without ever becoming flashy. A newcomer will easily and pleasantly discover the field. But there is a second possible reading of this book: it is a manifesto of the particular viewpoint of the authors on the field. Thus one may find general remarks on the validity of variational approaches, on the equations most often used to describe these systems such as the Ginzburg-Landau equations, or else statements on the important features of flows in transition to developed turbulence. The underlying idea is that there is a kind of thermodynamic picture adapted to chaotic systems, in which the transition to chaos is a phase transition. However the precise domain of applicability of these thermodynamics remains to be found. Nevertheless it allows us to derive most of the qualitative description of the transition to turbulence. This duality of viewpoints, both introductory and subtle makes this nice little book an excellent reference for the beginner as well as the specialist.

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Hydrodynamics and nonlinear instabilities, edited by **C. Godrèche, P. Manneville** (Cambridge University Press, 1998, 681pp.) £ 85.00, US$ 100.00, hardcover ISBN 0 521 45503 0.

The study of hydrodynamics has fascinated theorists since the early days of science and it is not hard to see why. Here is a subject which is not only concerned with many everyday phenomena, but which is in the main susceptible to experiments that do not demand the GDP of a small nation to construct. The governing equations are accepted by all as applying accurately to the vast majority of situations, but while they are easy to write down, their full solution is elusive. Their difficulty stems from their nonlinearity, and the fields of boundary layer theory, bifurcation theory, exponential asymptotics and nonlinear dynamics have all received a powerful impetus from the effort of trying to get to grips with their complexities. The present volume, a joint effort by a distinguished group of French scientists, is principally concerned with these and other theoretical tools, while remaining very much in touch with the experimental basis of the subject. There are five long chapters; an overview of hydrodynamics (Castaing), on instabilities in extended closed and open flows (Huerre & Rossi), a discussion of asymptotic methods (Hakim), an extensive treatment of pattern-forming instabilities (Fauve) and flames and explosions (Joulin & Vidal). There is a nice introduction by Manneville emphasising the importance of the link between experiments and their description in terms of nonlinear theoretical models. The chapters are self-contained, and each aims to give a pedagogical description of its subject, accessible to graduate students, while still discussing up-to-date topics that have not yet been exhaustively studied. In my view, while inevitably the style of the chapters is somewhat nonuniform, the book succeeds pretty well in its aim, and I would recommend it as important reading for students embarking on a research career in hydrodynamics.

Chapter 1 gives an enthusiastic introduction to the Navier-Stokes equations and explains the physics behind them. There are sections on low Reynolds number flow (including a discussion of wakes), the energetics of turbulence, boundary layers, flow measurement, dimensional analysis and (the author's favourite) a statistical mechanical description of turbulence. This is all covered in just over 50 pages! Inevitably the pace is very rapid, and each part can only be considered a taster to encourage more detailed study. Chapter 2 is a comprehensive study of instabilities of shear flows, including spatially developing flows. There is a detailed discussion of Rayleigh's equations and viscous stability theory, and an explanation of the absolute stability criterion for such flows, though some very recent work on nonlinear effects is not included. There are also very useful sections on elliptical instabilities and on nonlinear travelling wave states on e.g. Poiseuille flow, whose instabilities are more relevant to turbulent breakdown than those of the basic state.

Chapter 3 exhibits a complete change of style. The author gives a number of interesting examples with fluid mechanical relevance showing the power of several asymptotic techniques that he has helped to develop. There is a nice description of two-scale analysis and boundary-layer methods, and a very readable and full discussion of exponential asymptotics, as applied to several problems including the Saffman-Taylor experiment. Motions of fronts and the existence of localised states are also discussed, though as yet there has been little investigation of the latter other than in simple evolution equation models. Chapter 4 deals with the nonlinear aspects of pattern-forming instabilities; those that lead to cellular structures or to travelling waves with a definite wavelength at onset. The emphasis throughout is on generality; although e.g. the particular problem of Rayleigh-Bénard instability is discussed explicitly, the main thrust is towards developing generic equations governing the various forms of pattern dynamics, and investigating which of their properties are robust and generalisable. In keeping with the book's pedagogical character, the treatment of secondary instabilities of rolls is restricted to the discussion of Eckhaus/zigzag type instabilities, which can be understood as phase instabilities arising out of translational symmetries of the primary pattern. There is no discussion of the (admittedly very complicated) 'convective textures' theories of Cross, Newell, Passot and others, which emphasise the role of weakly damped mean flows in destabilising patterns at low Prandtl numbers. Nonetheless, I found this chapter (which is the one closest to my interests), to be extremely valuable. The final article concerns flames and detonations, another subject that has not been widely disseminated in fluid mechanics texts. The authors have assembled some lovely pictures, and have given a wide ranging description of the theory, and of model equations such as that of Sivashinsky that seem to give a good description of flame fronts in a variety of situations. There is also a clear treatment of piston-type problems, though I am surprised that Lighthill's book "Waves in Fluids" which has a very thoughtful section on these problems was not given as a reference. This last chapter reads more like a review article than the others; reflecting perhaps the rapid development of the subject. Only in the future will it be possible to assign their true importance to the various models described.

In summary, I very much enjoyed reading this book, and learned much from it. While the articles are quite separate, each with its own bibliography, there is adequate cross-referencing and a global index. The quality of the English puts to shame the works of many native speakers! I expect that it will find a wide readership among theoretical hydrodynamicists, and will still be useful well into the next century.

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Asymptotic theory of separated flows, edited by **V.V. Sychev, A.I. Ruban, V.V. Sychev, G.L. Korolev** (Cambridge University Press, 1998, 334p.) £ 30.00, US$ 49.95, hardcover ISBN 0 521 45530 8.

This book seems, to this reviewer at least, to be one of the best such contributions in the area of separated flow theory. It is written by four Russian experts, all of whom were together at the central aero-hydrodynamic institute in Zhukovskii and made exciting and substantial efforts and progress in the area over many years. The successive chapter headings indicate the scope and emphasis of the presentation: the theory of separation from a smooth surface; flow separation from corners of a body contour; flow in the vicinity of the trailing edge of a thin airfoil; separation at the leading edge of a thin airfoil; the theory of unsteady separation; the asymptotic theory of flow past blunt bodies; numerical methods for solving the equations of interaction. The beautiful theory(ies) and computation(s) of separation are decribed very well in excellent English.