related active area is the determination of defects and atomic steps on surfaces, and all of these topics have received considerable attention in this volume.

Many of the contributions, there are sixty five in all, are excellent but often represent work already published, albeit in a slightly different form. Few of the contributions are really reviews but many fall into the category of being a statement of the current position. This volume, then, is for the serious surface scientist and it will have a fairly limited 'time of usefulness'.

P. J. DOBSON

*Philips Research Laboratories*
*Cross Oak Lane*
*Redhill*
*Surrey RH1 5HA*
*England*

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**Structure and statistics in crystallography.** Edited by A. J. C. WILSON. Pp. vii+225. New York: Adenine Press, 1985. Price US $65.00.

This book describes the proceedings of the symposium on Crystallographic Statistics held in Hamburg, West Germany in August 1984 in the course of the Thirteenth International Congress of the International Union of Crystallography. It also includes a few papers presented in the main Congress but which were considered as closely linked with the symposium topic.

The first and last contributions in the book stand out on their own, the first by J. Karle on the statistical basis underpinning direct methods and the last on 'expert systems' of data acquisition. The direct-methods contribution does not contain any new material but it is a splendid review of the theoretical developments which led to direct methods having their present pre-eminence and in which Karle and Hauptman played such a leading role. The 'expert systems' paper by H. J. Milledge and her collaborators presents the principles by which the data-acquisition process by a diffractometer may be optimized by analysing the data during collection.

The remainder, the bulk, of the book divides into two roughly equal parts - the first concerned with intensity statistics and the second with refinement processes. A most interesting paper by Weiss *et al.* deals with the representation of probability density functions by Fourier series, which is much better than previous methods using the central-limit theorem or based on the Edgeworth or Gram-Charlier series. There follow three papers dealing respectively with the effects of heavy atoms, non-crystallographic centres of symmetry and non-crystallographic translational symmetry on the normal or cumulative intensity or $|E|$ distributions. Since many crystal structures contain heavy atoms or a great deal of symmetry to do with the chemistry of molecules rather than the requirements of space groups, it is clear that departures from idealized random distributions of almost-equal atoms must be common. The papers presented here show much success in predicting distributions from known structural features; it is not quite so clear that the inverse problem has been solved.

After a paper by Parthasarathy & Elango on the best way of testing for symmetry elements from intensity statistics the section is rounded off by a contribution from Wilson on fluctuations and errors in intensity distributions. He concludes, regretfully, that there is no obvious easy way of representing distributions modified by random or systematic errors.

The second section, on refinement, starts with a paper by Prince commenting on the precision and accuracy which may be obtained in structure refinement by the Rietveld method. He concludes that while the calculated standard deviations may give a general indication of the precision of the parameters found they are not an accurate assessment of the r.m.s. errors. Clearly this paper was controversial; the following paper by Rollett is a discussion of Prince's paper and he comes to a contrary conclusion.

The next two papers are concerned with the application of information theory to refinement. The first, by Collins, is on the very topical subject of parameter estimation by entropy maximization. This is a good paper to read; firstly it confirms that there is a certain arbitrariness in the entropy function which is maximized and secondly it demystifies a topic which for many crystallographers has taken on the characteristics of a deity - all powerful and incomprehensible. The following paper by Wilkins *et al.* is similarly to be commended especially in providing a practical procedure for incorporating prior knowledge into information-theory procedures.

The three papers which follow, on the modification of weights in least-squares analysis, variance of intensities in the Bond method and the use of maximum likelihood and minimax methods, are useful but not exceptional in any way. However, the final paper in this section, by Prince & Nicholson, on the influence of individual reflections on precision in least-squares refinement, links very nicely with the already-mentioned final paper by Milledge *et al.* Here we are shown how one should concentrate time and effort in measuring just that selection of reflections which most influence the determination of parameters rather than measuring everything indiscriminately with equal effort.

The book is well produced, attractively printed and a useful addition to crystallographic literature. There is something here for the theorist and experimentalist alike and, at least, it should be available on the shelf of the local library.

M. M. WOOLFSON

*Department of Physics*
*University of York*
*York YO1 5DD*
*England*

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**Crystal structure analysis: A primer.** 2nd ed. By J. P. GLUSKER and K. N. TRUEBLOOD. Pp. xviii+269. Oxford University Press, 1985. Price hardback £29.00, US $37.50; softback £17.00, US $18.95.

The first edition of this text came out 13 years ago in 1972, and was reviewed then by J. L. Lawrence [*Acta Cryst.* (1972), A**28**, 680], who concluded '...this book can be highly recommended as an undergraduate text ... and ... to any scientist who desires an introduction to structure determination'. Now, in producing their second edition, the authors have made the book still better by updating and judiciously enlarging it. Almost every part has been affected, with modified or expanded text, new (extra) diagrams and photographs, such as the protein-crystal synchrotron-radiation diffraction photograph shown in the section on experimental methods. Direct methods and anomalous dispersion now have a chapter each; four-circle diffractometry is explained in detail, the glossary (a most valuable feature) has been doubled in size, and the index nearly doubled too. Of course, the price has more than doubled: the factor is about seven; but it is to be hoped that at least the paper cover version will nevertheless be within the reach of the students - to whom it is addressed.

One regret - which the authors will surely share. In the year of the award of a Nobel prize in the central core of this subject area, it is sad that this book, despite its 20-page 30-section annotated bibliography, just happens not to contain any reference to the papers, or the names, of Jerry Karle and Herbert Hauptman.

J. H. ROBERTSON

*School of Chemistry*
*University of Leeds*
*Leeds LS2 9JT*
*England*

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**Ferroelectrics and related materials.** Edited by G. A. SMOLENSKII. (Translated from the Russian.) Pp. xix+763. New York: Gordon & Breach, 1984. Price US $280.00.

Professor Smolenskii edits a volume by seven authors eminent in this field - a field in which he has been a leader since its beginning. There are sixteen chapters by the several authors. Some of the contributions are very striking, but inevitably some are not. And in spite of the title there is not a good coverage of the whole field. It seems likely that there was a Russian-language edition before this publication, but we are not told its date. It may account for the fact that most of the bibliographic references are not more recent than 1978. The bibliographies are at the ends of the chapters, which is unavoidable. So there is a pressing need for good indexes; there are none. A quarter of the sections are concerned with a specific material, including those in chapter 2 - a brief survey of 'seven most important ferroelectrics'. But other information, even about these same materials, is scattered throughout the volume, and there is no way to find it. This is even more awkward if you seek all information on a given topic or concept (nonlinearity; tunnelling; Goldstone theorem; diagram techniques; incommensurate transitions). A good subject index should most emphatically have been provided.

The very brief introductory chapter, written by the volume editor, expands the historical classification of displacive *vs* order-disorder ferroelectrics, and goes on to include more recent topics such as incommensurate transitions. It includes material on how to search for new ferroelectrics, a search in which Professor Smolenskii has been much involved.

The very long chapter on thermodynamic theory of the ferroelectric transition gives a very careful introduction, followed by thorough exposition of many less-simple situations, including an introduction to fluctuations (treated more fully in a later chapter), and of Landau theory, improper ferroelectrics and ferroelastics. The tables are very useful. The following chapter then shows the applications to a limited number of ferroelectric materials, including the historically interesting and important material Rochelle salt. A stimulating chapter.

Another very long chapter deals with microscopic theory and its connection with the thermodynamic properties, by concentrating on some of the more important models, and keeping the discussion 'understandable to experimenters'. Thus, for example, the dipole-dipole electrostatic interaction is given great weight. There is also here discussion of dynamic susceptibility, and the chapter ends with an unduly brief treatment of central peak phenomena, in which a narrow intense light scattering occurs, for a variety of reasons, at very low frequency, and also of a scattered neutron peak. These are thorough expositions, with the limitations of the treatment chosen explicitly stated.

Classical Landau theory of phase transitions, which takes no account of interaction of fluctuations of the order parameter, is in chapter 6, as well as the 'renormalisation group' method as applied to phase transitions. The latter method calls for careful exposition to any less mathematical reader, and that is what it gets in this chapter. Very useful.

In some areas the treatment is disappointing, being no more than a recital of well-known basic descriptive algebra and a catalogue of experimental findings in a few specific materials. This is the treatment given to domain effects, to acoustic and piezoelectric effects, to electrooptic and nonlinear optical effects, to nonlinear dielectric effects, and to temperature variation of dielectric constant. Very little attempt is made here to suggest any conceptual discussion, except for a handful of references to read; losses are barely mentioned. Electroacoustic echo is dealt with separately in chapter 10.

The volume editor is a world leader in the area of diffuse phase transitions, so it is surprising that chapter 12 is so slight. The principal cause of the diffuseness is undoubtedly composition fluctuation, but it is odd that Isupov so strongly discourages the idea that any other cause exists.

Chapter 13 deals with antiferroelectricity. The concept of an antiferroelectric is ambiguous. One has to accept a 'definition' involving a free energy 'nearly equal to' that of a ferroelectric. And Kittel's original thermodynamic potential uses thermodynamic variables which 'cannot play the role of conjugate thermodynamic variables'. Both ambiguities are recognized here, but it is typical of this book that they are stated 400 pages apart. The book discusses the situation in terms of links between antiferroelectric transition and improper transitions. A nine-point definition of antiferroelectricity is adopted, and the ensuing discussion is realistic and useful.

The book concludes with an exceedingly brief account of ferroelectrics with a magnetic ordering, and a very long account of oxygen octahedral ferroelectrics (already much discussed in earlier chapters), and others, organized in 32 sections material by material. The very important hydrogen-containing ferroelectrics, with their vast quantities of