PREFACE

A brief survey of the methods of solution of radiative transfer equations* conducted recently showed the extremely wide variety of methods now available to modern researchers in this discipline. However, there are some methods which go to the very heart of the equation of transfer, notably the natural method of solution (via scattering order decomposition), and which stand foremost by virtue of their power and elegance. Another such method is the spherical harmonic method, which attempts to extend the time-honored technique of separation of variables to the equation of transfer. Finally there is the method of diffusion equations of both approximate and exact type. I have selected these three-major methods for exposition here. The remaining principal method of solution, namely the invariant imbedding method, is reserved for study in Vols. IV and V:

As always, I have been concerned with the fundamental questions of the discipline, those that throw light on the conceptual structure of our subject. For this reason I have avoided discussing various extreme types of techniques of solution, chief among which are the abstract mathematical techniques concerned with uniqueness and existence questions, or with unrealizable algorithms which have no physical content and hence no role in the mathematical-physical foundations of the subject. Moreover, such techniques as the Monte Carlo method were avoided because of their zero conceptual content. Finally, I have not included purely numerical tabulations of solutions of the equation of transfer. Nothing is simpler in these days of powerful computers and exceedingly accomplished computer programs, to rack up several volumes of specialized solution tabulations for various selected geometries. I do. not deny the utility of such tabulations; I am simply adhering to my originally imposed constraints which try to keep this (already extensive) work on the track of fundamental conceptual constructions, rather than numerical and experimental compilations.

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*Preisendorfer, R. W. "A Survey of Theoretical Hydrologic Optics," J..Quant. Spectrosc. Radiat. Transfer 8,325 (1968).

A bibliography of solution procedures may be found in: Lenoble, J. (editor) Standard Procedures to Compute Atmospheric Radiative Transfer in a Scattering Atmosphere. Report of the Radiation Commission of the International Association of Meteorology and Atmospheric Optics (International Union of Geodesy and Geophysics) Vols. I-IV (1974). Laboratoire d' Optique Atmospherique, Universite des Sciences et Techniques de Lille, France.