

VOLUME 1

# Wave Propagation and Scattering in Random Media

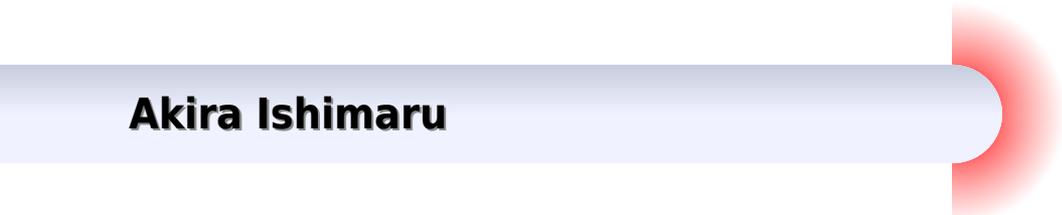
SINGLE SCATTERING AND TRANSPORT THEORY



Akira Ishimaru

# Wave Propagation In Random Media

**Akira Ishimaru**



## Wave Propagation In Random Media:

**Wave Propagation in Random Media** Joseph Bishop Keller, 1960 **Wave Propagation in Random Media (Scintillation)**. V. I. Tatarskii, Akira Ishimaru, V. U. Zavorotny, 1995 Wave Propagation in Random Media Uriel Frisch, 1965 A theory of multiple scattering of waves by a continuous random medium is developed An exact solution of the scalar wave equation with random index is given by means of a functional space integration Perturbation expansions and several approximation methods are studied New results are given some of which disagree with previous ones Coupling between different wave modes and subsequent energy transfer are also considered *Wave Propagation and Scattering in Random Media* Akira Ishimaru, 1978 *Wave Propagation and Scattering in Random Media Volume 2* presents the fundamental formulations of wave propagation and scattering in random media in a unified and systematic manner The topics covered in this book may be grouped into three categories waves in random scatterers waves in random continua and rough surface scattering Random scatterers are random distributions of many particles Examples are rain fog smog hail ocean particles red blood cells polymers and other particles in a state of Brownian motion Random continua are the media whose characteristics vary randomly an **WAVE PROPAGATION IN RANDOM MEDIA.**, 1960 Wave propagation and random media are defined and the nature of the mathematical problems arising in random media is described The two principal types of methods for solving these problems honest and dishonest methods are explained These methods are first illustrated by considering the geometrical optics of a random medium by one method of each type Some new results are obtained by an honest method and some errors in a previous work are pointed out Comparison is made between the results of the two methods and the reasons why they disagree are explained As the propagation in random media is described The two principal types of methods for solving these problems honest and dishonest methods are explained These methods are first illustrated by considering the geometrical optics of a random medium by one method of each type Some new results are obtained by an honest method and some errors in a previous work are pointed out Comparison is made between the results of the two methods and the reasons why they disagree are explained As a second illustration of an honest method an analysis of the reduced wave equation in a random medium is presented Some known results are obtained in a new way which is simpler than the usual one and which appears to be capable of yielding further results Wave Propagation in Random Media (scintillation) Valer'iĭ Il'ich Tatarskiĭ, Akira Ishimaru, V. U. Zavorotny, 1993 Wave Propagation and Scattering in Random Media Akira Ishimaru, 1999-02-04 Electrical Engineering *Wave Propagation and Scattering in Random Media* A volume in the IEEE OUP Series on Electromagnetic Wave Theory Donald G Dudley Series Editor This IEEE Classic Reissue presents a unified introduction to the fundamental theories and applications of wave propagation and scattering in random media Now for the first time the two volumes of *Wave Propagation and Scattering in Random Media* previously published by Academic Press in 1978 are combined into one comprehensive volume This book presents a clear picture of how waves

interact with the atmosphere terrain ocean turbulence aerosols rain snow biological tissues composite material and other media The theories presented will enable you to solve a variety of problems relating to clutter interference imaging object detection and communication theory for various media This book is expressly designed for engineers and scientists who have an interest in optical microwave or acoustic wave propagation and scattering Topics covered include Wave characteristics in aerosols and hydrometeors Optical and acoustic scattering in sea water Scattering from biological materials Pulse scattering and beam wave propagation in such media Optical diffusion in tissues and blood Transport and radiative transfer theory Kubelka Munk flux theory and plane parallel problem Multiple scattering theory Wave fluctuations in turbulence Strong fluctuation theory Rough surface scattering Remote sensing and inversion techniques Imaging through various media About the IEEE OUP Series on Electromagnetic Wave Theory Formerly the IEEE Press Series on Electromagnetic Waves this joint series between IEEE Press and Oxford University Press offers outstanding coverage of the field with new titles as well as reprintings and revisions of recognized classics that maintain long term archival significance in electromagnetic waves and applications Designed specifically for graduate students practicing engineers and researchers this series provides affordable volumes that explore electromagnetic waves and applications beyond the undergraduate level See page ii of the front matter for a listing of books in this series

*Wave Propagation and Time Reversal in Randomly Layered Media* Jean-Pierre Fouque, Josselin Garnier, G. Papanicolaou, Knut Solna, 2007-06-30 Our motivation for writing this book is twofold First the theory of waves propagating in randomly layered media has been studied extensively during the last thirty years but the results are scattered in many different papers This theory is now in a mature state especially in the very interesting regime of separation of scales as introduced by G Papanicolaou and his coauthors and described in 8 which is a building block for this book Second we were motivated by the time reversal experiments of M Fink and his group in Paris They were done with ultrasonic waves and have attracted considerable attention because of the surprising effects of enhanced spatial focusing and time compression in random media An exposition of this work and its applications is presented in 56 Time reversal experiments were also carried out with sonar arrays in shallow water by W Kuperman 113 and his group in San Diego The enhanced spatial focusing and time compression of signals in time reversal in random media have many diverse applications in detection and in focused energy delivery on small targets as for example in the destruction of kidney stones Enhanced spatial focusing is also useful in sonar and wireless communications for reducing interference Time reversal ideas have played an important role in the development of new methods for array imaging in random media as presented in 19

**Wave Propagation and Scattering in Random Media** Akira Ishimaru, 1978 *Wave Propagation in Random Media (Scintillation)* V Tatarskii, A Ishimaru, V.U Zavorotny, 1993-10 This book of proceedings contains the invited papers presented at the conference held in Seattle The main aim of the meeting was to promote a multi disciplinary approach to research in scintillation the optical radio and acoustical communities are therefore well represented in these papers

**The Elements**

**of Wave Propagation in Random Media** B. J. Uscinski,1977      **Wave propagation and scattering in random media**  
ISHIMARU AKIRA.,1978      **Scattering and Propagation in Random Media** North Atlantic Treaty Organization. Advisory  
Group for Aerospace Research and Development. Electromagnetic Wave Propagation Panel. Specialists' Meeting,1988 The  
topic of scattering and propagation in random media is one that has implications for the design development and operation of  
most military systems that radiate energy as a means of accomplishing their function Primary emphasis is on scattering and  
transmission in the atmosphere however other related random medium effects are not excluded Modern methods of  
characterizing random media mathematical methods and their applicability effects on electromagnetic waves and the  
interpretation of these effects to specific system applications are described The region of the spectrum considered is  
essentially unlimited and ranges from very long waves to optics The performance of existing surveillance communication and  
navigation systems as well as the design of future systems is influenced by the propagation of energy via random media An  
understanding of the nature of the medium and its impact on system design and performance is essential to the NATO  
community      *Optical Wave Propagation in Random Media* Chester Stone Gardner,1973      **Numerical and Analytical**  
**Investigations of Wave Propagation in Random Media** Moshe Tur,1981      *Wave Propagation and Scattering in Random*  
*Media: Single scattering and transport theory* Akira Ishimaru,1977      *Wave propagation and scattering in random media*  
,1978      **Electromagnetic Wave Propagation in Random Media** H. L. Pécseli,1984      **Wave Propagation and**  
**Scattering in Random Media** Akira Ishimaru,1978-01-01      **Wave Propagation Inside Random Media** Xiaojun  
Cheng,2017

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