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BOOK REVIEWS

Heat Transfer in Radio Electronic Devices. G. N. DUL'NEV. Gosenergoizdat, Moscow, 1963, 1 r. 7 c.

ONE of the main factors affecting the reliability of operation and, in general, the efficiency of various radio electronic devices is the selection of thermal regimes for radio electronic devices.

It is impossible to specify optimum design of some units and parts as well as the whole radio electronic device and it is difficult and sometimes impossible to choose the circuits and design solutions without calculation and predetermination of heat-transfer conditions.

The widespread trial and error method, which is often used because of the lack of thermal regime theory for radio electronic devices, impedes the study and greatly increases the time of production for various radio electronic devices of new design.

In this respect the publication of the monograph *Heat transfer in radio electronic devices* by G. N. Dul'nev is of great value and will of course influence the technological progress in the field in question.

Since Dul'nev is a pioneer in the field of radio engineering and thermal physics, his monograph is designed to meet the needs of scientists, engineers, technicians, teachers and students in this discipline.

The author has developed a theory of thermal regimes for a number of radio electronic devices, which satisfactorily correlates the experimental results of various investigators, as well as the works of the author and his co-workers.

It should be noted that there is no well-developed theory in this field, and the general analytical study of heat-transfer processes in radio electronic devices is regarded by many to be impossible. Dul'nev's monograph disproves this point of view and is the first generalized study based on strictly scientific and experimental data. On the basis of general heat-transfer theory and extensive experimental study the author developed the fundamentals of thermal regime theory and modern methods of design calculation for radio electronic devices.

In the first two chapters the general heat-transfer laws are stated in relation to various problems which are characteristic of radio electronic devices. These chapters give a concise interpretation of the main statements and expressions of heat transfer, which are used later in more specialized chapters. Such an interpretation is in our opinion quite satisfactory as far as the present monograph is concerned.

In the remaining six chapters some particular problems of heat transfer in radio electronic devices are considered. In these chapters the author gives scientifically based design calculation methods which take into account the influence of constructional and operational characteristics of radio electronic devices. He considers the theory in question and gives a detailed physical study of the process, together with an analysis of the problem.

The author considers and analyses the effects of various geometric, thermal and operational parameters on the construction and reliability of radio electronic devices. The fundamental theories which should be followed when calculating and designing various radio electronic devices are discussed.

The third chapter deals with thermal processes in radiators under natural convection conditions and gives an evaluation of finning efficiency and design techniques.

The fourth chapter is devoted to thermal regimes of resistors and presents a detailed description of thermal conditions of semiconductor thermistors and ohmic resistors. The physical processes in operation of semiconductor thermistors are studied in relation to their electrical properties and thermal conditions.

In the fifth and sixth chapters thermal regimes of radiator-type semiconductor rectifiers are examined in addition to semiconductor diodes and thiodes of low and high power. Together with the calculation methods, the author gives details of experimental testing and design techniques. The same problems are considered in the seventh chapter as applied to low power transformers.

The eighth chapter presents a study of general problems and calculation methods for thermal regimes of radio electronic devices and describes the main stages of this study, stating the problems and giving a schematic representation of a heat-transfer process. The author concludes the chapter with an analysis of the influence of various parameters on the character of the temperature field inside the heated zone.

In some chapters the author develops a number of new ideas and gives some particular engineering recommendations in this connexion.

It is valuable that these ideas and solutions have come from the combined theoretical and experimental study of heat-transfer processes in radio electronic devices.

Our technical literature is supplemented by fundamental investigations of great scientific and practical importance.

A. F. CHUDNOVSKY

The Perfect Gas: J. S. ROWLINSON. Pergamon Press, Oxford, 1963, xii + 136 pp. 30*s*.

AS MIGHT be expected from the previous work of the author, this is an interesting and well-written book. It is one of the volumes in Topic 10, "The Fluid State", of the new *International Encyclopedia of Physical Chemistry and Chemical Physics*. It is hard to know what to expect in a short book on the perfect gas: too strict a definition and there is little to discuss; too liberal a definition and

there is far too much to discuss, including most of kinetic theory and large segments of fluid dynamics and statistical mechanics. Professor Rowlinson picks a reasonable middle course (unfortunately not explicitly stated), and the real meat of the book is concerned with the internal mechanics of molecules as related to the calculation of the thermodynamic properties of gases by statistical mechanics.

There is a short first chapter on the thermodynamics of the perfect gas; this is clear and concise. A slightly longer second chapter reviews the experimental measurement of heat capacities. The third chapter is the longest and best, and essentially covers the statistical thermodynamics of perfect gases. It could fairly be described as a revised and up-to-date summary of parts of the well-known books by Fowler and Guggenheim and by Mayer and Mayer. Anyone who wishes to learn about the statistical mechanical calculation of thermodynamic properties of perfect gases can do no better than to start here. The subject is topped off with a short chapter on gas mixtures.

The last two chapters have a different flavor from the rest of the book. Chapter 5 is entitled "Molecular Collisions". Clearly this is too vast a subject to be covered in 19 brief pages; the aim is apparently to say something about the absorption and dispersion of sound in polyatomic gases due to relaxation effects in inelastic collisions. This is of importance in connection with the measurement of heat capacities by sound measurements. Chapter 6 is entitled "Flowing Gases", and is a short introduction to one-dimensional, steady-state, adiabatic flow, with some emphasis on shock studies. Both Chapters 5 and 6 could have been expanded into whole books by themselves. It is hard to say whether the book as a whole would have been improved if the space devoted to these last two chapters had been used for something else; such questions probably fall into the category of matters of personal taste for individual readers. What is certain is that Professor Rowlinson has done a highly competent job on those topics he has chosen to discuss.

E. A. MASON

Handbook of Heat Transfer Media: PAUL H. GEIRINGER. Reinhold Publishing Corporation, New York. Chapman and Hall Ltd., London, 256 pp. $12.50.

THIS book presents and discusses property data for fluids which are employed as energy carriers in heat-transfer equipment. The book is arranged in four sections. Section one deals with the appropriate theoretical background and definitions and gives a classification of the fluids according to their thermodynamic and transport properties, their stability and cost, and their handling characteristics (surface tension, corrosiveness, etc.). Section two contains a brief discussion of the natural materials available and reviews some of the methods used for predicting the properties of synthetic materials. Section three presents graphs of thermodynamic and transport properties versus temperature together with explanatory text and brief notes on stability, cost and handling characteristics. In section four the fluids are classified according to recommended ranges of working temperatures; in addition brief descriptions are given of some typical heat-transfer equipment for process, space-heating and nuclear applications.

The major part of the book is taken up with the graphical data of section three. The graphs are clearly drawn on closely ruled grids, permitting them to be read to an accuracy normally acceptable for engineering calculations; as a supplement to the curves, selected points on each curve have their co-ordinates marked adjacent to them. Sixty two commercially available materials are considered, ranging from permanent gases to liquid metals; refrigerants are not included. The temperature range covered by the graphs is 0°F to 2400°F.

The book is well-indexed and contains a large number of references. Although the book incorporates terminology and presents some of the concepts in a manner with which many would not concur, the property graphs given in section three are a useful addition to the data on material properties.

E. H. COLE