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BOOK REVIEW

M. D. MIKHAILOV and M. N. ÖZIŞIK, **Unified Analysis and Solutions of Heat and Mass Diffusion.** John Wiley, New York, 1984, 524 pp.

THIS BOOK concerns itself with the presentation of a general approach to the analysis of linear heat and mass diffusion problems. The monograph differs from other similar monographs in that it generalizes analytical methods of investigating the heat and mass transfer problems. Another interesting aspect of the monograph is that it covers a very broad range of specific problems of transfer in the presence of phase and chemical conversions. The monograph incorporates, among other things, a number of original works of the authors on the phenomena of transport in porous bodies, multi-component and multi-phase systems.

The material as presented is intelligible to many different kinds of readers embarking on the study of the mathematical theory of transfer processes. The authors have succeeded in teaching the reader to clearly formulate the mathematical models of different heat and mass transfer processes; and in teaching him the technique of basic integral transforms in the analysis of different mathematical models. The monograph can serve as both a textbook for students and a handbook for scientific workers. It assembles an appreciable body of information concerning the transport phenomena and surveys recent works in the field.

The material is presented in a traditional manner. Chapter 1 presents one-dimensional and multi-dimensional mathematical models of heat and mass transfer processes in one- and multi-component media. The classification of boundary-value problems of the mathematical theory of heat and mass transfer is carried out. Thus, Class I problems include steady and unsteady heat and mass diffusion in an arbitrarily shaped body under the boundary conditions of the first, second and third kinds; Class II problems encompass these very problems in a composite body consisting of *n* subregions. Class III investigates the unsteady equations of heat and mass diffusion with the equations being coupled through the boundary conditions. The Class IV problems are characterized by a set of diffusion equations in a multi-component medium the boundedness of which is determined by the sources of separate components. The fourth and fifth classes are characterized by sets of diffusion equations in multi-component media. The source terms in equations allowed the authors to investigate the problems of controlling the processes.

The boundary-value problems of diffusion under complicated boundary conditions are related to Class VI. Class VII studies the processes of diffusion in the presence of chemical conversions.

The second and third chapters are concerned with the technique of constructing the generalised solutions of the above classes of boundary-value problems describing heat and mass transfer situations. The mathematical procedures set out in these chapters are of more interest for the mathematician-reader.

Chapter 4 presents the solutions of one-dimensional unsteady problems of diffusion for all of the seven classes.

Chapters 5 and 6 are concerned with the solution of the steady problems of the diffusion in one- and multi-component media in rectangular, cylindrical and spherical coordinate systems. Thus, in Chap. 6 the heat transfer problem for bodies of complex shape is considered.

The unsteady boundary-value problems of heat and mass diffusion, relating to Class I, are dealt with in Chap. 7. Here the solutions of one-dimensional unsteady problems for a plate, cylinder and sphere are given.

Chapter 8 concerns itself with the application of the method developed by the authors and with the investigation of the problems of heat transfer in steady and unsteady forced convection in channels of different geometry. Specific problems are considered which are of great practical interest.

Chapter 9 covers the range of problems associated with the application of the methods developed in the theory of heat transfer in composite bodies. The problems considered in this Chapter relate to Class II.

Chapter 10 embraces the range of problems having a relevance to heat and mass transfer in capillary-porous bodies. The models presented in this chapter are based on the system of equations that have been derived by A. V. Luikov.

Chapter 11 deals with the solution of boundary-value heat and mass transfer problems in heterogeneous systems. Here, a large class of one-dimensional problems for a plate, sphere and cylinder are considered illustrating the effectiveness of the authors' method.

Chapter 12 presents the analysis of concentration and temperature distribution in chemically reacting flow inside conduits.

Chapter 13 gives an analysis of the heating of bodies in a limited volume of well-stirred fluid, mass diffusion into a body from a limited volume of well-stirred fluid, and flow development in the hydrodynamic entrance region of ducts.

Chapter 14 contains the solution of mass transfer problems in the presence of chemical reactions.

Thus, the researches carried out by the authors reflect all possible cases of heat and mass transfer in the presence of phase and chemical conversions. Of special interest is the description of heat and mass transfer processes and their interrelation with momentum transfer.

The procedural advantage of the monograph is that it incorporates test problems and tables.

In conclusion it may be said that the book is an ingenious one, the material is set out rather well and it is of great interest for studying the technique of constructing heat and mass transfer problems in one- and multi-component and multi-phase systems.

It is hoped that the book will be beneficial for potential readers among thermal physicists and specialists concerned with applied mathematics.

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