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BOOK REVIEWS

Nuclear Magnetic Resonance, Concepts and Methods, Daniel Canet. Wiley, Chichester, 1996, 260 pages, $49.95 (paper). ISBN: 0-471-94234 0 (cloth); 0-471-96145-0 (paper).

This book is a translation, with substantial revision, of a volume written in French by the same author in 1991. It is divided into five chapters, the first of which is a general introduction to NMR spectroscopy, beginning at a relatively elementary level but leading fairly quickly into the mathematics of spectral simulation, an important area omitted from many current texts. This is followed by a section on spectra in anisotropic media, including the effects of quadrupolar interactions and motional averaging.

In the second chapter, the basic mathematics of nuclear resonance is presented, first by way of the Bloch equations, and then by the density matrix and density operator treatment. Application of the operator methods to various steps in a pulse sequence, including field-gradient pulses, is outlined. The third chapter describes various aspects of data processing, including the mathematics of the Fourier transform, its relation to apodization, and its application to 2D spectroscopy. Alternative approaches, such as linear prediction and maximum entropy methods, are also briefly described.

The fourth chapter deals with dynamic phenomena, including methods of measuring relaxation times as well as of interpreting the experimental data once it has been obtained. This material includes a detailed consideration of cross-relaxation and chemical exchange phenomena. The fifth and final chapter is entitled ''Multipulse and Multidimensional NMR.'' It lives up to the author's desire to present a unified treatment of various advanced experiments, including imaging. Emphasis is on aspects of coherence transfer and the basic components of pulse sequences, rather than on coverage of a great variety of specific experiments. There is an excellent discussion of selective excitation, illustrated with numerous diagrams.

This volume represents a compact and comprehensive review of NMR at an advanced but still practical level. It includes a great deal of mathematics, although many of the derivations are set off by printing in a smaller type font than that of the main text. The language and typography are excellent, and the author has evidently put much thought into providing a clear and logical presentation. The book can be highly recommended to any spectroscopist who wants an overview of the principles and mathematics of the diverse aspects of nuclear magnetic resonance. It would make an excellent graduate-level textbook for students aiming to specialize in NMR, but understanding and appreciation of most of it would require some background and experience in this type of spectroscopy.

W.S.B.

NMR Data Processing, Jeffrey C. Hoch and Alan S. Stern. Wiley–Liss, New York, 1996, 196 pages, $69.95. ISBN: 0-471-03900-4.

This is a very practical and useful little book. As the authors state in the Preface about the focus of the volume, ''It concentrates solely on that middle area so often taken for granted: the reduction of raw data to a form that is usable for further scientific investigation.''

A brief introduction includes some historical background and definitions of terms such as resolution, sensitivity, noise, and FID. There is then a chapter describing the discrete Fourier transform, its mathematical form, and its characteristics. Such aspects as quadrature detection, convolution, and causality are explained. In the next chapter, the authors show how the DFT is applied to NMR, including zero filling, various apidization functions, data in multiple dimensions, oversampling, phase correction, and artifact elimination.

A chapter on linear prediction, a method often used as an adjunct to the DFT, follows. Practical aspects such as the choice of parameters and range of applicability, as well as the mathematical basis, are well covered. An alternative, next described, is maximum entropy reconstruction. The mathematical basis of MaxEnt is presented, followed by examples which illustrate very well its capability. An interesting application is its use with nonlinear sampling.

In a short Chap. 6, three interesting ''emerging'' methods with potential for NMR use are introduced: iterated soft thresholding, smoothing by wavelets, and Bayesian techniques. This *Journal* has recently included a number of papers related to the last two of these methods.

This book will be useful for anyone wishing to understand the basis of NMR data-processing methods or needing to make a choice among methods. The mathematics is presented in detail, with extensive illustrations. Best of all, the chatty style of writing makes the mathematics easy to digest and reduces the tendency of the reader to nod over series of equations. The volume is highly recommended to anyone with interests in or concerns about its subject.

W.S.B.

1090-7807/97 $25.00

Nuclear Magnetic Resonance Probes of Molecular Dynamics, Robert Tycko, Editor. Kluwer Academic, Dordrecht, 1994, 550 pages, $252.00; £168.00. ISBN: 0-7923-2795-0.

The editor has assembled a distinguished group of contributors for this volume, which is designated as Vol. 8 in a series called ''Understanding Chemical Reactivity,'' and each of these authors has done an excellent job. The first of the 12 chapters, by the editor, provides a brief mathematical introduction, using density operator theory, as well as illustrations of dynamic studies, using solid fullerenes and fullerides.

The three longest chapters, each of 68 pages or more, are by Regitze R. Vold on deuterium dynamics in solids and liquid crystals, by Shimon Vega on dynamic magic-angle-spinning spectroscopy, and by Jeffry W. Peng and Gerhard Wagner on protein mobility from ^{15}N relaxation. Each of these subjects is covered at a fairly advanced level with much theoretical background, and each section requires a considerable degree of sophistication on the part of the reader. There are two other chapters which also include a strong mathematical flavor, one by Werbelow on the theory of dynamics and polarization in mobile phases, and the other by Brüschweiler on the dynamics of biopolymers in solution.

Oriented much more toward specific applications are chapters on solid polymers by Chmelka, Schmidt-Rohr, and Spiess, on pressure studies by Jonas, on furanose ring dynamics in solid nucleotides using ^{2}H by Matiello and Drobny, on transport-ordered 2D spectroscopy by Johnson, on motion in porous media by Callaghan and Coy, and on catalytic surfaces by Duncan.

The physical presentation of the book is excellent; while the reviewer clearly could not check the accuracy of all the mathematics, no typos were noted in the text. Each of the chapters has an extensive up-to-date list of references, but no overall index is provided. The volume is definitely not for beginners. It would, indeed, seem highly desirable to have the elements of the basic theory combined and provided in a much longer introduction, rather than dispersed, with some duplication, through many of the chapters.

W.S.B.