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Book Reviews

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Fluid Mechanics

E. Krause, Springer, New York, 2005, 355 pp., $99.00

Traditionally, fluid mechanics has been taught at the undergraduate level with segments devoted to potential flow, compressible flow, and viscous flow, with a separate segment devoted to laboratory work. In the past, these segments have been either quarters or semesters depending on the academic schedule of the institution, but accreditation requirements at many institutions have resulted in a compression of this sequence into shorter periods. Nevertheless, the order of these topics remains largely unchanged. Immediately after World War II the number of texts available for the teaching of fluid mechanics in this fashion was limited, but in the ensuing half century a large number of books have become available so that today an instructor has a variety of choices.

Professor Krause has provided an attractive addition to this array of texts. The presentation is structured as Fluid Mechanics I and II, Exercises in Fluid Mechanics, Gas Dynamics, Exercises in Gas Dynamics, and finally, Aerodynamics Laboratory. An experienced instructor will immediately identify the topics in each of these sections, but the novelty here resides in the large number of excellent diagrams and graphs that accompany relatively sparse text and that clearly illuminate not only fundamental issues but also many practical applications. The latter extend beyond the usual, e.g., the application of the Bernoulli equation to the measurement of fluid velocity to, e.g., Euler's turbine equation as an application of the moment of momentum theorem and to water waves as an application of potential flow theory. Thus, an instructor using this text, if so inclined, can readily expose students to topics beyond those in the usual introductory course in fluid mechanics.

Fluid Mechanics I concerns the standard fare of hydrostatics and laminar and turbulent pipe flows. In Fluid Mechanics II, the equations of motion are derived and then specialized to apply to potential flows and laminar and turbulent boundary layers. The derivation of the latter theory is based on the usual order-of-magnitude arguments, and so some instructors will want to supplement this development with the asymptotic method with its diverse applicability in engineering science. The chapter Gasdynamics presents nozzle flows, the shock polar, and the method of characteristics, but here the presentation, although involving excellent diagrams, is so condensed that significant classroom supplementation is indicated. The chapter Aerodynamics Laboratory presents measurement techniques and the equipment, wind tunnels, instruments, etc., required to make them and in doing so covers many of the topics discussed in the earlier chapters but from the perspective of measuring forces, e.g., drag and lift, lift distributions, and pressure drop. Some, for pedagogical reasons, may wish to incorporate this material in the appropriate lectures in earlier chapters.

We thus have here an attractive book with all of the material one would want for courses covering the standard topics of fluid mechanics and with a large number of problems. An experienced instructor may wish to present the material in an altered sequence, but the relevant topics are included and set forth in an attractive manner. The origin of the book and its use at RWTH Aachen University is reflected in the occasional awkward wording that arises in the translation and a bibliography largely confined to German literature.

Paul A. Libby
University of California, San Diego