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Book reviews

D. Diamond (Ed.), *Principles of Chemical and Biological Sensors*, Wiley, New York, 1998 (ISBN: 0-471-54619-4, hardback). 334 pp. Price £ 70.00.

The increase in sensor research and development as well as the commercialisation of sensor technology over the last 20 years makes this introduction to the principles of chemical and biological sensors timely. The book covers a large portion of the main sensor research areas (ion selective electrodes, amperometric, biological and optical sensors) both in terms of their classification and presentation of the underlying principles. The latter are introduced in a clear and simple way making the book ideal for postgraduates engaged in sensor research. There are many examples and case studies (especially in the biological sensors' section) as well as reasonable referencing to give the reader a good overview of current applications. The clarity of presentation and abundance of examples gives this monograph in our opinion an advantage over another very good summary of sensors' principle that has recently appeared in the literature [1].

The monograph benefits from the fact that all the contributing authors are either directly or indirectly involved with the Dublin City University Biomedical and Environmental Sensor Technology (BEST) Centre where sensor research has flourished during the last decade. This has also resulted in a uniform style rarely found in multi-authored monographs.

Unlike other reviews on the same topic the importance of electrochemical sensors is not over stressed and indeed there are excellent chapters on the emerging types of optical and biological sensors as well as smart sensors and sensor arrays. Having said that, the chapter on amperometric detection includes a very good classification of voltammetric methods. However the absence of chapters devoted to sensors based on metal oxide semiconductors and field effect transistors constitutes an obvious omission. Also the chapter on sensor signal processing, although a very useful step by step introduction to the subject, is rather poorly linked to the core of the monograph. It might have been better to give a summary in an appendix.

An interesting feature of most chapters of the book is the critical presentation of current and future trends in sensor research and development, with particular emphasis on the needs of the marketplace. The monograph is typical of the high standards of the Series of Monographs on Analytical Chemistry and Its Applications published by Wiley. It could have benefited, however, from more photographs of commercial sensor devices.

In summary, this is a very good introduction to the principles of chemical and biological sensors and a brief overview of important applications and trends that reads very well. It should be useful to postgraduates in sensor research and scientists that are end-users of sensor technology.

References

[1] J. Janata, Principles of Chemical Sensors, Plenum Press, New York, 1989.

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Introduction to Chemical Reaction Engineering and Kinetics. R.W. Missen, C.A. Minns and B.A. Saville, Wiley, 1999, 672 pp., hardback, £29.95, ISBN 0-471-16339-2.

It is perhaps unfortunate that the first new introductory textbook to CRE for some years should come out so soon after the third edition of Levenspiel; it invites comparisons, and I am afraid the comparisons are not particularly flattering to the present work. It is long, slightly longer than Levenspiel of 672 pages, and densely packed, and has the feel of a 'weighty tome' compared to Levenspiel's more relaxed style. It also has some of the skimpiest right and bottom margins I have ever seen, although the left margin is generous enough for any budding Fermat. This reinforces the general impression of cramming things in.

After an introductory chapter and a chapter on elementary reactor models, there follow eight chapters on kinetics, including experimental techniques, simple systems, complex systems, mechanisms, catalysis, multiphase reactions and enzyme kinetics. The CRE section has chapters on general process design of reactors, a chapter each on four ideal reactor types (batch, CSTR, PFR and laminar flow), together with one on combinations of ideal reactors, and one on reactors for complex reactions. Three chapters deal with various aspects of residence time distribution in ideal and non-ideal reactors. These are not consecutively placed, and the authors explain why in their introduction, but I feel it makes the topic a bit disjointed. The final four chapters deal with heterogeneous reactors – fixed bed catalytic, reacting solids, fluidised beds, and fluid-fluid reactors.

In many ways, the text falls between two stools. Billed as 'An Introduction', its mass of detail would daunt, rather than encourage the undergraduates I teach. This is especially true of the presentation of generalised stoichiometry in Chapter 1, clearly an interest of one of the authors, but, I should have thought, out of place in an introductory text. On the other hand, the book does not go into most of its topics in the sort of depth you would expect in an advanced text, such as Froment and Bischoff. An example would be its discussion of fixed bed catalytic reactors in Chapter 21, where it gives the equations for the non-adiabatic shell-and-tube type of reactor, and lists the solution procedure, without once mentioning temperature profiles, hot spots, and parametric sensitivity, which are the real problems. In contrast, Levenspiel mentions the problems in a paragraph in his text (430 p.), does not give any equations, and refers the reader to more advanced works for details.

For some years, no self-respecting text on chemical thermodynamics has been without its floppy disc of programmes to solve EOS-related problems. Now, it seems, CRE is joining the trend, although, moving with the times, the floppy has become a CD. To be fair, the CD does contain some general-purpose software, 'E-Z solve', which can solve sets of algebraic equations and of first order differential equations, and also do parameter fitting (non-linear regression). Some such programme is needed in CRE if anything realistic is to be solved without soul-destroying calculations. In this respect, the present text is more up-to-date than Levenspiel, who prefers graphical methods. Not being familiar with Mathcad or its stable-mates, I cannot compare 'E-Z solve' with them, but it seems easy enough to use. However, the authors seem at times to have a touching faith in its powers; for example, when fitting the dispersed plug flow model to experimental RTD curves in Chapter 19, they seem to imply that non-linear regression will automatically give you the 'right' answer, as though all the arguments over what constitutes a 'best fit' had never been.

One reason any lecturer turns to a new textbook is to look at its problems, and here the authors fare pretty well. Each chapter has a lot of worked examples (which will please students) and a large number of problems, often 20 or more, at the chapter end. Numerical answers are given at the end of the book for a selection of these (which will also please students!). While many of the problems are about hypothetical systems (A+B react to give), there are quite a few useful real examples with real kinetics, quoted from the literature. I was thrilled to find several of these in the early chapters, but they dwindle, or are endlessly repeated, as you progress.

In summary, this book is likely to prove too heavy for introducing the subject to UK undergraduates, but not deep enough for their design projects. Its good problems and rather neat CD software make it worth having in the library, and even on the lecturer's bookshelves, but I am still advising my students to buy Levenspiel.

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Chemical Reaction Engineering, 3rd ed., by Octave Levenspiel, Wiley, New York, 1999, 668 pp., £29.95, hardback, ISBN 0-471-25424-X

There are a few books in Chemical Engineering that can be defined as "classical", and Chemical Reaction Engineering by Octave Levenspiel is certainly one of them. Revisiting a classical, successful book is not only hard work for the author, it is also a courageous choice since the reader will inevitably make comparisons with the previous edition. In the present case, however, the result is even better than it was before. The book remains a textbook, the style is a didactic one; nevertheless, some new additions make it rather an advanced text. To some extent it is a hybrid: a textbook that can be used at different levels by different students. In other words, it is an undergraduate textbook for the first half and a book for the specialist or for graduate students for the second.

The book is divided into five parts; homogeneous reactions and ideal reactors are presented in Part I. This part is not essentially different from the previous editions, except for devoting two chapters to multiple reactions, with parallel reactions occupying the whole of Chapter 6. Indeed, this is not an isolated choice: flow models (dispersion, tanks in series, convection, etc.) are separated and occupy individual chapters as well. There does not appear a major change: the reader will find in a number of chapters material that was presented only in a couple of chapters before. However, for didactic purposes, the actual distinction results in a very effective Part I, which, together with Part II, constitutes our basic knowledge of Chemical Reaction Engineering. In other words, what we know (should know) and teach