Book Reviews[*]

Design of Experiments in Chemical Engineering: A Practical Guide. By Živorad R. Lazić. Wiley-VCH: Weinhem. 610 pp. 179 Euros. ISBN: 3-527-31142-4.

This book covers the basic theory of Design of Experiments (DOE) and provides numerous practical examples of its application in the chemical process industries. The majority of examples are drawn from the author's own experience or are taken from Russian or East European literature, which may be less familiar to western-based scientists. Despite the title, the problems addressed are not purely "chemical engineering" concerns—but rather the optimization of process yields, physical properties, or quality attributes of many chemical products.

The text begins with a thorough exposition of the statistical theory underpinning the method. This occupies roughly one-quarter of the book and explores the statistics in rather greater depth than most modern DOE texts do. The second and largest section describes the designs used for screening and optimising process factors, while the final section concerns the optimisation of mixtures.

According to the introductory blurb on the cover, the book has been "written in a simple and lively manner", but this is only true for those who are comfortable with pages of algebraic formulae (an aspect where the engineers may well have an advantage over process chemists). Immersion in the mathematics is unavoidable for an appreciation of the subject at this level, but in this case the author's clumsy style of English makes it particularly hard going—a situation exacerbated by the generally poor standard of editing, which has allowed innumerable spelling, grammatical, and even numerical errors to slip through, in many cases completely distorting the author's real meaning.

The choice of material is idiosyncratic. For example, a "method of random balance" is strongly advocated for a preliminary screening of factors, and several examples of this technique are given. In each case, however, a more straightforward fractional factorial design would have been more informative and could have required fewer experiments. In fact, some of the "random balance" designs suggested actually confound several of the factors. For instance, in example 2.10 (page 206) four factors are screened using just four trials, but X_2 and X_4 in fact have equivalent patterns of variation ($- - + +$ and $+ + - -$). The subsequent analysis purports to distinguish between them, but this is totally spurious and misleading.

For optimization, most emphasis is rightly placed on central composite designs, with a useful discussion on the distinction between the rotatable and orthogonal varieties. Simplex and Steepest Ascent methods are also covered. However, well-known alternative approaches such as Box-Behnken and Doehlert designs are not discussed at all. (The section on "Box-Behnken Design" in fact deals with something completely different.) The author briefly alludes to more obscure methods such as Kono, B_k and Hartley designs, which appear to require considerably more experimentation.

It is generally recognised that the revival of interest in DOE in recent years is largely due to the availability of good software to create designs, analyse data, and present results intelligibly in a graphical format. However, this aspect is completely ignored here, with the emphasis exclusively on manual calculation of the model parameters, coupled with canonical analysis of second-order models. In fact, there is little in this book that could not have been written 30 years ago. Many ingenious numerical methods are set out to analyse the results from the main types of design, but these are really of historical interest only, as they require a prodigious amount of computation for all but the simplest cases. In fact, all of the examples given can be solved by multiple linear regression, using an Excel spreadsheet, in a fraction of the time required to plow through the arithmetic suggested here.

In summary, this book could not be recommended as an introductory text for beginners. However, the already experienced practitioner may find it more rewarding—particularly in terms of the deeper mathematical and statistical insight offered, the large number of detailed examples, and the inclusion of some less commonly known methods.

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Industrial Chemical Cresols and Downstream Derivatives. By A. K. Mukhopadhyay. Marcel Dekker: New York. 2005. xix + 202 pp. $149.95. ISBN 0-8247-5940-0.

There is a need for books which comprehensively analyse aspects of chemical production, a gap in the literature to date. In this volume, the author, who has considerable experience in the production of cresols and related compounds, has attempted to survey, both from an economic and a chemical viewpoint, the latest research and developments in the field. The book is No. 102 in the series "Chemical Industries" which includes the excellent "Catalysis of Organic Reactions".

Unfortunately, the book is littered with errors and typos—in a quick search I found more than a hundred errors of fact or mistakes in spelling. Company names come off the worst, DSP Andino (for DSM), Koffoks (Koffolk), Burrow's

[*]Unsigned book reviews are by the Editor.

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Welcome(!) and Boeringer Manuheim(!) for example. The author seems unaware that Degussa now owns Laporte, that Rhone Poulenc Chemicals is now Rhodia, that Haarman and Reimer is now Symrise, and that May and Baker no longer exists. BASF, H and R, and Givaudan are described as "pharmaceutical majors".

The formulae are badly drawn and occasionally incorrect. The names of products are also on occasions incorrect. (Bromoxynil, diltiazem).

There is a useful insight in to the Indian chemical industry, but apart from that, little that could not be obtained from Kirk Othmer or Ullmann.

This is a wasted opportunity. If the book had described processes in detail with yields and conditions and if the patent literature had been adequately surveyed, then the errors would seem less important. As it stands, there is little positive to say about the work.

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