Preface

Cognitive Radio (CR) is emerging as the dominant solution for the scarce spectrum in the near future. The cyclic recognition cycle of sensing, learning, and adaptation in the CR enables it to jump between channels according to temporal and spatial opportunities. This rapid behavior needs to be further analyzed in terms of accessibility for the information providers and tracking spectrum users. To illustrate this, CR transmission speed/reliability may face great obstacles due to the spectrum dynamic access models. Therefore, a cognitive base station may fail to transmit at irregular times. This will urge the CR network management entities to look for alternative routes to maintain online services. In addition, wireless broadcasting faces a drop in the delivery of high data rate requests, as there is no guarantee for the free channel availability in secondary systems. Here, designed solutions are required to secure high bandwidth and low power consumption for promising cognitive networking features. Low attenuation loss in short range transmissions, such as metropolitans (which are the ambitious environments for the future CR networks), enhance the emergence of smaller transmission domains such as cognitive femtocell networks. Different challenges are expected for such applications, starting from developed communication layers to improved corresponding technologies. Therefore, a fully steered “service delivery” network, which will revolutionize the traditional way of communications exchange, will soon be a reality.

This book is an advanced research work on cognitive networks that combines the network architectural design with the necessary technical modifications to deliver high quality services. It provides a state-of-the-art guide to cognitive networks and raises many discussions and solutions for the ongoing research challenges. The book covers all of the important aspects of cognitive networks, including chapters on concepts and fundamentals for beginners, advanced topics, and research-oriented chapters.

For the industry practitioner, this book is an instruction manual for immediate solutions that incorporate new concepts and techniques in this emerging area. There are a wide range of topics in this book that provide the readers with a clear vision of what they need to consider, while developing the technology and putting forward the challenges of standardizing and interfacing users. There are new approaches that employ practical solutions for realistic challenges and market demands that will be a source for designing/implementing cognitive radio systems and networks. The contributions of this book to the industry were certified by our editorial advisory board, which contains many specialists and experts from world-known mobile operators.

For academic researchers, there has been huge interest in cognitive radio communications in the last few years. Although there are now a considerable number of publications in this field, there are still many open research problems remaining to be explored. This edited book presents the work of many internationally leading teams and experts with the latest solutions and algorithms. The book explores a wide range of challenges for cognitive radio networks, such as architecture, modeling, and coexistence.
This is not just a publication in the field of academia, but it is a step toward a fully applicable systematic modeling of what the cognitive network will be and what it needs for final deployment. This makes this book an interesting textbook for the courses offered by universities in cognitive radio networks and 4G wireless systems engineering.

The chapters in this book are arranged in an order that gradually builds upon the knowledge and information gained from previous chapters. However, we also put together similar topics and working aspects to provide the different solutions of certain layers together. This sequential management of chapters enables new learners in this field to build up their knowledge step-by-step, either in formal classrooms or via self-learning. The book is also an important source of knowledge for communication planning engineers seeking to develop their competence in new technologies, as it provides a vision of what the next generation networks may look like in the near future.

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