BOOKS

Fundamentals of Heat Transfer, 2nd Revised Edition, Samson Semenovich Kutateladze, Academic Press, New York (1963), 485 pages.

Professor Kutateladze is associated with the Siberian Branch of the USSR Academy of Sciences at Novosibirsk. He is an acknowledged authority on heat transfer, and is a prolific writer of papers and books concerned with boiling, condensation, and two-phase flow. This is a second edition of his 1952 heat transfer book. It has been considerably expanded into a comprehensive treatise on heat transfer.

The translation is excellent. The translation editor, Professor R. D. Cess of the State University of New York at Stony Brook, deserves high compliments for producing a smooth-reading book with a consistent style of good idiomatic English prose. The editor's footnotes are of special help.

The metric system of units has been retained. The original symbols are used also. These symbols are consistent with those used throughout most of Europe and will be familiar to international readers. But for many practicing engineers in the United States, the symbols will be confusing.

The book is not well suited for use as a sole text for a university course. It contains no problems. The number of solved examples is sixteen, or about one for each chapter. No mathematical tables or tables of physical properties are included. Neither is the book useful as a design manual. Omitted topics include the art of equipment selection, principles of optimization, and the use of correlations for cases when theory is lacking. It is noteworthy that the log-mean temperature difference is not presented until page 451. Numerical methods, conformal mapping, and graphical methods are omitted. A table of contents is included, but there is no subject or author index.

The book is intended to be a modern scientific treatise. It leans heavily on mathematical analysis. It is particularly valuable for its presentation of recent Soviet progress. Some 130 Soviet references are listed. The most thorough sections are those dealing with forced convection, boiling, two-phase flow, and filmwise condensation. Equations not found in other books occur frequently in these sections. Heat transfer to a falling jet is analyzed. The mathematical treatment of filmwise condensation includes the effect of surface tension, acceleration, vapor

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For condensation polymerizations involving propagation of bifunctional species (x or y units in length) of the type

$$M_x + M_y \xrightarrow{k'} M_{x+y}$$

the lifetime of each growing chain is as long as the duration of the polymerization; hence, the latter effect should prevail, regarding molecular size distribution.

Moreover, in batch polycondensation distributions, unlike addition polymerization, the maximum occurs at low degrees of polymerization even at high degrees of conversion. Hence, in the continuous stirred reactor, owing to the random manner in which molecules of all sizes leave in the exit stream, one might expect large fractions of unreacted monomer to appear in the distribution curve.

The distribution for the second type of propagation has been predicted for batch conditions by Flory (*4*) using statistical arguments; Dostal and Raff (*5*) attempted to calculate the distribution kinetically.

The following treatment represents a complete analytical analysis of the batch and continuous cases with the usual assumptions:

1. The principle of equal reactivity is valid; that is k' is independent of chain length, x.
2. Density changes may be neglected.
3. Isothermal conditions prevail.
4. Mixing is perfect.
5. Continuous polymerization proceeds under steady state conditions.

BATCH POLYMERIZATION

The equations are, for $x = 1$

$$\frac{dM_1}{dt} = -K' M_1 \sum_{i=1}^{\infty} M_i$$

or

$$\frac{dm_1}{dt} = -2Km_1\phi$$

and for $x > 1$

$$\frac{dm_x}{dt} = -2Km_x\phi + K\sum_{i=1}^{x-1} m_i m_{x-i}$$

with

$$\frac{d\phi}{dt} = -K\phi^2$$

and initial conditions

$$m_x = \begin{cases} 1 \text{ if } x = 1 \\ 0 \text{ if } x > 1 \end{cases} \text{ at } t = 0$$

The time required for a given degree of conversion (P) may be computed at once from the last equation as

$$t = \frac{1-\phi}{K\phi} = \frac{P}{K(1-P)}$$

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drag, and turbulence. The wall temperature distribution and fluid temperature distribution for a tube having a sine flux distribution(such as occurs in nuclear reactors) are derived. Separate chapters are devoted to high velocity flow and rarified gas flow.

The presentation of conduction consists of a selection of the traditional topics. No mention is made of Carslaw and Jaeger, but familiarity with their work is evident. The equations and graphs for fins are mostly those of Harper and Brown and of E. Schmidt, but without credit. The Graetz treatment of laminar flow in a tube is given, but again without credit. In fact, very little credit is given to non-Soviet authors, although their many works were obviously used. The failure to indicate credit is very common among Soviet science writers, therefore, Kutateladze is by no means peculiar.

Today no one man can be expert in all branches of heat transfer. Kutateladze's one page of filmwise condensation is scarcely more than a short introduction. Radiation is treated concisely; however, the omission of Hottel's charts for the view factor detracts from the practical value of this chapter. A chapter on combined heat and mass transfer is given. It is aimed primarily at presenting the three-way analogy among heat, mass, and momentum transfer. The information is insufficient to permit calculations of a condenser for mixed vapors or a vapor in the presence of a non-condensable gas.

The practicing engineer will have modest interest in the book. Research workers will find it very interesting, primarily for the inclusion of some Soviet work not readily available otherwise.

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Engineering Design, Joseph H. Faupel, Wiley, New York, 960 pages, $19.75.

The subtitle of this book describes the contents, "a synthesis of stress analysis and materials engineering." Experimental results from the literature of the mechanical properties of materials are interspersed with analyses ranging from elementary mechanics of materials to the results of analyses by the theories of elasticity and plasticity. Design is here taken to be the calculation of stresses in load-carrying members or the dimensioning of loaded elements of structures, machines, pressure vessels, and composites for static, repeated, or rapidly applied loads. Essentially, this book is a handbook of mechanics of materials.

In its 960 pages, the book covers all topics to be found in the subject of mechanics of materials, from elementary riveted connections in tanks to stress wave propagation. Starting with a chapter on mechanical properties of materials, the book proceeds with analyses of tension, torsion and bending, and combined stresses. Theories of failure and their application are included in the latter chapter. The analysis of composite, honeycomb, and reinforced materials includes stress-strain relations (elastic) for orthotropic materials as well as the two-material problems and filament-reinforced structures. A considerable discussion of creep properties is included in the chapter on designing with plastics. Inelastic behavior in structures and machine parts, energy methods, and a chapter on buckling present analyses in the named areas. A long chapter on "Shock, Impact, Inertia and Fatigue" reviews the literature on high-loading-rate materials tests and fatigue tests, together with stress wave and vibration analyses and an analytical treatment of stresses in rotating members.

The chapter on prestressing for strength includes methods of determining residual stresses and development of stresses in such processes as shrink fits. Methods of experimental stress analysis and diagrams for geometric stress concentration factors are given for many kinds of members. Thermal stress, creep, and stress rupture are covered in the final chapter. Large numbers of references are given throughout the book.

The treatment throughout the book is somewhere between a handbook and a text book. In some cases complete derivations are given, whereas in others the formulas resulting from more complex analysis are presented without derivation. In this sense, the book is more complete in giving background than is a handbook. On the other hand, the absence of illustrative examples or problems would make it difficult for one not familiar with the subject to teach himself from this book. In attaining a breadth of subject matter coverage, there is a sacrifice of depth of development in nearly all subjects, when compared with the reference text books available to the student of mechanics.

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