Int. J. Heat Mass Transfer. Vol. 14 pp. 333–336. Pergamon Press 1971. Printed in Great Britain

BOOK REVIEWS

A. V. LUIKOV, **Heat-Conduction Theory.** Vyssh. Shkola, Moscow. (1968). (In English by Academic Press, New York, 1969).

THE HEAT-CONDUCTION theory is one of the basic sections in the heat-transfer theory; it is most widely spread in design calculations of apparatuses and machines of power machine-building, energy engineering, production of building materials, etc.

The heat-conduction theory is also of importance for modern technique, where unsteady-state heat-transfer processes acquire particular significance.

The monograph under review is devoted to the solution of unsteady-state problems of the heat-conduction theory. The novelty of the book is introduction of the boundary conditions of the fourth kind and a solution of the problems for these very conditions. The method of solving these problems by operational calculus is developed. The author has extended the range of these problems. A number of problems for the fourth kind boundary conditions with an arbitrary initial distribution are solved by the Fourier finite transformations. That allowed a new approach to convective heat-transfer problems. In particular, a strict statement of the problem on convective heat transfer is reduced to the solution of an equation system of heat transfer in a boundary layer of a fluid or a solid in a fluid flow. Nowadays such a problem statement is known as the solution of an ajoint problem, and the problems with boundary conditions of the fourth kind have become of great significance.

The book is valuable for the solution of applied engineering problems; it is extremely useful for engineers having no special mathematical knowledge, since it permits them to solve complicated problems without methods of the analytical function theory. This is possible because of a wide use of the Laplace transforms. In particular, by his own method the author derives expansion theorems for a general case of multiple roots, not making use of a contour integral and the Cauchy residue theorem.

As the result, using the relations of operational calculus, algebra and higher mathematics, one succeeds in solving the basic problems of the heat-conduction theory which are usually solved by a rather complicated method.

Operational methods allow the basic problems to be solved in two forms: as the Laplace transform and the Fourier transform. The first form is of use for small Fourier numbers, while the second one is convenient for large ones. The author demonstrates an efficiency of the solution for small Fourier numbers by numerical calculations.

The book is well compiled. The problems are arranged according to the types of boundary conditions so that from one chapter to another they become more and more complicated. First, detailed solution procedures are given. The solutions are illustrated by numerical calculations which are then compared with the data of tables and graphs. With this end, the author presents many graphs and nomograms which may successively be used for approximate engineering calculations.

The book contains some new important results, obtained by the author. The author's method for the solution of nonlinear heat conduction problems for the case of thermophysical properties, dependent on the coordinates, is of a particular note. This method allowed the general solution to be obtained of one-dimensional nonlinear problems.

The second important result in the field of the heat-conduction theory is a development of the method for asymptotic estimates on the basis of analytical properties of the Laplace transform. With this object in purpose the author has written a special chapter (15) dealing with the elements of the analytical function theory. Such analytical estimates are of particular importance for the cases when exact solutions are not easy to be obtained.

In the book a mathematical analysis is given in close relation with the physical essence of a phenomenon considered. As an example we may mention the relationship found between the operational calculus of Heaviside–Laplace and the theory of generalized variables (the similarity theory). Such a relationship allows physical interpretation of transformed solutions.

To conclude the review, it may be said that linking of a mathematical analysis with the physical significance of heat-transfer processes, applicability to the solution of practical problems, presentation of new results and ideas of the heat-conduction theory make this monograph to be useful for students and engineers.

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V. I. SUBBOTIN, D. N. SOROKIN, D. M. OVECHKIN and A. P. KUDRYAVTSEV, **Boiling Heat Transfer in Metals Under Natural Convection,** Moscow, Nauka (1969).

THE BOOK under review represents experimental and theoretical results of works carried out by the authors on heat transfer in boiling alkali metals. In the book the works published in the USSR and abroad are analysed.

The book contains four chapters.

Chapter I deals with experimental methods for heat transfer at boiling liquids and experimental installation to be used in such kind of researches.

Modes of heating experimental sections are described in detail, an emphasis being laid on electronic heating used in the authors' experimental installations.