Bluff Body Flow – Some Recollections

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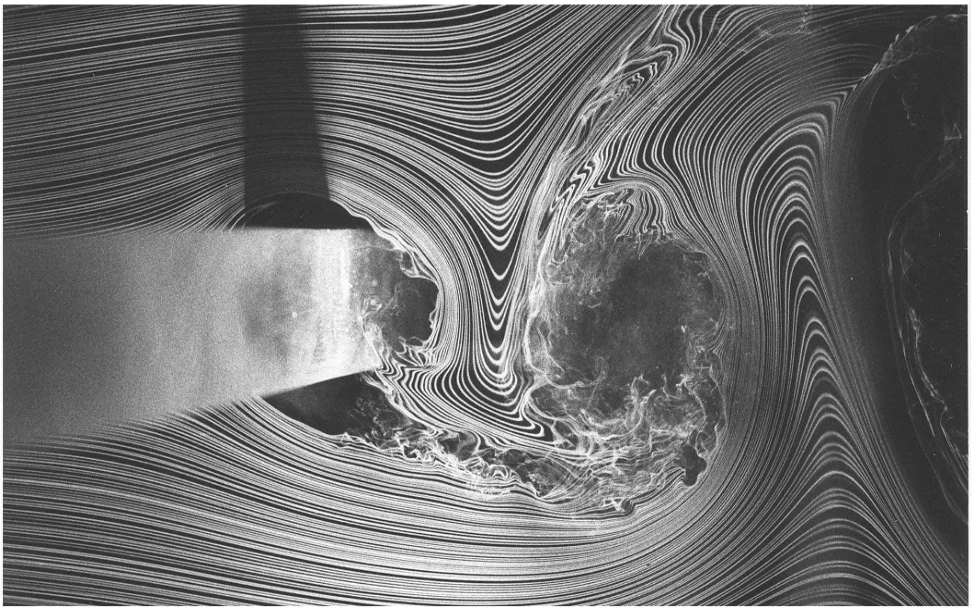
The basis of this presentation is on the following three important contributions by Peter Bearman (and co-workers) within the field of bluff-body flow, in order of presentation: Bearman & Harvey (1976), Bearman (1965), and Bearman & Trueman (1972).

After an introduction of the aerodynamic drag on a smooth sphere (ball) and its relation to the Reynolds number, the first part concerns golf ball aerodynamics, in which the paper by Bearman & Harvey [3] is an obvious starting point for all interested in this fascinating topic. Simplified expressions for some aerodynamic coefficients vs. the spin ratio will be provided.

The middle part relates to some of the pioneering findings presented by Bearman in his first paper in the Journal of Fluid Mechanics [1]. In his studies on the effects of a splitter plate attached to the base of a cylindrical bluff body, Bearman finds that the base suction, the negative of the base pressure coefficient, is roughly proportional to the inverse vortex formation length; $C_{pb} \propto d/L_f$, where d is the cross-stream dimension of the bluff body. Although not a universal working relation for all bluff body wakes it is nonetheless a very fruitful and general guiding principle when analyzing turbulent bluff body wakes. Some further aspects of this relationship for the case of a circular cylinder in cross flow will be presented.

The last part concerns rectangular cylinders with one side facing the flow. The paper by Bearman & Trueman [2] presents some very interesting facts and discussions about the critical case for which the drag coefficient reaches a local maximum, at a side ratio of about c/d = 0.62, where c is the chord of the cylinder. Some additional flow visualizations and quantitative results relating to this intriguing phenomenon will be presented.



c/d = 0.62, Re = 8×10^3

References

[1] Bearman, P. W., Investigation of the flow behind a two-dimensional model with a blunt trailing edge and fitted with splitter plates. *Journal of Fluid Mechanics* **21**(2), 241-255, 1965.

[2] Bearman, P. W., Trueman, D. M., An investigation of the flow around rectangular cylinders. The Aeronautical Quarterly **23**, 229-237, Aug. 1972.

[3] Bearman, P. W., Harvey, J. K., Golf ball aerodynamics, *The Aeronautical Quarterly* **27**, 112-122, May 1976.