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Book Review

Computational Heat Transfer
By A. A. Samarskii, P. N. Vrabishevich (Russian Academy of Sciences, Moscow) John Wiley & Sons, Chichester, New York, Brisbane, Toronto, Singapore, 1995. The book is published in two volumes. Vol. 1. 'Mathematical Modelling' (418 p.) and Vol. 2. 'The Finite Difference Methodology' (430 p.). Vol. 1 contains a preface and 7 chapters, Vol. 2 is divided in 5 chapters and an appendix.

Chap. 1. 'Introduction' (14 p.) is a brief presentation of mathematical modelling, computational tools and of computational experiment.
Chap. 2. 'Mathematical Models of Physics of Heat' (42 p.) is dealing with models mainly associated with heat/mass transfer involving solids.
Chap 3. 'Analytical Methods of Heat Transfer' (30 p.) presents the dimensionless analysis, solution of linear and nonlinear problems, asymptotic methods, as well as some illustrative examples of implementation of analytical methods in typical heat transfer problems.
Chap. 4. 'Stationary Problems of Heat Transfer' (135 p.) recalls some fundamental problems of the theory of partial differential equations and uses finite difference methods in solving classical heat transfer problems. The construction of difference schemes is discussed and both direct and iterative methods for finding approximate solutions are described.
Chap. 5. 'Nonstationary Problems of Heat Transfer' (76 p.) also uses finite difference methods and a particular attention is paid to the general stability theory for difference schemes.
Chap. 6. 'Economical Difference Schemes for Nonstationary Heat Conduction Problems' (48 p.) considers the method of alternating directions, factorized, additive and locally one-dimensional difference schemes, ensuring asymptotically optimal computational costs.
Chap. 7. 'Heat Conduction Problems with Phase Transitions' (50 p.) studies the classical Stefan problem and discusses modelling of melting/solidification of binary alloys.
Chap. 8. 'Radiative Heat Exchange' (26 p.) investigates special features of heat radiation from the surface of a solid.
Chap. 9 'Convective Heat Exchange' (98 p.) studies an important class of heat exchange problems for which monotonic difference schemes are constructed. The solution of these problems is discussed both in natural variables and in the variables 'vortex and stream function'.

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Chap. 10. 'Problems of Thermoelasticity' (34 p.) deals mainly with plane deformations of both solids with rectangular cross-section and thin plates.
In chap. 11. 'Problems of Control over Heat Processes' (56 p.) gradient methods are used in control problems for stationary and nonstationary sources of heat. The features of boundary control and of optimal heating are discussed.
Chap. 12. 'Inverse Problems of Heat Exchange' (62 p.) discusses retrospective inverse problems of heat conduction, boundary inverse problems and coefficient inverse problems by using perturbation methods.
In chap. 13. 'Examples of Numerical Modelling for Thermophysical Processes' (36 p.) dimensionless parameters are separated, numerical algorithms are constructed and FORTRAN codes are given for actual two-dimensional problems.
In the appendix the mathematical apparatus of theory of difference schemes, i.e. Hilbert spaces, operators in finite dimensional linear and Hilbert spaces are briefly presented.
At the end of each paragraph two problems (exercises) are proposed and their solution is also given. Thus the book contains altogether 140 such exercises.
In the text there are no references to other works, but at the end of each chapter the used and recommended bibliography is listed. These are not original papers, but textbooks. Although the major part of the works cited are published in Russian, all paragraphs are covered also by works written in English.
The book is intended for both experts in mathematical modelling and those studying the field. Authors give a comprehensive review of the methods employed in modern applied mathematics and describe the technology of computational experiment applied to the physics of heat by using the minimum amount of mathematics necessary for a thorough and clear consideration of the numerical methods.
This work can be used also as textbook for graduate students interested in applied mathematical modelling, as well as for training engineering students.
Since an important part of the material has not yet been published in monographs or textbooks, these two volumes might be of great interest to researchers dealing with numerical simulation, as well as to specialists in mathematical modelling applied to other branches of science than heat transfer.
The book represents a systematic, clear, thorough and complex presentation of the numerical methods of mathematical physics applied to heat transfer problems. At the moment it is probably the only one work where all three basic problems of mathematical physics, viz. the direct, control and inverse problems of partial differential equations, are considered in great detail.

János Zsakó

Ferenc Paulik 'Special Trends in Thermal Analysis' published in 1995 by John Wiley & Sons

One of the well known constructors of the thermoanalytical equipment called 'derivatograph' presents a book which synthesizes his 45 years of activity and experience in the field of thermal analysis.
The book is mainly dedicated to derivatography with its classical and modern aspects, and related techniques.
Structured in three parts, namely:
Part I: Simultaneous thermoanalytical examinations under conventional conditions
Part II: Kinetics and mechanism of thermal reactions
Part III: Thermoanalytical studies under quasi-isothermal, quasi-isobaric conditions
and 18 chapters, the book covers not only all the significant problems of derivatography, but also those of thermal analysis in general and solid-state chemistry. Special emphasis is given to quasi-isothermal and quasi-isobaric techniques used for following solid-gas decompositions, desorption of vapours from solid surfaces or microdistillation.
All the chapters of the book are illustrated by examples, by the personal contributions of the author and his co-workers, as well as by a rich and up-to-date literature, covering almost 3000 references. The contributions of the Rumanian groups of thermal analysis are illustrated by their representative works in the field.
The book, conceived as a high level monograph, is characterised by clarity and conciseness. It is a classical book considering the balance sheet of the work performed in the field and at the same time a modern one due to the new ideas and techniques suggested.
Taking into account its obvious value, I think that the book should be present on the desk of every research worker involved in thermal analysis, no matter the equipment he uses.
The book is equally useful to students and teachers of chemistry, metallurgy, material science and related topics.
I warmly recommend it to all specialists dealing with thermal analysis.

E. Segal