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Book Reviews

Multi-media Fluid Mechanics

G. M. Homsey, H. Aref, K. S. Breuer, S. Hochgreb, J. R. Koseff, B. R. Munson, K. G. Powell, C. R. Robertson, and S. T. Thoroddsen, Cambridge University Press, New York, 2000, CD-ROM, $19.95

This is a CD-ROM that provides excellent supplementary learning material for students of fluid mechanics. It appears to be geared toward undergraduate students from a broad base of engineering and applied science disciplines. According to the preface, it was part of a national effort instigated by the Division of Fluid Mechanics of the American Physical Society and sponsored by the National Science Foundation with the aim of providing modern interactive methods for the teaching of fluid mechanics. The concept was to modernize the well-respected National Committee for Fluid Mechanics Films (NCFMF) series and to provide an animated adjunct to Van Dyke's *An Album of Fluid Motion*.

I, like many of you, had my interest in fluid mechanics stimulated by Shapiro's provocative film series *The Fluid Dynamics of Drag* and later solidified many important concepts of fluid mechanics through the other films in the NCFMF series. Indeed, many of us still show our students these films today, now thankfully on video, and for me, after 35 years, they continue to provide new insights and understanding. However, I have always been disappointed that they are not easy to use as an adjunct in illustrating a concept during lectures and for students to peruse on their own. I believe that this CD-ROM does just that and more.

The CD-ROM contains five modules, including three teaching modules: Kinematics, Dynamics, and Boundary Layers, along with a History module and a Video Library. Each of the teaching modules is further divided into subsections. For example, Kinematics is divided into a number of subsections containing point and fluid particle kinematics, fields, particles and reference frames, the material derivative, compressibility, flowlines and flow visualization, pathlines, streaklines, timelines, streamlines and the stream function, and two-dimensional flow and vorticity. The Dynamics Module is divided into seven subsections: Newton's second law of motion, Navier–Stokes equations, boundary conditions, Reynolds number inertia and viscosity, low-Reynolds-number flow, dependence of forces on Reynolds number and geometry, and potential flow. The Boundary Layer Module is divided into five subsections including boundary-layer concepts, impulsively started flow, laminar boundary layers, separation and instability, and transition and turbulence. For these three teaching modules, each of the subsections is further subdivided into four to as many as 19 topics, which are sometimes divided again into two to three subtopics. This large amount of material is organized with a very slick interface involving buttons, pull-down menus, bar codes, tabs, color-coded links, and even rollovers. Anyone accustomed to surfing the Internet should have no trouble navigating the CD.

Each topic or subtopic contains descriptions ranging from qualitative discussions to graphs and equations, to still photos or sketches to video clips, and to interactive features such as virtual labs, demonstrations, computer simulations and animations. For example, under Dynamics, the subsection on dependence of forces on Reynolds number and viscosity contains 14 topics. One of the topics, the effect of Reynolds number and geometry on the flow, contains five shape buttons (cylinder, ellipse, teardrop, block, and vertical plate) and four buttons for Reynolds number ($Re = 1$, 50, 10^4, and potential flow). Picking any combination of the two plays a video clip of the flow visualization or the flow simulation, in the case of potential flow. In other places there are virtual labs where a video clip of the lab experiment is shown, and the viewer is instructed on using the mouse to make flow "measurements" and plotting the results. In other topics there are demonstrations that show a variety of clips and animations. For example, under Kinematics there is the topic "Euler vs. Lagrange: What's Steady and Unsteady?," which shows animations of the same scenes from different frames of reference. An example of simulations may be found under the topic "Numerical Solution of the Boundary Layer Equations," which invokes Java applets to perform computations and plots results based on the user inputs.

The remaining two modules, History and the Video Library, are arranged differently from the teaching modules. The History module contains what the authors call a "rogues' gallery" of 15 fluid dynamicists, ranging from da Vinci and Euler to G. I. Taylor and von Kármán. Clicking on each portrait leads you to a discussion of the subject's life and accomplishments. The Video Library is a gallery of some 250 flows, ranging from atomic bomb explosions and backward-facing steps to a water strider and wing tip vortices.

From a pedagogical view, I am very enthusiastic about this CD. Although it will not replace a textbook in a fluid dynamics course, it can be very useful in several ways. I can see it being used by the instructor to project video clips to the class illustrating and augmenting other lecture material; for various subsections and topics to be assigned as part of homework assignments and independent study; and for graduate students as a review prior to qualifying and preliminary exams. I believe that the price puts it within reach of all students, and I look forward to working with it in my courses.

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Non-Classical Problems in the Theory of Elastic Stability

Isaac Elishakoff, Yiwei Li, and James H. Starnes Jr., Cambridge University Press, New York, 2000, 336 pp., $85.00

The authors present a purposeful rationale for this monograph on elastic stability in the preface section and quote Philip Guedalla to reinforce this fact. The statement reads, "The preface is the most important part of the book. Even reviewers read a preface." In this case, all readers, students, and certainly reviewers should read this preface for its excellent presentation of the philosophy and raison d'être for this book.

The authors focus on presenting two competing theories representative of uncertainties inherent in stability applications in the real world. The two techniques developed in the book are described as "competing yet complementary": the probabilistic theory of stability and the alternative based on ideas associated with antioptimization.

The book contains seven chapters, with the first two chapters examining representative new deterministic problems. Some examples include mode localization in a deterministic setting and geometric influences such as thickness variations. Chapters 3 and 4 deal with stochastic buckling of structures with random imperfections. Chapter 3 examines Monte Carlo techniques, and Chapter 4 examines analytical and numerical techniques. The latter include asymptotic and finite element techniques. Chapter 5 examines uncertainty in buckling problems, and Chapter 6 examines so-called shorting techniques based on work by Godunov-Conte. The final chapter discusses applications associated with computerized symbolic algebra.

The authors direct this book at practitioners such as design engineers, researchers, and graduate students dealing with structural stability issues. It can serve as a useful text and/or reference material in graduate courses dealing with the subject of structural stability. The book is replete with references to classical and current research, including 35 pages of bibliography. It is well written, with the material presented in an informational fashion as well as to raise questions related to unresolved or questionable challenges. The book meets its objectives and should be included in the library of active researchers and students of structural stability if not for the bibliography alone, then for the well-constructed preface. In the vernacular of film critics, "a thumbs up."

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