

Book Reviews

ADVANCED COMPUTATIONAL AND DESIGN TECHNIQUES IN APPLIED ELECTROMAGNETIC SYSTEMS

Edited by Song-Yop Hahn

Elsevier Science, Amsterdam, The Netherlands, 1995, 766 pages, hard cover, Dfl.
455.00, US\$267.75.

This book presents the proceedings of the international ISEM Symposium on Advanced Computational and Design Techniques in Applied Electromagnetic Systems, held in Seoul, Korea, 22–24 June 1994. The 179 reviewed papers included in the book cover a wide variety of topics within the general theme of electromagnetic systems. In particular, optimal design techniques and applications, inverse problems and the mechanism and dynamics of new actuators are dealt with. The physics and applications of magnetic levitation, electromagnetic propulsion and superconductivity receive extensive coverage. Other topics are the modelling and applications of magnetic fluids, plasma and arc discharge, high-frequency field computations and electronic device simulations. This book is concluded with a comprehensive section on magnetic materials.

Of particular interest to the reviewer is the presence of a general optimisation philosophy throughout the book. This is especially prominent in the first section on Optimal Design Techniques and Applications where the formal application of various mathematical optimisation methods is presented. It is of interest and significant that no single method dominates. The particular problem at hand appears to determine the choice of the optimisation method. Amongst the methods presented and applied are stochastic methods, such as simulated annealing and genetic algorithms as well as classical methods which use, amongst others, the conjugate gradient method in a sequential unconstrained minimisation technique (SUMT) which is based on a penalty function approach. This method is a very natural and easy-to-understand approach popular with physicists and engineers. More modern methods based on quasi-Newton approaches with active set strategies are also discussed. Contributions on the calculation of sensitivities, important in the application of classical optimisation methods, are well represented.

A large number of papers are concerned with shape optimisation of, for example, d.c. motors, solenoids, magnetic shielding vessels and deflection devices. In these cases the evaluation of the objective or fitness functions require expensive finite element analyses. In other cases, such as where ground state configurations are to be determined the evaluation of the objective function requires complex and time consuming summations. It appears that in these computationally demanding cases workers give preference to genetic and evolution strategies. Of novel interest is a paper concerned with the design of a linear induction motor by combining SUMT with a neural network.

The importance of stochastic optimisation methods in preference to more classical gradient methods clearly emerges from the book. It appears that in the field of applied electromagnetic systems, as in other practical areas, function evaluations of objective and constraint functions often require expensive numerical evaluations. In such cases, for the sake of economy, workers are forced to allow for insufficient convergence of intermediate solution or perform rough time simulations which results in inaccurate objective and gradient function evaluations. These inaccurate results in effect disqualify the use of methods based on accurate derivatives. It is the reviewer's belief that this fact, namely the existence of "numerical noise", is not generally recognised and that this book will contribute to the awareness of this problem and the importance of the application and improvement of stochastic optimisation methods.

The book is available from Elsevier Science, P.O. Box 1991, 1000 BZ Amsterdam, The Netherlands, or in the USA/Canada from Elsevier Science Inc., P.O. Box 945, Madison Square Station, New York, NY 10160-0757, USA.

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MINERAL AND METAL EXTRACTION: AN OVERVIEW

L.C. Woollacott and R.H. Eric
The South African Institute of Mining and Metallurgy, Johannesburg, South Africa 1994, hard cover, 412 pages, US\$70.00

Writing handbooks on mineral processing is a difficult business today. Although there is not lot of competition in the market, a serious stumbling block is to find an approach that would allow an author to present a balanced view on a wide and rather rapidly changing interdisciplinary field.

Woollacott and Eric decided to add an additional degree of difficulty by providing "*concise overview of the processing of mined material*". It is a tall order if the overview is to be "*comprehensive in scope and digestible in form*". Moreover, in view of the considerable breadth of the subject, great effort and discipline are required to avoid excessive detail. At the same time, concepts and principles should be presented in a professional and lucid way, avoiding naivete in those areas that are outside the authors' expertise.

The book consists of 13 chapters: An overview of minerals engineering, The properties of mined material, Physical properties — Sizing and size reduction, Agglomeration and solid-liquid separation, Mineral beneficiation: the physical separation of minerals, Introduction to chemical extraction processes, Introduction to pyrometallurgy, Solid-state pyrometallurgy, Liquid-state pyrometallurgy,

Gaseous-state pyrometallurgy, Hydrometallurgy, Electrometallurgy and Mineral and metal extraction routes.

The handbook comes across as a positive and useful piece of work: the language is lucid and exact, the structure of the text is logical while the modular approach allows a reader to inspect individual chapters in isolation. There is essentially no mathematics and heavy physics or chemistry in the book and readers, even those with basic technical training, would benefit from reading this first-rate coverage of a wide field of minerals treatment.

Of special interest to this reviewer, and to the readership of this journal, is the section on magnetic and electrical separation. On ten pages, a very basic and simple physical picture of separation is presented, supplemented by first-class diagrams. In view of the small space allocated to the subject, the condensed text is instructive and descriptive. Only where the authors ventured into magnetic properties of materials and their separability, some misinformation unnecessarily crept in.

All in all, Woollacott and Eric's book is a readable first-rate text, with excellent illustrations. The quality of print, paper and binding matches the quality of the content of the publication. The only weakness appears to be the lack of suitable references. A list of recommended reading is included for those keen to learn more. However, the recommended literature probably does not offer additional up-to-date insight, at least as far as minerals beneficiation is concerned. Moreover, the absence of references does not allow one to determine the time frame covered by the book. This is of considerable importance because the authors mention that their book refers to probably out-dated lectures given in 1984.

The South African Institute of Mining and Metallurgy must be congratulated for publishing this neat, meticulously edited monograph. It is without a doubt that the authors will be given recognition for this well-written and practical handbook from a wide spectrum of readers who will undoubtedly enjoy reading the text as much as this reviewer did.

The book is available from The South African Institute of Mining and Metallurgy, P.O. Box 61127, Marshalltown 2107, South Africa, fax number 27-11-838-5923.

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