extension of the Euler and Navier–Stokes equations to vortex and turbulent flows.

In conclusion of this chapter the hyperbolic heat conduction equation is derived and used for solution of the Stefan problem.

The second chapter of the monograph entitled "Heat Conduction" is devoted to the solution of practical problems concerned with propagation of heat in a solid. The author considers in detail the statement of problems, initial and boundary conditions and all existing methods of integration of parabolic partial differential equations.

All mathematical procedures are given in a simple easily understood form and particular applications to engineering problems are given.

In the next chapter some aspects of heat and mass transfer in flows under forced and free-convection are

One of the main problems of the viscous flow theory is that of a flow over a plate, solved by Blasius in 1908. The fluid flow theory was further developed by refinements of the problem. Unfortunately, these refinements are not important for engineering practice and are of minor mathematical interest.

This is probably the reason why in this chapter the author has presented various heat and mass transfer problems arising in turbulent and laminar flows over a plate. Great attention is paid here to free convective flows in finite and infinite ranges. These passages are based on theoretical and experimental results obtained at the Heat and Mass Transfer Institute, B.S.S.R. Academy of Sciences.

Chapter 4 deals with the conjugate heat transfer problems. The author gives a detailed presentation of the physical basis which allows simultaneous consideration of heat transfer process in a solid and in the main gaseous flow.

The mathematical methods are illustrated by particular engineering calculations.

The next chapter is devoted to transfer processes in capillary-porous bodies and essentially based on the results by the author and his numerous pupils, which are widely used in practice in this country and abroad.

The author was the first to introduce the term "a capillary-porous body", which implies that properties of porous bodies are considered simultaneously with capillary properties of saturating liquids and gases.

In the book an extensive description is given of application of capillary porous bodies to space engineering. Capillary-porous bodies are primarily used to provide normal vital functions of astronauts under no gravity; they are also important for release of heat accumulated inside the space vehicle.

In the final part of this chapter some problems of hydrodynamics and heat transfer under zero gravity are given.

Chapter 6 is devoted to the same subject as the previous one. The recent mathematical results on unsteady-state heat and mass transfer in capillary-porous bodies and porous materials are mainly discussed.

Unfortunately, the book under review does not include the works on filtration by N. E. Zhukovsky, a well-known Russian scientist in mechanics. Zhukovsky's ideas were further developed by L. S. Leibenzon whose works constitute a scientific basis for the Soviet petroleum engineering.

The book by A. V. Luikov is a new type of a handbook which may be very useful for engineers, research students and research workers concerned with heat physics.

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Professor M. A. GLINKOV, **Fondements de la Théorie Générale de Fonctionnement des Fours** (Foundations for a General Theory of Furnace Operation).
Maison et Cie, Paris, 1971. French translation by Professor R. VICHNIEVSKY and J. JULLIEN, Faculté des Sciences de Paris. 170F, 446 pp.

THE PUBLISHERS do not disclose the date of publication of the original Russian edition. Private and unconfirmed researches on the part of the reviewer suggest that their French translation is of the second and last Russian edition which appeared in 1962.

Professor Glinkov has recognized the need to unite the several specialized sciences: fluid mechanics, convective heat and mass transfer, combustion and thermal radiation in order to provide a theoretical base for the establishment of mathematical procedures for furnace design; his book is devoted to this cause.

A general discussion of heat equipment is presented in the first chapter according to four principal subdivisions: thermal machines; heat exchangers; thermal generators (taken to include equipment such as convertors and resistance and induction furnaces where the emphasis is on the production of heat rather than on the transfer of heat); and an equipment group, having no apparent English name equivalent, which comprises: boilers, evaporators, dryers, open-hearth and billet-reheating furnaces, and all other furnaces characterized by both the production of heat and its transfer to a receiver substance. It is this latter group which serves to bond the material of the subsequent chapters. The principal subject headings include: general furnace operational characteristics, aerodynamics of non-reacting jets, the reacting jet or flame, thermal radiation, convection, and particle beds. The subjects: heat production by electricity, automatic control of furnaces, and the thermal behaviour of refactory are also treated, but at a lesser depth. The book is well documented by 363 references, the great majority of which are Russian.

A book on furnace theory cannot be assessed without first deciding to which of two kinds of reader it is most likely to appeal: the practising engineer who wishes to design furnaces; or the research scientist engaged on the development of design procedures who requires a comprehensive reference treatment of his field. Professor Glinkov neglects to name his intended audience, but a present-day one must be primarily composed of readers of the former kind. This is because the modern theorist is concerned with the development of computer-based numerical methods, for these are the only ones which will ultimately permit the complex reacting, absorbing, three-dimensional turbulent flows, which most often occur in furnaces, to be predicted with adequate accuracy and generality. The author deals wholly with more traditional and empirical methods which were available in the early sixties; thus for example, his analysis of jet flows draws heavily from the classic works of Abramovich.

In apparent appeal to the practical individual, Professor Glinkov has minimized the dosage of mathematics, and has endeavoured to present the principles of a unified furnace theory in a readily comprehensible way. Sufficient analysis and empirical evidence are advanced to support the simpler formulae and conclusions. More complicated results are simply quoted. A quite extensive selection of fairly complex situations are covered. Thus, for example, the practising engineer will find treated impinging, confined, and multiple jet flows which should supplement the knowledge he has gained through experience and enable him to establish burner locations with greater precision.

The author's purpose of unification of theory and quest for generality of example results in a sobering quantity of subject material. He has endeavoured to lighten the task of the reader with a considered content organisation, and in this he is successful to an adequate extent. The chapter which deals with processes in the flame, for example, leads the reader from elementary descriptions and analyses of chemical kinetics, turbulent heat and mass transfer, flame length, flame temperature and flame stability, through to more complex considerations of flame ionization, two-phase combustion and confined-flame behaviour. Useful practical conclusions are drawn at intervals.

Authoritative sounding statements about complex phenomena, likely to vex the specialised expert, are frequently made. The authors assertion of a rather simplified hydrogen-oxygen reaction chain is an example. But this is an inevitable consequence, and a probably desirable one, of gathering several specialised subjects under one roof. There are, however, some surprising omissions. Thermal radiation is handled by traditional global techniques and interesting practical implications are formulated. But simple formulae for estimating flame emission are not given. Hottel's charts or their equivalents for nonluminous gas emissivities are not included. Indeed, no mention is made of the 'zone method' of Hottel and Cohen which had certainly appeared in the literature well prior to the publication of the Russian edition.

In summary, this book constitutes a useful reference for the engineer concerned with the design of real furnaces. Its principal contribution is, and this was particularly true at the apparent time of first publication, the grouping of the relevant sciences into a unified and palatable presentation. This combined with the many formulae, experimental data, and summarising statements which the book contains must enable the furnace designer to replace some of the art, which has traditionally characterized his work, with more quantitative calculations. But such comments are only justifiable for as long as the rapidly-developing computer-based methods take to reach maturity. They too are founded on the principles of a unified theory and, as design tools, they must eventually supercede the capabilities of precomputer approaches. One might well ask why it has taken so long for this work to receive the attention of a Western audience.

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