H. C. HOTTEL and A. F. SAROFIM, **Radiative Transfer,** 520 pp. McGraw-Hill, New York (1967). Price £7 4*s* 6*d*.

THE PUBLICATION of this book, which is based on some 40 years of research and teaching by Hottel and his students at the Massachusets Institute of Technology, is most welcome to students of radiative heat transfer. The declared intention of the book is to provide the practising engineer or the scientist with a background for attacking a radiation problem of "almost any degree of complexity". For those who will patiently follow the line of argument presented, and will not be discouraged by the large amount of not too difficult mathematics, the book will certainly serve its intended purpose.

After a short introductory chapter on principles, problems of radiative interchange between surfaces are discussed (Chapters 2–5). Starting first with the assumption that the surfaces are grey Lambert emitters and absorbers, followed by a general rigorous treatment of non-ideal surfaces, the properties of real surfaces and the mechanism of the emission and absorption at such surfaces are examined; and this examination is supplemented by a valuable appendix containing numerical data on surface emissivities.

Theory and experiment on the radiative properties of gas and of clouds of particles are presented in Chapter 6. A short historical account of research on banded radiation spans a period of 80 years from the first measurements of emission and absorption spectra by Paschein in 1894, through studies by Schack, Schmidt, Hottel, Eckert and others, resulting in the total emissivity charts for CO_2 and H_2O and followed by advanced theories of molecular structure and band models, which enable the data to be extrapolated to high temperature and pressure conditions not easily accessible to the experimenter.

Discussions on the basic attentuation laws on the single line in banded emission and on the application of band models are included in this chapter together with gas emissivity data of practical interest. Emissivities of heteropolar gases important in radiative transfer in furnaces are presented in the form of the familiar charts giving total emissivity as a function of the product of the partial pressure of the gas component and the length of the optical beam for varying gas temperatures and total gas pressures. Air emissivity data at high temperatures relevant to satellite re-entry problems are also included. Chapter 6 also includes a section dealing with radiation from clouds of particles. Luminous radiation from soot-laden hot combustion products is the dominant mode of heat transfer in many combustion systems; it is therefore a subject of considerable practical importance. It seems to the reviewer that the significance of luminous radiation is somewhat understated in this chapter, as reflected in the limited space devoted to its discussion.

By the time he has reached the end of Chapter 6, the reader will have acquired the ability to solve problems of radiative exchange between an isothermal gas mass and its bounding walls, with the wall emissivity independent of the wave length of the incident radiation. Geometrical problems of gas radiative interchange are presented in Chapter 7, with the effects of configuration expressed in terms of "exchange areas" for particular shapes of the enclosure. These are then applied to cases where the temperature variation in the gas can be ignored or where the dimensions of the enclosure are large compared with the radiation mean free path and the radiation can, therefore, be treated as a diffusion process; to uni-dimensional fields to which rigorous treatment can be applied; and finally to cases where three-dimensional temperature distribution has to be allowed for.

For the solution of problems in this last category, the zone method of analysis is used. This method is based on the sub-division of the furnace volume into zones assumed to be of uniform temperature and concentration. Equations are then derived for the energy balance of each zone and the simultaneous solutions of these equations yield the detailed wall heat flux distribution. In the zone method of analysis, a complicated integral equation is replaced by a series of algebraic equations. The solution usually required the use of high-speed digital computers. The detailed discussions of this method will be particularly valuable to engineers who wish to use radiative-heat-transfer calculations for more quantitative design of furnaces and combustors.

Following this discussion on radiative exchange in systems containing volume emitters, there is a detailed presentation of single-particle scatter and of radiative transfer in an absorbing scattering medium. Approximate methods for treating anisotropic scatter capable of solving engineering problems such as thermal radiative transfer through clouds of particles large compared with the wave length of the incident radiation are also given.

There follows a chapter which gives examples of the application of radiation exchange data to furnaces. This covers a large number of problems, which will certainly help the reader who wishes to absorb fully the material presented in the preceding chapters of the book.

The book is eminently readable; ample references are given separately for each chapter, together with carefully compiled subject and author indices. To summarize, this is a most valuable book strongly recommended to applied mathematicians and engineers working in the field of computation of radiative heat transfer.

J. M. BEÉR

Department of Fuel Technology
and Chemical Engineering,
The University of Sheffield
Mappin St.,
Sheffield 1.