the $3d$ Navier-Stokes equation. The basic tool for compactness (i.e., the averaging lemma of Golse, Lions, Perthame, and Sentis) is the subject of step 11 of the proof. The authors not only stress that this is a global result, but also that it relies on physical estimates which are related to the decay of entropy.

Topic 2 continues on one hand with the spatially homogeneous equation where existence, uniqueness, and asymptotic behavior are obtained, and on the other hand with the space-dependent problem with initial data close to an absolute Maxwellian. For this regime, perturbation of the linearized equation is used and the relevant and nontrivial properties of this linearized equation are very well documented; they will be used in other sections of the book. Finally, the boundary value problem is treated, precise theorems are given, and some asymptotic regimes (this refers to Topic 3 of the program) are described. In particular, the stability of a flow past an obstacle is treated with partial proofs according to the perturbation method of Ukai and Asano, which uses the properties of the linearized collision operator near an absolute Maxwellian.

The question of the hydrodynamic limits is one of the basic issues concerning the Boltzmann equation and, as mentioned above, explains some of the difficulties of the problem. It is presented with historical comment in many parts of the book but is more precisely the subject of Chapter 5, where a formal description using entropy dissipation is given. As is now well known, the authors show that different types of equations—compressible, incompressible, viscous, and nonviscous—can be obtained according to different scalings that involve both the Knudsen and the Mach number. Along with references to other approaches, a rigorous proof using perturbation near equilibrium is given along the lines of Caflisch's work.

The impetus given to the theory by the problem of space flight and in particular re-entry has been especially important in the design and improvement of numerical codes, and this is the subject of Topic 5 of the program and of Chapter 10 in the book. Two different methods are given, the method of Bird and the method of Nambu; they both share the fact that they are based on the introduction of particles for the simulation of the effect of the Boltzmann operator and therefore they are closely related to the derivation of the Boltzmann equation from the Liouville equation. However, the Bird method is in some sense a direct simulation of a gas with many particles, while the Nambu method is based on a genuine discretization of the Boltzmann equation. The authors discuss the proof of convergence, the recent improvement, and compare these two methods.

The book closes with a chapter devoted to new and open problems. This is in agreement with a comment made in the introduction, "This book can only be a temporary reference point in a rapidly developing field such as kinetic theory."

Indeed, one can observe the following facts. Most of the material in the book has not been published elsewhere from such a precise, well-presented, and comprehensive point of view. This is particularly true for all the parts concerning the relationship between the Liouville equation and the Boltzmann equation. In the meantime, some results or proofs have been improved since the publication of the book. An example can be given by the notion of renormalized solution, which has been presented by Lions using some regularity results he obtained alone and further simplified and improved by Wennberg.

This book is the result of an active, long-lasting collaboration among the three authors; this explains the quality of the material, the unity of the ideas, but also some minor "chaos" at the level of writing. Some redundancy appears from one chapter to the other and some topics that could have been selected by the authors have been skipped. One example is the analysis of the shock profile carried out by Thurber, Caflisch, and Nicolaenko, which also turns out to be a good tool for understanding the hydrodynamic limit.

Nevertheless, it had to be written at the present time and it should be read as containing the essential state of the art and some (if not all) the basic ideas for future developments.

CLAUDE BARDOS
University of Paris VII
and CMLA ENS-Cachan

A Friendly Guide to Wavelets. *By Gerald Kaiser.* Birkhäuser, Boston, 1994. $34.50, 300 pp., cloth. ISBN 0-8176-3711-7.

The author makes clear in the preface to this book that it is intended for individuals interested in wavelets who find the standard literature very difficult to read. With the proliferation of wavelet techniques throughout science and industry, this must by now be a large group. In particular, Kaiser's book is designed to be accessible to advanced undergraduates or graduate students in science, engineering, and mathematics. Readers with the mathematical maturity to read, for example, [1] or [2] will prefer these wavelet classics for their elegance, depth, and authoritative nature. But many others will benefit from Kaiser's detailed informal style. Frequently we are so accustomed to our mathematical culture that we imagine it to be universal, and have no awareness of how mystifying it may be to the uninitiated. Kaiser's book is full of patient explanations, e.g., in noting the different conventions for the Fourier transform or the various wavelet normalizations. He emphasizes physical intuition whenever possible, e.g., in describing time-frequency analysis in terms of acoustic signals.

The book is fashioned as a text, complete with exercises that are relatively easy but undoubtedly help the student fix the ideas and notation. Proofs are usually informal and sometimes omitted. Chapter 1 is a review of some basic linear algebra and an introduction to Fourier analysis, including an intuitive discussion of the Lebesgue integral.

Chapter 2 introduces the windowed Fourier transform (WFT) as a tool for time-frequency analysis. An identity recovering a function f from its WFT is obtained. Replacing Fourier modulation by scaling, we are led to the continuous wavelet transform (CWT) in Chapter 3. The CWT is then inverted by means analogous to those used for the WFT.

The author motivates the transition from continuous to discrete identities by introducing, in Chapter 4, his notion of generalized frames, which are formulated so as to apply to both cases. He shows that a frame always leads to an identity via an inversion formula. In Chapter 5 the continuous frame provided by the WFT is sampled appropriately to yield a discrete frame and a corresponding identity. The same procedure is then applied to the CWT in Chapter 6 to obtain discrete wavelet frames and identities.

The heuristics of the presentation so far are appealing: the WFT and CWT are analogous, the discrete and continuous cases are analogous, and frame theory is the unifying principle. Moreover, the existence of a discrete wavelet frame motivates the search for an orthonormal wavelet basis. Chapter 7 shows how multiresolution analysis can be used to obtain such a basis. As a special case, Daubechies compactly supported wavelets are constructed in Chapter 8. For many readers, these last two chapters will be the main interest. However, this material requires relatively specialized and technically difficult techniques (e.g., subband filtering), that do not particularly fit into the philosophy established earlier.

The remainder of the book is called Part II. It presents some of the author's research on wavelets and electromagnetism. In Chapter 9, general solutions of Maxwell's equations are shown to be expressible in terms of certain matrix-valued wavelet solutions. Applications to radar and scattering are discussed in Chapter 10. The scalar case of acoustic waves is treated in Chapter 11, the final chapter. It is usually good to end an introductory text with a more advanced topic, to give the reader something to chew on. However, in this case, it is not clear how many members of the intended audience for this book will be successful in understanding the more sophisticated material in Part II.

Being an expository introduction to wavelets, the scope of the book is, of course, limited. Wavelet packets are only briefly described. Biorthogonal wavelets are not presented, although the appropriate groundwork is laid in Chapter 1. The local sine and cosine transform, Wilson bases, interpolating wavelets, multiwavelets, and wavelets on an interval are not discussed. Naturally the mathematical connections with Littlewood-Paley theory and operator analysis are not touched on either.

The text is oriented more toward pure than toward industrial mathematics. Key examples of wavelet applications, such as compression, numerical analysis of differential equations, and signal denoising are not addressed. At a more elementary level, computational topics such as the fast Fourier transform and the fast wavelet transform are not considered. In particular, Kaiser's book should not be confused with a how-to manual of applied wavelets, such as [3].

This volume is probably the most gentle introduction to wavelet theory on the market. As such, it responds to a significant need. The intended audience will profit from the motivation and common-sense explanations in the text. Ultimately, it may lead many readers, who may not otherwise have been able to do so, to go further into wavelet theory, Fourier analysis, and signal processing.

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MICHAEL FRAZIER
Michigan State University

Periodic Motions. *By Miklós Farkas.* Springer-Verlag, New York, 1995. $54.50, 577 pp., cloth. ISBN 0-387-94204-1.

For those of us who carry out research involving periodic solutions of ordinary differential equations, this is the book we have been waiting for. It contains as complete a story as possible (in a book of this size) of the existence and stability of periodic solutions of autonomous and nonautonomous equations, with techniques ranging from perturbations to bifurcations, all written in an easy-to-read, easy-to-follow style.

The introductory chapter reviews concepts needed in the discussions to follow. Topics such as dynamical systems and stability are briefly reviewed. Basically, it is assumed that the reader is already familiar with such things as Liapunov functions. The next chapter contains a thorough discussion of periodic solutions of linear systems. It begins with unforced systems, moves on to forced systems, and finishes with examples from equations of Hill and Mathieu.

In Chapter 3, there is an extensive discussion of autonomous systems in the plane. Separate sections are devoted to Lienard's equation, Duffing's equation, the Lotka-Volterra predator-prey system, and Hilbert's sixteenth problem. Of course, each of these topics has volumes of literature devoted to them, which are not reproduced in this text, nor should they be. But the main essences of the problems are presented, and the references show where to find the more extensive results.

Chapter 4 deals with periodic time-dependent systems, including the forced Lienard and Duffing equations. There is also an interesting example of competition between populations in a periodically changing environment.

In Chapter 5 there is a return to autonomous systems, but of arbitrary dimension. Here subjects such as orbital stability, Poincaré maps, and invariant manifolds are treated. Examples include higher order competition and cooperation among biological populations.

The text concludes with the two most important and interesting chapters which are on perturbations and bifurcations. Chapter 6 deals with the question of when periodicity and stability of solutions is preserved under perturbation. In particular the method of averaging, so familiar to the analysts of the former Soviet Union, is discussed along with singular perturbations.

In the final chapter, the most important topic currently in the treatment of periodic solutions is discussed, namely, bifurcation theory. Again, there are entire texts devoted to this topic containing many results that are not found here, but the references tell the reader where to look. However, two aspects of this chapter are noteworthy. There is a discussion of the Hopf bifurcation theorem, one of the most useful theorems of modern bifurcation theory. Also there is an introduction to zip bifurcation (for competitive systems), developed by Professor Farkas, which is a beautiful theory in which periodic solutions open up from a curve of equilibria as a parameter changes, just like a zipper.

Finally, a substantial bibliography is included in this book, which is a must for all researchers in this field.

H. I. FREEDMAN
University of Alberta

Parallel Computing Using the Prefix Problem. *By S. Lakshmivarahan and Sudarshan K. Dhall.* Oxford University Press, New York, 1994. $59.95, 294 pp., hardcover. ISBN 0-19-508849.

The usual definition of the prefix[1] computation is the following:

> Given elements $a_1, \dots, a_N$ from a set A that is closed under an associative binary operation $*$, compute the terms $d_i = a_1 * \cdots * a_i$ for $i = 1, \dots, N$.

On a single processor, this computation is straightforward and generates little interest. What better proof than the lack of any reference to the problem in [8]? Enter parallel computation, and the landscape suddenly changes. One of the most popular recent books on algorithms and data structures devotes the better part of its chapter on parallel algorithms to prefix computations [4, Chap. 30]. Karp and Ramachandran

[1] Other terms that have been used for this or closely related computations are suf x [1] and scan [3].