tedly lies the great merit of the book, which can in no way be dismissed as a mere theoretical treatise.

Inevitably there are some detailed shortcomings. Thus, while absolute rigour is not to be expected, the use made of approximations at times borders on the misleading. Examples of this are the extensive reliance on perfect gas relations, even when dealing with vapours, and the treatment of variables, such as plant efficiencies, as constant, resulting in a tendency to optimism in estimating the benefits of control system modifications. Lack of rigour extends also to the symbology and terminology used, no discrimination being made between absolute and Fahrenheit temperatures, and the somewhat confusingly termed "head at 100% efficiency" being used rather than enthalpy increase for a compressor (p. 156). Confusion of a different kind appears a possible effect of the derivation of available work relations (themselves unexceptionable) in Chapter 1, but it seems nevertheless unfortunate that these are not more fully exploited subsequently (notably in relation to refrigeration where the Carnot cycle is suddenly introduced instead, and in the 'entropy analyses' of mass-transfer processes). Finally, the absence of any reference to microprocessors–in part, no doubt, a reflection of the original date of publication—is noteworthy.

The above points notwithstanding the overriding impression is of the sheer quantity and quality of information packed into the 300 or so pages of this volume.

IAN J. G. BERRY

M. NECATI ÖZISIK, **Heat Conduction**. John Wiley, New York (1980). 687 pp. £14.90.

CONDUCTION heat transfer is a satisfying subject for both students and teachers of engineering science alike. It may be studied and taught at almost any level of mathematical and physical complexity; the physical significance of its problems and solutions are always apparent; and there are many non-experimental methods whereby the problems may be solved, including different analytical and numerical methods for a single problem. In addition it has its analogies in the fields of electricity and the diffusion of matter and momentum. For all these reasons, it can serve as a paradigm for the relationship between science, engineering and mathematics, including computer-driven numerical models. Of course there are already several outstanding, advanced works devoted to its study including Fourier's (1822), Carslaw and Jaeger (1946, 1959), Schneider (1955), Arpaci (1966) and Myers (1971). Professor Özisik's book is a worthy, welcome and timely addition to this collection, for although most of the topics in it are covered adequately in the earlier books, now they are brought together, carefully arranged, thoroughly discussed and conveniently presented.

In his preface the author states: "To follow the material in this book, all the reader needs is an understanding of the methods of advanced calculus and of the solution of elementary partial differential equations. The book is intended to contribute to effective teaching at graduate level and to serve as a reference volume for scientists, engineering graduates, and industry." This is a fair claim, though possibly one that somewhat underplays the the degree of mathematical fluency required for a ready assimilation of the contents.

The book is fairly comprehensive in coverage. The methods of solution include: separation of variables; integral transforms; Laplace transforms; approximate analytical methods; and numerical methods. Some are discussed for several co-ordinate systems, the basic equation having been presented earlier in general orthogonal curvilinear co-ordinates. A few chapters are devoted to special topics including: phase-change problems; non-linear problems; and composite and anisotropic media. Finite-difference numerical solution methods are also presented, but finite element methods have been intentionally excluded (for lack of space). Solutions of basic transient problems in chart form are not included, but these are readily available elsewhere. With space limited and an evident intention to deal thoroughly with methods of solution, it is inevitable that much less attention and space is given to engineering applications and illustrations than in some other books. Nevertheless, Professor Özisik's *Heat Conduction* can be warmly recommended.

J. R. SINGHAM

Imperial College,
London

NORMAN CHIGIER (Editor), **Energy and Combustion Science**, Pergamon Press, Oxford (1979). 325 pp. £8.75 (U.S. price $19.50).

THE BOOK is composed of articles which have been selected from the first three volumes of the journal *Progress in Energy and Combustion Science* published since 1975. The objective of the editor was to gather a number of review articles which are ... "intermediate between the concise articles printed in scientific journals and the extensive treatment provided by textbooks"....

For a more attractive presentation, the volume has been subdivided into five sections, with the respective titles: Pollution, Gas, Oil, Coal and Engines. From this layout, one can see that emphasis has been given to the study of pollution. Indeed, the word "Pollution" is included in the titles of five chapters, out of a total of fourteen.

This volume can certainly be recommended as a textbook in the field of combustion, but, in my opinion, only for *post-graduate* courses at a rather high level. Furthermore, one can imagine that, to facilitate the teaching time-table, many professors will probably adopt a more conventional and more logical planning, starting with "Fundamentals of Combustion" and ending with "Pollution Control".

With such an objective we would suggest the following chronological order, for studying the book:

a first group of three chapters (5, 6, 7) is devoted to: "Fundamentals of Gas Combustion", with the following main topics: burning velocities, diffusion flame structure, laminar aerated-flames, catalytic flames and ignition. Special emphasis is given to turbulence theory, stream mixing and age mixing, with their influences on chemical reaction efficiencies;

a second group of four chapters (8, 9, 10, 11) concerns the "Combustion of Particles". The combustion of a single droplet of light fuel is first considered, then that of heavy fuel, afterwards the atomization and burning of liquid fuel sprays, and finally the combustion of solid particles;

a third group of three chapters (12, 13, 14) is devoted to "Spark-Ignition and Diesel Engines", specially to the influence of turbulence on efficiency, fuel economy and pollutant formation.

As a matter of fact, the formation of pollutants is examined by almost all the authors, in the course of the more general treatment of each topic.

However, a fourth group of three chapters (1, 3, 4) presents the general basis of "Pollutant Formation", Control and Destruction" in combustion.

Of course, the book does not cover all the aspects of combustion, but the topics which are discussed constitute a representative sample of the industrial applications of combustion science, and will thus be useful for teaching purposes.

The very large number of references given at the end of each chapter will also be very useful for students.

P. LE GOFF

Laboratoire des Sciences du Genie Chimique
1 rue Grandville
54042 *Nancy cedex*
France