

# Download Ebook Antenna And Wave Propagation By K D Prasad Free

## **Antenna And Wave Propagation By K D Prasad Free**

*Good, No Highlights, No Markup, all pages are intact, Slight Shelfwear, may have the corners slightly dented, may have slight color changes/slightly damaged spine.*

*This text book on "Antennas and Radio-wave Propagation" describes the theory of various types of antennas that are in current use and the way in which the radiated waves get propagated through space. The theory has been written in a simple and easy-to-understand*

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*language. Lots of worked-out examples as well as diagrams in 2-D and 3-D have been included to illustrate the principles clearly. It is hoped that these features help the students to grasp the theories involved easily. Features Provided solid grasp of the subject. Every concept is explained in detail with 2 dimension or 3 dimension figures wherever necessary. Every chapter is fortified with lots of worked examples. Each chapter ends with review questions and exercise problems to allow the student to test their understanding of the material covered. Basic principles on antenna and*

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*special antennas are discussed in appendices  
Contents Antenna Basics Point Sources Antenna  
Arrays Electric Dipole and Thin Linear  
Antennas The Loop Antenna The Helical Antenna  
and the Yagi-Ud array Antenna Types  
Propagation of Ground and Space Waves Sky-  
Wave Propagation Appendices.*

*Antennas and Wave Propagation Oxford Higher  
Education*

*WAVE PROPAGATION AND ANTENNA ENGINEERING  
Understanding of Electrodynamics, Radio Wave  
Propagation and Antennas  
Antenna & wave propagation  
Radio Wave Propagation Fundamentals*

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Antennas and Wave Propagation is written for the first course on the same. The book begins with an introduction that discusses the fundamental concepts, notations, representation and principles that govern the field of antennas. A separate chapter on mathematical preliminaries is discussed followed by chapters on every aspect of antennas from Maxwell's equations to antenna array analysis, antenna array synthesis, antenna measurements and wave propagation.

One of the most methodical treatments of electromagnetic wave propagation, radiation, and scattering—including new applications and ideas Presented in two parts, this book takes an analytical approach on the subject and emphasizes new ideas and applications used today. Part one covers

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fundamentals of electromagnetic wave propagation, radiation, and scattering. It provides ample end-of-chapter problems and offers a 90-page solution manual to help readers check and comprehend their work. The second part of the book explores up-to-date applications of electromagnetic waves—including radiometry, geophysical remote sensing and imaging, and biomedical and signal processing applications. Written by a world renowned authority in the field of electromagnetic research, this new edition of *Electromagnetic Wave Propagation, Radiation, and Scattering: From Fundamentals to Applications* presents detailed applications with useful appendices, including mathematical formulas, Airy function, Abel's equation, Hilbert transform, and Riemann surfaces. The book also features

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newly revised material that focuses on the following topics:  
Statistical wave theories—which have been extensively applied to topics such as geophysical remote sensing, bio-electromagnetics, bio-optics, and bio-ultrasound imaging  
Integration of several distinct yet related disciplines, such as statistical wave theories, communications, signal processing, and time reversal imaging  
New phenomena of multiple scattering, such as coherent scattering and memory effects  
Multiphysics applications that combine theories for different physical phenomena, such as seismic coda waves, stochastic wave theory, heat diffusion, and temperature rise in biological and other media  
Metamaterials and solitons in optical fibers, nonlinear phenomena, and porous media  
Primarily a textbook for graduate courses in electrical engineering,

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Electromagnetic Wave Propagation, Radiation, and Scattering is also ideal for graduate students in bioengineering, geophysics, ocean engineering, and geophysical remote sensing. The book is also a useful reference for engineers and scientists working in fields such as geophysical remote sensing, bio-medical engineering in optics and ultrasound, and new materials and integration with signal processing.

This book is designed for the final year students in electronics and communication and for the first year post graduate students in Digital Communication and allied subjects. This compact and comprehensive text fulfils the long felt need for a suitable text book in the area of "Antenna and wave Propagation". It is written as per the revised syllabus of

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Rajasthan Technical University (RTU), Kota. It covers the topics, of fundamentals of antenna, types of antenna, antenna arrays, radio propagation modes, with basics of IE3D software and advance antenna topics. This well organized text lays emphasis on all the modes of propagation and practical aspects of antenna, with worked out examples & further previous year solved paper are included topic wise, which would be of considerable assistance to the reader. This comprehensive book covering all aspects of antenna and wave propagations, should prove to be an invaluable asset to both students & professionals. Features: According to the syllabus prescribed by Rajasthan Technical University (RTU), Kota. Including previous year's university papers. Precise definitions and clear exposure of fundamental concepts.



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Simple and easy explanation of the topics along with well labelled diagrams. Step by step procedure is followed for explaining the topics. Detailed coverage of advance antennas, helpful for the post graduation students. The recent applications of antenna are also summarized here again proving fruitful for the M.Tech. Students. IE3D software basic is been included for the purpose of dissertation for M. Tech. Students. Ideally suitable for self study.

Wave Propagation and Antennas

Antennas and Radiowave Propagation

Antennas and Wave Propagation: Fourth Edition

Theory of Electromagnetic Wave Propagation

***Discusses general concepts and illustrates them***

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***with specific examples and references from a variety of antenna systems. This title covers contents related to antenna arrays. It examines more than 100 common antenna working behaviour questions. It clarifies what you need to know about antenna arrays in a 3D manner and various arrangements.***

***Ranging from navigation to communication and defense, antenna and wave propagation technology has diverse applications. The extensive content of this book provides the readers with a thorough understanding of the***

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***subject. This book outlines the processes and applications of wave propagation in detail through elaborate discussions of concepts like phase velocity, types of antenna, polarization, etc. This book consists of contributions made by international experts. It is highly recommended for students pursuing engineering, physics, electronics and associated disciplines.***

***The book is primarily designed to cater to the needs of undergraduate and postgraduate students of Electronics and Communication Engineering and allied branches. It also caters***

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***for fundamental requirements of professionals working on design and development of antenna and wave propagation related equipment either in research laboratories or industries or academic institutions elsewhere. The book has been written with intent to grasp the basic understanding of theoretical as well as practical aspects of electromagnetic wave propagation and antenna engineering. The text has been aptly scripted considering the requirements of average students who can easily grasp and comprehend the basics of wave propagation and***

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***radiation mechanism of varieties of antennas coupled with their critical functionalities, utilities, advantages/disadvantages without any external assistance of teachers or other reference books. The book broaches very well on practical methods of parametric measurements of antenna with right measuring test equipment and associated tools. The last chapter of the book is dedicated to advance technology adopted in design and development of modern antenna. Key features • A fairly large number of well labelled diagrams to provide practical understanding of***

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***the concepts. • The placement of numericals at appropriate places develops confidence among readers and entuses them further to read in depth to crack any regular or competitive examinations. • Chapter summary highlights important points for quick recap and revision before examination. • Well-crafted multiple choice questions with answers at the end of each chapter to stimulate thought process and prepare better for viva-voce and competitive examinations. • Appropriate number of unsolved numerical problems with answers to improve***

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***problem solving skill of students.***

***Antenna Theory***

***Volume 7-Antennas and Wave Propagation***

***NAVEDTRA 14092***

***Analysis and Modeling of Radio Wave  
Propagation***

***Antenna Theory And Wave Propagation 2Nd Ed.***

This book emerged from teaching a graduate level course in propagation and smart antennas at the Naval Postgraduate School. In its present form, it is suitable not only as a graduate level text, but also as a reference book for industry and research use. The area of

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radiowave propagation and smart antennas is highly interdisciplinary, extracting material from electromagnetics, communications, and signal processing. This book is useful to workers in electromagnetics who would like to supplement their background with relevant communicational aspects and to workers in communications who would like to supplement their background with relevant electromagnetic aspects. Anyone with a basic understanding of probability, wave propagation, digital communications, and elementary signal processing should be able to appreciate the contents of the book. The book consists of nine chapters with several worked out examples dispersed throughout.



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Chapter 1 covers the basics of cellular communications. Chapter 2 covers the basic principles of electromagnetic wave propagation relevant to path loss predictions in wireless communications. Students with little prior background in electromagnetics should find the first few sections of Chapter 2 self-sufficient. Empirical path loss models that are used in system design are treated in Chapter 3. The chapter includes the traditional models as well as some of the newer models. Chapter 4 has a thorough discussion on the causes and characterization of small scale fading. The topic of spatial correlation that is very important for antenna arrays is discussed there in detail.

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Clear, coherent work for graduate-level study discusses the Maxwell field equations, radiation from wire antennas, wave aspects of radio-astronomical antenna theory, the Doppler effect, and more.

In the offered book the fundamentals of electromagnetic fields and waves are discussed based on the great Maxwell equations. The book is conceived as a textbook for serious technical and classical universities in the considered themes. Nevertheless, it can be used, of course, as the reference book for wide group of engineers, researches and practical experts. Material of this book is divided into four main parts connected between them. The first part (Fundamental of

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Electrodynamics) is devoted to explanation of Maxwell equations and methods of its solutions. Besides classical interpretation the generalized equations are discussed, which take into consideration the scalar magnetic fields. New approaches allow description of so-called longitudinal electromagnetic waves, which have the absolutely non-standard propagation properties, and permit to explain various electrodynamics paradoxes, which cannot be explained in another way. The main characteristics of wave processes in the free space and in transmission lines (feeders) are described. The second part (Radio Wave Propagation) investigates the obvious patterns of diffraction and interference

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phenomena at radio wave propagation for the obstacle presence in the propagation track, which is typical for all practical situations. Radio wave propagation of various frequency ranges is fulfilled separately taking into consideration the specific features of reflections from the atmosphere parts, attenuation in different media, types of propagating waves, multipath effects, diffraction and non-standard conditions of obstacle overcoming including non-usual ways of atmosphere ducts. The third part is devoted to description of various types and antennas, beginning from simplest (vibrators) and ending by complicate adaptive antenna arrays. Description is fulfilled on the reviewing level with many obvious figures,

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not to rely on strict mathematical methods, but rather on the concept level. Fourth part includes description of UHF devices, which are the elements—base of UHF devices including surface and bulk integrated UHF circuits. These results have in many aspects the pioneer character and they are not widely known to experts. Distinctive feature of the offered book is sufficiently simplifies description of the very complicated electrodynamics problems available for the modern students and for young engineers. Of course, it is impossible to deal without mathematics in these areas but required mathematics can be replaced by the many patterns, which give the chance to understand problems

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and to determine the complex questions. Sample  
Chapter(s) Chapter1: GENERAL DEFINITIONS AND  
RELATIONS OF ELECTRODYNAMICS (498  
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DEFINITIONS AND RELATIONS OF  
ELECTRODYNAMICSCHAPTER 2.  
ELECTROMAGNETIC FIELDS AND WAVESCHAPTER  
3. MAIN PHYSICAL PHENOMENA AT RADIO WAVES  
PROPAGATIONCHAPTER 4. PROPAGATION OF  
RADIO WAVES OF DIFFERENT RANGES AND ITS  
APPLICATION AREASCHAPTER 5. PRINCIPAL  
CHARACTERISTICS OF ANTENNASCHAPTER 6.  
ANTENNAS OF DECIMILLIMETER, MILLIMETER AND

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CENTIMETER WAVESCHAPTER 7. ANTENNAS OF  
DECIMETER, METER AND DECAMETER  
WAVESCHAPTER 8. ANTENNAS OF HECTOMETER,  
KILOMETER MYRIAMETER WAVESCHAPTER 9.  
ANTENNAS FOR TV, RADIO RELAY AND SPACE  
COMMUNICATION LINESCHAPTER 10.  
ELECTROMAGNETIC COMPATIBILITY OF RADIO  
ENGINEERING SYSTEMS. ANTENNAS AND THE  
PROBLEM OF ITS MINIATURIZATIONCHAPTER 11.  
MAIN COMPONENTS OF THE ELEMENT BASE OF  
ANTENNA-FEEDER ENGINEERINGCHAPTER 12.  
BASE ELEMENTS AND FUNCTIONAL UNITS OF  
ANTENNA- FEEDER ENGINEERINGBACK

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**MATTER**Readership: The book is conceived as a textbook for serious technical and classical universities in the considered themes. Nevertheless, it can be used, of course, as the reference book for wide group of engineers, researches and practical experts.

From Fundamentals to Applications

ANTENNAS AND WAVE PROPAGATION

Antenna and Wave Propagation

Radio Wave Propagation

The goal of this book is to discuss fundamentals of electromagnetic wave propagation, especially radiowave propagation, groundwave propagation, surface wave propagation, maritime communication, radar applications in



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terms of parabolic equation modeling and simulation approaches This is the first book on the guided wave propagation model in nearly two decades. This book will cover several new applications. The book also introduces several simple and sophisticated MATLAB scripts as well as virtual electromagnetic tools for several well-known electromagnetic propagation problems.

Aimed at a single-semester course on antennas at the undergraduate level, Antennas and Wave Propagation provides a lucid explanation of the fundamentals of antennas and propagation. This student-friendly text also includes simple design procedures along with a large number of examples and exercises.

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Antennas and radio propagation are continuously and rapidly evolving and new challenges arise every day. As a result of these rapid changes the need for up-to-date texts that address this growing field from an interdisciplinary perspective persists. This book, organized into nine chapters, presents new antenna designs and materials that will be used in the future, due to the trend for higher frequencies, as well as a bird's eye view of some aspects related to radio propagation channel modeling. The book covers the theory but also the practical aspects of technology implementation in a way that is suitable for undergraduate and graduate-level students, as well as researchers and professional engineers.

Introduction to Antennas and RF Propagation Analysis

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The Physics and Mathematics of Electromagnetic Wave  
Propagation in Cellular Wireless Communication  
Antennas & Radio-Wave Propagation  
An Introduction for the Non-Specialist

**This book, now in its Second Edition,  
is primarily intended for the  
undergraduate and postgraduate students  
of electronics and communication,  
electronics and electrical and  
telecommunication engineering. It  
provides a thorough understanding of  
the fundamentals and applications of**

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the subject. The edition discusses the properties of several types of antennas such as dipoles, loop, Yagi-Uda, log-periodic, slot/DRA and microstrip antennas and also explains the phenomenon of wave propagation with emphasis on theory of operation and design procedures. It provides a comprehension of the principles of radiation and methods of excitation. The book also focuses on antenna measurements along with necessary

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requirements and different methods of measurement. Written in an easy-to-understand manner, the text includes several illustrative examples. A large number of solved examples and exercise problems with varying difficulty levels are included to reinforce the theoretical understanding of concepts. The book also contains several objective-type questions in each chapter along with a Question Bank at the end of the book. The Appendices

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provide a rich source of information and expressions as well as design data. NEW TO THE SECOND EDITION Separate new chapters are devoted to: • Reflector Antennas • Slot and Dielectric Resonator Antennas • Modern Antennas • Effect of Ground on Antenna Performances

This comprehensive guide helps readers understand the theory and techniques needed to analyze and model radio wave propagation in complex environments.

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All of the essential topics are covered, from the fundamental concepts of radio systems, to complex propagation phenomena. These topics include diffraction, ray tracing, scattering, atmospheric ducting, ionospheric ducting, scintillation, and propagation through both urban and non-urban environments. Emphasis is placed on practical procedures, with detailed discussion of numerical and mathematical methods providing readers

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with the necessary skills to build their own propagation models and develop their own techniques. MATLAB functions illustrating key modeling ideas are provided online. This is an invaluable resource for anyone wanting to use propagation models to understand the performance of radio systems for navigation, radar, communications, or broadcasting.

Volume 7—Antennas and Wave Propagation  
NAVEDTRA 14092



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**Radio Wave Propagation and Parabolic  
Equation Modeling**

**Physics and Applications**

**Module 10-Introduction to Wave**

**Propagation, Transmission Lines, and  
Antennas**

**Electronics Technician**

**This text should serve as an introduction to the application of electromagnetics EM, following an initial course in basic EM theory. A particular feature of the book is that it examines time domain rather than frequency domain methods in depth.; This book is intended for advanced undergraduate and graduates in**

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**electrical and electronic engineering. Research and practitioners in electromagnetics in electrical and electronic engineering and physics.**

**This practical resource covers the basics of electromagnetics, wave propagation, and antennas for radiated RF projects. General, high-level scenarios of one-way, two-antenna RF transmission-reception (also known as the Friis Equation) systems are illustrated. Characteristics of electromagnetic waves, free space loss, multipath loss, and Fresnel zone loss are presented. Antenna groupings, including isotropic point source, wire, aperture, and slot and array are explained. Antenna measurements are also presented, including squared wavelengths,  $\lambda^2$ , this electrical sizing resulting**

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**in low, medium, and high directivity (gain) antennas. antenna parameters are discussed, as well as mathematical analysis of the selected antennas and parameters, including electric and magnetic field intensity, power density, input impedance, total radiated power, directivity (and gain), efficiency, effective area, and effective height. Receiver noise and received noise that addresses various receiver-internal in-band noise and external noise that can be captured by antennas and sent to receiver-internal RF circuitry are examined. Signal-to-noise ratio (SNR), which discusses the necessity of establishing an appropriate SNR for the RF receiver and received RF signal application whether voice or digital, is presented. Written by an expert in the**

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**field with years of practical experience, this book will help readers understand the technical field of antennas and radiated RF wave propagation.**

**An introduction to RF propagation that spans all wireless applications This book provides readers with a solid understanding of the concepts involved in the propagation of electromagnetic waves and of the commonly used modeling techniques. While many books cover RF propagation, most are geared to cellular telephone systems and, therefore, are limited in scope. This title is comprehensive-it treats the growing number of wireless applications that range well beyond the mobile telecommunications industry, including radar and satellite communications. The author's**

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straightforward, clear style makes it easy for readers to gain the necessary background in electromagnetics, communication theory, and probability, so they can advance to propagation models for near-earth, indoor, and earth-space propagation. Critical topics that readers would otherwise have to search a number of resources to find are included: \* RF safety chapter provides a concise presentation of FCC recommendations, including application examples, and prepares readers to work with real-world propagating systems \* Antenna chapter provides an introduction to a wide variety of antennas and techniques for antenna analysis, including a detailed treatment of antenna polarization and axial ratio; the chapter contains a set of curves that permit readers

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to estimate polarization loss due to axial ratio mismatch between transmitting and receiving antennas without performing detailed calculations \* Atmospheric effects chapter provides curves of typical atmospheric loss, so that expected loss can be determined easily \* Rain attenuation chapter features a summary of how to apply the ITU and Crane rain models \* Satellite communication chapter provides the details of earth-space propagation analysis including rain attenuation, atmospheric absorption, path length determination and noise temperature determination Examples of widely used models provide all the details and information needed to allow readers to apply the models with confidence. References, provided throughout the

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book, enable readers to explore particular topics in greater depth. Additionally, an accompanying Wiley ftp site provides supporting MathCad files for select figures in the book. With its emphasis on fundamentals, detailed examples, and comprehensive coverage of models and applications, this is an excellent text for upper-level undergraduate or graduate students, or for the practicing engineer who needs to develop an understanding of propagation phenomena.

**An Introduction To Electromagnetic Wave Propagation  
And Antennas**

**Foundations of Antenna Engineering: A Unified  
Approach for Line-of-Sight and Multipath  
Antennas and Wave Propagation**

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### Antenna And Wave Propagation

**This is the first textbook that contains a holistic treatment of antennas both for traditional antennas mounted on masts (Line-of-Sight antenna systems) and for small antennas used on modern wireless devices such as smart phones being subject to signal variations (fading) due to multipath propagation. The focus is on characterization, as well as describing classical antennas by modern complex vector theory - thereby linking together many disciplines such as**



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**electromagnetic theory, classical antenna theory, wave propagation, and antenna system performance. Overall, this book represents a rethinking of the way basic antenna theory is presented. The book contains many references to important old and new papers and books on the analysis and design of the most useful antenna types, for the most interested readers.**

**An important resource that examines the physical aspects of wireless communications based on mathematical and physical evidence**

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**The Physics and Mathematics of Electromagnetic Wave Propagation in Cellular Wireless Communication** describes the electromagnetic principles for designing a cellular wireless system and includes the subtle electromagnetic principles that are often overlooked in designing such a system. This important text explores both the physics and mathematical concepts used in deploying antennas for transmission and reception of electromagnetic signals and examines how to select the proper methodology from a wide

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**range of scenarios. In this much-needed guide, the authors—noted experts in the field—explore the principle of electromagnetics as developed through the Maxwellian principles and describe the properties of an antenna in the frequency domain. The text also includes a review of the characterization of propagation path loss in a cellular wireless environment and examines ultrawideband antennas and the mechanisms of broadband transmission of both power and information. This important**

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**resource: Includes a discussion of the shortcomings of a MIMO system from both theoretical and practical aspects Demonstrates how to deploy base station antennas with better efficiency Validates the principle and the theoretical analysis of electromagnetic propagation in cellular wireless communication Contains results of experiments that are solidly grounded in mathematics and physics Written for engineers, researchers, and educators who are or plan to work in the field, The Physics**

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**and Mathematics of Electromagnetic Wave Propagation in Cellular Wireless Communication offers an essential resource for understanding the principles underpinning wireless communications. The Latest Resource for the Study of Antenna Theory! In a discipline that has experienced vast technological changes, this text offers the most recent look at all the necessary topics. Highlights include: \* New coverage of microstrip antennas provides information essential to a wide variety of practical**

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**designs of rectangular and circular patches, including computer programs. \* Applications of Fourier transform (spectral) method to antenna radiation. \* Updated material on moment methods, radar cross section, mutual impedances, aperture and horn antennas, compact range designs, and antenna measurements. A New Emphasis on Design! Balanis features a tremendous increase in design procedures and equations. This presents a solid solution to the challenge of meeting real-life situations faced**

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**by engineers. Computer programs contained in the book-and accompanying software-have been developed to help engineers analyze, design, and visualize the radiation characteristics of antennas.**

**Introduction to RF Propagation  
Substrate-Integrated Millimeter-Wave  
Antennas for Next-Generation Communication  
and Radar Systems  
Analysis and Design  
Antennas And Wave Propagation**

This work treats the essential elements of

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radio wave propagation without requiring recourse to advanced electromagnetic concepts and equations. However, it provides sufficient detail to allow those concerned with wireless systems to acquire quickly a practical working knowledge of the important concepts. Radio wave propagation is placed in a practical context by considering the design aspects of communications systems at microwave frequencies. A fuller consideration of the electromagnetic properties of materials is given late in the book rather than as an



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introductory chapter.

Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems The first and only comprehensive text on substrate-integrated mmW antenna technology, state-of-the-art antenna design, and emerging wireless applications Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems elaborates the most important topics related to revolutionary millimeter-wave (mmW)

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technology. Following a clear description of fundamental concepts including substrate-integrated waveguides and loss analysis, the text treats key design methods, prototyping techniques, and experimental setup and testing. The authors also highlight applications of mmW antennas in 5G wireless communication and next-generation radar systems. Readers are prepared to put techniques into practice through practical discussions of how to set up testing for impedance matching, radiation patterns, gain

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from 24GHz up to 325 GHz, and more. This book will bring readers state-of-the-art designs and recent progress in substrate-integrated mmW antennas for emerging wireless applications. Substrate-Integrated Millimeter-Wave Antennas for Next-Generation Communication and Radar Systems is the first comprehensive text on the topic, allowing readers to quickly master mmW technology. This book: Introduces basic concepts such as metamaterials Huygens's surface, zero-index structures, and pattern

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synthesis Describes prototyping in the form of fabrication based on printed-circuit-board, low-temperature-co-fired-ceramic and micromachining Explores applications for next-generation radar and imaging systems such as 24-GHz and 77-GHz vehicular radar systems Elaborates design methods including waveguide-based feeding network, three-dimensional feeding structure, dielectric loaded aperture antenna element, and low-sidelobe synthesis The mmW is one of today's most important emerging technologies. This

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book provides graduate students, researchers, and engineers with the knowledge they need to deploy mmW systems and develop new antenna designs with low cost, low loss, and low complexity.

The aim of this book is to give an introduction to the fundamental principles of antennas and wave propagation. Unlike other books available, there is more emphasis on mathematical explanation in addition to physical understanding. Physical principles are explained in detail with clear diagrams to

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support the theory.

Antenna and Wave Propagation Technology  
Radiowave Propagation

Radiowave Propagation and Smart Antennas  
for Wireless Communications

*An accessible student-oriented approach to radiowave propagation Propagation-the process whereby a signal is conveyed between transmitter and receiver-has a profound influence on communication systems design. Radiowave Propagation provides an overview of the physical mechanisms that govern electromagnetic wave propagation in the Earth's troposphere and ionosphere. Developed in*

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*conjunction with a graduate-level wave propagation course at The Ohio State University, this text offers a balance of physical and empirical models to provide basic physical insight as well as practical methods for system design. Beginning with discussions of propagation media properties, plane waves, and antenna and system concepts, successive chapters consider the most important wave propagation mechanisms for frequencies ranging from LF up to the millimeter wave range, including: Direct line-of-sight propagation through the atmosphere Rain attenuation The basic theory of reflection and refraction at material interfaces and in the Earth's atmosphere Reflection, refraction, and diffraction analysis in microwave link design for a specified terrain profile Empirical path loss*

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*models for point-to-point ground links Statistical fading models Standard techniques for prediction of ground wave propagation Ionospheric propagation, with emphasis on the skywave mechanism at MF and HF and on ionospheric perturbations for Earth-space links at VHF and higher frequencies A survey of other propagation mechanisms, including tropospheric scatter, meteor scatter, and propagation effects on GPS systems Radiowave Propagation incorporates fundamental materials to help senior undergraduate and graduate engineering students review and strengthen electromagnetic physics skills as well as the most current empirical methods recommended by the International Telecommunication Union. This book can also serve as a valuable teaching and reference text for*



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*engineers working with wireless communication, radar, or remote sensing systems.*

*Suitable for professional engineers and students who specialize in antenna, communication and radar systems, this book provides a thorough introduction to the basic principles of electromagnetic wave propagation of radio frequencies in real-world conditions.*

*Electromagnetic Wave Propagation, Radiation, and Scattering*