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Additional Information

BOOK REVIEW

Title: **Modulation and coding techniques in wireless communications**

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A timely book on wireless communications, with twelve chapters and more than 650 pages that covers theoretical results and material of standards. The first nine chapters, with an extension of 380 pages, are devoted to basic concepts on channel models, modulation and coding, equalization, MIMO techniques and multiple access methods. The last three chapters extend up to 274 pages and cover the modern wireless communication standards.

The first chapter of the book is devoted to explain typical communication channel models: the AWGN channel and fading channels (frequency-nonselective and frequency-selective channels).

In chapter 2, the classical modulation techniques are described fluently. The fundamentals are inspired in classical texts such as Sklar's or Proakis's, but with a more modern and dynamic focusing, we guess. OFDM modulation is explained in detail emphasizing the importance in many today's digital communication systems (WiMAX, WLAN, LTE, …). The description of the need of cyclic prefix and the problems that arise with ISI, ICI and PAPR are well detailed in the chapter. Perhaps a reference to the inventors of the FFT algorithm would have been included. Nice figures illustrate the chapter. (In page 70, first paragraph, line 12, the restriction of the FFT size may be / can be relaxed)

Chapter 3 and 4 are devoted to channel coding. In chapter 3, a good introduction to finite fields and vector space is provided. General concepts on linear and cyclic codes are presented and focusing in BCH and RS coding/decoding procedures. Newer techniques such as Reed-Solomon list decoding techniques are included. Besides, basic concepts about LDPC codes are introduced. Convolutional and turbo coding and decoding are introduced in chapter 4, with details to be used in subsequent chapters. Sequential decoding and Viterbi algorithm are pretty well explained. Also, a very nice introduction to parallel-concatenated convolutional codes is offered, together with a clear description of SISO and SOVA decoding algorithms. A set of well drawn figures illustrate both chapters. (There are typos in pages 118 and 119: in the legends of Figures 3.16 and 3.17, "McEliece at all I/II" is written and "McEliece et al. I/II" should be written.)

Chapter 5 is dedicated to the important function of channel equalization. Standard solutions such as zero forcing, minimum mean-square error, decision feedback-equalizer and a set of solution within the umbrella of sequence estimation equalization together with the rake receiver and turbo equalization are very well described and compared with a useful discussion about their pros and cons. The trade of between performance and complexity is highlighted.

It is a good decision to include a chapter devoted to ARQ in a book where error control coding techniques are described. Basic and hybrid techniques are also explained. A very good writing is observed in Chapter 6 together with excellent illustrations.

In Chapter 7 the author briefly presents a general view on coded modulation. Trellis code modulation scheme are described with precision. Very interesting is the section about performance of some TCM schemes. Nice illustration complements the chapter.

Chapter 8 is dedicated to MIMO systems. These systems are well explained with interesting details about space-time codes, the design of orthogonal codes, space-time trellis codes and spatial multiplexing techniques as BLAST

Chapter 9. Nice chapter on multiple access techniques. FDMA, TDMA and CDMA are well discussed together with other promising techniques such as Random OFDMA, multicarrier CDMA and DHA-FH-CDMA. When writing on signal representation in the signal space, some pointer to the well known Prolate Spheroidal Wave Functions should have been included. Regarding random access methods and when considering ALOHA protocol, sentences such as "*it is to be noted that in unslotted ALOHA packet can be of arbitrary length*" should have been documented with some suitable reference. The lack of precision could have been solved with sentences like: "*the collision probability does not depend on the packet length distribution*". However, the chapter offers many merits together with the extended number of classical and timely references.

Two chapters are dedicated to standardization bodies for wireless communication systems. After a very clear introduction to the IEEE organization, chapter 10 deals with the 802.11 or WLAN Working Group and with the 802.16 or WiMAX Working Group. Sections on 802.11 becomes precise and clear; but they could be enriched providing some basic references to some methods, ideas and concepts such as, for instance to low density parity check code method and to the concept of singular value decomposition (SVD). Also, a discussion about Barker sequences versus the alternative of complementary code keying (CCK) would have been highlighted. The IEEE802.16x (x=e, m) is presented in a second and extensive part of the chapter. The IEEE802.16 family is presented within a fine structure, showing several frame structures for UL and DL, MIMO transmission schemes. The chapter is very comprehensive and very useful to help students who are interested in the understanding of WiMAX systems.

Chapter 11 deals with the standardization task in 3GPP. The chapter is very long so plenty of room to go into many details about the 3GPP and its work. The organization of the 3GPP is clearly motivated together with the role of the technical releases. A detailed and fine presentation about 3G WCDMA concept is found in a long but very useful section. Also, a long section follows for a detailed and exhaustive treatment of 3.5G HSDPA/HSUPA. This section is very valuable for the handbook-like information that contains. The chapter ends with the section about 4G LTE in which a nice description of

OFDMA and MIMO concepts is given. All the chapter is very well illustrated with frame structures and coding schemes among other clarifying pictures.

Chapter 12 is dedicated to CDMA-2000 and its evolution. It appears well structured. A good introduction on standards on CDMA precedes the description of the reverse and forward CDMA-2000 channels. The chapter offers academic illustrations of the block diagram of the logical channels. The chapter ends with a nice description of the CDMA2000 1x EV-DO (Evolution –Data Only) in the aspect of access for terminal and network.

Summing up, this is a good book for the students and professionals involved in wireless communications. On one hand, the book covers in an extensive and intensive manner, basic ideas on channel and equalization methods, modulation and coding (blocks, convolutional and turbo-codes) and ARQ schemes. On the other hand the book offers a deepness treatment on wireless communication standards, mainly from IEEE, 3GPP and 3GPP2. The effort dedicated by the authors to bridge technology with standards for sure will be very well appreciated by the readers.