ELECTROMAGNETIC SCATTERING FROM RANDOM MEDIA

Timothy R. Field

This book develops the dynamical theory of scattering from random media from first principles. Its key findings are to characterize the time evolution of the scattered field in terms of stochastic differential equations, and to illustrate this framework in simulation and experimental data analysis. The physical models contain all correlation information and higher order statistics, which enables radar and laser scattering experiments to be interpreted. An emphasis is placed on the statistical character of the instantaneous fluctuations, as opposed to ensemble average properties. This leads to various means for detection, which have important consequences in radar signal processing and statistical optics. The book is also significant also because it illustrates how ideas in mathematical finance can be applied to physics problems in which non-Gaussian noise processes play an essential role. This pioneering book represents a significant advance in this field, and should prove valuable to leading edge researchers and practitioners at the postgraduate level and above.

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Timothy Field studied undergraduate mathematics at King's College, Cambridge University, and went on to receive a doctorate in mathematics from New College and the Mathematical Institute, Oxford University in 1997, where he studied mathematical physics under Sir Roger Penrose. He formerly held a UK government sponsored research fellowship for research into stochastic techniques in electromagnetic scattering problems. Currently Timothy is an Associate Professor in the Department of Electrical and Computer Engineering, an Associate Member in the Department of Mathematics, and faculty member of the Brain Body Institute at McMaster University, Canada. He was recently awarded a five year NSERC Discovery grant for his pioneering research into 'Applications of stochastic differential equations to electromagnetic phenomena'. He has lectured worldwide on topics in mathematical physics.