

Introduction to Theoretical and Computational Fluid Dynamics

► Costas Pozrikidis
Oxford U. P., New York, 1997.
675 pp. \$75.00 hc
ISBN 0-19-509320-8

The field of fluid dynamics is a classical one with many subdisciplines, most of

which have many active researchers. Among the latter are mechanical, chemical and aeronautical engineers, geophysicists, astrophysicists, biomechanicians and applied mathematicians. No book can cover the entire subject; an author has to make choices.

In his *Introduction to Theoretical and Computational Fluid Dynamics*, Costas Pozrikidis has written a book on the fundamentals of fluid mechanics from the point of view of an applied mathematician. The preface claims

that the book is both "introductory" and "useful to researchers." It could serve as an introduction to the subject for mathematically sophisticated students, but for others it would be regarded as advanced. The style of the book suggests comparison to the well-known *Introduction to Fluid Dynamics* by George Batchelor (Cambridge U. P., 1967). The two overlap considerably. Among the differences are that Batchelor covers compressible flow and aerodynamics, while Pozrikidis provides material on hydrodynamic stability and numerical methods, about which more will be said later.

On the subjects covered in both books, Batchelor's approach is more physically motivated, preferring words to equations, while Pozrikidis's is more formal and mathematical; both books are quite well written. The choice is thus a matter of the reader's taste, but I, as an engineer with a physics background, would select Batchelor's book for an introductory course and Pozrikidis's text for a second course.

Pozrikidis makes very limited use of experimental results in his book. This is perhaps not surprising, given the title of the book, but there are points at which a nice picture would have served as well as equations or words. As an example of the kind of treatment one can expect, consider the chapter on hydrodynamic stability. There are, as the author points out, several books and review articles devoted to this subject. He therefore presents an overview of the methods used to investigate stability, including normal mode analysis, Green's functions, Laplace transforms and numerical methods. Most of the important basic theorems of this subject are given. Presentation and discussion of results are allotted only a few pages.

There is a nice section in the same chapter on the stability of a liquid film on a wall, which takes into account the effects of surface tension—something that one might not expect in an introductory work. The section on numerical methods is too short to be really useful and does not cover all of the methods. Notably missing is any mention (except in passing) of critical layers and their effect on stability. All in all, this chapter gives a good flavor of the way linear stability analysis is conducted, but not much is said about the physical mechanisms or the states that result from instability.

The title mentions computational methods, and three chapters near the end of the book are devoted to this subject; computational approaches are also found in the other chapters, but these three chapters are concerned with boundary integral methods (for

RESEARCH GRADE PREAMPLIFIERS

- CURRENT ■ VOLTAGE
- OPTICAL ■ LOW-NOISE
- WIDE BANDWIDTH ■ PORTABLE
- Compatible with relevant EG&G Lock-in Amplifiers

Model 5185

Wideband Preamplifier
DC to 200 MHz response with low and high input impedance and $\times 10$ or $\times 100$ gain



Model 5188

Optical Input Preamplifier

Si and InGaAs versions.
Four switched conversion settings with separate AC and DC component outputs



Model 5182

Current Preamplifier
with four switched gain settings

Model 5183

Voltage Preamplifier
with high impedance, asymmetrical single input

Model 5184

Ultra Low-Noise Voltage Preamplifier
with medium impedance, asymmetrical single input and 800 pV/ $\sqrt{\text{Hz}}$ noise

Model 5186

Voltage Preamplifier
with high impedance, true differential input

Model 5187

Voltage Preamplifier
with low impedance, true differential input

ISO 9002
Certified
Manufacture



EG&G SIGNAL RECOVERY

Germany
089-92692444

Spain
1-5713466

France
1-69-898920

Japan
043-211-1411

USA Office (Sales and Service)
P.O. Box 2565
Princeton
NJ 08543-2565
Phone: (609) 530-1000
Fax: (609) 883-7259

Sorbus House
Mulberry Business Park
WOKINGHAM
Berk. RG41 2GY
United Kingdom
Phone: +44 (0) 118 977 3003
Fax: +44 (0) 118 977 3493
Email: info_sigrecovey@egginc.com

potential flow), convection–diffusion problems and incompressible viscous flow. They are short and present a number of methods, with little discussion of how they work, how good they are, to what they may be applied or how to choose among them. Also, many of the most powerful modern techniques, such as multigrid and conjugate gradient methods, are not even mentioned.

All in all, this is a useful addition to the literature for readers whose in-

terests lie on the mathematical or theoretical side of fluid mechanics.

JOEL H. FERZIGER
Stanford University
Stanford, California

NEW BOOKS

Materials Science

Handbook of Thermophysical Properties of Metals at High Temperatures. V. E. Zinov'ev. Nova Science, Commack,

N.Y., 1996. 581 pp. \$98.00 *hc* ISBN 1-56072-308-4

Mechanical Properties of Ceramics. J. B. Wachtman. Wiley, New York, 1996. 448 pp. \$72.95 *hc* ISBN 0-471-13316-7

Microwave Dielectric Spectroscopy of Ferroelectrics and Related Materials. *Ferroelectricity and Related Phenomena 9.* J. Grigas. Gordon and Breach, Newark, N.J., 1996. 336 pp. \$125.00 *hc* ISBN 2-88449-190-2

Microwave Studies of High Temperature Superconductors, Part II. *Studies of High Temperature Superconductors 18.* A. Narlikar, ed. Nova Science, Commack, N.Y., 1996. 265 pp. \$89.00 *hc* ISBN 1-56072-381-5

Particle Strengthening of Metals and Alloys. E. Nembach. Wiley, New York, 1997. 285 pp. \$84.95 *hc* ISBN 0-471-12072-3

Protein-Based Materials. *Bioengineering of Materials.* K. McGrath, D. Kaplan, eds. Birkhäuser, Boston, 1997. 429 pp. \$79.95 *hc* ISBN 0-8176-3848-2

Silicon Carbide and Related Materials 1995. *Institute of Physics Conference Series 142.* Proc. Conf., Kyoto, Japan, Sep. 1995. S. Nakashima, H. Matsunami, S. Yoshida, H. Harima, eds. IOP, Philadelphia, 1996. 1120 pp. \$450.00 *hc* ISBN 0-7503-0335-2

Nonlinear Science and Chaos

Chaotic Dynamics of Nonlinear Systems. S. N. Rasband. Wiley, New York, 1997. 230 pp. \$42.95 *pb* ISBN 0-471-18434-9

Nonlinear Physics with Maple for Scientists and Engineers. R. H. Enns, G. C. McGuire. Birkhäuser, Boston, 1997. 389 pp. \$54.50 *hc* ISBN 0-8176-3838-5, *Diskette*

Nonlinear Physics with Maple for Scientists and Engineers: A Laboratory Manual. R. H. Enns, G. C. McGuire. Birkhäuser, Boston, 1997. 136 pp. \$26.50 *pb* ISBN 0-8176-3841-5

Thinking in Complexity: The Complete Dynamics of Matter, Mind, and Mankind. 3rd revised and enlarged edition. K. Mainzer. Springer-Verlag, New York, 1997 [1994]. 361 pp. \$39.95 *hc* ISBN 3-540-62555-0

Nuclear Physics

Chiral Nuclear Dynamics. M. A. Nowak, M. Rho, I. Zahed. World Scientific, River Edge, N.J., 1997. 528 pp. \$68.00 *hc* ISBN 981-02-1000-0

Contemporary Nuclear Shell Models. *Lecture Notes in Physics 482.* Proc. Wksp., Philadelphia, Pa., Apr. 1996. X.-W. Pan, D. H. Feng, M. Vallières, eds. Springer-Verlag, New York, 1997. 309 pp. \$73.00 *hc* ISBN 3-540-62551-8

Optics and Photonics

Detection of Light: From the Ultraviolet to the Submillimeter. G. H. Rieke. Cambridge U. P., New York, 1996. 344 pp. \$34.95 *pb* ISBN 0-521-57674-1

Optical Fiber Telecommunications, Vol. 3: Part A and Part B. I. P. Kaminow, T. L. Koch, eds. Academic, San Diego, Calif., 1997. 1113 pp. \$178.00 *set hc* ISBN 0-12-395169-0



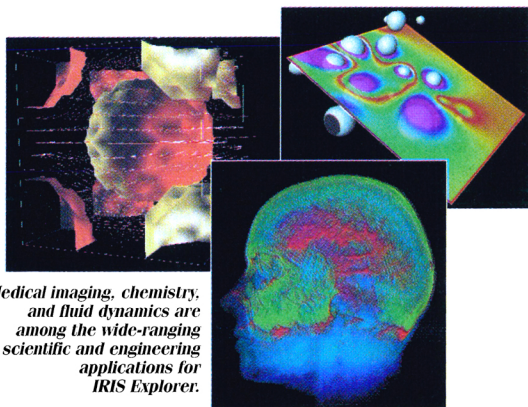
Cosmic strings and universe contours made visible with IE 3.0 on a DEC 3000 with 256MB RAM.



Ue-Li Pen, Ph.D.
Center for
Astrophysics*

I am a theoretical cosmologist studying the origin and structure of the universe. IRIS Explorer helps me visualize clusters of galaxies as interactive, 3D datasets. And we're dealing with some big datasets. Using IE routines like Volume Rendering is like having a telescope that can see 350 million light years, or like creating a huge spaceship that can whiz around in deep space and examine our simulation. IE accelerates my work and makes it easy to show to non-experts. I'm currently studying the core sizes of clusters of galaxies in numerical simulations. These were unknown until we ran out simulations with IE. Being able to calculate their size is quite an event.

What can IRIS Explorer help you see?



Medical imaging, chemistry, and fluid dynamics are among the wide-ranging scientific and engineering applications for IRIS Explorer.

IRIS Explorer – bringing you a new view of science.
Now offered by NAG for numerous UNIX workstations and Windows NT.

NUMERICAL ALGORITHMS GROUP, INC.

NAG®

1400 Opus Place, Suite 200 • Downers Grove, IL 60515-5702
(630) 971-2337. Fax: (630) 971-2706 • <http://www.nag.com> • info-pt@nag.com

* The Center for Astrophysics is run jointly by the Smithsonian Institution and the Harvard College Observatory.