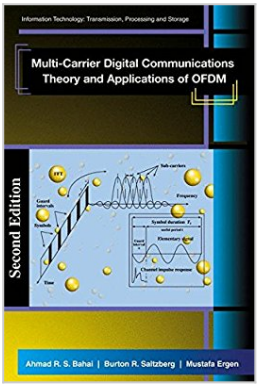

Multi-Carrier Digital Communications: Theory and Applications of OFDM (Information Technology: Transmission, Processing and Storage)

By Ahmad R.S. Bahai, Burton R. Saltzberg, Mustafa Ergen

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ulti-carrier modulation, Orthogonal Frequency Division Multi- Mplexing (OFDM) particularly, has been successfully applied to a wide variety of digital communications applications over the past several years. Although OFDM has been chosen as the physical layer standard for a diversity of important systems, the theory, algorithms, and implementation techniques remain subjects of current interest. This is clear from the high volume of papers appearing in technical journals and conferences. Multi-carrier modulation continues to evolve rapidly. It is hoped that this book will remain a valuable summary of the technology, p- viding an understanding of new advances as well as the present core technology. The Intended Audience This book is intended to be a concise summary of the present state of the art of the theory and practice of OFDM technology. The authors believe that the time is ripe for such a treatment. Particularly based on one of the author's long experience in development of wireless systems (AB), and the other's in wireline systems (BS), we have - tempted to present a unified presentation of OFDM performance and xviii implementation over a wide variety of channels. It is hoped that this will prove valuable both to developers of such systems and to researchers and graduate students involved in analysis of digital communications.

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Editorial Review

From the Publisher
Multi-Carrier Digital Communications is essential both to developers of communications systems and to researchers and graduate students involved in analysis of digital communications, and will remain a valuable summary of the technology, providing an understanding of new advances as well as present core technology.

From the Inside Flap
Multi-carrier modulation, Orthogonal Frequency Division Multiplexing (OFDM) particularly, has been successfully applied to a wide variety of digital communications applications over the past several years. Although OFDM has been chosen as the physical layer standard for a diversity of important systems, the theory, algorithms, and implementation techniques remain subjects of current interest. This is clear from the high volume of papers appearing in technical journals and conferences. Multi-carrier modulation continues to evolve rapidly. It is hoped that this book will remain a valuable summary of the technology, providing an understanding of new advances as well as the present core technology.

The Intended Audience

This book is intended to be a concise summary of the present state of the art of the theory and practice of OFDM technology. The authors believe that the time is ripe for such a treatment. Particularly based on one of the author’s long experience in development of wireless systems (AB), and the other’s in wireline systems (BS), we have at-tempted to present a unified presentation of OFDM performance and implementation over a wide variety of channels. It is hoped that this will prove valuable both to developers of such systems and to researchers and graduate students involved in analysis of digital communications. In the interest of brevity, we have minimized treatment of more general communication issues. There exist many excellent texts on communication theory and technology. Only brief summaries of top-ics not specific to multi-carrier modulation are presented in this book where essential. As a background, we presume that the reader has a clear knowledge of basic fundamentals of digital communications.

Highlights of the Second Edition

During the past few years since the publication of the first edition of this text, the technology and application of OFDM has continued their rapid pace of advancement. As a result, it became clear to us that a new edition of the text would be highly desirable. The new edition provides an opportunity to make those corrections and clarifications whose need became apparent from continued discussions with many readers. However, the main purpose is to introduce new topics that have come to the forefront during the past few years, and to amplify the treatment of other subject matter. Because of the particularly rapid development of wireless systems employing OFDM, we have introduced a section early in the text on wireless channel fundamentals. We have extended and modified our analysis of the effects of clipping, including simulation results that have been reported in a recent publication. These new results are re-stated here. A section on channel estimation has been added to the chapter on equalization. The chapter on local area networks has been greatly expanded to include the latest technology and applications. Two totally new chapters are added, on OFDM multiple access technology, ultra wideband technology, and WiMAX.

Organization of This Book

We begin with a historical overview of multi-carrier communications, wherein its advantages for transmission over highly dispersive chan-nels have long been recognized, particularly before the development of equalization techniques. We then focus on the bandwidth efficient technology of OFDM, in particular the digital signal processing tech-niques that have made the modulation format practical. Several chap-ters describe and analyze the sub-systems of an OFDM implementa-tion, such as clipping, synchronization, channel estimation, equaliza-tion, and coding. Analysis of performance over channels with various impairments is presented. The book continues with descriptions of three very important and diverse applications of OFDM that have been standardized and are now being deployed. ADSL provides access to digital services at sev-eral Mb/s over the ordinary wire-pair connection between customers and the local telephone company central office. Digital Broadcasting enables the radio reception of high quality digitized sound and video. A unique configuration that is enabled by OFDM is the simultaneous transmission of identical signals by geographically dispersed transmitters. And, the new development of wireless LANs for multi-Mb/s communications is presented in detail. Each of these successful applications required the development of new fundamental technology. Finally, the book concludes with describing the OFDM based multiple access techniques and ultra wideband technology.

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