

Wireless Communications Systems

After many years of research activity devoted to the optimisation of the physical layer of mobile radio networks, it appears that the focus is shifting in part towards system and applications level engineering and optimization, for an improved performance of wireless communications. In this field of research, new topics are currently being introduced in scientific publications. Most of them aim not only at incrementally improving current systems, but also at providing superior capacity, spectral efficiency and flexible operation to next generation wireless and mobile systems. This can be achieved, e.g., by extending the system bandwidth and pushing up the transmission rate, by coordinating radio resources across adjacent cells for reduced interference in dense re-use cellular networks, by introducing ad-hoc network components to cellular, and by introducing smart antenna technology for spatial multiplex based transmissions.

A representative set of system level related papers addressing these subjects is contained in this special issue, which has been assembled from a set of oral presentations made at the 13th European Wireless Conference, Paris, France, April 1-4, 2007. Based on the high scientific quality of the selected best papers, the Technical Program Committee of EW 2007 has invited the authors to develop extended versions of their original work. The content of the special issue is the result of this selection, after strict peer reviewing according to the rules of Annals of Telecommunications.

In the first addressed topic, by Misha Dohler et al., fundamental scaling aspects of ad-hoc networks with a very large number of nodes are investigated. Optimum network structures are derived and discussed.

In the second paper, Patrick Marsch et al. analyze cellular networks. They show how multi-cell cooperative signal processing can significantly increase system capacity.

In the third paper, Yikang Xiang et al. show why inter-cell interference in OFDMA networks is expected to be a key limiting factor of performance. They propose optimised power allocation schemes, in order to mitigate this effect.

In the fourth paper, Oriol Sallent et al. present a framework to achieve an efficient dynamic and decentralized spectrum and radio resource usage, in heterogeneous wireless networks scenarios.

In the fifth paper, Didier Leruyet et al. analyze the performance of multicast OFDM systems with single and multiple transmit antennas. They propose power allocation algorithms based on the maximization of the sum data rate, and on the maximization of the minimum user data rate criteria.

In the sixth paper, Michel Sortais et al. show why the localization of mobile devices is essential for the provisioning of location based services. They present novel approaches for the computation of the information gain that can be achieved by intersection based range-free localization.

Among all these original contributions, it appears that wireless communications systems should be able to offer, in the near future, through collaboration algorithms and cross-layer design, much higher capacity and higher user data rate than the ones known from current systems. This will be achieved concurrently with a reduced signal power level, and with an efficient interference control throughout the systems. Talking in modern research terminology, the contributions contained in this issue can be categorized as related to a topic

summarized in actual research under the headline "Cognitive Radio". Wireless systems based on cognitive radio operate like humans, employ cognition to mutually interact for the purpose of improved capacity, coexistence, higher spectral efficiency and low cost of operation.

We sincerely hope that, in this context, the readers of this special issue will find the EW 2007 papers compiled into this journal worth reading, and more importantly valuable to inject fruitful ideas in their own research work, towards the progress of radio access networks.

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