Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. F. Bryan, Department of Chemistry, University of Virginia, McCormick Road, Charlottesville, Virginia 22901, USA). As far as practicable, books will be reviewed in a country different from that of publication.

Acta Cryst. (1997). A**53**, 251

Symmetry in chaos. By M. Field and M. Golubitsky. Pp. 230. Oxford University Press, 1996. Price £15.00 (Paper). ISBN 0-19-853688-7.

In this book, the authors present the kinds of pictures that may be produced when the seemingly contradictory ideas of symmetry and chaos are combined, and they provide in as elementary a way as possible the mathematical ideas that lead to those pictures. Both symmetry and chaos are topics about which much has been written lately at all levels, from the supposedly introductory to the very sophisticated, but this book takes nothing for granted. Each topic is carefully defined so that it is placed in the proper context. Symmetry is first defined, then demonstrated, with simple examples that lead into a nice introduction to groups. The same is done for chaos; first the definition, then carefully explained examples, and then a more general treatment of chaotic systems. The two concepts are then brought together very neatly with an excellent explanation of what is meant by symmetry in chaos.

Since chaos has become a topic of interest with very little general understanding of what it means precisely, it is good to have a book by authors who understand this state of affairs and who set out to explain clearly what is meant by a chaotic system. They develop the logistic equation from the initial premise inherent in the special population problem it is meant to describe. They next explain in detail how chaos can arise from such a simple system and how it comes about. This simple equation, which is not symmetric, is transformed into a symmetric equation and the first step to symmetric chaos is developed. With these fundamentals out of the way, the authors then work out in detail the interesting cases of symmetric icons – symmetric chaotic systems having either rotational or reflection symmetry, or both – and of systems having translational symmetry, so-called quilts. The final chapter deals with symmetric fractals, and is again a clearly written exposition of an interesting topic.

In 54 color plates, the authors illustrate the outcome of the formalism. These pictures are not only aesthetically pleasing but are the real message of the book. That being so, the authors realize that, unless the way in which the pictures are generated is clearly explained, they will not fully convey the meaning of symmetry in chaos. They explain the method by which the images are created by first using a very simple model of a screen, then developing the introduction of color, and then showing in detail how they are completed. The process is brought to closure by including computer programs for the use of the reader.

We need more books of this type. In the best sense of the word, this is a pedagogical book that lays the groundwork for the further work it is sure to generate on the part of the reader. A certain level of mathematics is expected, but it is not very high, and each mathematical topic is developed from a very elementary level. The reader will benefit from the authors' clear grasp of what they wish to say and the great care they have taken to make sure that the essence of this interesting topic is presented in a clear and concise fashion. I found the book an excellent introduction to a field of very general interest.

W. D. Whitehead

Department of Physics
University of Virginia
Charlottesville
VA 22901
USA

Acta Cryst. (1997). A**53**, 251–252

Introduction to crystallographic statistics. By Uri Shmueli and George H. Weiss (IUCr Monographs on Crystallography, No. 6). Pp. ix + 173. Oxford University Press/International Union of Crystallography, 1995. Price £45.00. ISBN 0-19-855926-7.

This book is concerned with the derivation of probability density functions (p.d.f.s) for structure amplitudes and in part for phases. It is an overview of the research work of the two authors, augmented with all necessary introductory material and overviews of related work. The authors' significant contribution in this field has been the application of Fourier representations to the derivation and calculation of exact p.d.f.s.

The Introductory Material leads the reader through an explanation of structure-factor representations (F, U, E), the notion of rational independence, random variables and fundamental ideas in probability theory such as the p.d.f., moments, characteristic functions, cumulants and conditional p.d.f.s. A complete derivation of the p.d.f.s of $|E|$ in space groups $P1$ and $P\bar{1}$ follows. This leads naturally to the need for some approximate solutions, so the authors present a derivation of the 'ideal' distributions, based upon the use of the central limit theorem, for the same two cases. As an extension of these two approximate solutions, the authors analyse the effects of non-crystallographic symmetry (bicentric and subcentric distributions) and end Chapter III by deriving the ideal conditional p.d.f. of a three-phase invariant. Chapter IV deals with the conventional higher-order approximations to a p.d.f. obtained from the ideal p.d.f.s by the use of various orthogonal polynomial expansions, illustrating the need for improved representations of the p.d.f. of $|E|$ with several examples. I have the impression that the authors' hearts are not in these elaborate although approximate expansions, and Chapter V begins their *pièce de résistance*, the derivation and use of the Fourier representation of exact p.d.f.s. They treat