Preface

The Wireless Communication Network is developing at an accelerated pace enabling real-time multimedia services. The last few years have experienced a rapid growth in research on wireless networks having attractive outcomes. Researchers are currently envisioning different attractive properties of wireless networks. The expectations are increasing about what the current and future generation wireless network can do for a wide range of applications. Successful design and deployment of wireless networks, thus, call for technology advances. This book offers the basics as well as advanced research materials for wireless networks. The book highlights the current design issues, which put the reader in good pace to be able to understand more advanced research and make a contribution in this field for themselves. It is believed that the students who seek to learn the latest development in wireless technologies will need this book.

Chapter 1 provides the fundamentals of wireless networks so that the general readers can be able to easily grasp some of the ideas in this area.

Chapter 2 focuses the most recent research on secure communications where a legitimate user communicates with a legitimate receiver in the presence of an eavesdropper. Perfect secrecy is achieved when the transmitter and the legitimate receiver can communicate at some positive rate, while insuring that eavesdropper gets zero bits of information.

Chapter 3 analyzes the ISO 18000-6 Type C protocol, which is one of the major radio frequency identification (RFID) protocols for passive RFID systems to identify potential security vulnerabilities. RFID provides a low power and economical method to link remote sensors to larger control systems. Security solutions designed for the retail and transit fare management systems are not sufficient for these new control systems. New avenues of attack are available and attackers have different goals. Therefore, the security of these RFID protocols is re-examined in this chapter.

Chapter 4 presents a novel weakly synchronous and distributed coordination function, called Time-Division Unbalanced Carrier Sense Multiple Access (TD-uCSMA). TD-uCSMA relies on synchronization among nodes and the contextual switching of channel access parameters to enable resource management and Quality of Service (QoS) provisioning over CSMA/CA wireless access networks. The TD-uCSMA operating principles and issue of synchronization are discussed in details.

Chapter 5 deals with the application of network coding principle at different communications layers of the protocol stack, specifically, the Medium Access Control (MAC) and physical (PHY) Layers for wireless communication networks. Network coding (NC) is a promising technique recently proposed to improve network performance in terms of maximum throughput, minimum delivery delay, and energy consumption. Recently, it has been considered as an efficient approach to improve performance in wireless networks, mainly in terms of data reliability and lower energy consumption, especially for broadcast communications.
Chapter 6 presents Algebraic Space Time Coding (ASTC) to frequency selective channels. The authors consider the MIMO-OFDM system with Algebraic Space Time Coding (ASTC), threaded algebraic space-time (TAST) and Diagonal Algebraic Space Time (DAST) coding. The OFDM technique allows overcoming the channel selectivity. Thus, the ASTC codes can still maintain their properties and achieve good capacity under frequency selective channels.

Chapter 7 describes the recent advances in precoder design for multi-user multiple input multiple output (MU-MIMO) and introduces a new technique to improve the precoder performance. MU-MIMO is expected to adopt for future wireless networks.

Chapter 8 provides a realistic vehicular mobility model in order to have a holistic view of the network functioning. Mobility model deals with the realistic representation of vehicular movement including mobility pattern.

Chapter 9 presents Concern-Oriented Reference Model (CORM) for architecting future computer networks. CORM stands as a guiding framework from which several network architectures can be derived. CORM represents a pioneering attempt within the network realm, and to the best of the authors’ knowledge, it is the first reference model that is bio-inspired, accounts for complex system characteristics, and applies a software engineering approach to network design. Moreover, CORM’s derivation process conforms to the function-behavior-structure (FBS) engineering framework, which is credited to be applicable to most of the engineering discipline for reasoning about, and explaining the process of design.

Chapter 10 first gives a brief overview on spectrum sensing and its impact on the system throughput in a cognitive radio (CR) network. Later on, the chapter provides a detailed analysis of power allocation to achieve maximum throughput. Cognitive radio is a new technology introduced to deal with the issues of spectrum scarcity and underutilization. It has emerged as a smart solution under which licensed spectrum is made available to intelligent and reconfigurable secondary users.

Chapter 11 outlines the state-of-the-art research results, challenges and future perspectives of spectrum sensing in CR systems, and also presents a comparison of different methods. It provides a comprehensive insight of signal processing methods of spectrum sensing for cognitive radio networks and the ongoing research and development in this area.

Chapter 12 compares different spectrum sensing techniques in terms of their sensing accuracy, implementation, and computational complexities, along with merits and demerits of these approaches and proposed possible solutions.

Chapter 13 first introduces different localization methods and algorithms which are available in the body area sensor networks (BASNs) literature and later on presents their own approach for localizing person. The location estimation of a user in a BASN helps in realizing real-time monitoring of the person for better health supervision.

Chapter 14 describes wireless mesh network architecture to solve the communication needs of the traffic control system in Sydney. This system, known as SCATS and used in over 100 cities around the world — from individual traffic light controllers to regional computers and the central TMC — places stringent requirements on the reliability and latency of the data exchanges.

It is hoped that this book serves as a comprehensive reference for graduate students and that it will be a useful learning tool for research in this exciting field.

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