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BOOK REVIEWS

DRAZIN, P. G., *Nonlinear systems* (Cambridge University Press, Cambridge 1992) 330 pp., hardback 0 521 40489, £40; paper 0 521 40668 4, £17.95.

Why is chaos like a beard? The answer will be found as early as p. 3 of this textbook, in the introductory chapter, but chaos itself is treated at length only in the last chapter. This chapter contains interesting and important topics not usually seen in books at this level (see below), including a summary of routes to chaos, and the characterization of chaos in time series. Similarly the fourth chapter provides introductions to Cantor sets, fractals, and Feigenbaum theory. The remaining chapters are more routine: bifurcations, difference equations, and free and forced oscillations. These chapters have much in common with other applied mathematics texts in this general area.

The book is aimed at final-year undergraduates or first-year postgraduates, and is said to be suitable not only for mathematics students but also for eager students in physics, engineering, economics, etc. Indeed the treatment is refreshingly informal, with no theorems, few abstractions, and plenty of derivations and worked examples integrated seamlessly into the text, though unfortunately applications rarely get more than a passing mention.

There are very large numbers of problems for the reader. The answers and hints given at the back seem adequate, though the outline answer to Question 5.2 seems to me to lead in quite the wrong direction, and the calculations in 8.1 are sufficiently tricky that a statement of the answer would have been reassuring; perhaps it was considered too long to print.

There are listings of a number of short, useful, BASIC computer programs, and the bibliography includes movies and videos. The index is detailed enough to be useful, and I have found few misprints, my favourite being a quote from Gentnude Stein [*sic*].

D. C. HEGGIE

HOGGAR, S. G. *Mathematics for computer graphics* (Cambridge University Press, Cambridge 1993), xviii+472 pp., 0 521 37574 6, £25.

This is an unusual book, its fractal-festooned dustjacket giving a clue to the pictorial riches contained inside. For this is not a service textbook on the mathematics that a computer graphics enthusiast needs to know. (It contains no projective geometry.) Rather, it is primarily a book about *Pictures with Symmetry*.

The idea of writing a text centred around pictures with symmetry is an inspired one. For, if you start by admiring the pictures, they raise questions which lead to many different branches of mathematics. On the other hand, the mathematics is very much enlivened by being applied to understanding the pictures.

Let us discuss the pictures separately from the mathematics. To see how they fit together, I refer you to the book! First the pictures. The first major class of pictures (i.e. subsets of $\mathbb{R}^2$ with some symmetry) considered is braid patterns—pictures all of whose translational symmetries form a discrete set of parallel vectors. Such pictures may have other symmetries (e.g. reflections), resulting in braid patterns being classified into seven distinct types, depending on the totality of their symmetries.

The next major class of pictures is the *net*, the orbit of a single point under some finite