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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).

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Profile	1	2	3		
	Circular arc	Circular-back	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: 2.5 10⁵ instead of 2.0 10⁵,
- 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: 3.0 10⁵ instead of 2.0 10⁵,
- 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.