

Preface

The demand for multimedia wireless communications is growing today at an explosive pace. One common feature of many current wireless standards for high-rate multimedia transmission is the adoption of a multicarrier air interface based on either orthogonal frequency-division multiplexing (OFDM) or orthogonal frequency-division multiple-access (OFDMA). The latest examples of this trend are represented by the IEEE 802.11 and IEEE 802.16 families of standards for wireless local area networks (WLANs) and wireless metropolitan area networks (WMANs). Although the basic principle of OFDM/OFDMA is well established among researchers and communication engineers, its practical implementation is far from being trivial as it requires rather sophisticated signal processing techniques in order to fully achieve the attainable system performance.

This book is intended to provide an accessible introduction to OFDM-based systems from a signal processing perspective. The first part provides a concise treatment of some fundamental concepts related to wireless communications and multicarrier systems, whereas the second part offers a comprehensive survey of recent developments on a variety of critical design issues including synchronization techniques, channel estimation methods, adaptive resource allocation and practical schemes for reducing the peak-to-average power ratio of the transmitted waveform. The selection and treatment of topics makes this book quite different from other texts in digital communication engineering. In most books devoted to multicarrier transmissions the issue of resource assignment is not discussed at all while synchronization and channel estimation are only superficially addressed. This may give the reader the erroneous impression that these tasks are rather trivial and the system can always operate close to the limiting case of ideal synchronization and channel estimation. However, as discussed

in this book, special design attentions are required for successfully accomplishing these tasks. In many cases, the trade-off between performance and system complexity has to be carefully taken into consideration in the practical implementation of multicarrier systems.

Most of the presented material originates from several projects and research activities conducted by the authors in the field of multicarrier transmissions. In order to keep the book concise, we do not cover advanced topics in multiple-input multiple-output (MIMO) OFDM systems as well as latest results in the field of resource assignment based on game theory. Also, we do not include a description of current wireless standards employing OFDM or OFDMA which are available in many other texts and journal papers.

The book is written for graduate students, design engineers in telecommunications industry as well as researchers in academia. Readers are assumed to be familiar with the basic concepts of digital communication theory and to have a working knowledge of Fourier transforms, stochastic processes and estimation theory. Whenever possible, we have attempted to keep the presentation as simple as possible without sacrificing accuracy. We hope that the book will contribute to a better understanding of most critical issues encountered in the design of a multicarrier communication system and may motivate further investigation in this exciting research area.

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