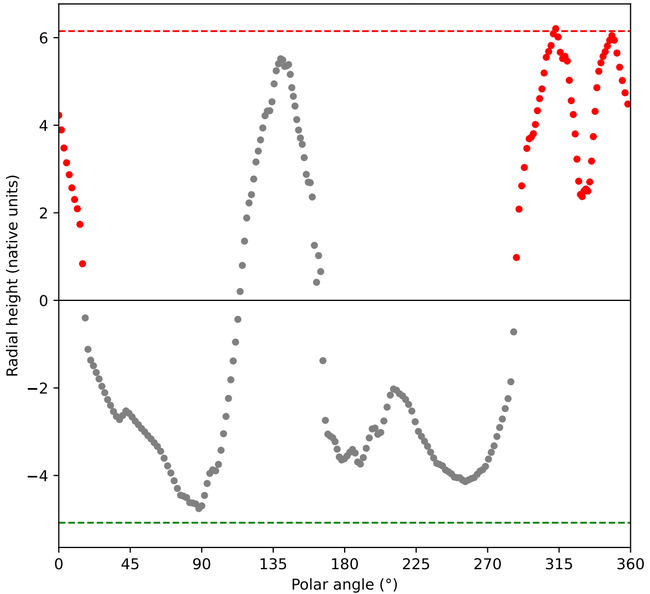

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

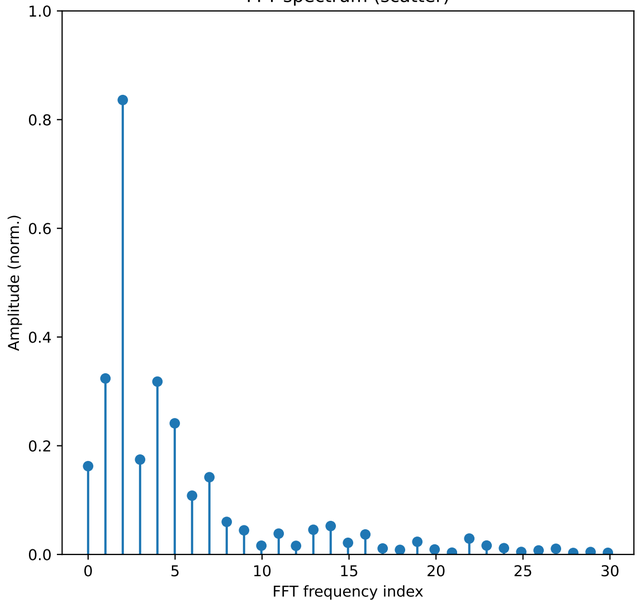

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

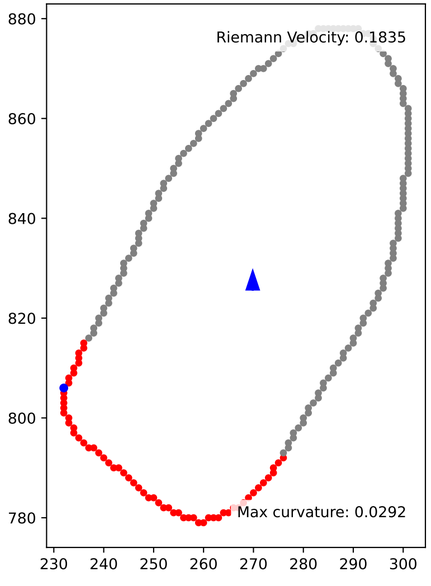

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

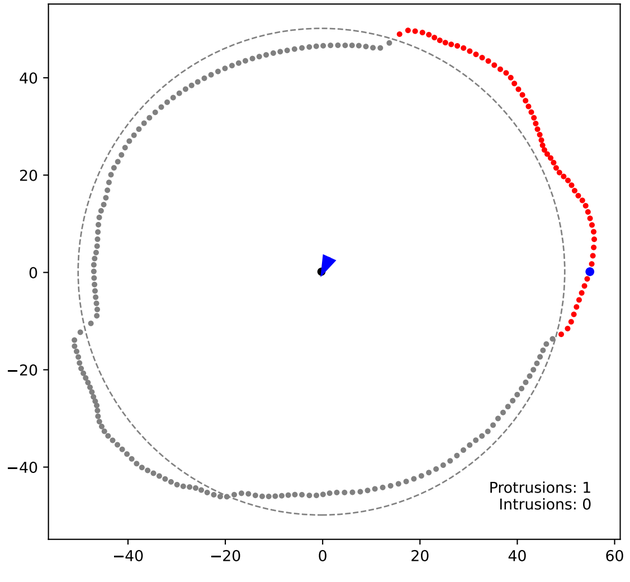

Shape evolution (t = 96.00)
Riemann Velocity: 0.1898
Max curvature: 0.0668
880
860
840
820
800
780
240
250
260
270
280
290
300

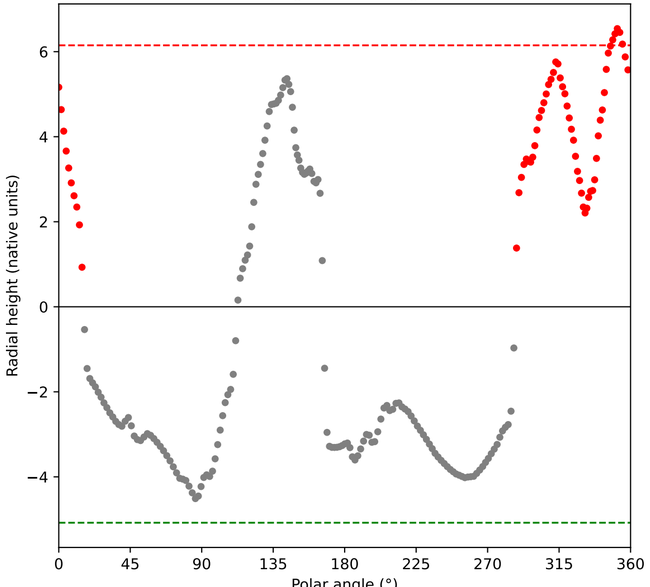

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

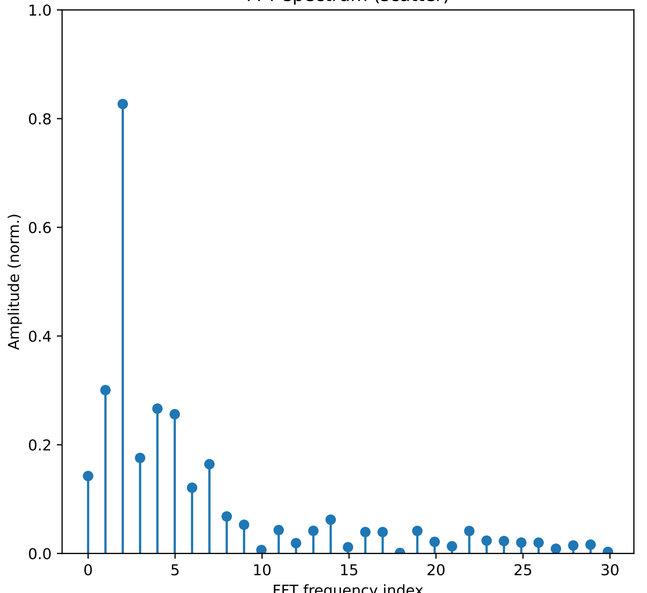

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

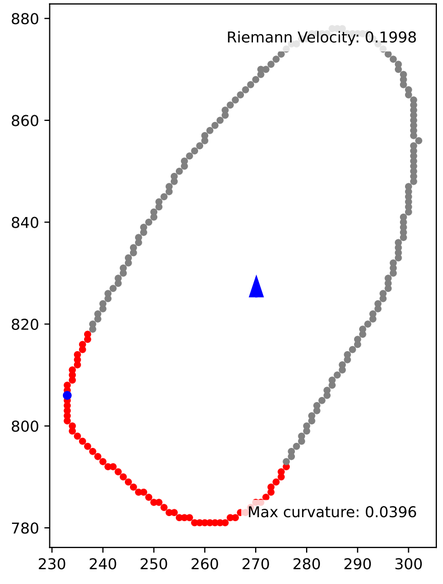

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

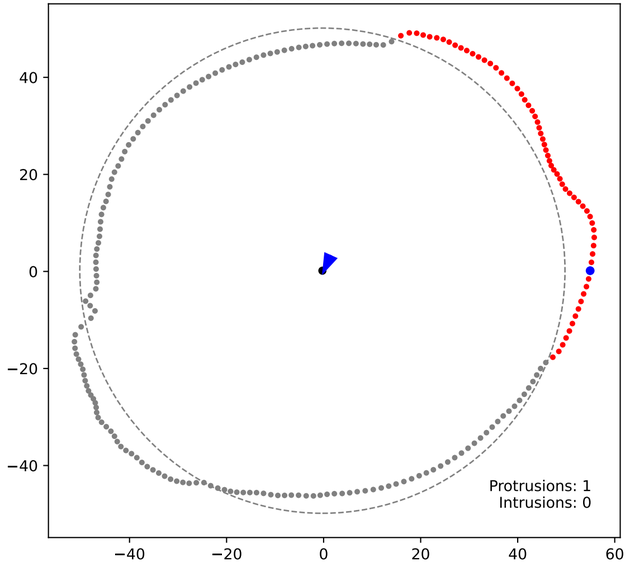

Shape evolution (t = 97.00)
Riemann Velocity: 0.1835
Max curvature: 0.0292
880
860
840
820
800
780
230
240
250
260
270
280
290
300

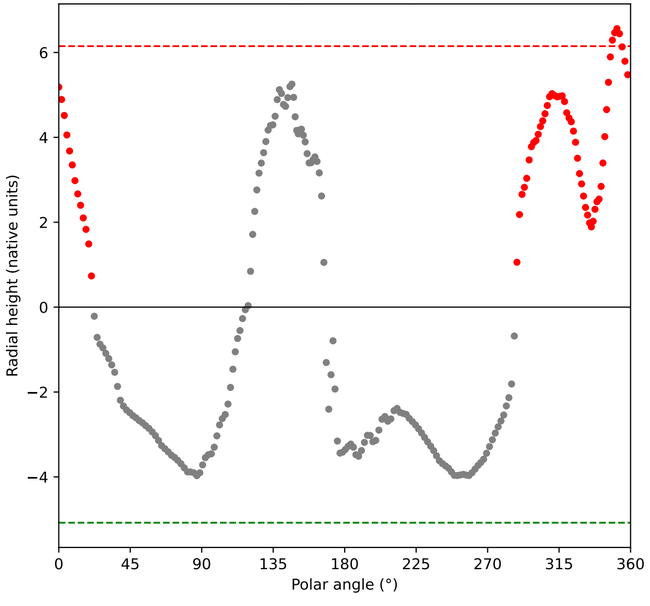

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

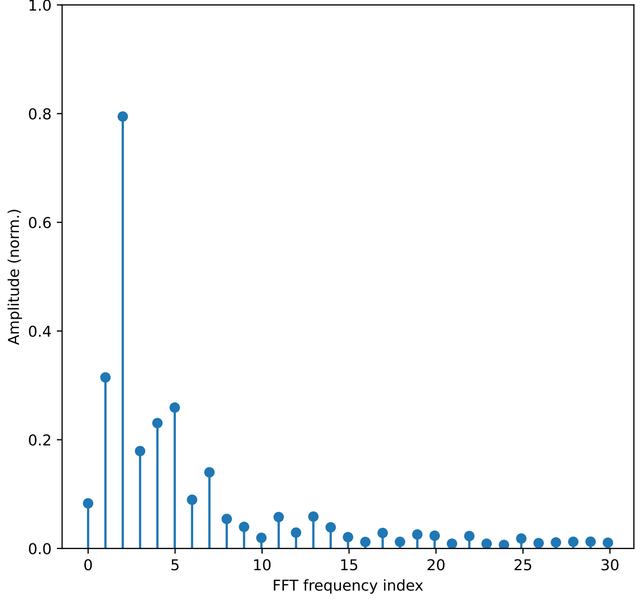

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

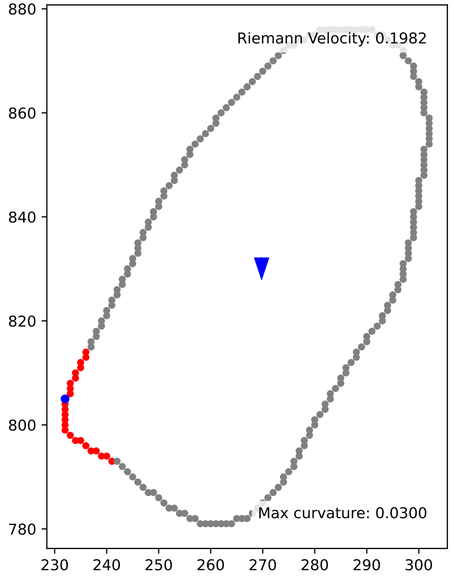

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

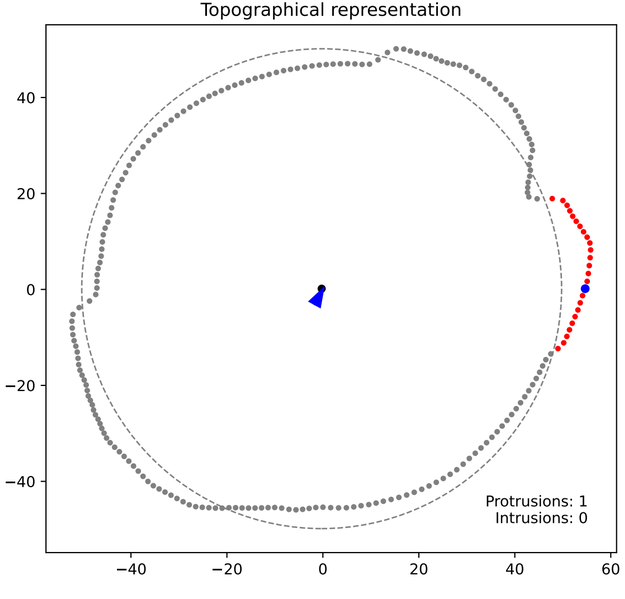

Shape evolution (t = 98.00)
Riemann Velocity: 0.1998
Max curvature: 0.0396
880
860
840
820
800
780
230
240
250
260
270
280
290
300

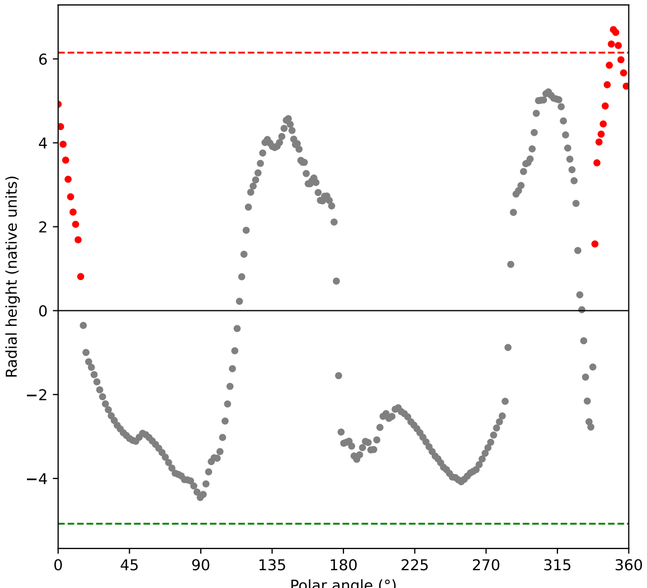

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

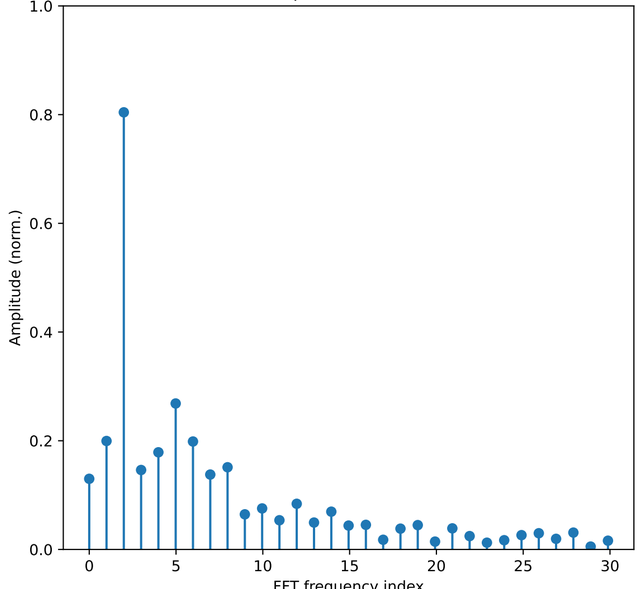

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

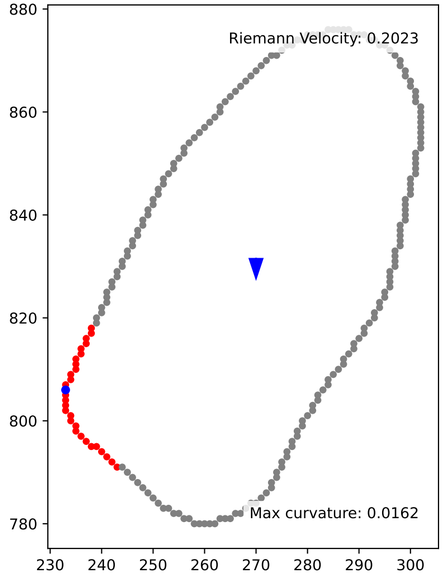

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

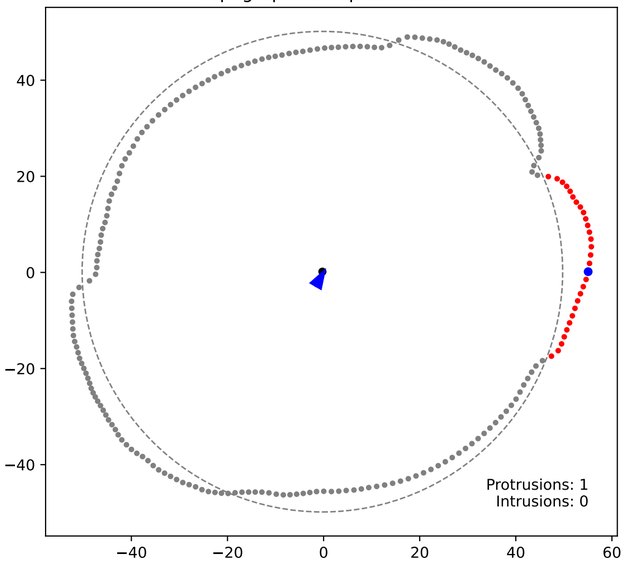

Shape evolution (t = 99.00)
Riemann Velocity: 0.1982
Max curvature: 0.0300
880
860
840
820
800
780
230
240
250
260
270
280
290
300

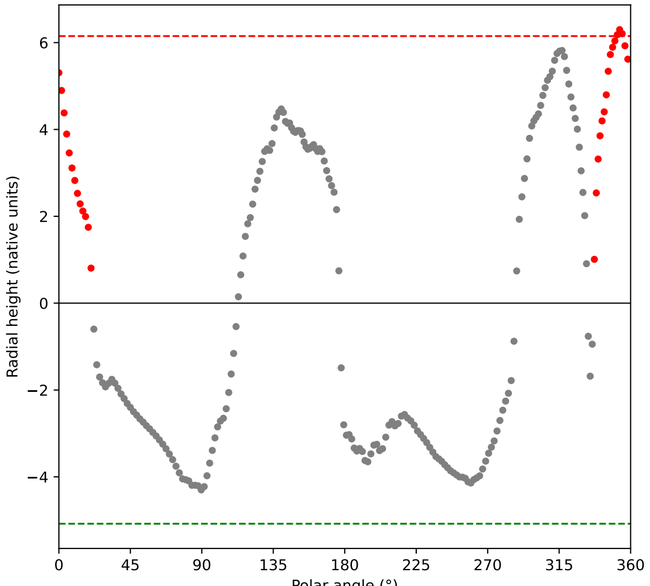

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

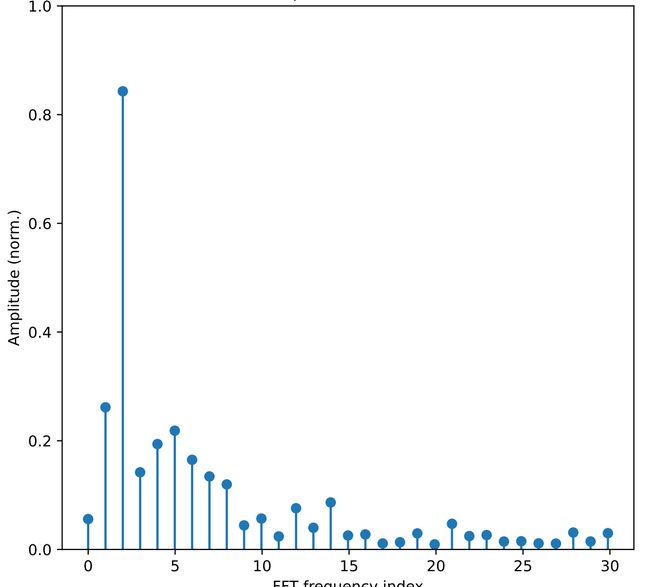

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

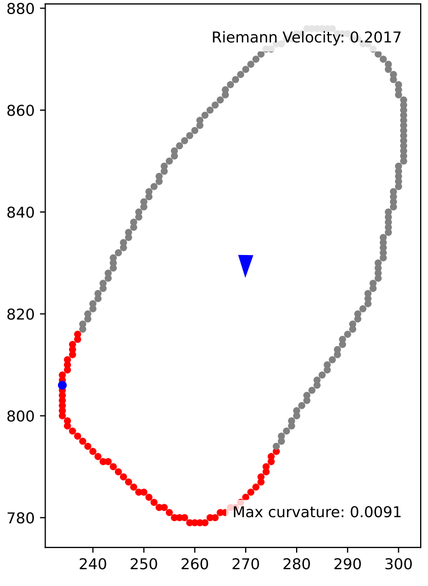

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

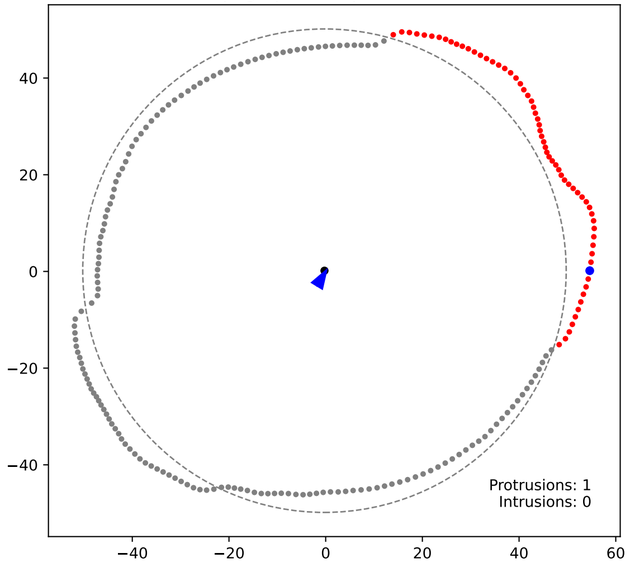

Shape evolution (t = 100.00)
Riemann Velocity: 0.2023
Max curvature: 0.0162
880
860
840
820
800
780
230
240
250
260
270
280
290
300

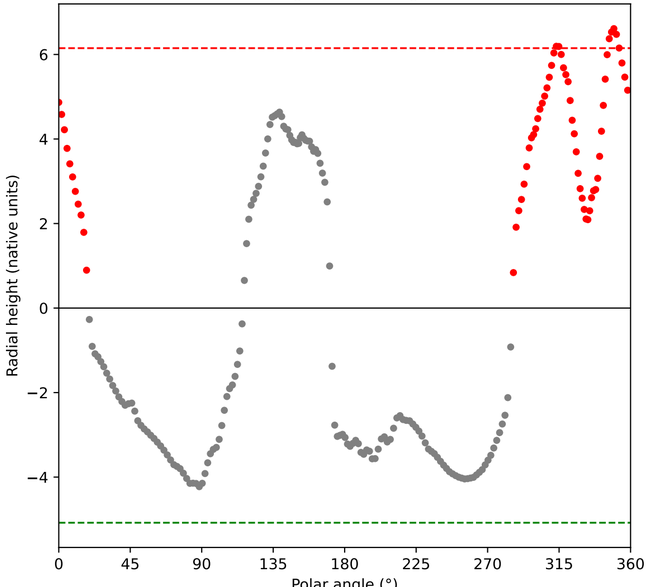

Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

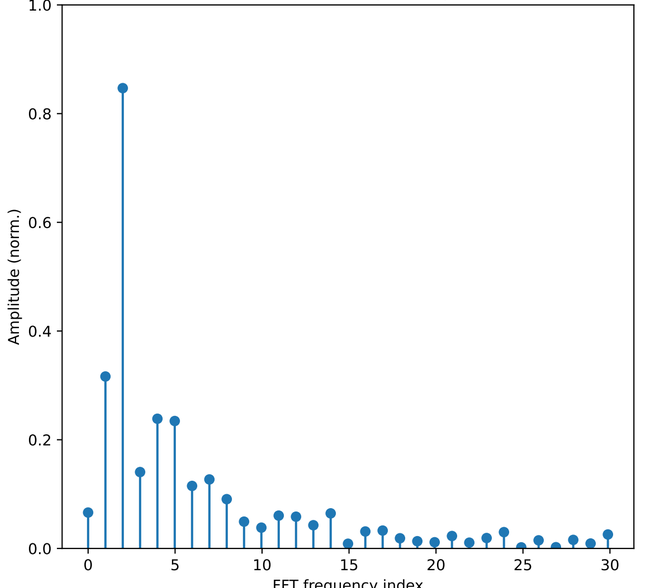

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30


Shape evolution (t = 101.00)
Riemann Velocity: 0.2017
Max curvature: 0.0091
880
860
840
820
800
780
240
250
260
270
280
290
300


Topographical representation
Protrusions: 1
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60


Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
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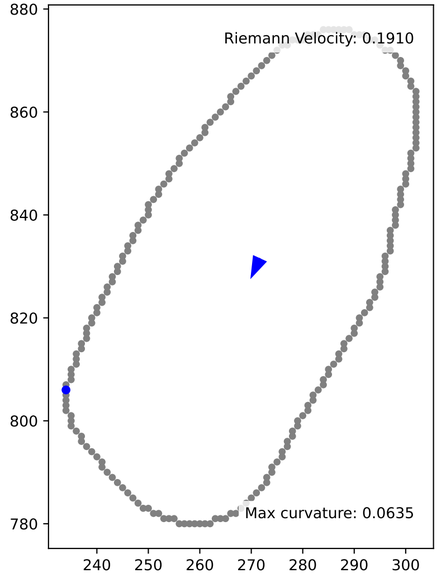
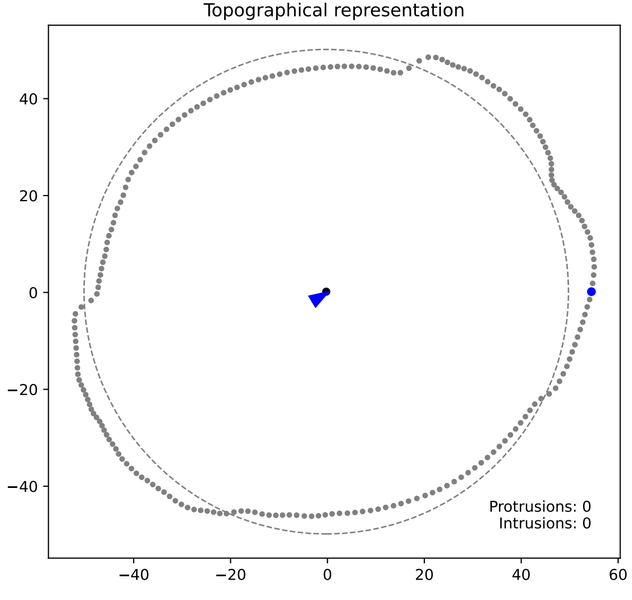
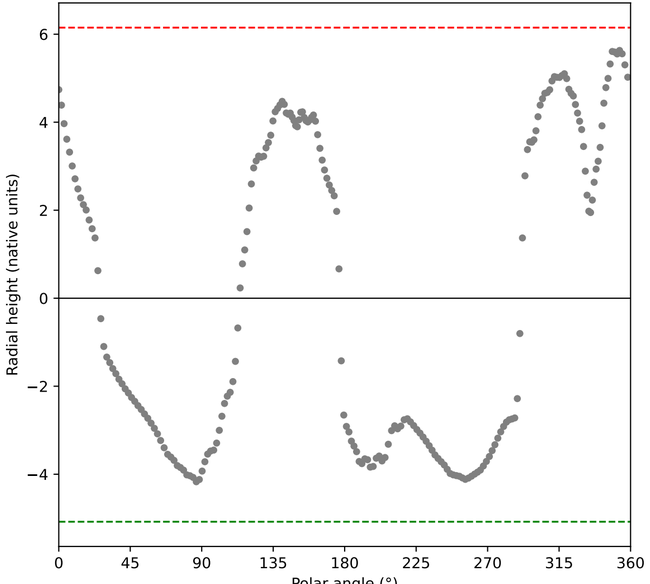
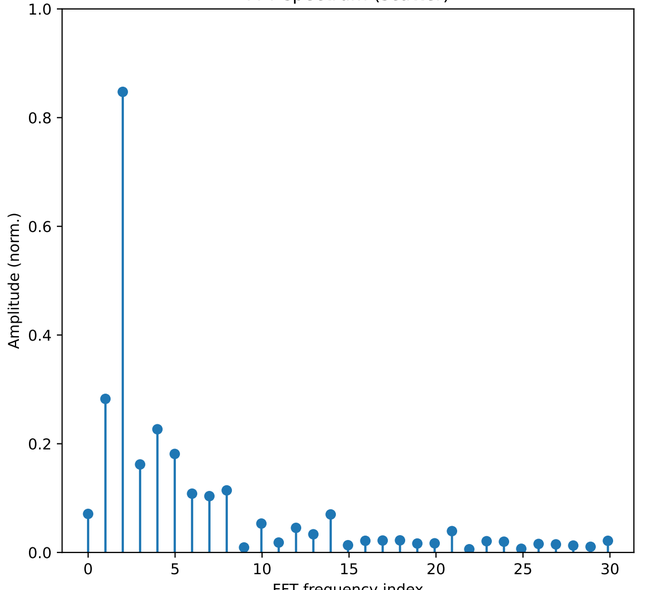
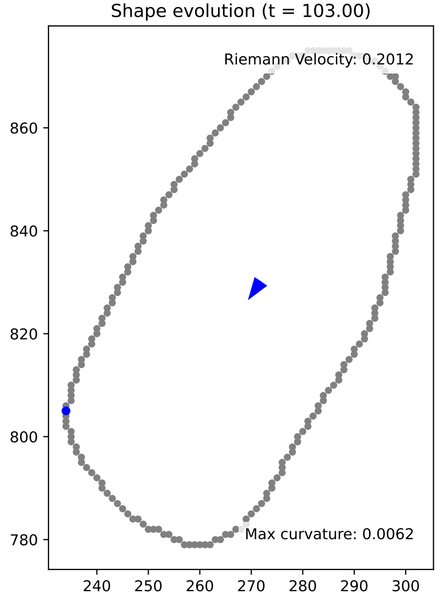
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

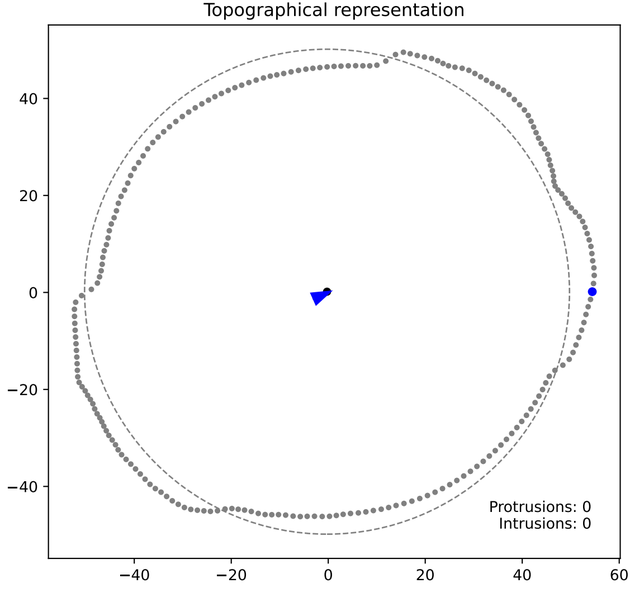

Shape evolution (t = 102.00)
Riemann Velocity: 0.1910
Max curvature: 0.0635
880
860
840
820
800
780
240
250
260
270
280
290
300

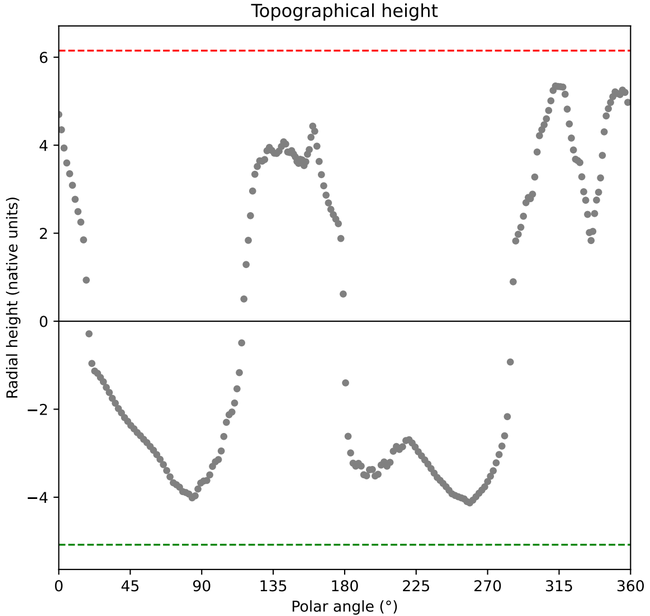

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60

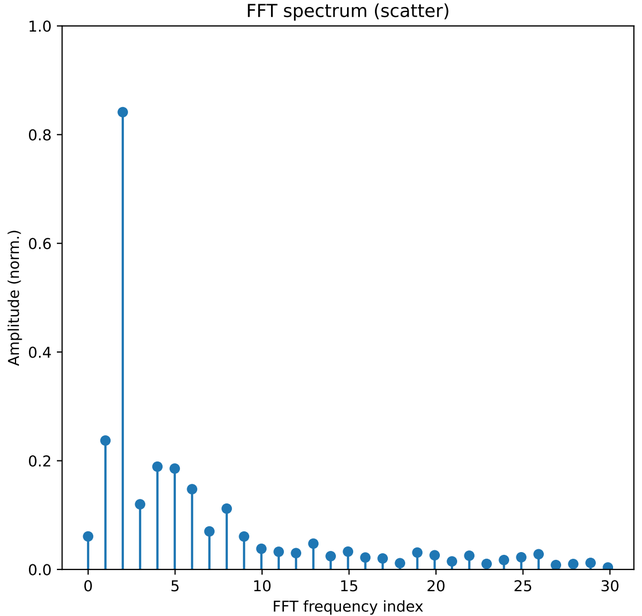

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30


Shape evolution (t = 103.00)
Riemann Velocity: 0.2012
Max curvature: 0.0062
860
840
820
800
780
240
250
260
270
280
290
300


Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40
60


Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
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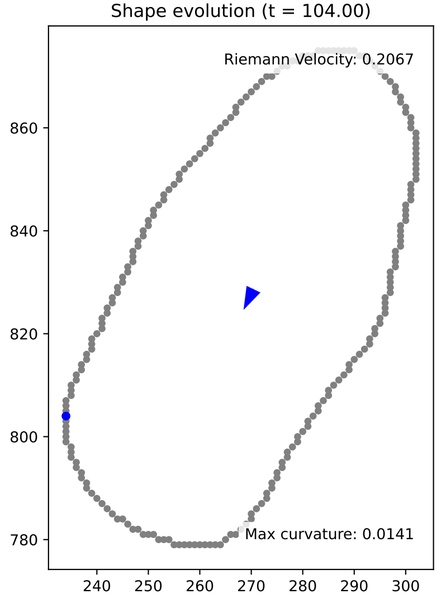
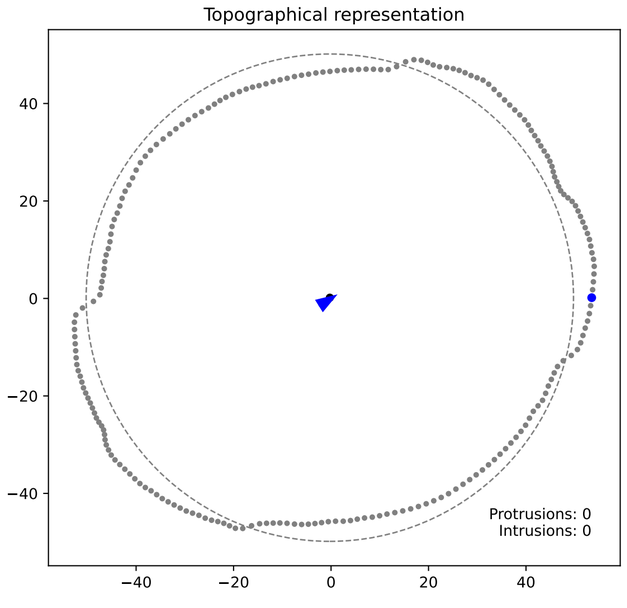
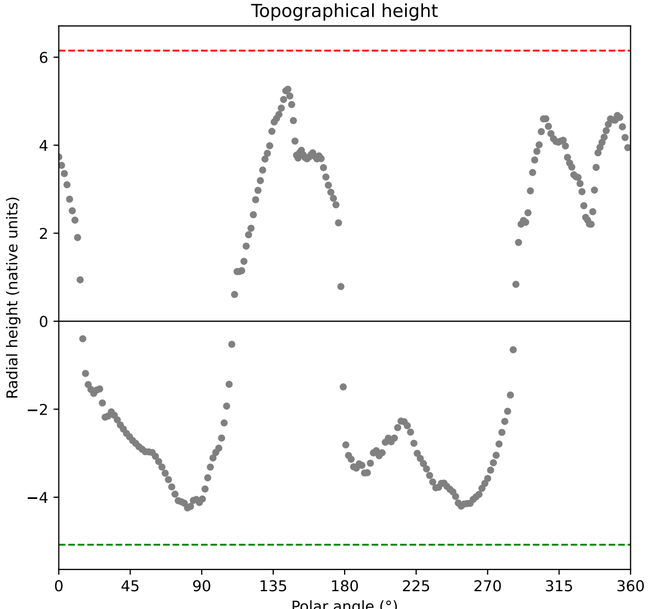
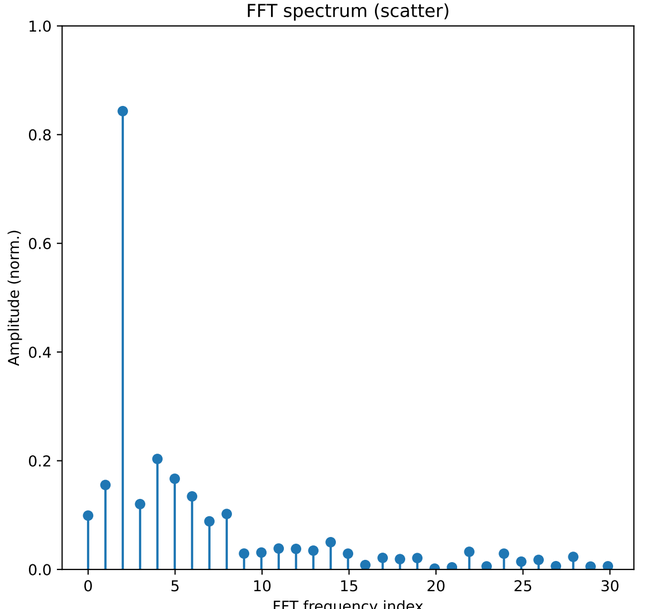
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30


Shape evolution (t = 104.00)
Riemann Velocity: 0.2067
Max curvature: 0.0141
860
840
820
800
780
240
250
260
270
280
290
300


Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40


Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
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0.8
0.6
0.4
0.2
0.0
0
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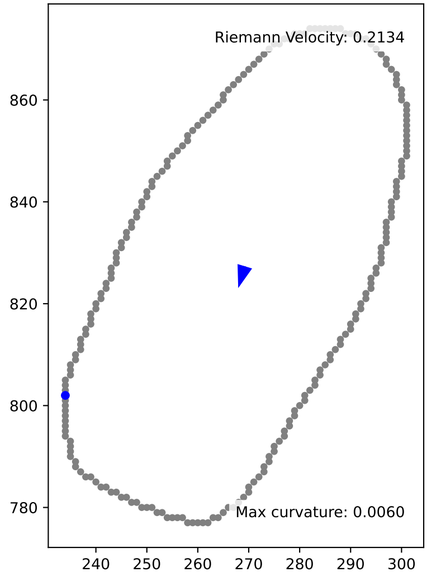
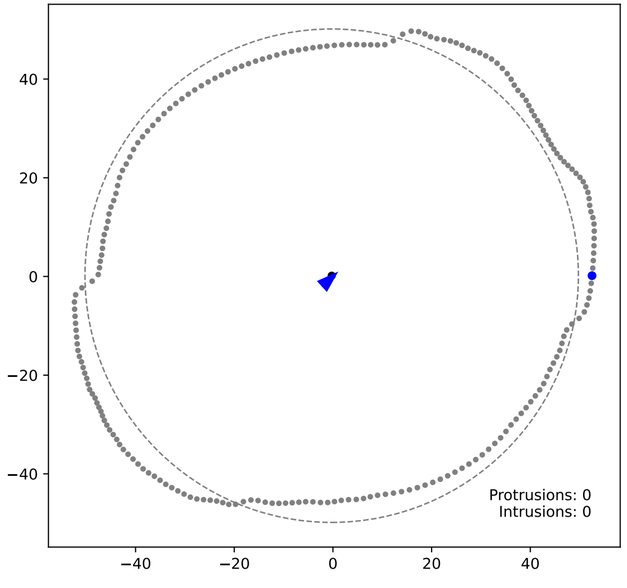
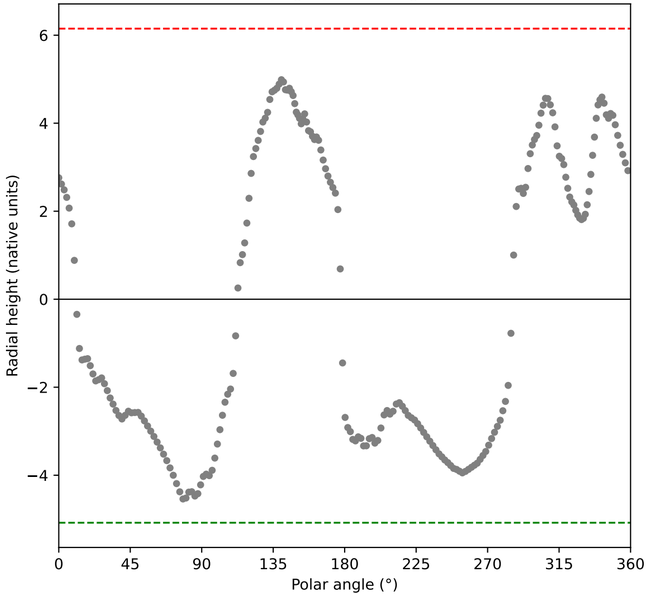
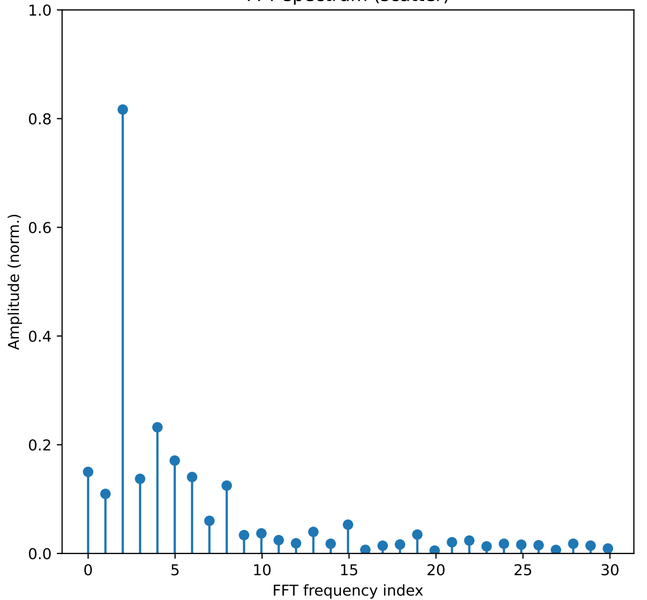
15
20
25
30


Shape evolution (t = 105.00)
Riemann Velocity: 0.2134
Max curvature: 0.0060
860
840
820
800
780
240
250
260
270
280
290
300


Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40


Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
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15
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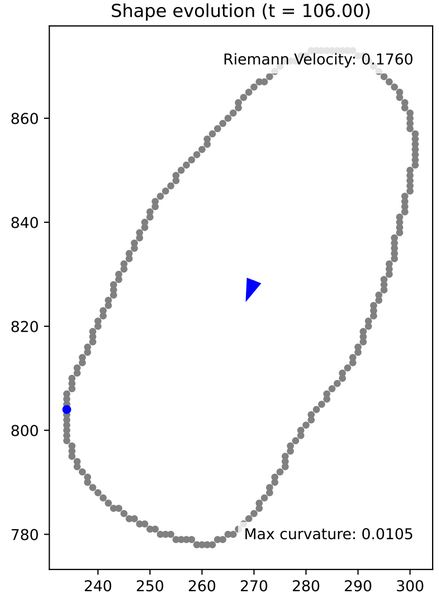
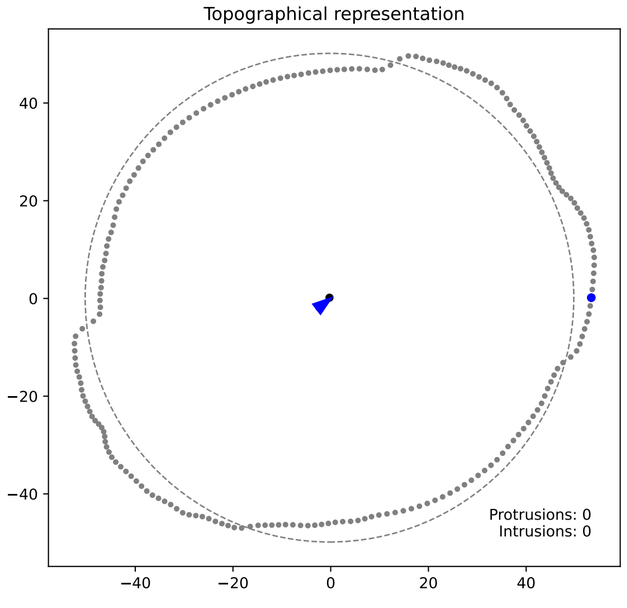
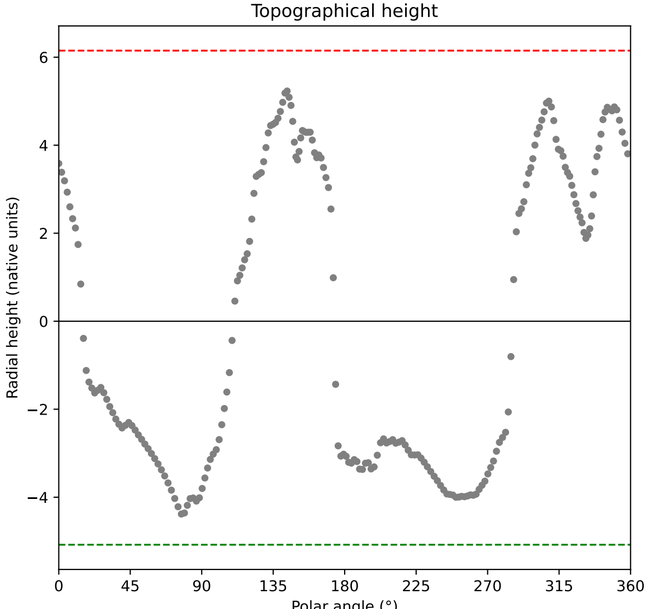
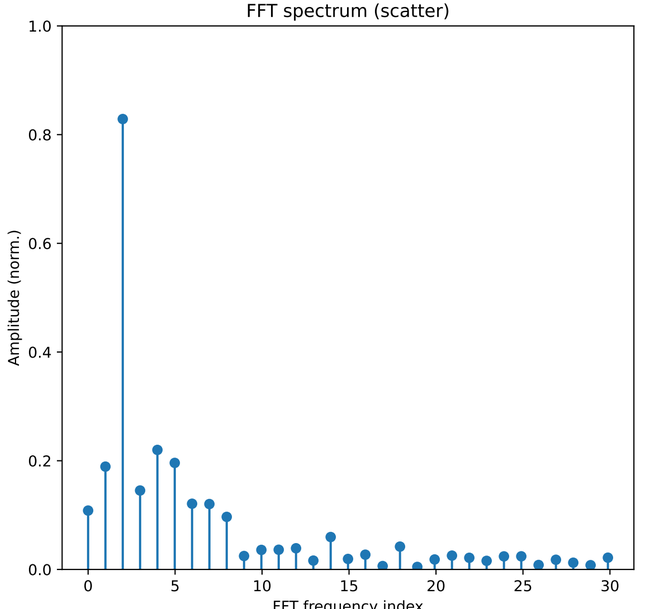
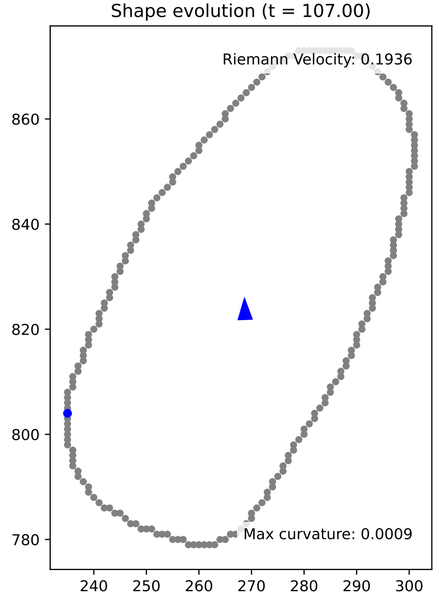
25
30

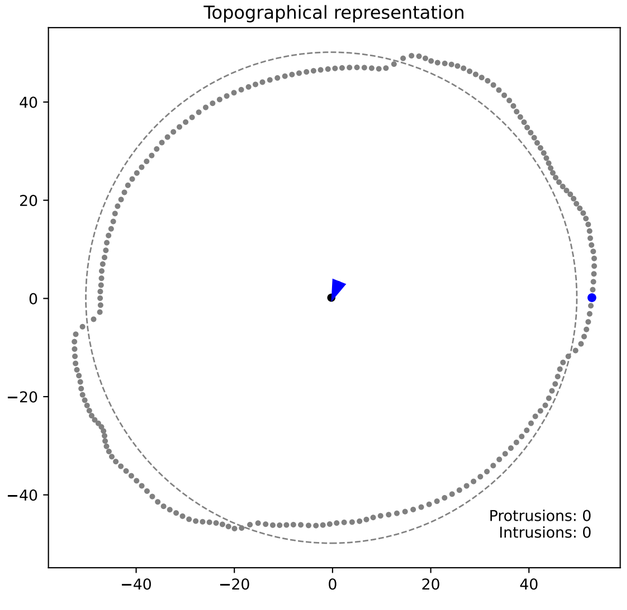

Shape evolution (t = 106.00)
Riemann Velocity: 0.1760
Max curvature: 0.0105
860
840
820
800
780
240
250
260
270
280
290
300

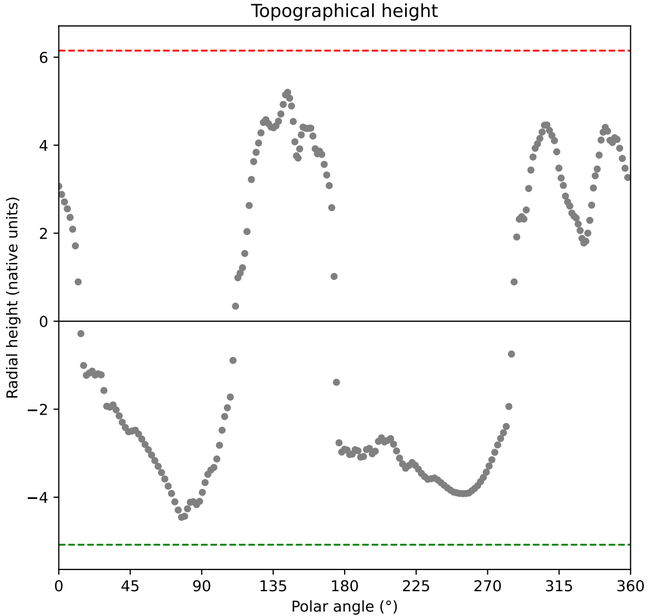

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

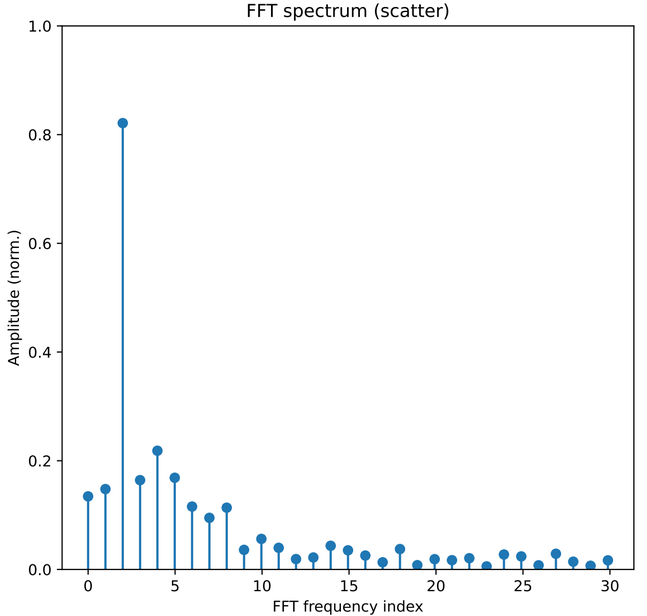

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

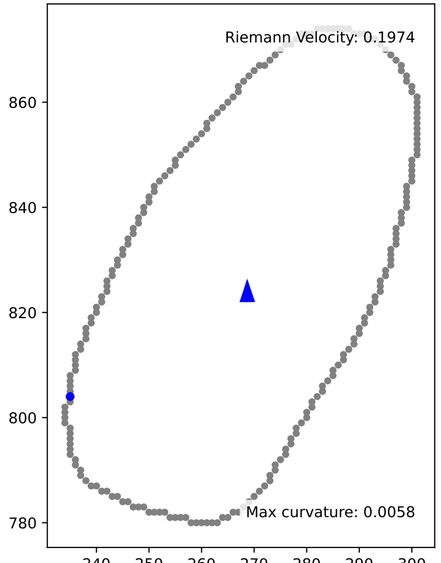

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

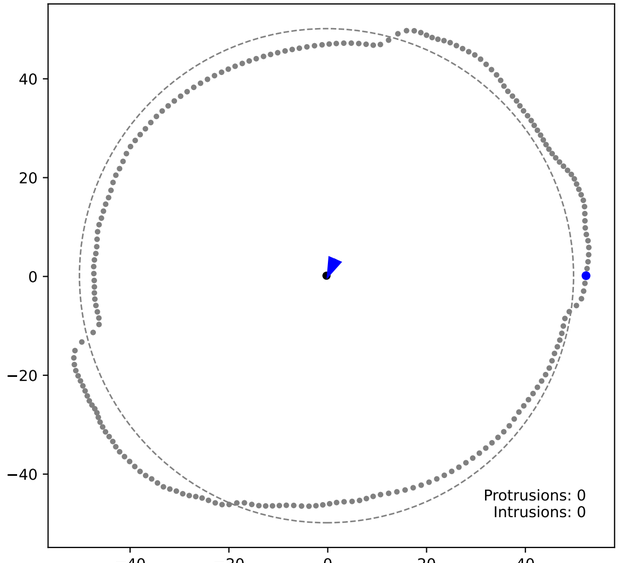

Shape evolution (t = 107.00)
Riemann Velocity: 0.1936
Max curvature: 0.0009
860
840
820
800
780
240
250
260
270
280
290
300

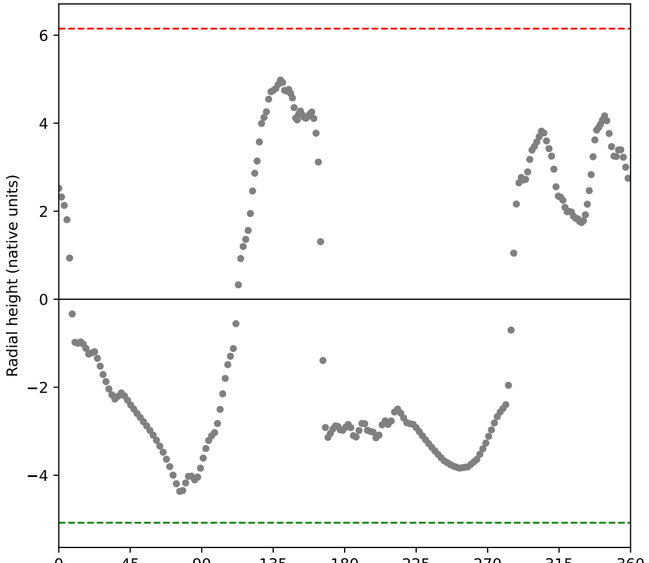

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

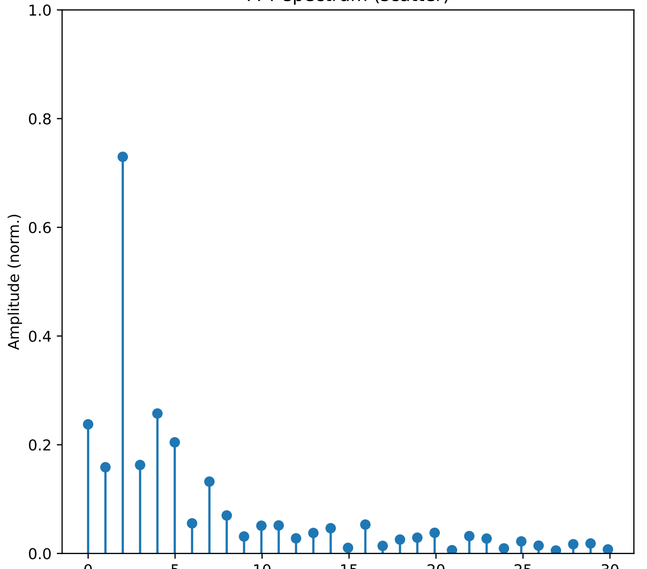

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

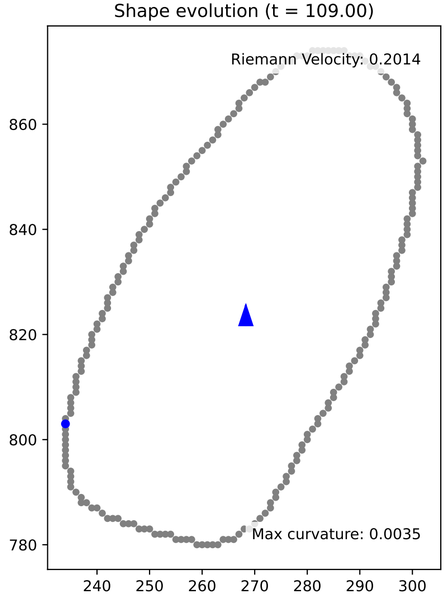

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

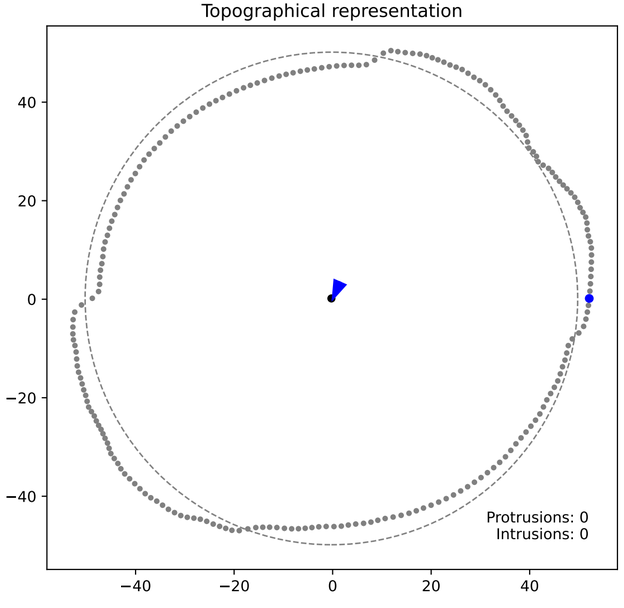

Shape evolution (t = 108.00)
Riemann Velocity: 0.1974
Max curvature: 0.0058
860
840
820
800
780
240
250
260
270
280
290
300

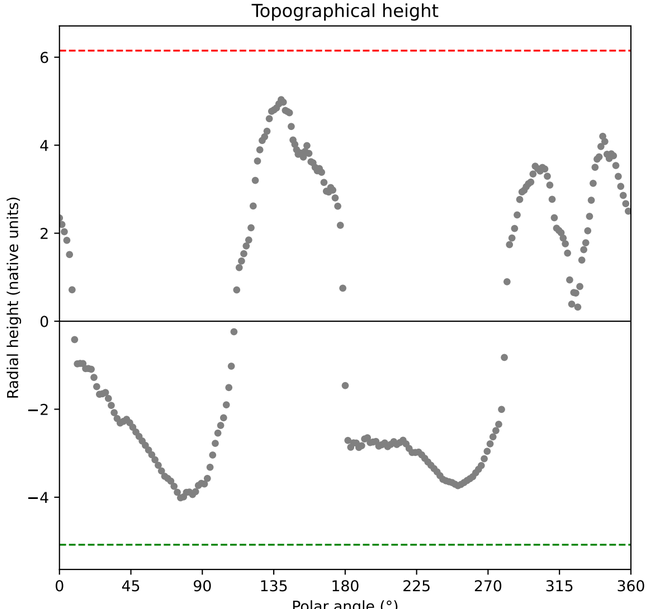

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

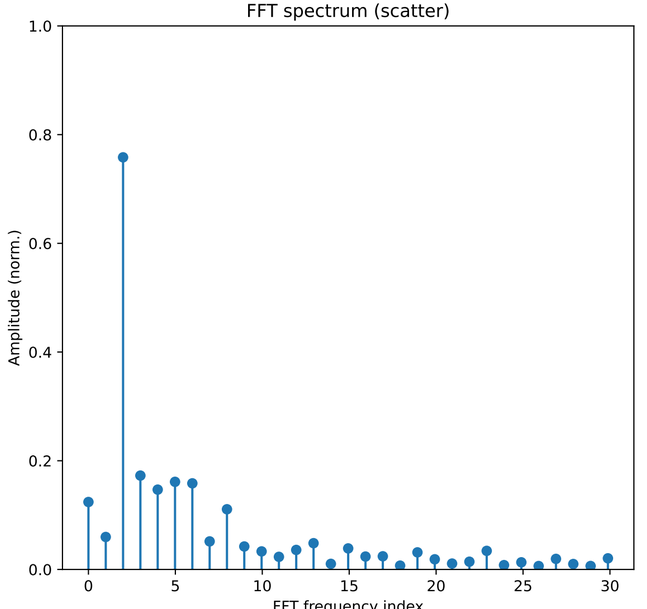

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

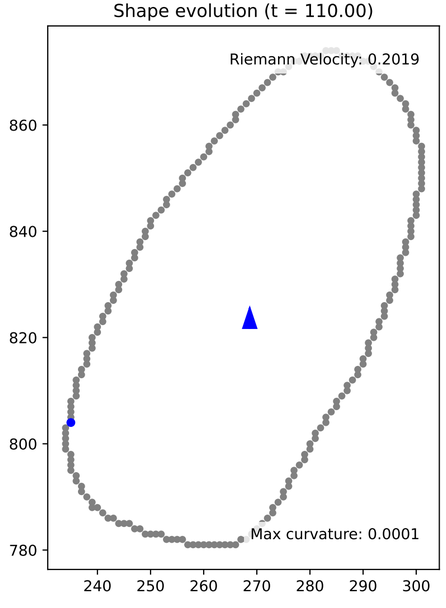

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

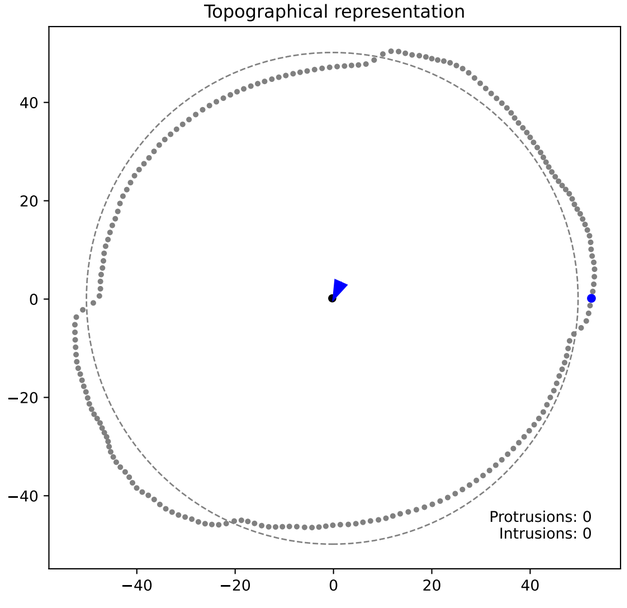

Shape evolution (t = 109.00)
Riemann Velocity: 0.2014
Max curvature: 0.0035
860
840
820
800
780
240
250
260
270
280
290
300

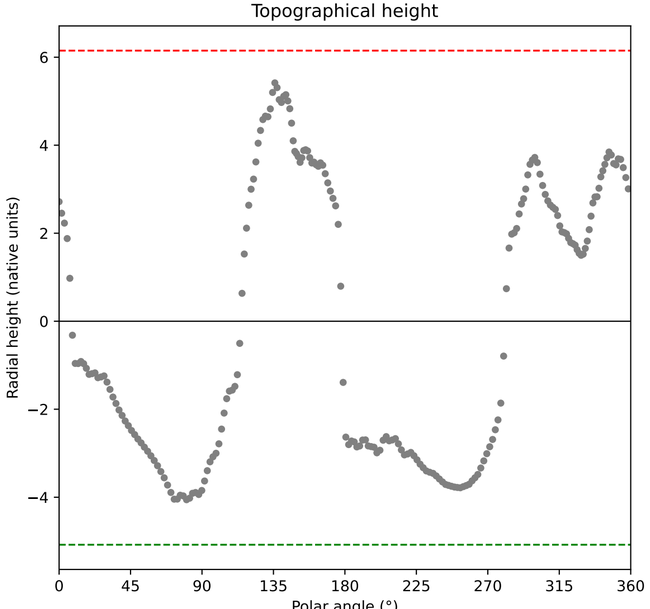

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

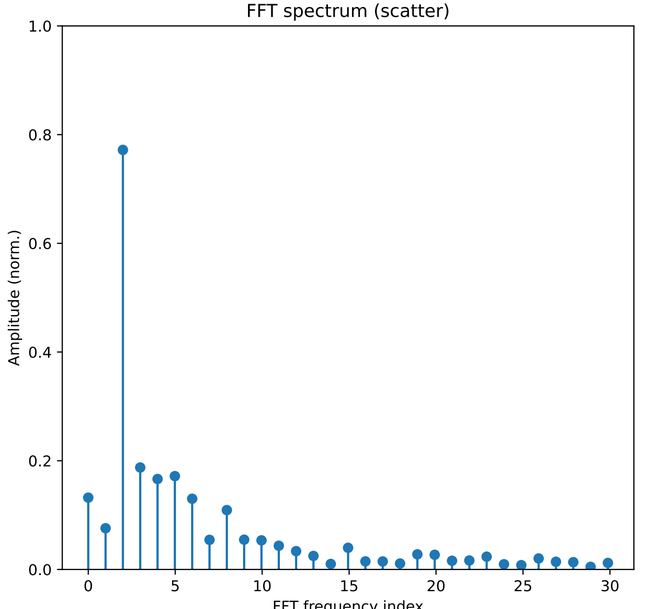

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

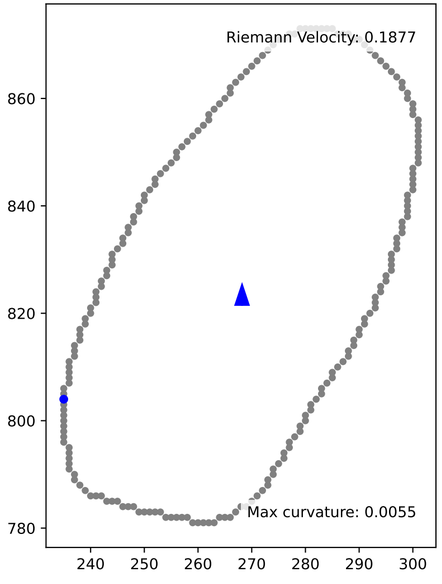

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

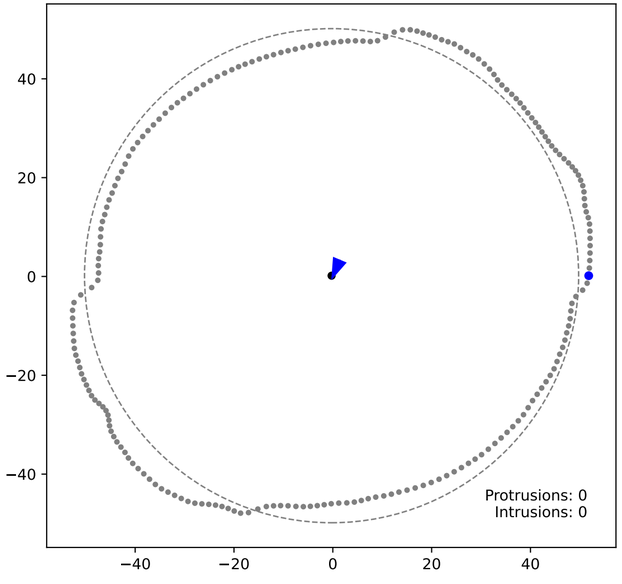

Shape evolution (t = 110.00)
Riemann Velocity: 0.2019
Max curvature: 0.0001
860
840
820
800
780
240
250
260
270
280
290
300

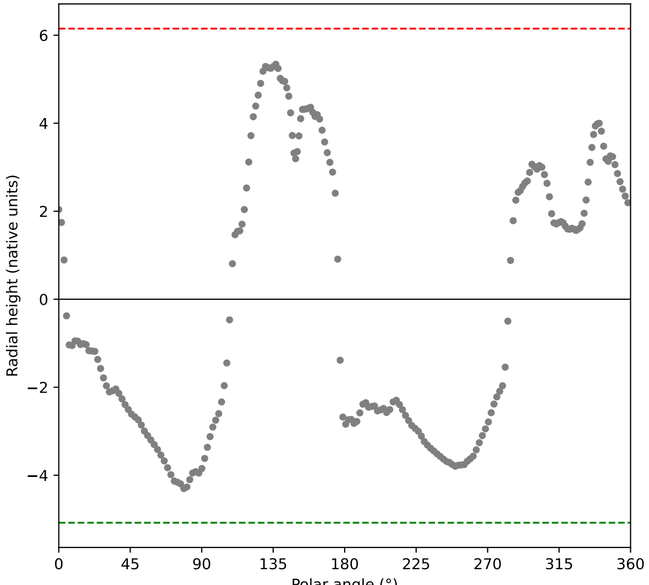

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

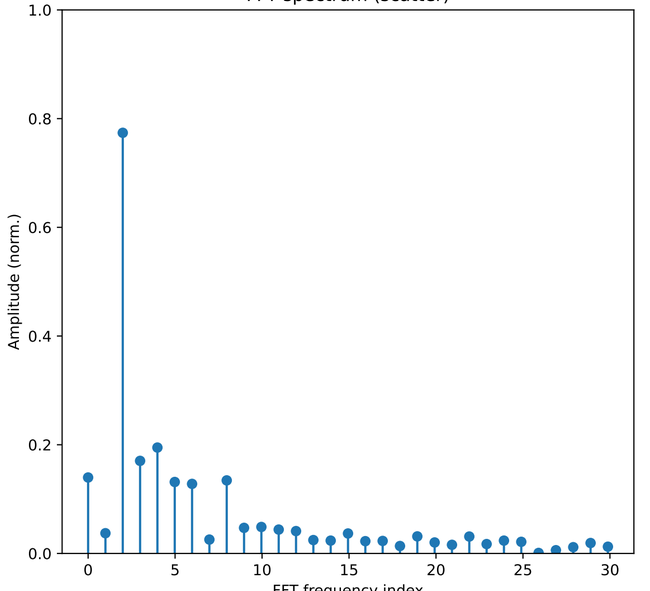

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

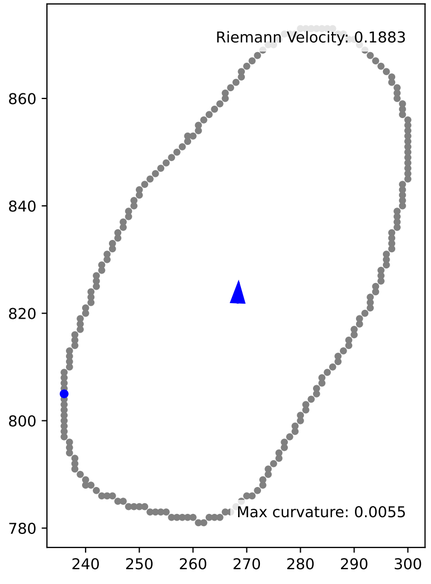

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

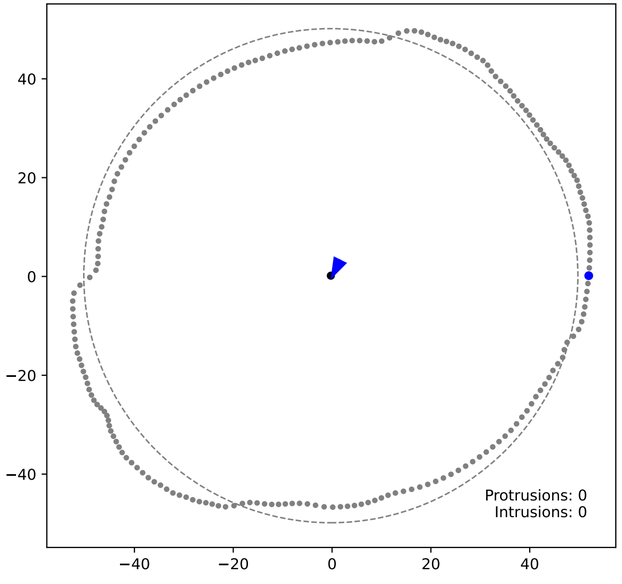

Shape evolution (t = 111.00)
Riemann Velocity: 0.1877
Max curvature: 0.0055
860
840
820
800
780
240
250
260
270
280
290
300

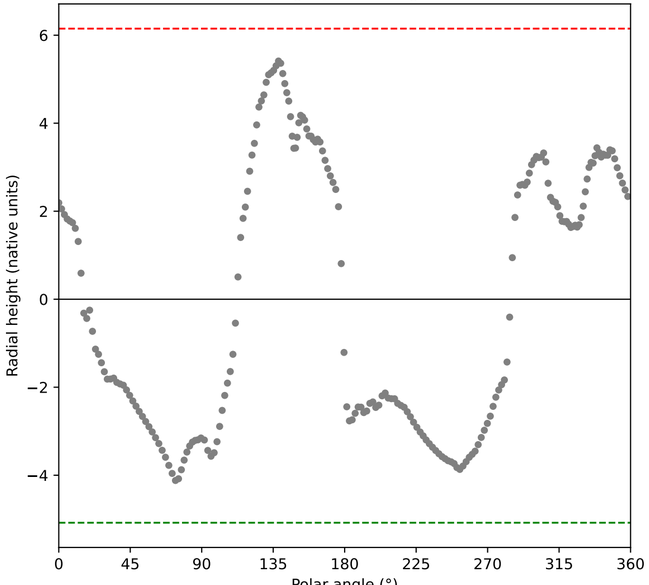

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

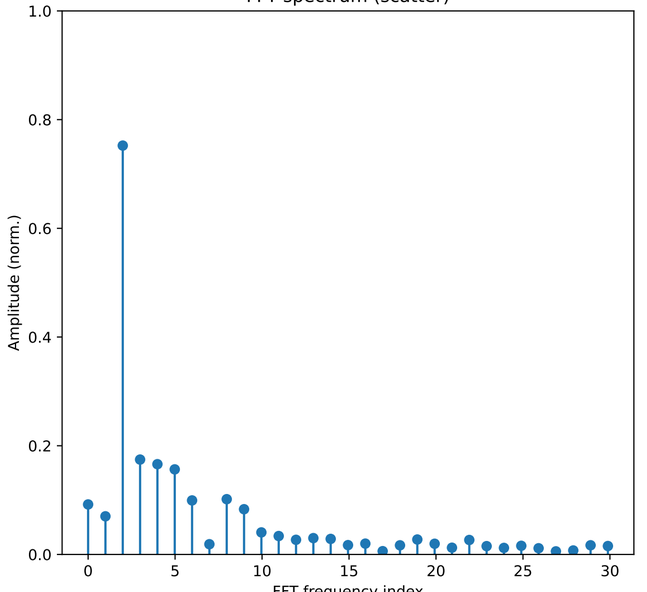

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

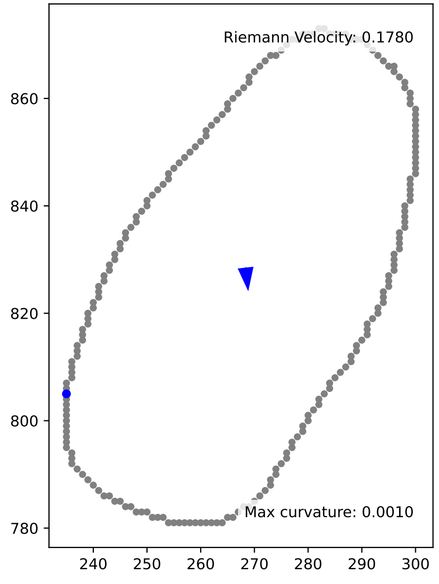

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

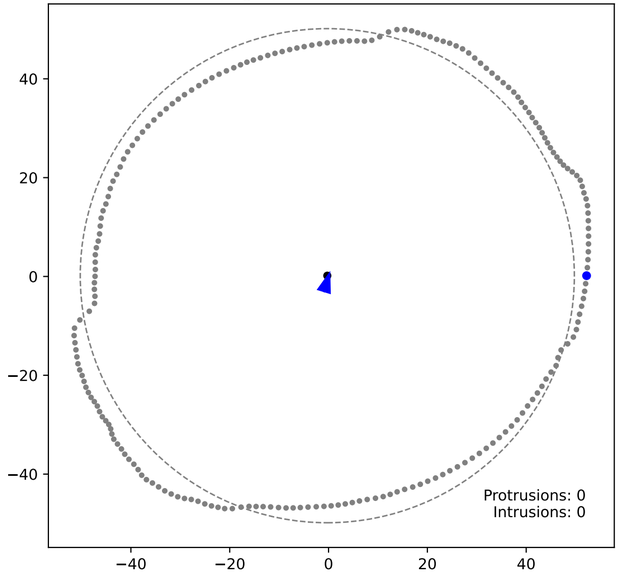

Shape evolution (t = 112.00)
Riemann Velocity: 0.1883
Max curvature: 0.0055
860
840
820
800
780
240
250
260
270
280
290
300

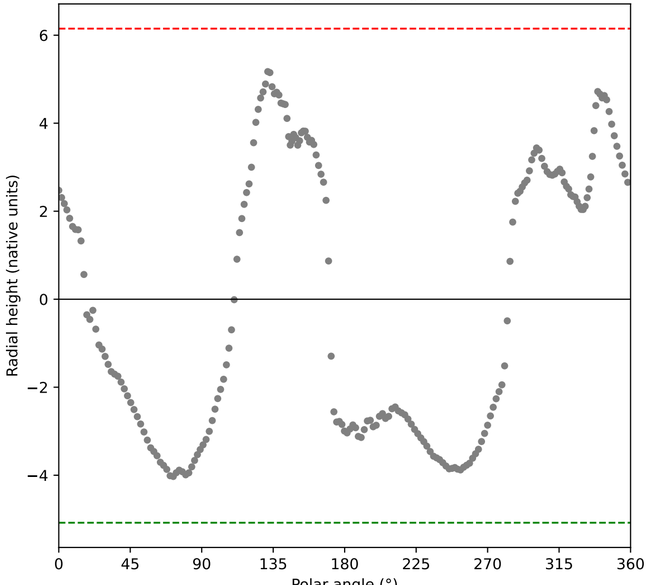

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

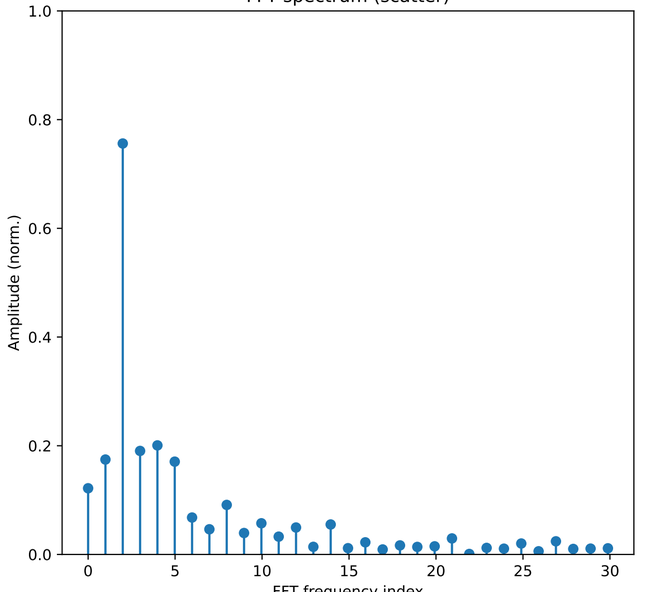

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

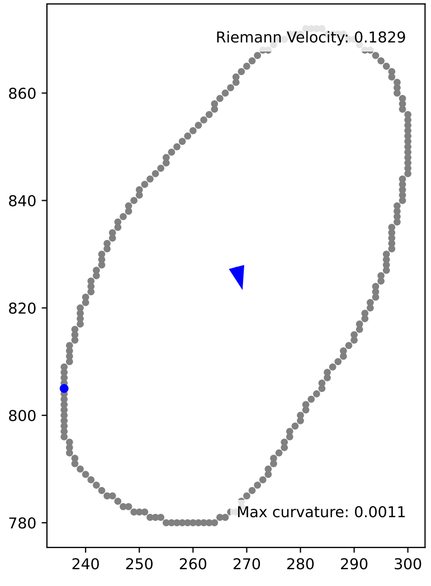

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

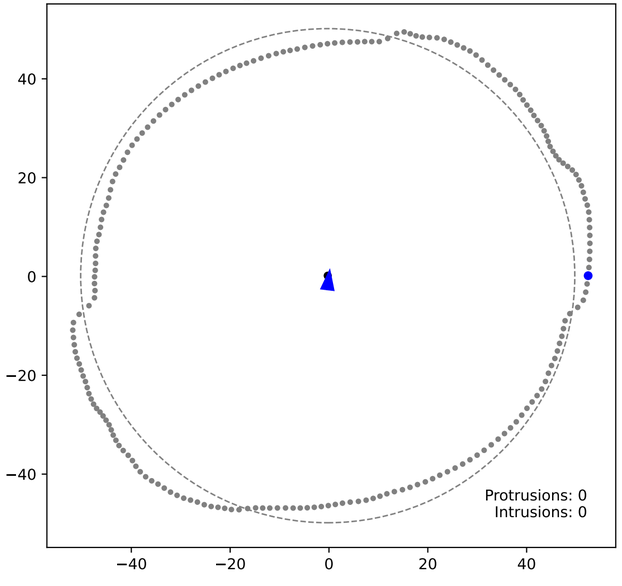

Shape evolution (t = 113.00)
Riemann Velocity: 0.1780
Max curvature: 0.0010
860
840
820
800
780
240
250
260
270
280
290
300

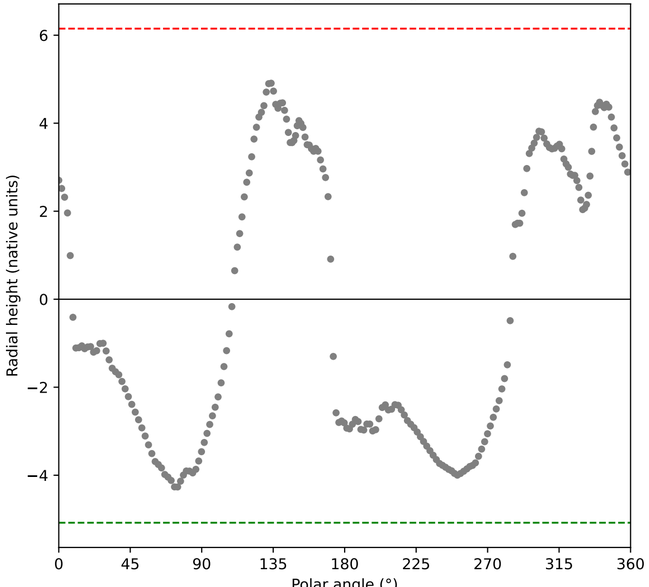

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

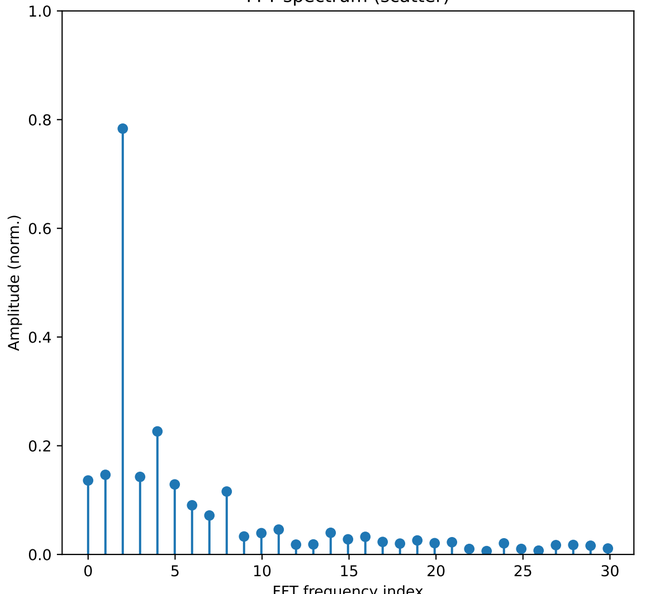

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

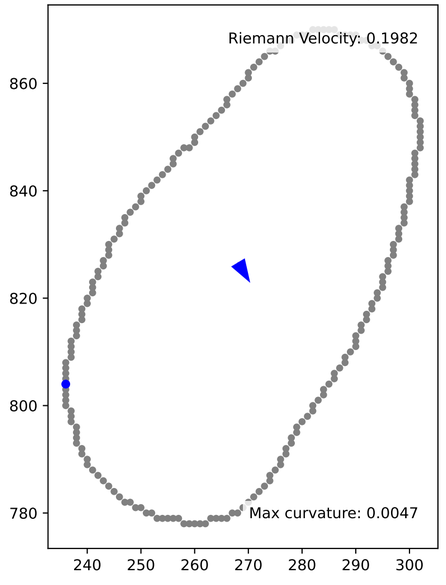

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

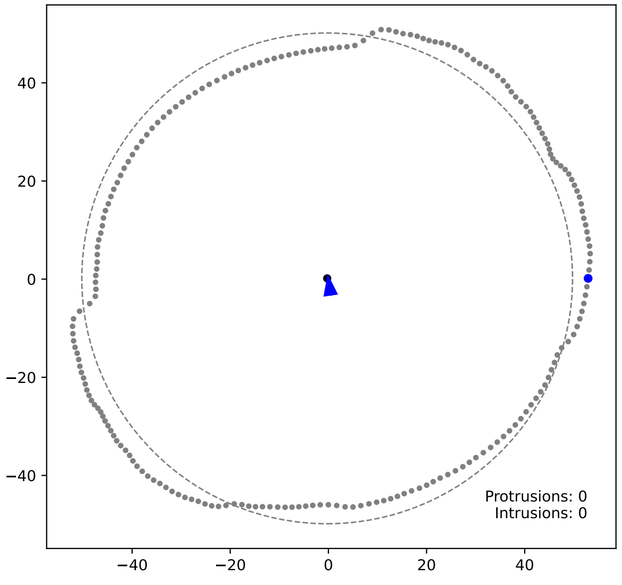

Shape evolution (t = 114.00)
Riemann Velocity: 0.1829
Max curvature: 0.0011
860
840
820
800
780
240
250
260
270
280
290
300

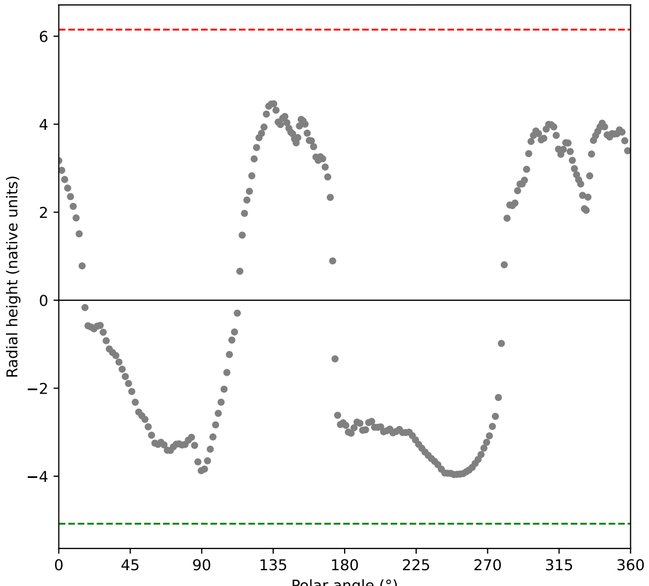

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

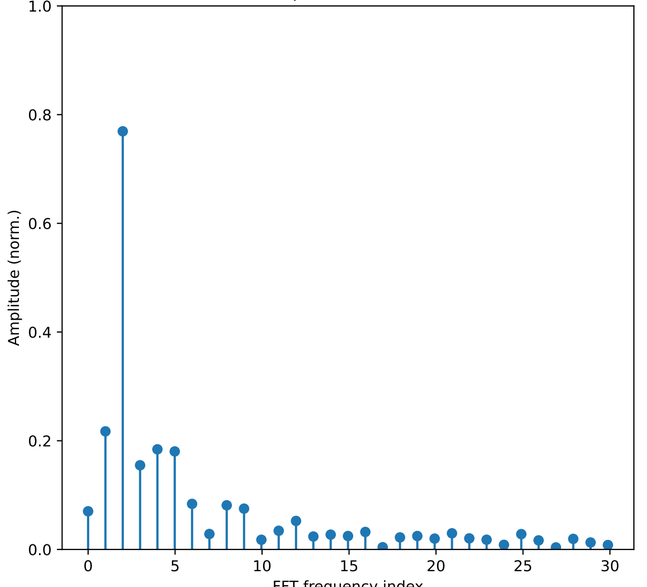

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30


Shape evolution (t = 115.00)
Riemann Velocity: 0.1982
Max curvature: 0.0047
860
840
820
800
780
240
250
260
270
280
290
300


Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40


Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
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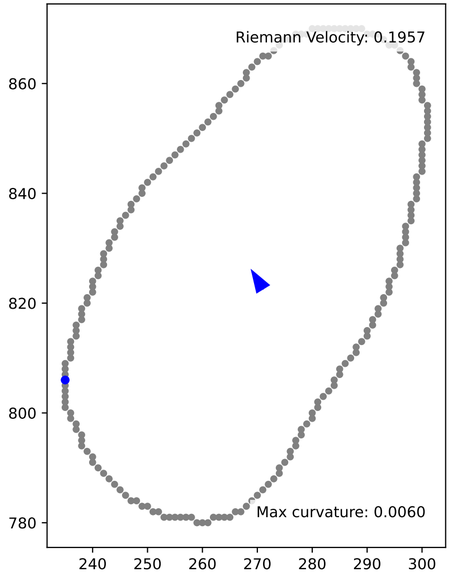
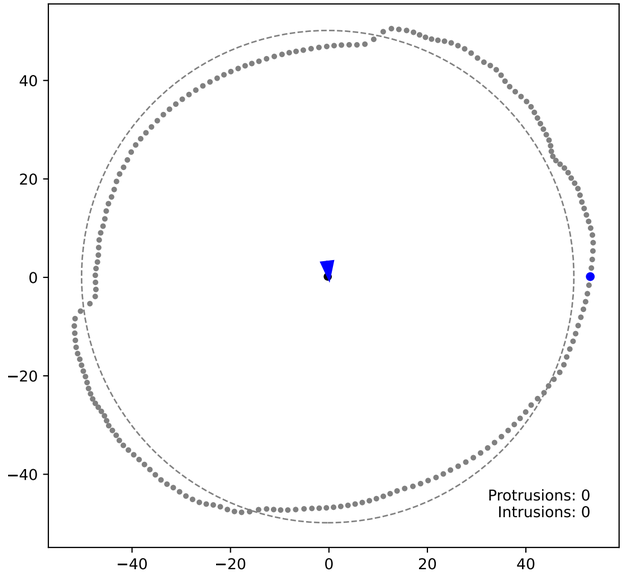
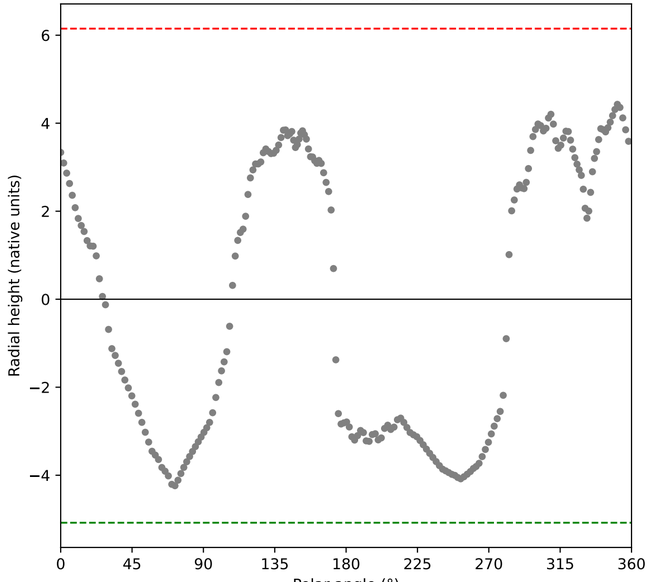
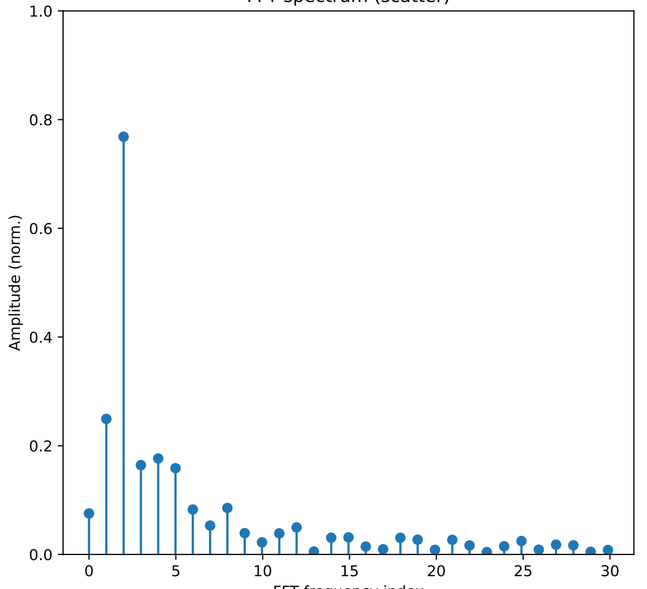
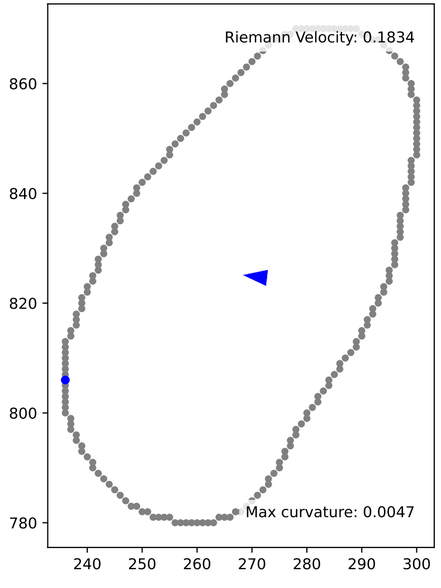
10
15
20
25
30

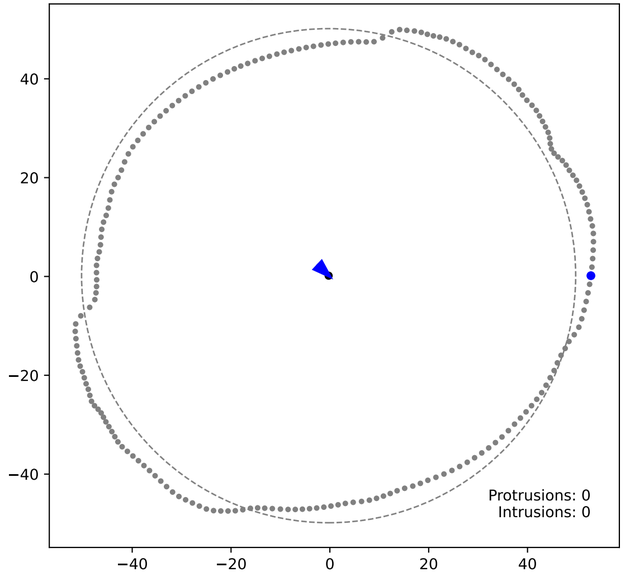

Shape evolution (t = 116.00)
Riemann Velocity: 0.1957
Max curvature: 0.0060
860
840
820
800
780
240
250
260
270
280
290
300

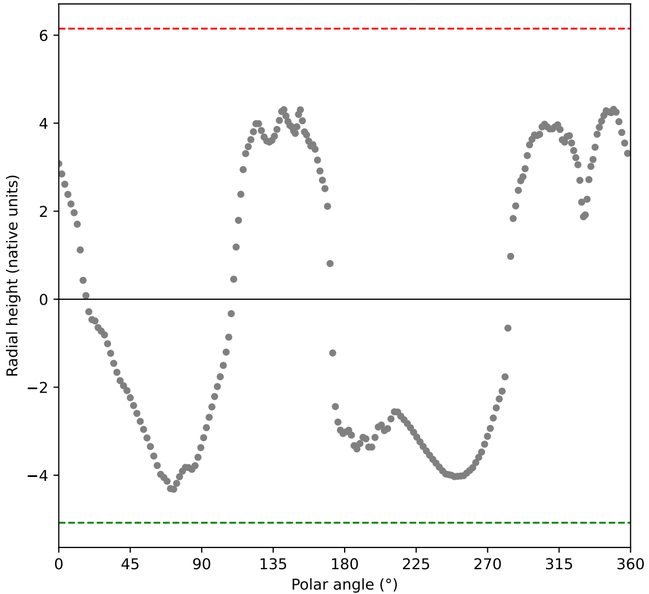

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

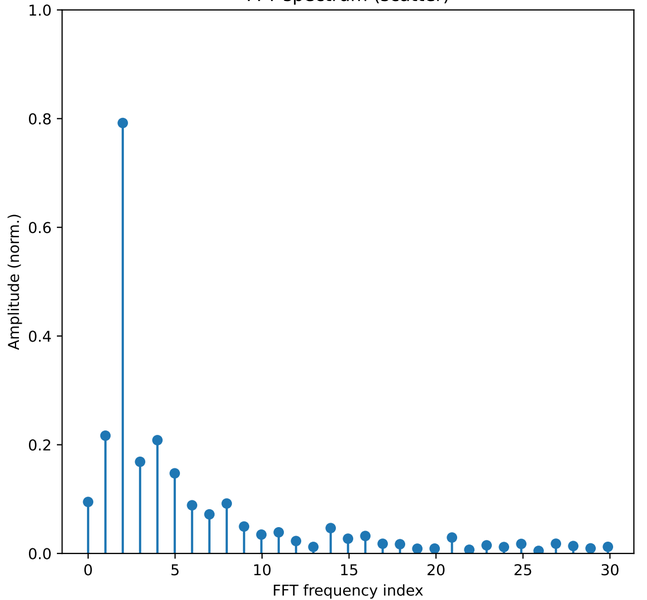

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360

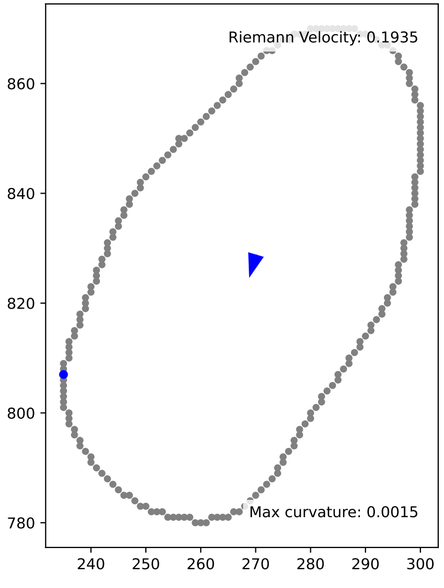

FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30

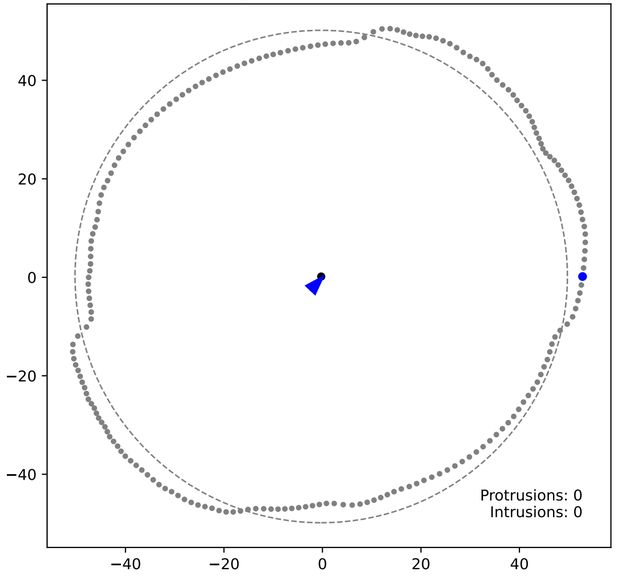

Shape evolution (t = 117.00)
Riemann Velocity: 0.1834
Max curvature: 0.0047
860
840
820
800
780
240
250
260
270
280
290
300

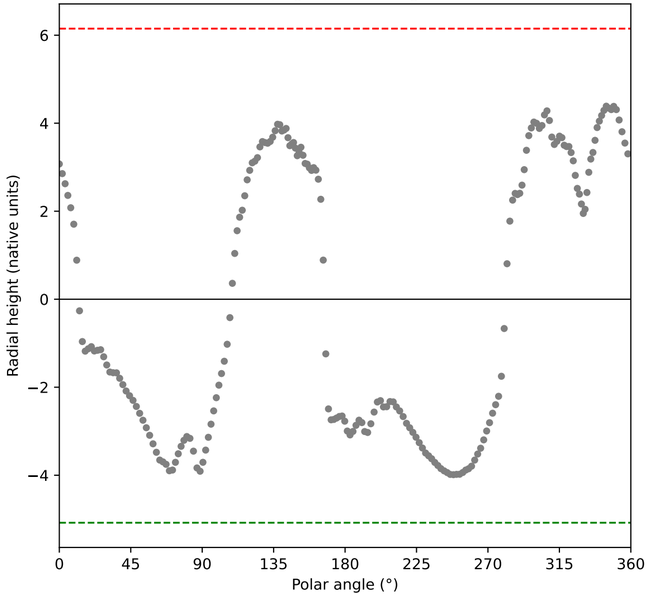

Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40

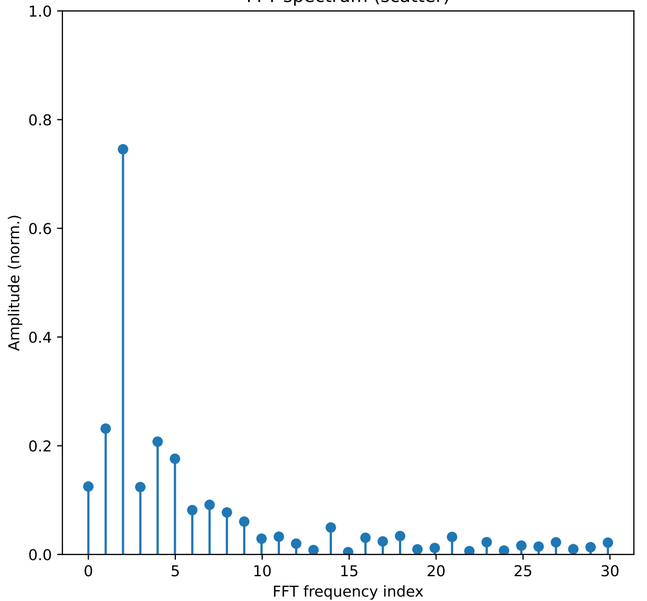

Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30


Shape evolution (t = 118.00)
Riemann Velocity: 0.1935
Max curvature: 0.0015
860
840
820
800
780
240
250
260
270
280
290
300


Topographical representation
Protrusions: 0
Intrusions: 0
40
20
0
−20
−40
−40
−20
0
20
40


Topographical height
Radial height (native units)
Polar angle (°)
6
4
2
0
−2
−4
0
45
90
135
180
225
270
315
360


FFT spectrum (scatter)
Amplitude (norm.)
FFT frequency index
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30