

## 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.*

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**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.

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**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

these representations in detail and compare them with the results for ideal p.d.f.s based on the central limit theorem.

The text is written in a uniform style where words and diagrams have been carefully chosen and are used sparingly to great effect. The ideas involved are clearly exposed without an excess of detail obscuring the underlying principles. The text has been composed by the authors themselves, using L<sup>A</sup>T<sub>E</sub>X, resulting in few typographic errors but with its characteristic poor hyphenation of words. To my taste, titles and subtitles are used too sparingly with wording that often does not enable the content to be easily identified, and it is disappointing that the references do not contain the terminal page numbers of the works cited. The authors provide an internet document correcting known typographic errors of the book (<http://chemsg7.tau.ac.il/xtal/corstat/corstat.html>).

A reader needs a good grounding in mathematics to find a way through the Fourier transforms and other algebra necessary for an understanding of intensity and phase statistics. A knowledge of probability theory and statistics is not necessary. I found this text most valuable to read but requiring a high level of concentration. I thoroughly recommend its study.

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**Symmetry of crystals: Introduction to *International Tables for Crystallography* Vol. A.** By THEO HAHN and HANS WONDRA TSCHKE. Pp. 144. Sofia: Heron Press, 1994. Price (paper) DM 25. ISBN 954-580-007-0.

This book is intended as an introduction to the space-group symmetries of crystals and their compilation in *International Tables for Crystallography* Volume A. It has its origin in lecture notes for a series of Summer Schools on the Symmetry of Crystals, presented by the authors since 1988, most recently in Bulgaria in 1994.

The text begins with a review of group theory (Chapter 1) and the representation of crystallographic symmetry operations by matrices (Chapter 2). Group theory is then used to describe space-group types (Chapter 3), changes in coordinate systems (Chapter 4), group-subgroup relations (Chapter 5), generators of space groups (Chapter 6), space-group projections (Chapter 7) and systematic absences and reflection conditions (Chapter 8).

The set of 16 varied problems provided is a useful feature of the work. Included are problems using group theory and matrix algebra applied to general position and symmetry diagrams, coordinate transformations and phase transitions. Also included are examples of interpretation of a reciprocal lattice, a set of precession photographs and line splitting in a powder pattern. The solutions to all problems are complete and clearly presented.

The style of the text is similar to that of the five introductory chapters in Volume A itself. Readers who desire a more

complete group-theory basis to amplify those chapters will find this new book very useful. However, those who wish simply to use the Tables, but not necessarily master the underlying theory, are unlikely to find much additional help in this Introduction to Volume A over and above that already provided by Professor Hahn in his *Brief Teaching Edition* of Volume A.

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*Editor's note:* Heron Press is a three-year-old publishing house whose main goal, according to its Editor in Chief, Dr Ilya Petrov, 'is to fill the gap, existing in the Balkans, in the publishing of scientific literature and to open a kind of exchange of scientific literature between our region and the West'. The Press's registered offices are located at 18 Oborishte Str., 1504 Sofia, Bulgaria.

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#### Books Received

*The following books have been received by the Editor. Brief and generally uncritical notices are given of works of marginal crystallographic interest; occasionally, a book of fundamental interest is included under this heading because of difficulty in finding a suitable reviewer without great delay.*

**Molecular modeling of inorganic compounds.** Edited by P. COMBA and T. W. HAMBLEY. Pp. x + 197. Weinheim: VCH Verlagsgesellschaft mbH, 1995. Price DM 197.00. ISBN 3-527-29076-1. A review of this book, by Michal Sabat, has been published in the October 1996 issue of *Acta Crystallographica Section B*, page 1058.

**Electrooptic effects in liquid crystal materials.** By L. M. BLINOV and V. G. CHIGRINOV. Pp. xvii + 464. Berlin: Springer-Verlag, 1996. Price DM 89.00 (Soft cover). ISBN 0-387-94708. This is a 'Study Edition' of the 1993 hard-cover version of this work. The book 'by two of the leaders in liquid-crystal research in Russia, presents a complete and accessible treatment of virtually all known phenomena occurring in liquid crystals under the influence of electric fields'.

**Crystal identification with the polarizing microscope.** By R. E. STOIBER and S. A. MORSE. Pp. xiv + 358. London: Chapman & Hall, 1994. Price £24.95 (paperback). ISBN 0-412-04821-3. The book is 'intended to serve the needs of industrial and forensic scientists as well as petrographers who deal with rocks'.

**Metamorphic crystallization.** By R. KRETZ. Pp. xiv + 507. Chichester: John Wiley & Sons, 1994. Price £22.50 (paperback). ISBN 0-471-94214-6. This book 'is an introduction to the science of metamorphism, prepared for senior undergraduate and graduate students in geology and geochemistry'.