

Book reviews

Adsorption of Gases on Heterogeneous Surfaces, by W. Rudzinski and D.H. Everett (Academic Press)* \$274.80

An understanding of adsorption processes has significant practical importance in many areas of technology. Examples of these applications are gas separation and purification, and environmental problems such as the study of aerosols. The study of the adsorption phenomenon is also required to understand the processes involved in gas chromatography.

The authors have written this book taking a historical perspective of the development of adsorption theory. They start with the homogeneous adsorption theorems of Langmuir, Fowler-Guggenheim, Bragg-Williams and Hill-deBoer; and continue with the heterogeneous isotherms of Freundlich, Dubinin-Radushkevich, Temkin, Gottwald-Haul and many others. They finish off with recent work on the computer simulation of the adsorption phenomenon. The breadth of the work discussed in the book is impressive and, for a person new to the field, may be overwhelming.

The first two chapters introduce the basic empirical theorems and related background used to model adsorption onto homogeneous and heterogeneous surfaces. The following four chapters deal with effects of the thermodynamics, adsorption energies and surface topography on the adsorption isotherm. They also discuss the theoretical modifications to the basic theorems arising from these effects. Chapters seven to ten discuss the influence of intermolecular force between the adsorptive molecules on the energy distribution and adsorption isotherm. This includes an extensive discussion of multilayer adsorption.

The last three chapters look at some of the more recent developments in the field including the applications of the adsorption isotherms to surface studies and multi-site adsorption of molecules. The last chapter is probably one of the most interesting as it outlines some of the recent work using Monte Carlo and molecular dynamics simulations. These studies investigate, on a molecular scale, the adsorption of gases onto heterogeneous surfaces. It discusses some very interesting results about the way heterogeneity affects the ordering of adsorptive molecules.

This book is not aimed at the scientist with a casual interest in the field. There is a distinct lack of examples, except when used to expound a modification to a theorem. Similarly there is minimal discussion of the applications of the theories presented. The few illustrations included are highly specialised dealing with the study of the heterogeneity of surfaces and there are no discussions of the practical applications to gas chromatography or atmospheric chemistry, etc. The authors appear to have avoided, wherever possible, making judgements about the usefulness of the theorems given.

The nomenclature used in the field is varied and to assist the reader the authors have included an excellent twenty-three page glossary of symbols. Any reader will be enormously grateful for this glossary and I personally wish more authors would follow this model. Similarly the three indices, author, subject and system, are all very good.

The book is aimed at chemical physicists and theoreticians in the field of adsorption of gases. The book is thorough and complete, concentrating strongly on the mathematics, but lacks examples and applications. Although very interesting to a physical chemist, the book has little to offer application scientists such as atmospheric chemists or meteorologists. Given the price of \$274.80 this is not a book I could recommend many atmospheric chemist or meteorologist to purchase.

Jane Warne

Jane Warne is a senior physicist at the Bureau of Meteorology. She has a background in spectroscopy and molecular dynamics simulations of solid state chemicals.

Atmospheric Transmission, Emission and Scattering by Thomas G. Kyle (Pergamon Press, 1991) ISBN 008 040287 9. Hard cover. 288 pp., Stg£40.00

Most people involved in research of any field have a special collection of notes, papers and 'important' information; this information at one time or another was thought by the collector to distil the essence of a particular topic or explanation. Kyle's book gives the impression of a formal collection of

*Available from Harcourt Brace Jovanovich Group, Locked Bag 16, Marrickville, NSW 2204, Australia.

such notes in the hope of instilling an understanding of the principal elements of radiation in the atmosphere.

The book contains 13 chapters, of which the first three deal with the atmosphere in its various modelled guises; the next four chapters focus on scattering theory for the model atmospheres; chapters 8 through 11 discuss various elements of the spectral line theory and determination, both for absorption and emission; chapter 12 examines absorption by specific atmospheric species, and chapter 13 introduces the AFGL algorithms (Lowtran and Midtran) and Fascode.

The book is different from normal texts on the subject. It was not the intent of the author to write a reference book, but rather explain the basic physics behind radiative transfer in the atmosphere; Kyle intended it to serve as a general source for the optical properties of the atmosphere. Another different slant to the book is the way in which figures are used; they attempt to be independent of the text.

In general I found the chapters on spectra, particularly the discussions on line origin and shape, to be the most interesting. In these chapters the bare outline of the text melded well with the figures and tables to give a good impression of the complexities involved in the theoretical requirements of studies that use or intend to use lidar, radar and interferometry. However, the remaining chapters were less than convincing in their discussion and revelation. Too often the discussion on a topic would stop before reaching a point where there would be convergence on a well-known algorithm or formulation. This is not surprising given the origins of the book, they being those aspects of the physics which are important to the author, and particularly those aspects and explanations which have enhanced his understanding of radiative transfer. The question is whether such a book has a wider appeal.

In all, I found the book very disappointing, despite the good intentions of the author. The colloquial style of the explanations, the lack of reference to relevant figures, and the reference to terms of an equation some three or four pages back in the text, without reference to the equation number (if there was one), became too much to bear. No longer could one dismiss the errors in science because of analogies stretched too far, numerous typographical errors, and redundant or simply bad grammar. After multiple readings my copy had become a patchwork quilt of suggested corrections, deletions and uncomplimentary comments.

Perusal of this book by a technical editor prior to its publication would have removed a number of the above problems, as the 'home-grown' production will not entice a general readership. In the Preface the author indicates that the book was produced using commercial IBM PC software

using WordPerfect and printed using a HP Laserjet II, presumably in camera-ready format. This is most likely the reason for the variable quality in the format of the text where on some pages line spacing seems random and the clarity of the characters is very poor. In general the figures (all black and white) are clear and captions easily discerned, however, it is then a considerable task to determine how they relate to the text on the surrounding pages.

One admires the attempt by Kyle to bring those ideas and explanations, which served him well, to others. However, one person's nexus of understanding may not be another person's point of revelation, particularly if it costs \$US80, and hence the potential reader should search for a copy in an institutional library. This book did have some side-effects: after reviewing this book I looked at my own 'notes of revelation' and made a decision to mark them for my eyes only, as I placed them in the bottom of my least inspected filing cabinet!

Bruce W. Forgan

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Environmental Modelling edited by P. Melli and P. Zanetti (Computational Mechanics Publications & Elsevier Applied Science, 1992) ISBN 1-85312-120-7. Hard cover, 425 pp., Stg£90.00 and **Mathematical Modelling: A source book of case studies** edited by I.D. Huntley and D.J.G. James (Oxford University Press, 1990) ISBN 0-19-853657-7. \$80.00

My review copy of *Environmental Modelling* arrived at the same time as *Mathematical Modelling — A source book of case studies* and I am going, therefore, to compare what are really quite dissimilar books. *Environmental Modelling* is aimed at the research community, whereas *Mathematical Modelling — A source book of case studies* is meant to be a textbook for undergraduate courses.

Environmental Modelling consists of nineteen papers presented at a European Summer Institute in 1990. The first four papers are devoted to groundwater models. There are then seven papers on air pollution models. There is a paper on a

coupled atmosphere-ocean model of the global climate followed by a review which has no modelling content at all but discusses the carbon-dioxide cycle and the impact of its perturbations by human activities. The book continues with three papers on ocean models, one on water quality models and two papers with a general scope, the first discussing future development (sic) in environmental modelling and the second discussing the choice of an environmental information system.

The book *Environmental Modelling* is misnamed. I base this not on the fact that I would like to get the term Environmetrics adopted for all examples of the use of quantitative techniques to the environment, but on the stern warning given in the preface to *Mathematical Modelling — A source book of case studies* which reads: 'It is important to distinguish between . . . modelling and . . . models'. The reader is here invited to substitute environmental or mathematical for the ellipses. It continues by pointing out that models do not, on their own, provide insight into the process of model formulation and their study should not be regarded as modelling. True enough. What we have in *Environmental Modelling* (which should have been called Environmental Models) is a collection of specialised papers, written by a group of experts, which will be read by experts in the same field. It is valuable as a compendium for finding out the stage of development reached by a number of leading lights in 1990, but it will be very heavy going for the generalist wanting to know how to model the environment or, for that matter, the meteorologist wanting to know how to model groundwater.

The dilemma in environmetrics is that research quality models, by definition, are complicated and understandable by only a few initiates. But the environmental practitioner has to produce answers to questions that may require a much simplified model. What we get in *Environmental Modelling* are some meteorologists, oceanographers, hydrologists, etc. describing their latest model.

Mathematical Modelling — A source book of case studies takes a totally different tack. It is based on 28 case studies that were produced as a result of a series of national workshops (in the UK) on the teaching of mathematical modelling. They must have been great fun, and are graded in difficulty. The easier examples at the start deal with topics such as the mathematical bioeconomics of forest management. An example of one of the more difficult studies given towards the end of the book is a factor analysis of marine signal flags which distinguishes the colour groupings that are easy to recognise from the ones that are not. This book is one that a student could work through (the exercises are simple enough) and be greatly enriched by the process.

If two interested readers worked through both books, the one who completed *Environmental Modelling* would have acquired a detailed and specialised knowledge of the behaviour of the computational models used to study the air, the ocean and groundwater. The one who finished *Mathematical Modelling — A source book of case studies* would have a sound knowledge of how to go about formulating a model to study a problem. Neither would have ended up with much feel for the crucial importance of validation: i.e. go out in the field, collect some more data and make sure that your model actually works.

Tom Beer

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Fundamentals of Weather and Climate by Robin McIlveen (Chapman and Hall, 1992) ISBN 412 41160 1. 497 pp., \$59.95

As an old operational forecaster, it has never fallen to my lot to review a book, so I approached the task with a certain amount of pleasure and anticipation as something different and a little off the beaten track. I also did not realise at the time that one of the perks of the job was receiving a free copy of the book-to-be-reviewed, so this made the job at hand even more attractive.

This task was also made a little easier by the fact that I have already used the book as text in a lecture course I run at the University of New South Wales called 'Introductory Meteorology', so some familiarity could be claimed at the outset.

McIlveen had me onside right from the preface, when he stated 'To all of us involved in the study of our magnificent, and yet bewildering atmosphere, it is exciting to see our subject centre stage. It is also a little worrying, since however little else we know, we know how uneasily its stubborn subtleties are likely to fit in to the simplistic schemes of politicians and the media'. With that resounding and lucid remark, McIlveen summarises the great global problem threatening publicly funded meteorology in the late Twentieth century, and then does more than his bit to alleviate this problem by constructing a superlative book which will greatly enhance any reader's knowledge of the subject (including even politicians and journalists).

The book appeared initially in 1986 as *Basic Meteorology: A physical outline*, but McIlveen

realised over the following six years that because of the information revolution proceeding in such areas as climate, climate change and human interaction with the atmosphere, an update was necessary both in title and content.

Written for 'undergraduates and serious amateurs', the book carries its new title well, and succeeds admirably in explaining the fundamentals of weather and climate.

Beginning with a six-page table of 'Useful Information', containing data on such items as universal constants, meteorological magnitudes and general units in common use, the book proper then begins and develops into thirteen comprehensive chapters.

In the first of these, the outline of the general atmospheric system is given, and some interesting remarks on determinism and chaos are also made, whetting the reader's appetite for the main course to come. Here McIlveen sets the basic form for the book with the text of each chapter being followed by a series of well thought out problems rated as Levels 1, 2 and 3, as their degree of difficulty increases.

Chapter 2 concerns itself with meteorological observations, including information on what is a must for any modern text on the subject, the meteorological satellite. It is pleasing that on the point of satellite photographs, images from both hemispheres are to be found in the book, including a magnificent shot of Africa from Meteostat 2 on page 2, and a GMS view of eastern Australia and New Zealand on page 265.

The book then shifts into high gear from Chapter 3 onwards, covering the constitution of the atmosphere, state and climate, thermodynamics and atmospheric dynamics. The mathematical discussions of these complex issues are lucid and well set out, with frequent recourse to diagrams, and are liberally interspersed also with black and white photography which greatly assists as illustrative material.

The obligatory Greenhouse effect is discussed in Chapter 8, but in a sensible manner and without all the hype and sensationalism that we have come to associate with this issue in recent times.

Surface and boundary layers are dealt with in Chapter 9, and smaller scale weather systems in Chapter 10, covering such phenomena as cumulus development, severe local storms and atmospheric waves.

An interesting historical introduction leads us into large-scale weather systems in mid-latitudes in Chapter 11, followed by the corresponding tropical discussion in Chapter 12.

The book concludes with an overall discussion of the atmospheric engine in Chapter 13, followed by those 'must haves' of a pedigreed textbook, a well constructed bibliography, list of references, glossary and comprehensive index.

Having used the publication as a reference work and also having received appropriate feedback from my students, I believe that the publication is excellent value, and have no doubt that it will become recommended text for many tertiary level meteorological courses around the world. Although naturally containing a northern hemisphere bias, McIlveen makes a real effort to minimise this, with frequent reference to southern hemisphere meteorology, thereby increasing the global appeal of the book.

Over the past decade or so, under the aegis of economic rationalism, we have seen a tendency for sections of academia to become increasingly concerned with lobbying, and performing 'trendy' research with overall efficiency judged by the number of papers produced ('the more papers the bigger the grant' syndrome). It is therefore refreshing and encouraging to see an academic like McIlveen go against this trend and produce a solid, practical textbook that is a real contribution to our area of endeavour. The book is a credit to the author, and is probably now the yardstick for tertiary level introductory courses in Meteorology.

R.N. Whitaker

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