E.M. Sparrow, R.D. Cess, "Radiation Heat Transfer", Brooks/Cole Publishing Company, Belmont, California, 1966. XIV + 322 pages.

This book is concerned primarily with energy exchange by the mechanism of thermal radiation as related to both surface-to-surface radiation in absorbing, emitting and scattering media. It has been written from the viewpoint of the engineer and is intended as a textbook for a course in radiation heat transfer and as a reference source for practicing engineers. The book is organized into three more or less autonomous parts.

Part one (pages 1-74) is a joint effort by the two authors to present a general exposition of the characteristics of thermal radiation and of radiation properties. The result is a fine introductory text, written in a very clear style. Graphs and tables of numerical values of characteristic parameters are included for several materials (e.g. an extensive tabulation of total emittance data for metals as well as nonmetals). The reviewer found Section 2-3 mathematically unsatisfactory; for example, if the expansion (2-43) is supposed to hold for small values of $(r/\lambda)^{\frac{1}{2}}$, the numerical coefficient of the last term should read 0.0667 instead of 0.0464; moreover, it is impossible to check the formulae (2-50) and (2-52) without going to the original references; finally, the approximations that lead to Eq. (2-52) remain obscure.

Part two (pages 75-188), written by Sparrow, is devoted to the analysis of radiant interchange between surfaces. In the first chapter (Ch. 3) attention is focused upon diffusely emitting and diffusely reflecting surfaces; a short survey of methods for solving the integral equations of radiant interchange is included. Chapter 4 contains a detailed discussion of means for obtaining angle-factors for diffuse interchange; an extensive catalogue of angle-factors is given in Appendix A. The situation in which one allows for specular components of reflection by the participating surfaces, is dealt with in Chapter 5. Obviously, the analytical complexities increase considerably; expressions for the exchange factors, which take the place of angle-factors, can be obtained only in some idealized geometrical configurations. An approach that might prove efficient in solving practical engineering problems is given by the Monte Carlo method. This method, which is used successfully in studies of the neutron density in nuclear reactors, relies heavily upon the availability of a fast digital computer with large storage capacity; it is only briefly mentioned in the present book. In the last chapter (Ch. 6) a range of specific problems is presented to illustrate several technically interesting situations: pure radiative transport, interaction between radiation and conduction, interaction between radiation and convection. Most of these examples are taken from earlier papers by Sparrow and coworkers.

Part three (pages 189-299), written by Cess, is concerned with radiant energy transfer within media that absorb, emit and scatter thermal radiation. Problems in this area invariably lead to integrodifferential equations of a complicated structure, that can be treated analytically only after a sufficient number of approximations has been introduced. This is probably the reason why the reviewer had the impression of being confronted with a collection of specific situations rather than with a more or less unified theory. The presentation could have been improved if the author had used recent results of transport theory (especially neutron transport theory). Attention has been restricted to one-dimensional radiation transfer. In Chapter 7 the energy equation within a radiation-participating medium is derived and discussed in the specific cases of the optically thin and optically thick limit. The reviewer found the treatment of the radiation slip concept insufficient; advantage could have been taken of an analysis of the Milne problem. Also, it seems to be possible to present the optically thick limit approximation in a unified way. The last three chapters are directed towards

solutions of the governing radiation equations in idealized situations under the conditions of radiation equilibrium (Ch. 8), combined radiation and conduction (Ch. 9) and combined radiation and convection (Ch. 10).

Despite these critical remarks it can be said that this book is the best currently available in the field.

The printing and binding of the book are excellent.

H. G. Kaper