# Modern Lens Antennas for Communications Engineering

John Thornton • Kao-Cheng Huang

IEEE
IEEE PRESS

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**IEEE Press**
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Piscataway, NJ 08854

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Cover Design: John Wiley & Sons, Inc.
Cover Illustration: © simon2579/iStockphoto.



Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.



***Library of Congress Cataloging-in-Publication Data is available.***

ISBN: 978-1-118-01065-5

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

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# PREFACE

The aim of this book is to present the modern design principles and analyses of lens antennas. It gives graduates and RF/microwave professionals the design insights in order to make full use of lens antennas. The reader might ask: Why is such a book considered necessary and timely? The reply we would bring to such an inquiry is that the topic has not been thoroughly publicized recently and so its importance has become somewhat underestimated. Furthermore, the work has brought about an opportunity to gather together the authors' contributions to several areas of research where lens antennas have been promoted. Foremost among these are communications applications, where of course antennas play a key role and where we will show why certain advantages accrue from the particular characteristics of lens antennas.

The major advantages of lens antennas are narrow beamwidth, high gain, low sidelobes and low noise temperature. Their structures can be more compact and weigh less than horn antennas and parabolic reflector antennas. Lens antennas, with their quasi-optical characteristics, also have low loss, particularly at near millimeter and submillimeter wavelengths where they have particular advantages. Beam shaping can be achieved by controlling the phase distribution across the lens aperture in a manner that can be more accurate and less costly than would be the case for a reflector. Such a shaped dielectric lens can be more economical to produce in small- to medium-scale production runs than other antenna types where certain niche applications are considered. In addition, spherical lens antennas have the benefit of no scan loss and wide bandwidth, with the option for multiple beams from a common aperture.

*Modern Lens Antennas for Communications Engineering* serves as an excellent tool for RF/microwave professionals (engineers, designers, and developers) and industries with microwave and millimeter wave research projects. For university students, this book requires a prerequisite course on antennas and electromagnetic waves, which covers propagation, reflection, and transmission of waves, waveguides, transmission lines, and some other antenna fundamental concepts. Such a course is usually followed by design projects. This book can be used as further study material in such design projects. Advanced students and researchers working in the field of modern communications will also find this book of interest. Included is a bibliography of current research literature and patents in this area.

Based on these credentials, this book systematically conducts advanced and up-to-date treatment of lens antennas. It does not purport to present a far-reaching treatise on every aspect of lens antennas, but rather, following the introductory chapters, the