

BOOK REVIEWS

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METHODS OF NONSTEADY-STATE
HEAT CONDUCTION*

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The development of modern technology confronts researchers ever more often with the problem of studying heat-transfer processes whose mathematical statement makes it necessary to find approximate solutions of the nonlinear boundary problem of heat conduction. In recent decades, a large number of methods of approximate solutions have been worked out. The number of publications dealing with this subject is very large, but they are scattered in narrowly specialized scientific-technical journals as well as in separate monographs. The authors of the monograph under review set themselves the task, as the foreword says, to "systematize and help the reader to master not only the traditional methods of solving heat-conduction problems but also various approximate methods including those devised in recent years."

The book is recommended as a textbook; therefore the exposition of the material is arranged to meet the corresponding requirements from basic notions developed in devising the heat-conduction theory to complex problems of modern research in this field.

In the first two chapters the reader becomes acquainted with the fundamentals of the analytical theory of heat conduction; the book presents a classification of the analytical methods of solving boundary problems and explains the classical methods of solution.

The third chapter deals with methods of integral transformations within finite and infinite limits. For the first time a textbook explains the methods of numerical conversion of Laplace transforms; it describes in detail and gives examples of using algorithms of numerical conversion written in ALGOL-60.

Approximate methods of solving heat-conduction problems are very important for practice because it happens very frequently that a problem does not have an exact solution. One way of obtaining an approximate solution is the use of variational methods in the heat-conduction theory. The fourth chapter deals with these methods. This is the first textbook of heat conduction that contains the recently developed simultaneous application of Laplace transform and variational methods.

A separate chapter (the fifth) contains material on the use of the so-called integral methods in the heat-conduction theory.

The sixth and seventh chapters deal with methods of approximately solving boundary problems with nonlinear boundary conditions, methods of linearizing nonlinear equations of transfer, and approximate methods of directly solving boundary problems with nonlinear heat-conduction equations.

All chapters (except the sixth) contain problems for the reader to solve. Appendixes contain useful material facilitating the practical application of the analytical methods. An interesting feature is the selection of the algorithms of numerical methods which sometimes have to be used to obtain definite results in the application of analytical methods of solving boundary problems. In this connection, it must be said that the textbook would have greatly gained if it had dealt not only with analytical, but also with numerical methods of solving heat-conduction problems which make it possible to solve effectively the most complex problems.

From the methodological point of view, the book as a whole meets the requirements that a university textbook has to fulfill. It is no exaggeration to say that this is a very necessary and timely textbook on heat-conduction theory. The monograph treats a number of problems that were omitted in previous textbooks on heat-conduction theory or only mentioned in passing. It reflects the results of up-to-date research by Soviet

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and foreign scientists. Yet the authors successfully combined brevity, lucidity, and sufficiently popular ways of presentation based on well-known classical concepts of mathematical physics with perfectly concrete solutions of important thermophysical problems that confront researchers owing to the development of technology. The book is therefore accessible, in our opinion, not only to senior undergraduates, but it is also interesting and useful to a wide range of scientific, engineering, and technical staff, including persons specialized in the fields of thermophysics, power engineering, heat engineering, and metallurgy.