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Batchelor G K. *An introduction to fluid dynamics.* Cambridge, England: Cambridge University Press, 1967. 615 p. [Applied Mathematics, University of Cambridge, England]

This textbook was intended to introduce students to the subject and to lay the foundation for further advanced study. The book lies somewhere between applied mathematics, physics, and engineering, and like its author, it undoubtedly has a theoretical bias. [The *SCI*® indicates that this book has been cited in more than 1,700 publications.]

An Introduction to Fluid Dynamics

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The diary that I kept when writing this book shows that the first notes about its purpose and the list of chapter titles were made in June 1958. I had been teaching courses on fluid mechanics, mainly classical hydrodynamics of "Ideal" (that is, inviscid) fluids, to second and third year students of applied mathematics at Cambridge, and I had become unhappy about the difficulty of relating the flow systems considered in lectures—and in the available textbooks—to those actually observed and described in more practical books on hydraulics and aerodynamics. The difficulty is not, as is sometimes supposed, that the study of ideal-fluid flow has nothing to say about the motion of real fluids; the difficulty is that ideal-fluid theory itself cannot predict the circumstances in which ideal-fluid flow coincides with that of a real fluid. Largeness of the Reynolds number of the flow is a necessary condition for the coincidence, but it is not sufficient because the limit is singular. Elucidation of the additional conditions for reality of a particular ideal-fluid flow field involves study of high-Reynoldsnumber flow fields and boundary layers and the shedding of vorticity from boundaries, which is not easily taught in a first course for students. There is thus a pedagogical dilemma. Classical hydrodynamics provides suitable material for a first course in fluid mechanics, but a student does not know which ideal-fluid flow fields are realistic unless and until he or she goes on to the more advanced study of the effects of fluid viscosity. The authors of textbooks for applied mathematics students used in the 1950s, almost all prewar publications, were not affected much by the dilemma because the improved understanding of high Reynolds-number flow needed for decisions on the reality of the ideal-fluid flow fields was not generally available until the research of the 1930s had been codified and integrated, most notably in S. Goldstein's *Modern Developments in Fluid Dynamics.*[1] But the dilemma could not be ignored in 1958.

With the usual optimism of the educational reformer, I resolved to write a textbook in which the more difficult material on high-Reynolds-number flow and effects of viscosity would precede the more straightforward and mainly mathematical study of ideal-fluid flow. That is the logical order, but it conflicts with the educational practice of taking simpler topics first. I am glad I did invert the conventional order, because textbooks are for teachers as well as for students, and I think it is essential that the teacher should be able to perceive the logic of the presentation and to convey it to students even though, for practical reasons, the emphasis in an introductory course might be placed on flow systems which are amenable to mathematical analysis.

The other and more general purpose that I had in mind was to convey to students the richness of fluid dynamical phenomena and the challenge of understanding them in qualitative physical terms. A textbook of fluid dynamics, even one which might be used by applied mathematics students, gains a lot from the inclusion of photographs of flow fields and explanations of the mechanical processes at work. There are now many books on fluid dynamics that similarly stress the importance of understanding flow systems physically.

The writing was completed after eight years of hard work. The final product was satisfying to me, and it is a bonus that a number of students, teachers, and researchers have learned from it. Undergraduates have found it hard going, I gather, but many graduate students in applied mathematics and engineering have found it helpful.

1. **Goldstein S,** ed. *Modern developments in fluid dynamics.* Oxford, England: Oxford University Press, 1938. (Cited 620 times since 1945.)

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