Hindawi Publishing Corporation
EURASIP Journal on Wireless Communications and Networking
Volume 2010, Article ID 687649, 2 pages
doi:10.1155/2010/687649

Editorial

Interference Management in Wireless Communication Systems: Theory and Applications

Yan Xin,[1] Xiaodong Wang,[2] Geert Leus,[3] Guosen Yue,[1] and Jinhua Jiang[4]

[1] *NEC Laboratories America, Princeton, NJ 08540, USA*
[2] *Department of Electrical Engineering, Columbia University, New York, NY 10027, USA*
[3] *Faculty of Electrical Engineering, Mathematics, and Computer Science, Delft University of Technology, Mekelweg 4, 2628 CD Delft, The Netherlands*
[4] *Department of Electrical Engineering, Stanford University, Stanford, CA 94305, USA*

Correspondence should be addressed to Yan Xin, yanxin@nec-labs.com

Received 31 December 2010; Accepted 31 December 2010

Interference is a fundamental nature of wireless communication systems, in which multiple transmissions often take place simultaneously over a common communication medium. In recent years, there has been a rapidly growing interest in developing reliable and spectrally efficient wireless communication systems. One primary challenge in such a development is how to deal with the interference, which may substantially limit the reliability and the throughput of a wireless communication system. In most existing wireless communication systems, interference is dealt with by coordinating users to orthogonalize their transmissions in time or frequency or by increasing the transmission power and treating each other's interference as noise. Over the past twenty years, a number of sophisticated receiver designs, for example, multiuser detection, have been proposed for interference suppression under various settings. Recently, the paradigm has shifted to focus on how to intelligently exploit the knowledge and/or the structure of interference to achieve improved reliability and throughput of wireless communication systems. The focus of this special issue is to present state-of-the-art research contributions and practical implementations that effectively manage interference in wireless communication systems.

Our call for papers attracted 43 submissions worldwide. After a rigorous review process, we bring together 11 papers that best fit the theme of this special issue. These 11 papers cover a broad spectrum of research topics including resource allocation, relay systems, interference channels, base station cooperation, and multiple-input multiple-output (MIMO) systems.

The first paper entitled *"Joint utility-based power control and receive beamforming in decentralized wireless networks,"* by A. Feistel et al., studies the problem of joint power control and receive beamforming to maximize a network utility function. The paper proposes a convergent alternating optimization algorithm that is applicable to decentralized wireless networks. In the case where there exist noisy measurements and estimations, the authors analyze the proposed algorithm in the context of stochastic approximation theory and study the convergence property of the proposed algorithm via simulations.

The second paper by J.-M. Kelif et al., *"A fluid model for performance analysis in cellular networks,"* uses a fluid model to study the performance of cellular network. Based on this model, the authors derive analytical formulas for interference, outage probability, and spatial outage probability. It is shown by simulations that the obtained analytical formulas match well with Monte Carlo simulation results even in the traditional hexagonal network.

The next paper *"Coordinated transmission of interference mitigation and power allocation in two-user two-hop MIMO relay systems,"* by H.-N. Cho et al., considers coordinated transmission for cochannel interference (CCI) mitigation and power allocation in correlated two-user two-hop MIMO relay systems. The authors propose a transmission scheme that utilizes statistical channel state information (CSI) to minimize the CCI caused by the relay. It is shown that when certain conditions are satisfied, the proposed scheme is able to achieve a sum rate similar to that of the minimum mean-square error-based coordinated beamforming that relies on instantaneous CSI.

As the title suggests, the fourth paper "*Resource allocation with EGOS constraint in multicell OFDMA communication systems: combating intercell interference,*" by H. Li, studies resource allocation in a multicell orthogonal frequency division multiple access (OFDMA) system using the fairness constraint of equal grade of service (EGOS). The paper considers the situation where there is no explicit cooperation across different cells and each user's resource (power and bandwidth) is stationarily allocated with the awareness of intercell interference. The paper derives a resource allocation scheme for finite systems using a heuristic rise over thermal (ROT) constraint. In addition, the author employs the large system analysis and variational analysis to obtain the optimal power and bandwidth profiles for the case where there exist sufficiently many users in each cell.

In the fifth paper "*Blind separation of two users based on user delays and optimal pulse-shape design,*" by X. Liu et al., considers the problem of multiuser detection in wireless networks. Combing blind user separation with successive interference cancellation, the authors develop a blind multiuser separation scheme that relies on intentional user delays and optimal pulse-shape waveform design. It is shown that the proposed approach achieves low symbol error rate (SER) at a reasonable signal-to-noise ratio level.

The next paper "*Pricing in noncooperative interference channels for improved energy efficiency,*" by Z. Chong et al., considers noncooperative energy-efficient resource allocation in the interference channel. The authors use linear pricing to the utility of the systems and consider the setting from a noncooperative game-theoretic perspective. Based on the assumption that there exists an arbitrator choosing the power prices, the authors consider the problem of minimizing the sum transmit power with the constraint of satisfying minimum utility requirements and minimum rate requirements, respectively. The authors derive analytical solutions for the optimal power prices that solve these problems.

The seventh paper "*Impact of base station cooperation on cell planning,*" by I. D. Garcia et al., studies impacts of base station cooperation (BSC) on cell planning. The authors analyze the impact of the different cooperating base station cluster types and site-to-site distances on the spectral efficiency, the area and shape of the cooperation regions, the coverage, and the capacity of the BSC network. The paper shows that BSC maximizes its gains over noncooperation (NC) in a network wherein interference from cooperating BSs is the main limitation.

The eighth paper "*Probability of error of linearly modulated signals with Gaussian cochannel interference in maximally correlated Rayleigh fading channels,*" by L. Rugini and P. Banelli, presents the SER analysis of linearly modulated signals in the presence of Gaussian CCI and Rayleigh fading channels. The authors compare the proposed theoretical analysis with numerical and statistical approaches. It is shown that the proposed theoretical method achieves a better accuracy as compared with numerical and statistical methods and is able to accurately predict the SER performance in many different scenarios

The ninth paper by E. Cano et al., "*On the evaluation of MB-OFDM UWB interference effects on a WiMAX receiver,*" presents a novel approach for analyzing the ultra wideband (UWB) interference effects on the worldwide interoperability for microwave access (WiMAX) downlink. The authors derive analytical bit error rate expressions for both uncoded and coded WiMAX systems that are impaired by a single multiband-OFDM (MB-OFDM) UWB interference signal, in a Rayleigh fading environment.

The next paper by T. B. Tokel and D. Aktas, "*A low-complexity transmission and scheduling scheme for WiMAX systems with base station cooperation,*" considers BSC as an interference management technique for WiMAX downlink transmissions with a frequency reuse factor of one. The authors propose a low-complexity cooperative transmission and scheduling scheme that requires limited feedback from the users and limited information exchange between the base stations. The paper compares the proposed scheme with noncooperative schemes with similar complexity via Monte Carlo simulations. It is shown that BSC provides an attractive solution for mitigating the CCI and increases the system spectral efficiency compared to traditional cellular architectures based on frequency reuse.

The last paper by M. Monti et al., "*Coexistence mechanism for colocated HDR/LDR WPANs air interfaces,*" addresses the issues of interference management among low-data-rate (LDR) and high-data-rate (HDR) wireless personal area network (WPAN) air interfaces that are located in close proximity and eventually on the same multimode device. The paper considers IEEE 802.15.4 and ECMA-368 standards. The authors propose a collaborative coexistence mechanism called alternating wireless activity (AWA) for managing the simultaneous operation in close proximity of these two complementary WPANs. It is shown that the AWA mechanism achieves perfect coexistence by controlling and synchronizing the access to the network of the HDR and LDR air interfaces.

Acknowledgments

In closing, we would like to thank all the authors who have submitted their papers to this special issue. We would also like to thank all the reviewers for their time and efforts. Their careful reviews and valuable comments helped us select the papers as well as improve the quality of this special issue. Finally, we hope that the contents of this special issue will serve as good references for your research work.

Yan Xin
Xiaodong Wang
Geert Leus
Guosen Yue
Jinhua Jiang