The monograph considers the state and prospects of the development of methods of the energy technology which according to the author's words are the high road in developing energetics and industry.

The third and final section of the monograph closely connected with the first two is devoted to single methods for evaluation of the economic efficiency of the socialist production.

In this section the equation on social cost of production determining actual full labour expenses which are necessary under the conditions of continuously expanding production of products is derived on the basis of the analysis of both economics of various industrial processes and the law of cost.

The new economic method of analysis allows one to take into account the influence of the time factor on the economics of quantitative production. According to the author's data the time factor influences the economics through such indices as annual increase in the production of products; time for building enterprises; period of full amortization and the time for a total production cycle.

The cost equation obtained and the balance of special expenditure allows a univalence evaluation of various methods of production (hydro- and electric heat power stations), different fuels (natural gas, oil, coals etc.) as well as allowing one to determine the economic efficiency of such arrangements as mechanization and automation.

Results obtained from the economic analysis with the help of the new method and experimentally proved by the balance of special expenditure allow the author to draw important general conclusions concerning the ways of determining a new technique; increase in the efficiency of the application of existing funds and trends in the development of concrete branches of national economy and, in particular, in the fuel-energetic industry.

Parallel with positive features it is necessary to note some negative ones in the monograph in question. The fact that the derivation of important equations is presented and interpreted concisely (intermediate equations omitted) is the main drawback of the monograph which causes difficulties in its understanding.

The schematic presentation of theoretical fundamentals of energy technology and the theory of some important processes (with reference to original papers) does not contribute integrally to the second section and causes some difficulty in its understanding.

Finally the third shortcoming which should be noted is an inadequate regard for the latest works in the field of combustion theory and heat and mass transfer non-stationary processes which would allow more precise and cogent development of some important problems on the intensification of heterogeneous processes.

However, in spite of the drawbacks mentioned above the publication of the monograph may be considered to play a significant role both in the field of developing the theory of heterogeneous processes and fuel-energetic industry, and in the development of single methods of economic calculations which are of extreme importance at present.

B. M. SMOLSKY

Theoretical Fundamentals of Building Thermophysics. A. V. LUIKOV, Byelorussian Academy of Science Press, Minsk, 1961 (*Teoreticheskie osnovy stroitelnoi teplofiziki*, Izd. AN BSSR), 518 pp.

THIS book by Academician Luikov is a fundamental summarizing presentation containing a wealth of original ideas and perspective problems. Theoretical material in it as well as in his previous books, such as "*Heat Conduction Theory*", "*Mass Transfer under Drying Processes*", "*Transfer Phenomena in Capillary-Porous Bodies*", "*Energy and Mass Transfer Theory*", is accompanied by and combines with practical engineering applications. However, in the reviewed work this peculiarity has revealed itself more vividly.

The point is that up to now neither in the U.S.S.R., nor abroad, has there been any generalized summary work dealing with theoretical fundamentals of buildings thermophysics as well as any corresponding division of science already formed. A number of interesting books are available on thermal endurance of buildings, thermal properties of insulation, house heating and ventilating and on other thermal engineering building problems. However, what branch of science should be the basis of all these important technical engineering problems, on what grounds the problems of thermal engineering building should be solved, what the sources of technical aspects of calculation, planning and regulation of thermal regimes in building are, in short, what physical regularities should be utilized to comprehend and regulate these regimes, remained quite obscure.

In the first place Luikov outlined rationally the bounds of this new branch of science, for the first time formulated the complexity of theoretical knowledge required for a heating engineer and builder and expounded it in a rational progression. This main feature of the book, i.e. the spirit of innovation, should be emphasized first of all. One cannot but note the filicitous character of the material chosen with respect to the contents, breadth of scope, clarity and succession, and based on the group of problems which are to be solved by various specialist representatives.

The author had to face two circumstances. Firstly, here he met with a new body of technical knowledge covering various adjacent branches of science: heat conduction, heat dynamics, physics of capillary-porous media, molecular physics in the region of phase conversions, and so on. This circumstance cannot but give rise to great difficulties when choosing the necessary minimum knowledge from each branch and reasonable combination of it into an indivisible logically exclusive link. There can already be no question of the great erudition required of the author for this. Secondly, certain great difficulties had to be overcome in connexion with the wide statement of the problem intended for satisfying the requirements of representatives of all the links of building thermal physics; starting from investigators who for the most part are interested in the principal and theoretical aspect of the problem and including designers and constructors concerned with practical industrial applications. Moreover, the needs of post-graduates and students

of corresponding specialities who are interested in all the aspects of the problems were taken into account.

It seems to us that the author has overcome these difficulties. Really, the material chosen and its successive arrangement seem to be quite expedient.

The first chapters are of a general thermophysical character and are to prepare the reader theoretically for an understanding of all the following material. Two hundred pages are allocated for basic information, general regularities and main conclusions in the field of thermodynamics of moist air, heat and mass transfer in moving fluids, elements of the similarity theory and all the types of heat transfer of a solid with the surrounding medium. Moreover, physical concepts of the structure of capillary-porous bodies, forms of their bond with moisture are considered, and the main parameters of these bodies necessary for evaluating important regularities in heat and mass transfer processes in them are discussed. Thus, the foundation is prepared for understanding the properties and states of building materials (being capillary-porous systems), to comprehend the most important processes, i.e. heating and cooling, drying and moistening, air exchange proceeding in walls of buildings and protective constructions. The following 150 pages are devoted to these very questions (papers 6, 7, 8). General information given in Chapters 1–5 is applied here, as a result of which the main differential equations of heat and mass transfer could be written, solved and analysed; thermophysical characteristics qualitatively evaluated and the condition of heat, moisture and air exchange in actual uniform and multilayer protective constructions under real natural unsteady thermal regimes and, in particular, under twenty-four-hours and yearly temperature variations, being of interest for an engineer, may be found. Here a detailed discussion is given on the questions of determining the quality of technological processes taking place with fabrication and production of building materials, for example, when burning, drying or steaming them. The results arising from the calculations given are necessary for choosing optimum regimes through which the fabricated material passes. To facilitate practical utilization of the main conclusions drawn throughout the whole book the author gives in Chapter 9 the main experimental methodical procedures with the help of which one may determine easily and reliably the necessarily large number of parameters and characteristics introduced to describe such complex and interconnected processes as internal and external heat and mass transfer in multiphase, nonuniform and unsteady structures as building materials are.

All the calculations become real when it is explained how the coefficients of heat conduction and thermal diffusion as well as potentials of mass transfer and mass capacity applied in formulae are found.

The last and tenth chapter of the book serves the same purpose of facilitating the use of theoretical constructions. It contains various effective modes from which the principal equations of theoretical thermophysics such as unsteady heat conduction, unsteady heat and mass transfer, are brought to operative numerical solutions. It is shown here that under hard conditions, for example, the presence of temperature dependence on heat transfer coefficients, or the necessity of solving the system of nonlinear heat conduction equations with internal heat sources, one may achieve successful results by applying modern processes and methods expounded by the author; such as the net-point method, graphic and the improved Schmidt method, the Bach method, the improved version of finite differences in Osida-Yushov's interpretation. Finally, the experimental methods of hydrothermal, electrothermal and membraneous-thermal analogy, being very powerful means of practical realization of problems of the theoretical thermophysics and their engineering application are deduced in considerable detail. Fifty pages of Appendices are also of great help. There are roots of characteristic equations and some detailed solutions of particular but important problems (e.g. an equation of transfer in binary gaseous mixtures under nonisothermal regimes, integral equations both on transfer in a boundary layer of a plate in a liquid flow and on heat and mass transfer in a boundary layer of a plate under nonsymmetric conditions of the third kind etc. and, finally, numerous tables on coefficients of heat and moisture transfer, air penetration, constants of radiation and other characteristics of building materials which are important and necessary for engineering calculations.

Thus, the complexity of questions considered, their representation and interconnexion have made the necessary and adequate foundation for analysis, evaluation and regulation of the most important problems known in modern thermophysics and thermal technique.

The spirit of the present running through the entire book, the high and up-to-date level of the material deduced, the break from outdated standard methods, the utilization of the newest theoretical methods and technical procedures of the analysis are important and positive features of the book. This can be proved by a great number of examples. Really, the modern widely developed theory of heat and mass transfer, one of the creators of which is Luikov himself, is the basis of all the theoretical formulations used by the author. Undoubtedly one should consider now the processes of heating, cooling, moistening of protective constructions only on such a principal progressive basis, since it reflects an equivalent character of thermal and moisture transfer processes proceeding in unity.

The author's method of approach is also fruitful, by virtue of which building materials are considered from the point of view of the modern molecular–kinetic idea as a multiphase capillary-porous system, and the bond of the skeleton of this system with moisture is treated differentially: different forms of these bonds are given at various stages of moistening, and quantitative regularities corresponding to them are found.

The up-to-date level of the material expounded runs through all the divisions of the book. Thus, for example, when describing thermodynamic processes in moist air the Onsager theorem is used. Transfer equations are presented in a vectorial form. All results and solutions are given in the form of criteria in a separate chapter acquainting the reader with the fundamentals of the

similarity theory. To master the conditions of external heat and mass transfer, the basic information on hydrodynamics, turbulent flow and convection processes are presented, and the most significant works of the latest period including those by the author and his colleagues are given. The chapters presenting the methods of determining heat and mass transfer coefficients are written in quite a new fashion and with regard to the the latest achievements. The book contains a profound and very thorough review of that division of science which is the most applicable for building physics. New material, concrete data illustrating the inconsistency of these coefficients, their dependence on a great number of factors: temperature, moisture content, density, porosity are of particular value. Here, all the most essential appearing in recent literature is taken into account. Finally, the last chapter is of great interest from the point of view of novelty and contains experimental and numerical methods of solving differential equations.

One more distinctive important feature of the present book is worthy of note. It is a profound physico-mathematical interpretation of the questions with engineering applications. Almost every principal conclusion is accompanied by an example or illustration, diagrams, graphs and tables. This applies to the most complicated problems such as processes of moisture and heat transfer in capillary-porous systems in the presence of phase conversions for any region of temperature or the solution of non-linear differential equations of heat conduction with regard to a temperature variation of heat transfer coefficients and so on.

Finally, it is very important to note that there are a great number of the author's own original suggestions of a theoretical, methodical and experimental character. To say nothing of the author's methods of the determination of thermophysical properties of building materials, empirical regularities in the region of internal and external heat transfer. One should also note those specifications he introduces into the questions of heat transfer in protecting constructions under periodic temperature variations of the medium. Here the author has revised more precisely the main concepts of heat absorption and the index of thermal inertia. It is shown that they cannot characterize heat absorption of a construction in the manner usually adopted. Then the physical essence of the process is revealed, the true criterion characterizing it is determined and the role of the Predvoditelev function in forming this criterion is noted.

However, some drawbacks may be marked in this great and interesting work produced by the author, some places require improvement. Thus, for example, it seems to be insufficiently proved that there exist no solutions for heat and mass transfer problems in the presence of the dependence of thermophysical characteristics on co-ordinates and time. It is very necessary to take into account this circumstance for the walls of houses where moisture content and temperature vary with depth. In Chapter 9 where the review of experimental methods is given one would like to see a system of classification of the methods presented and, especially, recommendations on the advisability of applying this or that method to a particular problem.

The question of building physics considered in Chapters 7 and 8 would only be of benefit if they were developed and supplemented.

It is not clear why section 6 on unsteady heat conduction in a solid was included in the chapter on external heat transfer.

Undoubtedly, these minor shortcomings are not important and can be easily removed. Undoubtedly, the book reviewed will be of use and cause great interest among thermal physicists and builders.

A. F. CHUDNOVSKY

Tables of Integral Error Functions and Hermite's Polynomials, O. S. BERLYAND, R. I. GAVRILOVA and A. P. PRUDNIKOV, Byelorussian Academy of Science Press Minsk, 1961 (*Tablitsy integral'nykh funktsii oshibok i polinomov Ermita*, Izd. AN BSSR), 164 pp.

FOR the first time there have been published tables of integral error functions and Hermite's polynomials. As is known, many problems of heat transfer theory, hydrodynamics, quantum mechanics and a number of other problems are reduced to solving ordinary differential equations of the second order:

$$y'' - 2xy' + 2ny = 0, \tag{1}$$

$$y'' - 2xy' + 2ny = 0, \tag{2}$$

$$y'' - 2xy' + 2ny = 0, \tag{3}$$

$$y'' - 2xy' - 2ny = 0. \tag{4}$$

Functions

$$i^n \operatorname{erfc} x = \int_x^\infty i^{n-1} \operatorname{erfc} u \, du (n \geqslant 1), \; i^0 \operatorname{erfc} x = \operatorname{erfc} x = \frac{2}{\sqrt{(\pi)}} \int_x^\infty e^{-u^2} du, \tag{1a}$$

(integral error functions),

$$H_n(x) = (-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2}) \tag{2a}$$

(Hermite's polynomials)

$$i^n \operatorname{erfc} x = \frac{2}{\sqrt{(\pi)}} e^{-x^2} H_{n-1}(x), \tag{3a}$$

$$H_n(x) = \frac{\sqrt{(\pi)}}{2} e^{x^2} i^{n-1} \operatorname{erfc} x \tag{4a}$$

satisfy these equations, respectively. For convenience sake in making up tables the following functions are introduced:

$$I_n \operatorname{erfc} x = A_n i^n \operatorname{erfc} x (n \geqslant 0)$$