J. Indian Inst. Sci., 64_(B), May 1983, Pp. 173–188.

BOOK REVIEWS

Social history of nineteenth century mathematics edited by Herbert Mehrtens, Henk Bos and Ivo Schneider, Birkhauser, 1981, pp. 301, S.Fr. 58.

This volume is the outcome of an international workshop on the social history of mathematics held in West Berlin in 1979. It combines sociological study of mathematics with historiography and adduces support for the growing tendency among scholors to regard science in general as a cultural activity influenced by and influencing the human condition of existence in a certain period. The book is conveniently divided into three parts : Part I deals with the fundamental changes that took place in the early nineteenth century ; Part II discusses the rise of professionalism in mathematics, and Part III is devoted to a study of some individual case histories. Each part carries its own introduction that makes the book particularly readable. The Appendix by Herbert Mehrtens completes the work with a very readable critique of different methodologies relevant to the social history mathematics. The bibliography is sufficiently exhaustive. Now, a few comments on the main points. It is a commonplace that art imitates life. It is also true that to a degree life imitates art. This is so fundamentally because of the very subjective nature of art, and its direct appeal. It is possible in art, *e.g.* to speak of moral values. In the case of mathematics, however, given its objectivity and inherent constraint of logic admitting no value judgement or freedom, it is not easy to 'argue the connection'. And this connection is precisely what this book is about. The choice of the period under study, namely the turn to the 19th century, is particularly appropriate since it was a period of great many qualitative changes in the society and as such it ought to reveal the connection, if any. It is, of course, possible to see the connection at some rather obvious but quite important levels as discussed in Part II, *e.g.* professionalization and autonomization of mathematics, educational system, life insurance companies, etc., are obviously connected just as mensuration was connected to the urbanized Egyptian-Babylonian societies. One can easily observe some connection between the work of the individual and the institution he belonged to, *e.g.* the Weierstrassian influence of the Berlin School on the works of Georg Frobenius and Wilhelm Killing, and similar examples from the Göttingen School of Hilbert and Klein as discussed in Part III. One can indeed produce a wealth of evidence from such biographical and prosopographical studies. But this is after all superficial as far as mathematics is concerned. To argue a connection at a deeper level one must show how the mathematical paradigms are efficiently, casually related to the prevailing social forces. This has been attempted

in the very absorbing studies of Part I. But one is left in doubt if the rigour of analy insisted upon by Cauchy or the arithematization of mathematics culminating with Hilb is effectively related to any specific social, political or economic movement. But t debate must go on. The example of Hamilton is certainly very convincing. Fina the book is naturally addressed to a rather limited and select readership. It presuppo a good apprcciation of mathematics, a sense of history and of psychology of creat thinking. But one could have hoped for some more clarity and simplicity of expo tion. For example, having mentioned 'discursive formation' one could have ea explained in simple terms what it really connotes. Also too many quotations throw in parenthetically only confuse. Recommended for libraries.

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Teaching teachers, teaching students—Reflections on mathematical educa edited by Lynn Arthur Steen and Donald J. Albers, Birkhauser, Basel, Switzerla 1981, pp 136, S.Fr. 26.

This book is a report—not official—of the Fourth International Congress on Mat matical Education in the sense that it is a collection of personal observations by so of the participants. The Congress was held in August 1980 at the Univ. of Californi Berkeley. Over 2000 mathematicians and mathematics teachers from around the wo participated in it and over 400 speakers from 100 different countries addressed doze of different issues that confront mathematics educators all over the world. Geo Polya was the Honorary President of the Congress.

The book contains in the beginning profiles of five individuals who shaped the iss facing the Congress : Henry Pollak, Chairman of the program committee and the fou plenary speakers, *viz.*, Hans Freudenthal, Hermina Sinclair, Seymour Papert, and H Loo-keng. Quotations from the remarks of these personalities are thought provoki and must be read from the original. Then we have special articles based on the lectur and discussions at the Congress. These articles are : 'Insights from ICME for U mathematics education', 'Uniting reality and action : A holistic approach to math matics', 'Decision—making in mathematics education', and 'Major trends from ICM IV : A South East Asian perspective'. These are followed by some special feature namely, a profile of George Polya, brief write-up on some of the Congress mini-cours that introduced new aspects of mathematics and its applications, commentary fro various participants on popular themes (like problem solving, 'death' of geometry and a historical perspective on the International Congress on Mathematical Educatio At the end we have reports from the round table discussions that highlight some of th major themes (like computers in the class room) of the Congress.

There was no participation from U.S.S.R. in this conference and very little from Japan, China, and Eastern Europe. Just like 1957 Russian Sputnik, 1959 Memorandum of Professor Wirszup (Chickago Univ.) made Americans think a lot about mathematics education in U.S.A. The Congress provided many sessions on geometry, algebra, calculus, applications, computers, research, statistics, problem solving, and teacher education. Problem of minimum mathematical education was of concern to many and was discussed in the congress. It has been vividly brought out how modern new course on coding theory, Ramsey theory, computer algebra and data analysis can find place even in school curriculum. Excerpts from discussions make a good reading and give ideas worth pondering. It is a good augury that from mid-1950's wellknown research mathematicians are paying attention to the question of mathematics education. This helps in an all-round improvement. We get a lot of useful information on such important matters in this book.

It will be highly rewarding if this book reaches many teachers, administrators, the enlightened public and parents, for whose benefiit this non-official report is brought out. Everybody interested in mathematics education must spend at least some time with this nice readable book having good material content, get-up and print.

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Differential equations by John A. Tierney. Allyn and Bacon, Inc., 1979, pp. 400 approx. $ 12.95.

The books on differential equations are not terribly short as far as their number goes, and yet when one browses through their agglomerate in a well-stocked library, one comes away with a feeling that there is a need to write more at various levels of sophistication to meet the needs of a whole variety of researchers in variegated scientific disciplines in which the ubiquitous differential equations find their use. This observation applies much more to nonlinear differential equations—both partial and ordinary.

The book *Differential Equations* by John A. Tierney should more aptly be denominated as 'Ordinary Differential Equations' since the portion on partial differential equations is covered merely in 50 pages of its total length of about 400 pages. This minor misnomer apart, this is a welcome addition to books on ODEs. It has quite a few good features to its credit. It is written in a simple manner, profusely illustrated with examples and endowed with a large number of exercises, for half of which answers are also provided. The simplicity however does not detract from its modern outlook and concepts. For example, existence and uniqueness theorems are provided both due to Picard and Peano, which have different hypotheses and hence different consequences. The geometrical approaches, such as the method of isoclines, are clearly brought out with neatly drawn

figures. Nonlinear equations are introduced whereever possible and their *vis-a-vis* linear equations is vividly brought out.

The best part of the book however relates to applications of differential equations to a whole spectrum of real-life problems from compound interest, chemical reactions, population growth, radiogeology to motion of a rocket, dissemination of technological innovations and a micro-economic model. This is the bane of teaching in Indian universities and technical institutions where model making is sadly a neglected and ignored aspect bearing upon both the teachers and the taught. Dr. Tierney attempts to provide necessary physical and technical background at an elementary level so that the student does not feel too strained. This is no mean an achievement.

The rest of the book, though bearing the stamp of the author's style of presentation, and close focussing wherever necessary, contains fairly conventional material. Chapters 4, 6–8 give the standard material on linear differential equations, Laplace transform technique and series solutions, etc. Chapter 6 gives numerical methods wherein the error aspect of the numerical methods is also touched upon. The last chapter on PDEs is not particularly illuminating.

To summarise, the book can be quite a useful aid to students of B.Sc. and B.E. of Indian universities, and does not require much background except elementary calculus. Surely, a book with a similar material and combining some of the bright spots of this book and yet attuned to the needs and ethos of Indian students may well be written by some Indian mathematician of course naturally influenced by his own didactic bias and research background.

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Probability and errors by S. K. Muthu. Orient Longman Ltd., New Delhi. pp. 570, Rs. 120.

This book gives an excellent introduction to elementary probability theory and statistics and is ideally suited for a first course in these topics at the early college level. It can also serve as a useful reference to experimental scientists who want to put to use the tools of probability and statistics without getting lost in the more abstract theory.

The first chapter opens with the definitions of elementary concepts such as experience, mutually exclusive events, etc., and proceeds to give the Laplace definition of probability. This is illustrated by means of many examples based on

methods. The chapter concludes with the modern 'set theoretic' definition of probability. Based on this, the second chapter establishes some elementary theorems and introduces conditional probability and Bayes rule. It has a section called 'some famous problems' where the above concepts are applied to solving standard problems such as the gambler's ruin problem or the occupancy problem.

The next chapter is devoted to an extensive discussion of elementary statistical concepts such as histograms, mean, variance, etc,. illustrated with examples and graphs. The concepts of mathematical expectations, moments, moment generating functions are introduced in the discrete set up first and then extended to the continuous case. The later part of the chapter is devoted to a general discussion of discrete and continuous distributions and ends with some applications to geometric probability and to physics. The fourth chapter studies in much greater detail special classes of discrete distributions, particularly the binomial and the Poisson distribution. A similar study of the normal distribution follows in the fifth chapter which also discusses related distribution like the x^2 and the student's t-distribution and establishes some key limit theorems in probability, such as the central limit theorem and the weak law of large numbers. The strong law of large numbers is stated without a proof.

Chapter Six starts with a qualitative discussion of errors supplemented by many examples and goes on to discuss propagation of errors, the normal law of errors, the case of weighted observations, etc. Chapter Seven is devoted to the 'least squares' approach. After describing qualitatively the nature of the problem, it proceeds to discuss linear, polynomial and general curve fitting using the least squares method. It concludes with a section on correlation and regression coefficients.

The last chapter includes a discussion on the role of probability in physics, the various theories of probability and some well-known paradoxes in probability. Appendices include some mathematical supplementaries and tables as well as short notes on the maximum likelihood method and Markov chains.

The highlights of the book, in my opinion, are the following :

(i) The ideas are well motivated by putting them in a historical perspective and by pointing out their applications to physical sciences from time to time. The main text is supplemented in this respect by copious notes at the end of each chapter.

(ii) A large number of worked out examples.

(iii) A summary of the key results at the end of each chapter. Also the results are often compiled in a tabular form to help the student get an overall view at a glance.

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Intermediate statistical methods by G. Barrie Wetherill. Chapman and Hall, London 1981, pp. 390, £ 9.75.

The book, as the title suggests, is a text on statistical techniques of analysis using the linear models. It begins with a review of statistics employed for significance and confidence-interval tests on the basis of t, x^2 and F distributions. The deviations of data from normality are discussed in terms of skewness, kurtosis serial correlation and outliers. Linear and regression models with least square method of parameter estimation in terms of corrected sum of products of regressor and response variables, and corrected sum of squares of regressor variables are discussed in chapter 2. Properties of the estimators and sums of squares are derived, leading to analysis of varince table. Chapter 3 deals with the general theory of parameter estimation with the properties of unbiasedness, consistency and asymptotic relative efficiency of the point estimators. Likelihood function in terms of joint probabilities is introduced next with graphical illustration for cases belonging to binomial, Poisson and normal p.d.fs. The theoretical concepts underlying the Cramer-Rao inequality leading to lower bounds on variance estimates, efficiency of estimators and sufficiency of statistics are discussed. The chapter ends with the definition of variance covariance matrix and multivariate normal distribution. Chapter 4 begins with working out of Maximum Likelihood estimates of parameters belonging to exponential, binomial and Poisson distributions, and goes on to discuss consistency, asymptotic unbiasedness and efficiency properties of ML estimators. The practical aspects of estimation procedures employing plots of likelihood function gradient of likelihood and the Newton's iterative procedure are discussed, followed by details of iterative methods and computer optimisation for directly maximising the likelihood.

The next three chapters (5, 6 and 7) are devoted to exposition of least square theory and techniques of multiple regression and polynomial regression. The least square theory is developed to obtain the parameter estimator with proof for its unbiasedness and minimum variance property. The properties of residuals and sums of squares are also discussed with reference to their relevance in estimation problems employing the method of least squares. Multiple regression as a statistical analysis tool for ascertaining the significant effects of certain explanatory variable on response variable, and for predicting the values of response variable, is discussed in terms of the methodology employed for regression and in terms of interpretation of the resulting analysis of variance table. Availability of computer regresssions programs of 'batch processing' and interactive types is pointed out. Possibilities of construction of powerful computer programs based on available multipurpose 'statistical system' programs are also pointed out. Polynomial regression employing least square method of parameter estimation is found to suffer from large errors involved in the computation of inverse of a matrix containing, as elements, large and greatly varying sums of squares. The

alternate approach of employing orthogonal polynomials of explanatory variables is suggested and worked out for the model using linear and quadratic polynomial.

Transformation of variable (response/explanatory) to realise simple relationships between them while retaining the linearity of response variable in both the unknown parameter and the transformed variable is duscussed in Chapter 8, which includes a list of transformation and worked out examples of transformation along with that of Box-Cox which permits linearity of the model, homogeneity of the variance, and normality of the distribution. Correlation between variable, its properties and its estimation procedure are discussed in Chapter 9 which includes procedures for confidence interval and hypothesis testing. Partial and multiple correlation coefficients are also defined in this chapter.

With a thoughtfully laid out foundation for intelligent appreciation of the properties of linear models and the theory underlying the techniques of parameter estimation the text proceeds to discuss a variety of topics/statistical methods such as generalised inverse techniques, one way/two-way classification ANOVA, regressions in the treatment effects, analysis of data on trees, components of variance, and problems associated with crossed and three way classifications. The last chapter (17) on generalised linear model discusses the theory underlying the validity of linearity of a model in the unknown parameters over a wide range of probability distributions for the random variable. Maximum likelihood ratio test is detailed out for deletion of certain parameters from the model. Availability of computer package (GLIM) for use of generalised linear model is pointed out to open vast possibilities for analysis of data belonging to a very wide class of models. In the end it must be said that the present book presents ahighly expository treatment of the theory and techniques of statistical methods employed for analysis of data pertaining to linear models. Derivation of important statistical results are very well supported, at each step, with meaningful discussions and worked out numerical examples. The book is, of course, a very readable text, admirably suited for not only a post-graduate course in the subject but for self-study as well. Inclusion of an appendix covering just the required material on matrix theory would prove useful to sections of readers engaged in self-study. Answers to exercises would be equally welcome, though a solution manual is separately available. It is suggested that the present book be seriously considered for publication as student's cheap edition or as a low-cost university edition (LCUE) in India.

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Cosmology (Second Edition) by M. Rowan-Robinson. Oxford Physics Series, Clarendon Press, Oxford, 1981, pp. 152, £ 5·95.

Cosmology which used to belong to the realm of philosophical speculation, is ten tending to become a regular scientific discipline. In the recent past tremendous progress has been made in observational astronomy. On the theoretical side, Einstein's General Theory of Relativity has now become a more routine part of astrophysical theories and is the basis for any discussion of large scale structure of space-time. Fur ther impetus has been provided by developments in elementary particle physics. With the advent of gauge theories in the last decade the fascinating possibility that a unified description of all natural pheonomena may well be within the physicist's grasp.

In this slender volume on cosmology, the interested student will find a useful introdctiuon to the basic elements of the subject, the empirical formulations and its theoretical scaffolding. It begins with a quick description of the experimental methods followed by a summary of our knowledge of our own galaxy and other galaxies. The fact that the large scale structure of universe is simple is then brought out. The evidence for a universe of finite age and that it could have started from a fireball phase is presented.

The second half of the book deals with elementary theoretical ideas on cosmology and the big bang model in particular. Some topics like microwave background radiation, helium production, average density of matter in the universe, possible scenarios for the way in which our universe could have emerged from its initial phase are sketched. Possible tests of the big bang models using discrete sources of radiation are discussed in a separate chapter. One of the virtues of the book is that it eschews dogmatism. Other cosmological theories are presented in a separate chapter. Further the very useful epilogue shows how very active the field of research is today. There are a useful set of problems at the end of each chapter for the diligent student.

This book is not without shortcomings. Discussion of almost any topic is only too brief. It would have been better if at least topics like general relativity or microwave radition were somewhat more detailed. There are many figures but adequate captions are not provided for most of them. Many a reader will not be able to follow easily the source from which he can get more information. These perhaps could have been overcome in a somewhat larger volume.

This book is recommended for anyone who wants to gain some knowledge of what our present scientific understanding of the universe is like.

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Elementary physics : Classical and modern by Richard T. Weidner and Robert L. Sells along with Arthus E. Walters. Allyn and Bacon Inc., Boston, USA, pp. xvi + 814, $ 19.95.

The book is intended as the basis for an introductory course in physics at the college level. It is a fairly thorough survey of the main topics in physics, but at a moderate level of conceptual and mathematical sophistication. For example, elementary ideas of differential and integral calculus are enough to follow the entire book.

Physics is in a sense a fundamental science aimed at making sense out of the behaviour of the physical world. Beginning with controlled observation, measurement and experimentation, it proceeds to synthesize the interrelationship among the diverse phenomena in terms of simple principles. This complementary role of experiment and theory is essential to the development of physics teaching. A good grasp of this feature is also important in emphasizing that physics is still a living topic, continually changing with the acquisition of new knowledge. The-so called 'laws' of one generation are found to be nothing more than very good approximations after several years or decades. However, this accuracy may be completely adequate for most situations conceivable, as for example is the case with classical physics. Here one is dealing with the behaviour of bodies of ordinary size. It has its origins in mechanics and later pervaded into heat and thermodynamics, electricity and magnetism, optics and so on. Towards the beginning of this century, the behaviour of material in small sizes, say atomic dimensions or of particles moving at high speeds comparable to the velocity of light, were investigated. The term 'modern physics' is used to describe the phase of physics. In the evolution of physics, there is no single simple 'scientific method' Imaginative as well as pedestrian experiments, intuitive conjectures and bold flights of fantasy, tedius mathematical analysis, radical re-examination of untested but apparently obvious presuppositions all play a role in the scientific work. The experimental observations must truly reflect the natural phenomena under study. The theoretical framework must summarize the observations not only with the greatest possible generality but also with the greatest simplicity.

It is this spirit of physics which is sought to be communicated through this book. There are 40 chapters, about-two thirds of them dealing with classical physics and one-third with modern physics. Almost all aspects of the subjcet are covered leaving out perhaps detailed applications such as heat engines, hydrodynamics or cosmology. The book starts with units and measurements, kinematics and dynamics. The last chapter deals with elementary particles and the current unsolved mysteries of their interactions. To summarize this wealth in a few sentences would be doing injustice to the book. Eight appendices deal with the values of fundamental constants or mathematical trigono metric functions. Each chapter has between 5 and 10 worked examples and between 20 and 40 problems. Answers to the odd numbered problems are provided. The book has plenty of good illustrations. The writing style is lucid, simple and yet precise.

The book has all the ingredients of a successful textbook. The authors are known for a number of other good textbooks. The present book is likely to another feather in their caps. It is warmly recommended to all students and teach of physics.

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Non-linear Raman spectroscopy and its chemical applications (NATO Advanced Stu Institutes Series C—Mathematical and Physical Sciences, Vol. 93) edited by W. Kiefe and D. A. Long . D. Reidel Publishing Company, Dordrecht, Holland, pp. ix + 6 1982, D. Fl. 170/$ 74.

In the past ten years with the development of powerful tunable lasers, several no linear Raman spectroscopic techniques have been developed very rapidly which prove to be excellent tools for solving various chemical and spectroscopic problems. The techniques include Hyper Raman Spectroscopy (HRS), Stimulated Raman Effect (SR Coherent Anti-Stokes Raman Scattering (CARS), Inverse Raman Effect (IRE), Rama Gain Spectroscopy (RGS), Raman-Induced Kerr Effect (RIKE), Photoacoustic Rama Spectroscopy (PARS) and other four wave mixing processes. These nonlinear tech niques have the important advantages over conventional spontaneous linear Rama spectroscopy of signal strength and resolution which are of orders of magnitude highe than those obtainable with the conventional technique. NATO arranged an Advance study Institute on the above subject in Bad Windsheim, Germany, from August 23 September, 3, 1982, under the Joint Directorship of W. Kiefer and D. A. Long. The NATO Advanced Study Institutes are aimed at dissemination of advanced knowledg and the formation of contacts among scientists of different countries. Thirty lecture were given in the present series on the topics mentioned above by experts drawn from France, Germany, the UK and the USA.

The lectures are reproduced in the book in the form of thirty chapters with copiou references. They are arranged into eight groups. The first group gives the state of th art reports on linear or spontaneous Raman spectrospcopy and infrared spectroscop The next group forms an introduction to the basic theory of nonlinear light scatterin with particular reference to the polarisability and hyperpolarizability tensors and third order nonlinear susceptibilities. The remaining five sections deal in detail with th theory and applications of hyper Rayleigh and hyper Raman spectroscopy, the stimulate Raman effect, coherent anti-Stokes Raman spectroscopy including resonance effect inverse Raman and Raman gain spectroscopy, photoacoustic Raman spectroscopy an the Raman-induced Kerr effect respectively. Each article is suitably illustrated wit

figures and there are copious references to original papers, articles, books and proceedings of international conferences. The volume is provided with subject and reference author indices covering all the chapters at the end.

The book is very information and is extremely useful for Raman spectroscopists and also for those who would like to use non-linear Raman spectroscopy to solve the physical and chemical problems. The entire presentation is masterly. The reviewer has no hesitation in recommending the book to all the university and post-graduate college libraries.

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Interfacial aspects of phase transformations edited by B. Mustaftschiev (NATO Advanced Study Institutes Series C : Mathematical and Physical Sciences) D. Reidel Pub. Co., Dordrecht, Holland, 1982, pp. pl. x 708, D. Fl. 185, $ 79.

This volume is a collection of 27 lectures presented at the NATO Advanced Study Institute course, held in Erice (Sicily) in 1981. It covers the area of interest to workers in surface science and crystal growth.

The topic, is in a literal sense, a frontier area of research, dealing with the boundary or frontier of a crystalline solid when it meets a vapour or a liquid or another solid phase. While the beauty of crystalline symmetry, the role of atoms and electrons in crystals and the potential of technological applications have been well recognized, the understanding is incomplete as regards the structures of the interfacial layer covering the solid. Scientists have so far idealized the situation as a perfect crystal on one side suddenly becoming a perfect gas or vacuum on the other side. Reality is however far from this idealization. Surface irregularities, adsorption, growth and dissolution of the material, activated catalytic sites, melting of the solid, and a variety of other phenomena take place at the surface. As a result, new interest has been focussed on this topic, from experimental and theoretical sides, from physicists, chemists and engineers, from basic studies to technical applications.

In the background of this current interest, the book deals with one aspect, namely the changes which take place at the interface when the material changes from one phase to another. The beautiful spiral patterns on the surface when a crystal is grown, the techniques of thin film deposition and so on have been studied in isolation. It is to the credit of the symposium organizers that a unified presentation is attempted. The contents of the book follow as a logical consequence of this attempt. The first three chapters deal

with the structural, energetic and thermodynamic descriptions of clean crystal surfac The next two lectures cover the elements of interactions with physical or chemica adsorption and two-dimensional transitions. When this theme is extended to solid liquid or hydration or grain boundary interactions, there is an inevitable amount o empirical information and approximate models, which are expanded in the next three lectures. The kinetic aspects of the interfaces are covered in the four chapters, starting with the elementary processes and going on to homogeneous nucleation, coalescenc and crystal growth.

After these dozen talks on the basics of suraface physics and kinetics, one has a dozen talks on a variety of specific applications of these ideas. Physisorption, chemisorption crystal growth in a variety of systems including vapours, melts, aqueous solutions, biological systems, non-aqueous solutions, electro-crystallization and recrystallization phenomena. The effects of impurities and the process of dissolution are also discussed. The final two talks concern experimental techniques of holography and electron microscopy. A wide range of disciplines from solid-state theory to experimental biology are represented in this collection of articles.

A book like this has its advantages and disadvantages. The advantage is the rapidity of publication and the currentness of the material presented by the various speakers. Many items discussed in the book are investigations in progress and yet to be completed. There is always need for contemporary reviews of the state-of-the-art. The disadvantages are the lack of continuity and coherence in the various sections and the risk of repetition or wide gaps by the various speakers. Also as the editor points out, some topics are altogether left out. A glaring example is the structures of liquid surfaces, both of normal liquid and of liquid crystals, which have considerable impact on various phase transformation studies. But then these are minor comments on a book otherwise well produced and brought out in a timely fashion.

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Two-dimensional nuclear magnetic resonance in liquids by Ad Bax. D. Reidel Publishing Co., Dordrecht, Holland, 1982, pp. vi + 208, D.Fl. 70/$ 29.50.

The field of two-dimensional NMR, now about a decade old, has literally opened up an additional dimension in the application of NMR to several areas in physics, chemistry and biology. A large number of experimental techniques have been developed, particularly in the high-resolution NMR spectroscopy and the available information is scattered in nearly 300 research papers. This first book on the subject of two-dimensional NMR

spectroscopy is very welcome and timely. The author has indeed succeeded in his attempt to explain the theory of the important two-dimensional experiments in an elementary way. The sequence of experiments is selected carefully such that even a complex technique is build up from simple explanations. The book is written in a readable manner, avoiding some of the complicating notations and details, without losing rigour, in general.

The book has the right content of theoretical treatment so as not to displease a discerning reader and also not to discourage the beginner. A detailed introductory chapter presents the basics of the density matrix treatment, the two-dimensional Fourier transformation, the transmission of phase and amplitude information from one dimension to another and the important subject of filtering. The second chapter describes in detail the two-dimensional correlation spectroscopy, the third discusses J-resolved spectroscopy and the fourth gives a brief description of multiple quantum coherences. The remaining chapters deal, in brief, on various subjects such as carbon-carbon coupling in natural abundance, spectrometer and computer requirements.

The book confines itself to essentially the coherent aspects of magnetization, treating relaxation only phenomenologically. This seems a deliberate choice, since any reasonable treatment of relaxation requires complex density matrix analysis with the added notational and mathematical complications such as super-operators. The book also confines itself to high-resolution NMR in liquids. The rigorous treatment of relaxation in two-dimensional NMR and applications to solid state could very well form the subject-matter of another volume. The field is developing so rapidly that since the compilation of this book, there have been important developments in the application of two-dimensional NMR spectroscopy to biological systems, necessitating another review.

Overall, it is a well written introductory book, recommended to chemists, and physicists who wish to learn the exciting subject of two-dimensional NMR.

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Static and dynamic properties of the polymer solid state (NATO Advanced Study Insittute Series C. Mathematical and Physical Sciences, Vol. 94) edited by R. A. Pethrick and R. W. Richards. D. Reidel Publishing Company, Dordrecht, Holland. 1981, pp. 475, $ 56·50.

The volume under review contains major portion of the material presented at the NATO Advanced Study Institute held at the University of Strathclyde, Glasgow, U.K. in September 1981. The chemical physics of macromolecules in the solid state is developing

in two parallel directions, structure and dynamics. In the Study Institute held a Glasgow, leading authorities on both the structural and dynamical properties of solid polymers are brought together on a common platform in order to have interaction between the two groups of workers. Although the lecture programme of the Study Institute was organised such that lectures on the theoretical and experimental aspects of the subject were held interleaved and were accompanied by small seminars illustrative of the main themes, in the published volume under review theoretical papers are given firrt followed by the experimentally-oriented topics of some of the seminars.

The topics covered in the lectures are the following : (1) The polymeric solid state (A. N. North), (2) Chain statistics of amorphous polymers (M. Daoud), (3) Polymer dynamics (S. F. Edwards), (4) Structural studies on crystalline polymers (D. M. Sadler), (5) Small angle light scattering from the polymeric solid state (R. S. Stein), (6) Small angle neutron scattering by amorphous polymers (Cl. Picot), (7) The mechanical properties and structure of oriented polymers (I. M. Ward), (8) Dynamic mechanical properties of amorphous polymers (J. Heijboer), (9) Dielectric relaxation of solid polymers (G. Williams), (10) Acoustic studies of polymers (R. A. Pethrick), (11) Nuclear magnetic resonance of solid polymers : An introduction (F. Heatley), (12) Local molecular motions in bulk polymers as studied by electron spin resonance (L. Monnerie), (13) Quasi-elastic light scattering from polymer systems (J. M. Vaughan), (14) Quasi-elastic and inelastic neutron scattering (J. S. Higgins), (15) Luminescence polarization methods for studying molecular mobility and orientation in bulk polymers (L. Monnerie), and (16) Infra-red and Raman studies of the polymeric solid state (P.C. Painter and M. M. Coleman). The following are the topics covered in the seminars : (1) An order disorder theory of stress strain behaviour of glassy polymers (J. Skolnick), (2) On the absorption of a polymer chain (M. K. Kosmas), (3) Small angle neutron scattering from styrene-isoprene block copolymers (R. W. Richards and J. L. Thomason), (4) Small angle neutron scattering studies of polymer dimensions in binary blends (J. S. Higgins), and (5) Inelastic and quasi-elastic neutron scattering studies of polymethyl methacrylate (K.Ma). The last two have been given only in the abstract form. A subject index has also been appended.

The material presented in this book provides a complete overview of the polymeric solid state. The book is unique in providing an up-to-date appraisal of both the theoretical and experimental aspects of the static and dynamic properties of polymers by acknowledged experts. The topics chosen and dealt with in the volume will define areas of research where significant advances could be made by utilising theory and techniques. It will therefore be of interest to those involved in the area of polymer physics, covering as it does, theory, spectroscopy, microscopy, ESR, NMR, ultrasonics, mechanical properties and light scattering.

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Introduction to topology Third Edition, by Bert Mendelson. Allyn and Bacon, Inc., pp. approx 200, $ 10·95.

Topology is a branch of pure mathematics. However, in recent years this branch of mathematics is finding enormous applications in various disciplines, from physics to biology. The study of this branch has become almost essential not only for serious theoreticians but those seeking new methods to apply in physics, biology and engineering.

The book under review is written at an elementary level and is meant for a one-semester undergraduate course. The author starts with a simple presentation of set theory in the first chapter. This is followed by a discussion of metric spaces (second chapter) with special attention to Euclidean n- space leading on to ordinary topology. This is generalized in chapter 3 to the concept of topological space. In chapters 4 and 5 we have introductions to connectedness and compactness. The reader is thus prepared for a more advanced study of metrization, homotopy and algebraic topology.

This is a very good book and is strongly recommended for beginners.

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