The Paraboloidal Reflector Antenna In Radio Astronomy And Communication Theory And Practice Astrophysics And Space Science Library

This is the first truly comprehensive and most up-to-date handbook available on modern reflector antennas and feed sources for diversified space and ground applications. There has never been such an all-encompassing reflector handbook in print, and no currently available title offers coverage of such recent research developments. The Handbook consists of three volumes. Volume II focuses on feed sources. Reflector antennas are extraordinary devices that combine high gain with geometrical simplicity, and can operate in broad frequency bands. Their performance, however, depends on the electrical characteristics of the feed system with which they operate. This comprehensive volume provides you with a solid understanding of feed system theory, design, and analysis. Featuring chapters authored by experts in each aspect of feed systems, this book takes you from fundamental mathematical techniques, electrically small and large dual reflectors, feed geometry and telemetry, tracking and command antennas, and more. Throughout the book numerous examples are provided to guide you in the practical aspects of feed design.

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 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. The NAB Engineering Handbook provides detailed information on virtually every aspect of the broadcast chain, from news gathering, program production and postproduction through master control and distribution links to transmission, antennas, RF propagation, cable and satellite. Hot topics covered include HD Radio, HDTV, 2 GHz broadcast auxiliary services, EAS, workflow, metadata, digital asset management, advanced video and audio compression, audio and video over IP, and Internet broadcasting. A wide range of related topics that engineers and managers need to understand are also covered, including broadcast administration, FCC practices, technical standards, security, safety, disaster planning, facility planning, project management, and engineering management. Basic principles and the latest technologies and issues are all addressed by respected professionals with first-hand experience in the broadcast industry and manufacturing. This edition has been fully revised and updated, with 104 chapters and over 2000 pages. The Engineering Handbook provides the single most comprehensive and accessible resource available for engineers and others working in production, postproduction, networks, local stations, equipment manufacturing or any of the associated areas of radio and television. * An National Association of Broadcasters official publication * Over 100 industry leaders combine their knowledge and expertise into one comprehensive

reference * Completely revised to add many new technologies such as HDTV, Video over IP, and more

The contributions of this book represent only a small sample of the work of the many researcher electromagneticians who have had the pleasure of being associated with Professor Papas, either as students or as colleagues. Many of us continue to work in the many and diverse areas that modem electro magnetism encompasses. There is, however, a common thread that was derived from our association with Professor Papas that has greatly influenced our thinking and technical style of expression. Professor Papas, from his studies at Harvard, brought with him to Pasadena a very fundamental and classical point of view that was instilled in all those who were associated with him. He saw research problems as a combination offundamental physical and mathematical principles and the electromagnetic "reality. " He searched and demanded clarity and often, in the rather involved and engaging discussions which took place in his office, he demanded that the "baby picture" be clearly drawn on the blackboard. This requirement, certainly for some of us who were working in widely varied subjects ranging from relativistic plasmas to almost periodic media, has forced us to reexamine the fundamentals. The clear and lucid marriage of fundamental concepts to applications has been the trademark of Professor Papas's intellectual tradition, and has greatly in fluenced the thinking of all of those who have associated with him.

"This book is a unique combination of practical payload systems engineering and communications theory and applications. Payload systems engineering itself is a complex endeavor that people only learn on the job over many years' time, and this book hopes to ease their learning path. There are detailed books on how to design the various kinds of units, e.g.,

antennas, of a payload but seemingly no books focusing on unit performance at a level appropriate for systems engineering.Potential satellite owners, few of whom have worked in the satellite field, need help to understand how to get what they want from the manufacturer.The satellite bus, particular satellites, and particular and general satellite communications systems have been written about in several books, but the payload has received typically a few pages in all these books"--

The Microwave Engineering Handbook provides the only complete reference available on microwave engineering. The three volumes of the handbook cover the entire field of microwave engineering, from basic components to system design. All entries in the handbook are written by experts in the area, bringing together an unrivalled collection of expertise on microwave technology. Volume 3: Microwave systems and applications provides a thorough introduction to the principal applications of microwave technology. Telecommunication, broadcasting, detection and ranging and scientific and industrial applications are covered with appendices on microwave measurement and frequency allocation. This volume shows the range of current and developing applications for microwave technology and will enable readers to appreciate the variety of applications and the requirements for the various system types.

During this program, a flexible, interactive program for Monte Carlo analysis of near-field and far-field fields of a prime focal fed out-of-band paraboloidal reflector antenna was developed and used for numerical simulation. The simulations are not sensitive to frequency only averaging. The distribution of the modal coefficient phases has the greatest effect on the numerically simulated patterns. The numerical simulations also

indicate the validity of near-field ensemble measurements in far-field pattern prediction and the role of near-field correlation terms in these patterns.

This is the first truly comprehensive and most up-to-date handbook available on modern reflector antennas and feed sources for diversified space and ground applications. There has never been such an all-encompassing reflector handbook in print, and no currently available title offers coverage of such recent research developments. The Handbook consists of three volumes. Volume I provides a unique combination of theoretical underpinnings with design considerations and techniques. The need for knowledge in reflector antennas has grown steadily over the last two decades due to increased use in space and ground applications, as well as their high gain and wide bandwidth capabilities at relatively low cost. This volume brings you to the leading edge of developments in the field related to numerical techniques, classical reflector geometries, adaptive reflector antennas, shaped reflectors, bifocal and bicollimated dual reflectors, advanced reflectors, and reflect arrays. A must-have reference for both practicing engineers as well as academic researchers.

Abstract: The use of parasitic wire dipoles are examined when placed in the proximity of a focused dipole feed in a parabolic reflector antenna. These parasitic elements are rotated around the feed dipole and a search is performed for the ideal positioning so as to yield maximum radiated power and main beam shift in order to develop a novel form of angle diversity. In addition a comparison is made between 2 element dipole feed

structures and linearly and circularly polarised patch feed structures. In order to analytically model the structure, mutual coupling between feed elements is calculated taking into account a varying reflection coe?cient due to an impedance mismatch between the transmission line and driven element. An analytical treatment of the calculation of the radiated co-polar and cross-polar feed pattern is presented in addition to the projected field at the reflector surface. A comparison is made to the results presented by E.M.T Jones in the 1954 IRE Transactions of Antennas and Propagation paper entitled 'Paraboloid Reflector and Hyperboloid Lens Antennas'. A theoretical treatment of the reflected field and far field radiation pattern is then presented using the methods of Geometrical Optics, Physical Optics and Fourier analysis. The author derives analytical equations for multiple element incident feed fields and surface current equations for half wave feeds of arbitrary position and number. The fndings are confirmed using a comparison of three methods. These are; original code developed from analytical derivations, the NEC2 Method of Moments using a meshed reflector model and finally, by experimental methods. Analysis of a 30cm 0.4 F/D prime focus reflector at 3GHz using a 2 element feed yields up to 2dB gain over a single dipole feed when the element is displaced either laterally or at 60 or 120 degrees from the feed axis. The optimum offset from the driven element is in the 0.4 to 0.6? range. Maximum beam shift for this structure at the half power points is shown to be approximately 10 degrees. When designed as a low-cost system with undemanding polarisation

requirements the structure presented provides an easily implemented or retrofitted alternative to multiple antenna diversity solutions.

Practical, concise and complete reference for the basics of modern antenna design Antennas: from Theory to Practice discusses the basics of modern antenna design and theory. Developed specifically for engineers and designers who work with radio communications, radar and RF engineering, this book offers practical and hands-on treatment of antenna theory and techniques, and provides its readers the skills to analyse, design and measure various antennas. Key features: Provides thorough coverage on the basics of transmission lines, radio waves and propagation, and antenna analysis and design Discusses industrial standard design software tools, and antenna measurement equipment, facilities and techniques Covers electrically small antennas, mobile antennas, UWB antennas and new materials for antennas Also discusses reconfigurable antennas, RFID antennas, Wide-band and multi-band antennas, radar antennas, and MIMO antennas Design examples of various antennas are provided Written in a practical and concise manner by authors who are experts in antenna design, with experience from both academia and industry This book will be an invaluable resource for engineers and designers working in RF engineering, radar and radio communications, seeking a comprehensive and practical introduction to the basics of antenna design. The book can also be used as a textbook for advanced students entering a profession in this field.

This practical new resource provides you with a much wider choice of analytical solutions to the everyday problems you encounter in electromagnetic modeling. The book enables you to use cutting-edge method-of-moments procedures, with new theories and techniques that help you optimize computer performance in numerical analysis of composite metallic and dielectric structures in the complex frequency domain.

Driven by the demand for high-data-rate, millimeter wave technologies with broad bandwidth are being explored in high-speed wireless communications. These technologies include gigabit wireless personal area networks (WPAN), high-speed wireless local area networks (WLAN), and high-speed wireless metropolitan area networks (WMAN). As a result of this technological push, standard organizations are actively calling for specifications of millimeter wave applications in the above wireless systems. Providing the guidance needed to help you navigate through these new technologies, Millimeter Wave Technology in Wireless PAN, LAN, and MAN covers the fundamental concepts, recent advances, and potential that these millimeter wave technologies will offer with respect to circuits design, system architecture, protocol development, and standardization activities. The book presents essential challenges and solutions related to topics that include millimeter wave monolithic integrated circuit (MMIC), packaging technology of millimeter wave system and circuits, and millimeter wave channel models. With numerous figures, tables and references, this text allows

speedy access to the fundamental problems, key challenges, open issues, future directions, and further readings on millimeter wave technologies in relation to WPAN, WLAN, and WMAN.

This book will interest researchers, scientists, engineers and graduate students in many disciplines, who make use of mathematical modeling and computer simulation. Although it represents only a small sample of the research activity on numerical simulations, the book will certainly serve as a valuable tool for researchers interested in getting involved in this multidisciplinary field. It will be useful to encourage further experimental and theoretical researches in the above mentioned areas of numerical simulation.

Written by one of the world's leading experts in the field, this book is intended as an advanced text for courses in antennas, with a focus on the mature but vital background field of aperture antennas. It is aimed at final year, MSc, PhD and post-doctoral students, as well as readers who are moving from academia into industry, beginning careers as wireless engineers, system designers, in R&D, or for practising engineers. It assumes the reader has undertaken an earlier course of study on Maxwell's equations, fields and waves. Some of these topics are summarized in the early few chapters in order to provide continuity and background for the remaining chapters. The aperture antennas covered include the main types of horns, reflectors and arrays as well as microstrip patches, reflectarrays and lenses. To provide more than a superficial treatment of arrays, the topic of mutual coupling is covered in greater detail compared to most similar books in this area. Also included is an introduction to arrays on non-planar surfaces, which are important in applications that involve curved surfaces such as in aerodynamics or for making aperture antennas unobtrusive. A chapter is included on some

modern aperture antennas to illustrate design techniques beyond the most common types of aperture antennas described in the early chapters. This is to show where advances have recently been made and where they could be improved in the future. Also included are selective topics that are practical in nature for aperture antennas, namely fabrication and measurement.

Extensive revision of the best-selling text on satellite communications — includes new chapters on cubesats, NGSO satellite systems, and Internet access by satellite There have been many changes in the thirty three years since the first edition of Satellite Communications was published. There has been a complete transition from analog to digital communication systems, withanalog techniques replaced by digital modulation and digital signal processing. While distribution of television programming remains the largest sector of commercial satellite communications, low earth orbit constellations of satellites for Internet access are set to challenge that dominance. In the third edition, chapters one through three cover topics that are specific to satellites, including orbits, launchers, and spacecraft. Chapters four through seven cover the principles of digital communication systems, radio frequency communications, digital modulation and multiple access techniques, and propagation in the earth's atmosphere, topics that are common to all radio communication systems. Chapters eight through twelve cover applications that include non-geostationary satellite systems, low throughput systems, direct broadcast satellite television, Internet access by satellite, and global navigation satellite systems. The chapter on Internet access by satellite is new to the third edition, and each of the chapters has been extensively revised to include the many changes in the field since the publication of the second edition in 2003. Two appendices have been added that cover digital

transmission of analog signals, and antennas. An invaluable resource for students and professionals alike, this book: Focuses on the fundamental theory of satellite communications Explains the underlying principles and essential mathematics required to understand the physics and engineering of satellite communications Discusses the expansion of satellite communication systems in areas such as direct-broadcast satellite TV, GPS, and internet access Introduces the rapidly advancing field of small satellites, referred to as SmallSats or CubeSats Provides relevant practice problems based on real-world satellite systems Satellite Communications is required reading for undergraduate and postgraduate students in satellite communications courses and an authoritative reference for engineers working in communications, systems and networks, and satellite operations and management.

Radio astronomers have developed techniques of calibration of large reflector antennas with radio astronomical methods, but these have not been comprehensively described. This text aims to fill this gap, taking a practical approach to the characterisation of antennas. All calculations and results in the form of tables and figures have been made with Mathematica by Wolfram Research. The reader can use the procedures for the implementation of his own input data.

Reflector antennas designed with the aid of a technique by which the caustics of the subreflector are matched to those of the main reflector are shown to have improved limited-sector-scanning capabilities. The matching is achieved over angular scanning sectors of interest by positioning and shaping subreflectors for parabolic cylinder and paraboloidal antennas. The important applications are in air traffic control radars and satellite communications where a small-aperture subreflector can be illuminated by a plane-wave

source such as a small phased array, resulting in high-gain limited-scan beam-steering on a large-aperture reflector.

The Second Edition of this book, while retaining the contents and style of the first edition, continues to fulfil the require-ments of the course curriculum in Electromagnetic Theory for the undergraduate students of electrical engineering, electronics and telecommunication engineering, and electro-nics and communication engineering. The text covers the modules of the syllabus corresponding to vectors and fields, Maxwell's equations in integral form and differential form, wave propagation in free space and material media, transmission line analysis and waveguide principles. It explains physical and mathematical aspects of the highly complicated electromagnetic theory in a very simple and lucid manner. This new edition includes : • Two separate chapters on Transmission Line and Waveguide • A thoroughly revised chapter on Plane Wave Propagation • Several new solved and unsolved numerical problems asked in various universities' examinations

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 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 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 the concepts. • The placement of numericals at appropriate places develops confidence among readers and enthuses 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 problem solving skill of students.

Discover a modern approach to the analysis, modeling and design of high sensitivity phased arrays. Network theory, numerical methods and computational electromagnetic simulation techniques are uniquely combined to enable full system analysis and design optimization. Beamforming and array signal processing theory are integrated into the treatment from the start. Digital signal processing methods such as polyphase filtering

and RFI mitigation are described, along with technologies for real-time hardware implementation. Key concepts from interferometric imaging used in radio telescopes are also considered. A basic development of theory and modeling techniques is accompanied by problem sets that guide readers in developing modeling codes that retain the simplicity of the classical array factor method while incorporating mutual coupling effects and interactions between elements. Combining current research trends with pedagogical material suitable for a first-year graduate course, this is an invaluable resource for students, teachers, researchers, and practicing RF/microwave and antenna design engineers.

Measurements were carried out on the 18.3 meter University of Iowa parabolic reflecting antenna using radioastronomical techniques at 400 MHz. The antenna beam pattern was found to be unsymmetrical with half-power widths of 2.75 degrees by 2.25 degrees. The aperture illumination provided by the log-periodic feed antenna is mainly responsible for a total aperture efficiency of 36%. The gain of the reflector antenna is 33.2 dB and its directivity is 33.7 dB. The most prominent side-lobes were observed to be at least 25dB down from the maximum response. The surface of the paraboloidal reflector itself has an rms deviation of approximately 1 cm from a true paraboloid. In terms of radio astronomy, the antenna perfromance factor is 0.034 K of antenna temperature per flux unit (10 to the minus 26th power watts/sq m/Hz). The pointing accuracy was found to vary randomly within plus or minus 0.25 degrees in elevation

and azimuth. (Modified author abstract).

This book discusses the innovative design, cable-net design and analysis, control, deployment, development and applications of large space-deployable antennas. Drawing on the authors' own work in this field, it describes and analyzes various typical deployable antennas, membrane antennas and super-large space-assembled antennas, while chiefly focusing on mesh antennas due to their wide range of applications. It also investigates forming–finding design and the analysis of cable-truss structures for high-precision reflector antennas, as well as deployment process control and deployment reliability based on flexible multibody dynamic analysis. The book covers not only mechanical structure performance, but also electromagnetic performance realization and stability. Lastly, it proposes an electrical equivalent method for mesh reflector antennas and a coupling model for the structural displacement field and electrostatic field. Given the nature of its content, the book is intended for researchers, graduate students and engineers in the field of space antennas.

A novel Feed-Reflector system for large Cassegrain antennas for Radio Astronomy and Deep-Space Communication applications is investigated. This Feed-Reflector is used to illuminate a hyperboloid sub-reflector with 5-10 m diameter located 500 m above the ground. Because the sub-reflector is located in the near field of the Feed-Reflector antenna, a theory based on the near field focusing properties of paraboloid reflectors is established. The focusing at near distance is formed by moving the feed horn away

from the focal point of the Feed-Reflector. In this theory the properties of axial defocused paraboloid reflectors at near distance are investigated in some detail. By using equivalence path law, sub-reflector shape is obtained. It is found that the hyperbola can approximate the sub-reflector well. A detailed ray tracing analysis is performed on the entire system which reveals that some part of the sub-reflector receive three rays per point from the feed. The performance of the system over the operating band (1-22 GHz) is also studied and shown that the lower frequency limit is dependent on sub-reflector and Feed-Reflector sizes. To obtain higher efficiencies, three sets of shaping techniques, based on the genetic algorithm and Jacobi Fourier surface expansion, are performed. An efficiency of 78.5% for a 5 m sub-reflector is obtained. In another method of analysis, the Feed-Reflector aperture field distribution is expanded into a set of Gaussian-Laguerre modes. These modes propagate from the Feed-Reflector aperture in a simple and well defined way. The Feed-Reflector near field radiation pattern is calculated at the sub-reflector location. The sub-reflector parameters in this system are found by maximizing the Large Adaptive Reflector (LAR) aperture efficiency which includes phase and taper efficiencies, and minimizing the LAR spillover loss. An exact equation for the offset LAR surface is obtained in this thesis. To scan the beam up to 60, which is one of the LAR.

This book presents the principal structure of space systems, functionality, media and applications for modern remote sensing, transmission systems, meteorological

antennas, propagation meteorological observation and transferring weather data from satellite to the ground infrastructures and users. The book starts with a short background to the development of Radio and Space systems including overview, concepts and applications of satellite communications in function of transfer meteorological observation data and images. It goes on to discuss the fundamental principles of the space platforms and orbital parameters, lows of satellite motions, new types of launching systems, satellite orbits and geometric relations, spacecraft configuration, payload structure, type of onboard antenna systems, satellite orbits and components of satellite bus. The author also provides comprehensive coverage of baseband and transmission systems, fundamentals of atmospheric electromagnetic radiation, satellite meteorological parameters and instruments, and research and applications in antenna systems and propagation. This is a companion book of Global Satellite Meteorological Observation Applications (Springer).

Reflector antennas are widely used in communication satellite systems because they provide high gain at low cost. Offset-fed single paraboloids and dual reflector offset Cassegrain and Gregorian antennas with multiple focal region feeds provide a simple, blockage-free means of forming multiple, shaped, and isolated beams with low sidelobes. Such antennas are applicable to communications satellite frequency reuse systems and earth stations requiring access to several satellites. While the single offset paraboloid has been the most extensively used configuration for the satellite multiple-

beam antenna, the trend toward large apertures requiring minimum scanned beam degradation over the field of view 18 degrees for full earth coverage from geostationary orbit may lead to impractically long focal length and large feed arrays. Dual reflector antennas offer packaging advantages and more degrees of design freedom to improve beam scanning and cross-polarization properties. The Cassegrain and Gregorian antennas are the most commonly used dual reflector antennas. A computer program for calculating the secondary pattern and directivity of a generalized dual reflector antenna system was developed and implemented at LeRC. The theoretical foundation for this program is based on the use of physical optics methodology for describing the induced currents on the sub-reflector and main reflector. The resulting induced currents on the main reflector are integrated to obtain the antenna far-zone electric fields. The computer program is verified with other physical optics programs and with measured antenna patterns. The comparison shows good agreement in far-field sidelobe reproduction and directivity. Acosta, Roberto J. and Lagin, Alan R. Glenn Research Center RTOP 679-40-00...

This book presents the fundamental background theory and analytical techniques of antenna design. It deals with a very wide range of antenna types, operating from very low frequencies to millimetre waves.

The Paraboloidal Reflector Antenna in Radio Astronomy and CommunicationTheory and PracticeSpringer Science & Business Media

Radiation patterns for narrow-beam reflector antennas operating near focus have been analyzed using standard aperture integration techniques. For the highly-defocused case, these techniques are more restricted and generally more difficult to apply. For this case, it is shown that ray-theory provides a good means of predicting radiation characteristics. Three methods for determining far-field amplitude and phase characteristics are presented. The first is the standard aperture integration method; the second employs ray-theory principles; and the third uses a ray-theory simplification, namely paraxial theory. An attempt is made to determine the amount of defocusing required in order that ray-theory rechniques are applicable. The paraboloidal reflector and Cassegrain are the antenna types discussed. The methods presented, however, can be applied to any circularlysymmetric reflector antenna. (Author).

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