Supplemental material to "Lift crisis on non-symmetrical obstacles"

This supplemental material shows the results briefly given in the paper for three different sections.

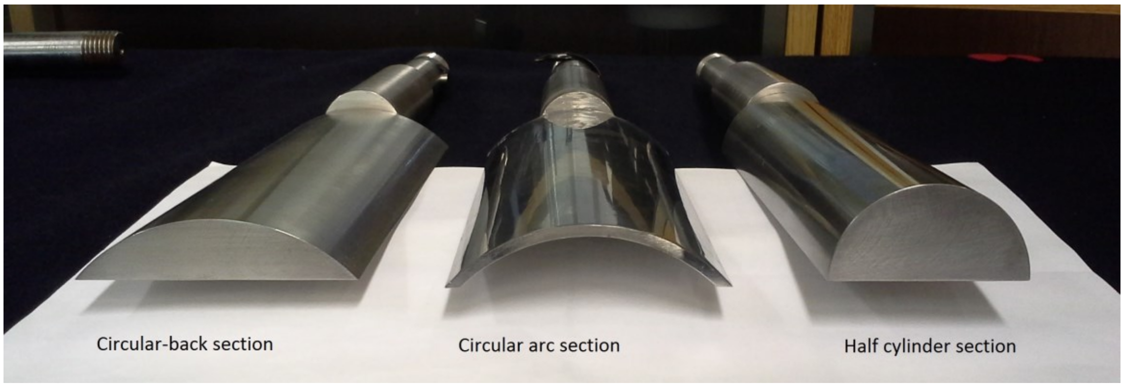

Figure SM1: The three sections tested (bodies 2, 1 and 3 from left to right).

As shown in Figures SM2 and SM3, the same behavior is evidenced on the 3 tested sections showing a simultaneous lift and drag crisis.

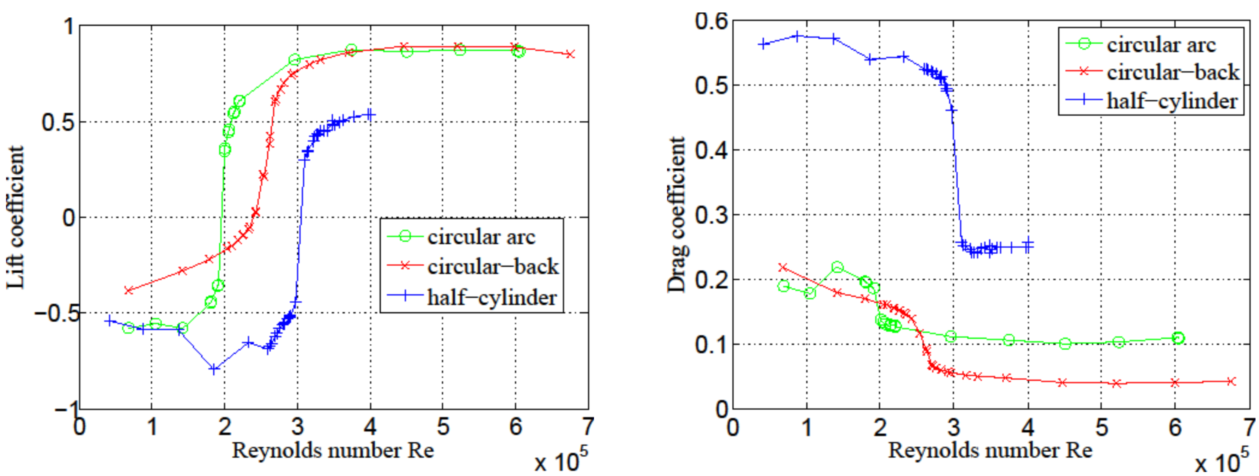

Figure SM2: Lift and drag crisis on the three sections tested. The crisis is less abrupt for the circular-back profile than for the other sections.

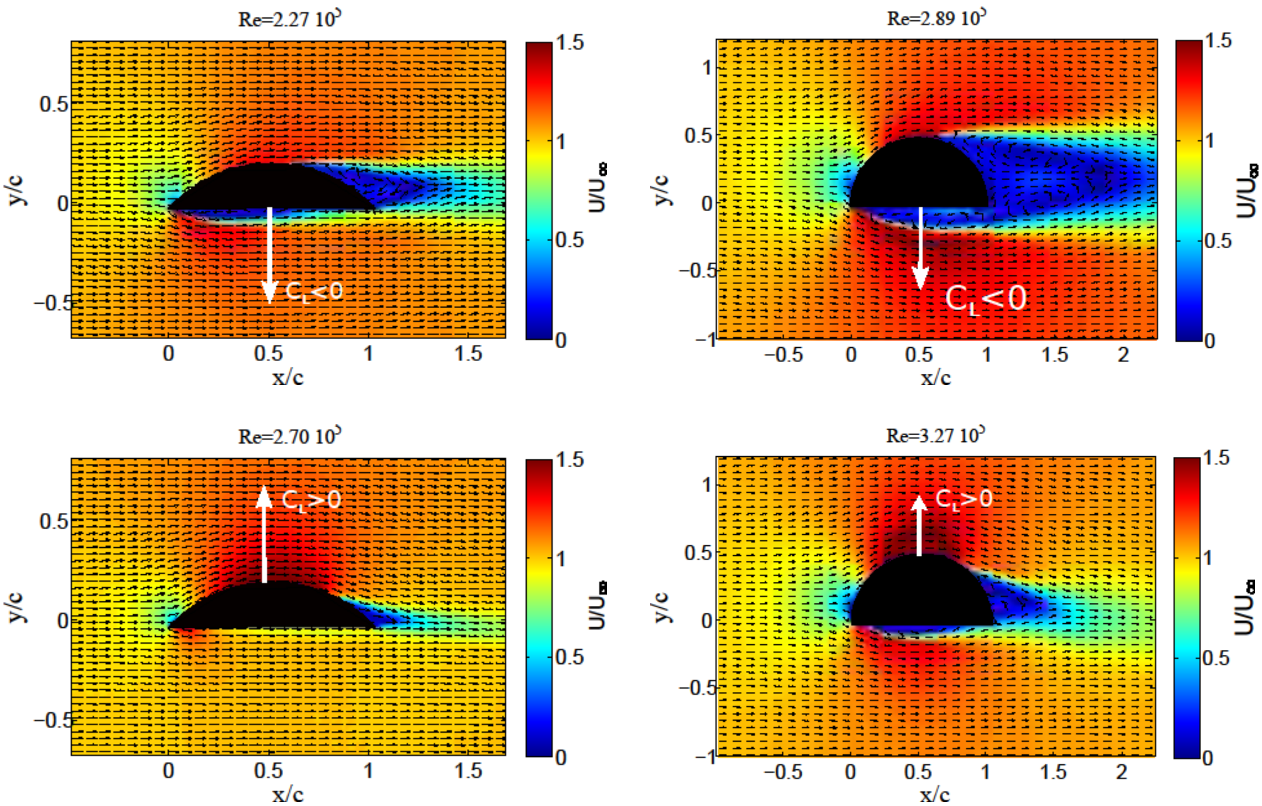

Figure SM3: Time-averaged velocity field below (top line) and above (bottom line) the critical Reynolds number, for the circular-back section (left column) and the half-cylinder section (right column).

The following table summarizes the results obtained on the three sections.

Profile	1 Circular arc	2 Circular-back	3 Half-cylinder
Re_C (10^5)	2.0	2.5	3.0
C_{L0}	0.08	0.24	-0.103
C_L below	-0.6	-0.3	-0.6
C_L above	0.87	0.9	0.53
C_D below	0.2	0.18	0.57
C_D above	0.1	0.04	0.25
γ	0.2	0.5	0.2
C_L/C_D below	-3	-0.2	-0.1
C_L/C_D above (max)	8.5	22	2
C_x below	0.9	0.81	1.14
C_x above	0.45	0.18	0.5

Table SM1: Comparison between the 3 profiles. C_L and C_D are defined with the chord length c as the reference length C_x is defined with the section thickness as the reference length. Values below and above the transition are given far away from the threshold Re_c.

Comparing the circular-back section with the circular arc section:

- The critical Reynolds number Re_c is slightly higher: 2.5 10^5 instead of 2.0 10^5,
- The lift coefficient above Re_c is similar and the drag coefficient is about half;
- The lift coefficient below Re_c is about half and the drag coefficient is similar.

Comparing the half-cylinder section with the circular arc section:

- The critical Reynolds number Re_c is higher: 3.0 10^5 instead of 2.0 10^5,
- The lift coefficient above Re_c is lower;
- The lift coefficient below Re_c is similar;
- The drag coefficient C_D (defined with the chord length) is far higher for all Re; the drag coefficient C_x defined with the frontal area is similar (of order 1 below Re_c, of order 0.5 above Re_c).

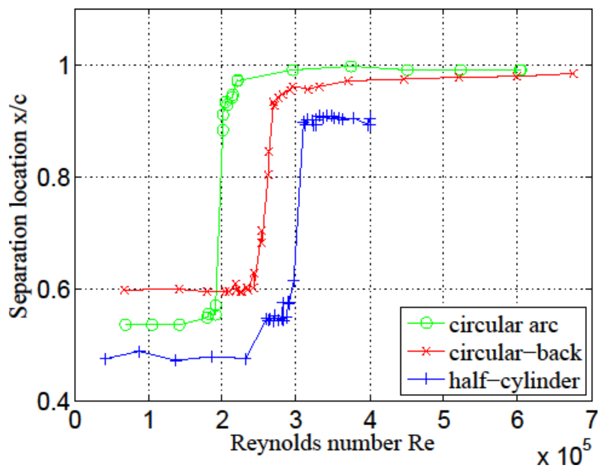

Figure SM4: Separation point location x/c for the 3 profiles.

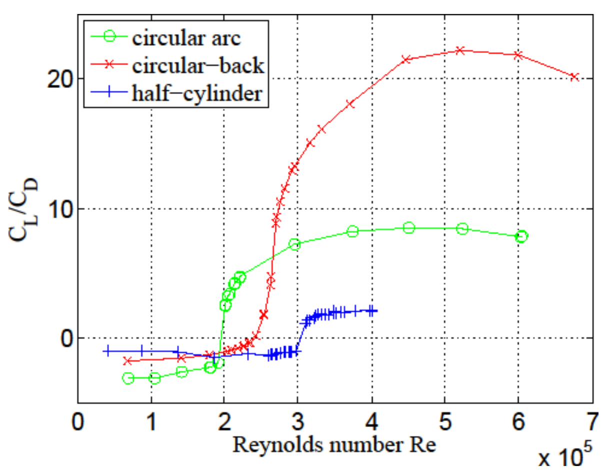

Figure SM5: Lift-to-drag ratio for the three different profiles. The circular-back profile has a large lift-to-drag ratio at high Reynolds numbers.