are devoted to core material (the summing and nuclear norms, Pietsch's fundamental theorem for p-absolutely summing operators, averaging techniques, the inequalities of Khinchin and Grothendieck, type and cotype) and the remainder with further selected ideas (basis constants, tensor products of operators, local reflexivity, cone-summing norms).

The book abounds with illustrations and exercises, and has been written in the author's characteristically enthusiastic style. He believes strongly that proofs of results should do more than merely establish their truth in a logical way; they should also give (as he says) a feel for *why* they are true. The only prerequisite is a knowledge of the basic theory of normed spaces and so it will prove an extremely useful text for a graduate student wishing to learn about an important area in modern Banach space theory.

T. A. GILLESPIE

ARROWSMITH, D. K. and PLACE, C. M. *An Introduction to Dynamical Systems* (Cambridge University Press, 1990), 433 pp., hard cover 0 521 30362 1, £50; paper 0 521 31650 2, £19.50.

There must be many university and college teachers who will grasp this book eagerly. The introduction of courses in modern dynamical systems theory is a growth industry, which is hampered only by a paucity of texts aimed at the right level. This one has its sights set on the interface between final-year undergraduates and first-year postgraduates. It does not aim to survey the field comprehensively, but the subjects on which it concentrates are taken at a measured pace which shows that the authors have kept this particular audience carefully in mind.

One of the great strengths of the book, at least as a teaching aid, is the abundance of exercises, over 300 in all. Most are in the style of ready-made examination questions, and, though there are no anwers, there is a helpful section of hints tucked at the back of the book. The 200-odd illustrations are also impressive, which is an important element in the teaching of such a subject as this where one diagram can convey a much better idea than pages of definitions. The figure illustrating the Melnikov function is just one of many beautifully executed diagrams.

The authors' fine sense of theatre will also appeal to readers fresh to this subject. For example, the earlier parts of Chapter 1 amble along, introducing ideas of diffeomorphisms, flows, invariant sets, conjugacy, equivalence, etc., just like any other text book, but then we turn the page and are struck with five pages of beautiful and intriguing illustrations of Hénon's quadratic map. And then down comes the curtain on Chapter 1. Familiar these pictures may be, but to a newcomer—and this is an introductory book—their appeal will be fresh and exciting, especially in the context of what has gone before.

It is hard to place this book on the applied-pure spectrum. It lacks the pervasive drive for abstraction which one would expect in a pure treatment. Many results are stated without proof, and sometimes quite informally. On the other hand there are conclusive signs that put it firmly in the pure camp. It is scrupulously unsensational, to the extent that chaotic behaviour is barely mentioned, though of course the publisher has ensured that the phrase appears in the very first sentence of the blurb on the cover. Another, more serious, sign is an almost complete lack of applications, as though all these problems of dynamical systems had nothing to do with mathematical models of convection, celestial mechanics, population growth, and so on, and are mere creations of the mathematician's imagination.

In fact the book concentrates on the "computational" aspects of dynamical systems, which here does not mean computer experiments, but rather such procedures as the calculation of normal forms, versal unfoldings, centre manifolds, etc., and the application of such techniques to the theory of bifurcations. For example, the beautiful kaleidoscopic diagrams of two-parameter bifurcations, which one associates so much with Arnold's books, are given quite spacious and illuminating treatment here.

Though the book is described as an introduction, and the treatment is for the most part carefully paced with learners in mind, the last chapter rapidly gets a good deal harder. Here the book makes contact with some current research problems. There is considerable material here which would be ripe for formulation as MSc projects, and the chapter ends with an obviously open problem.

In summary, then, the coverage of topics is quite selective, but the treatment of those which are included is generally very thorough and painstaking, in a way that students in particular will appreciate. The book will, I am sure, prove to be a highly successful learning and teaching medium for these subjects, which certainly hold a central position between abstract dynamical systems theory and applications.

DOUGLAS C. HEGGIE

ARNOL'D V. I., *Huygens and Barrow, Newton and Hooke,* translated by E. J. F. Primrose (Birkhäuser Verlag, Basel 1990), 118 pp., 3 7643 2383 3, sFr 24.

To many mathematicians what makes the seventeenth century so special is the birth of calculus and of analytical mechanics. To others, however, it goes down as the golden age of mud-slinging priority disputes (Newton and Leibniz, for instance). In this book Arnold sides with Hooke against Newton in another dispute, this time over the discovery of the inverse square law of gravitation. As historians of science are well aware, settling such disputes is a sterile exercise, and fortunately there is much more to this book than that. Indeed it is a lively, amusing and instructive tour through many of Arnold's favourite bits of mathematics, all ultimately tracing their roots to the great names of the seventeenth century.

Arnold's style is immediately recognisable on every page, and whether you are a mathematician or a physicist you need to be able to take a joke to enjoy the book fully. For example, "Bourbaki writes with some scorn that in [Barrow's] book in a hundred pages of the text there are about 180 drawings," he says, and then adds in an aside, "Concerning Bourbaki's books it can be said that in a thousand pages there is not one drawing, and it is not at all clear which is worse." Arnold's book is well illustrated, but there are some sections where the odd *equation* would not come amiss. For instance, my attention span is stretched to breaking point by a sentence like the following: "H is cut out from a sum of cosines defined on a q-dimensional torus under an imbedding a of a two-dimensional plane in a q-dimensional torus in the form of the irrational space of an irreducible representation of the cyclic group of order q."

One of the mathematical interests which links Arnold with the great 17th century scientists is celestial mechanics. He mentions the fact, easily explained with perturbation theory, that if the plane of motion of a binary system (like the earth and moon) is highly inclined to the plane of motion of a more distant third body (the sun, in this case), then the eccentricity of the binary orbit will exhibit large variations, leading to a collision between the two bodies. I did not know, but Arnold tells us, that this result dates back as far as 1963. On the other hand some of the phenomena which Arnold describes are really a great deal more interesting than one might gather from this book, and in ways which would, I am sure, appeal to Arnold. For example, Arnold mentions that there is an equilibrium solution of the three-body problem (due to Euler) such that a spacecraft can remain in a fixed position between the earth and the sun. He goes on to state that this is used in space astronomy, but in fact it is not, because it places the satellite in front of the sun, and radio communications are difficult. Instead, the craft can be put on a periodic orbit near the equilibrium position, and this orbit actually bifurcates from a family of Lyapunov orbits associated with the equilibrium. Furthermore, it has been shown that the stable invariant manifold of this periodic orbit passes very close to the earth, and so it is possible to inject a satellite into this orbit with the expenditure of a surprisingly small amount of energy.