
Preface

Next-generation broadband wireless standards, e.g. IEEE 802.16e and Third Generation Partnership Project – Long Term Evolution (3GPP-LTE), use Orthogonal Frequency Division Multiple Access (OFDMA) as the preferred physical layer multiple access scheme, esp. for the downlink. Due to the limited resources available at the base station, e.g. bandwidth and power, intelligent allocation of these resources to the users is crucial for delivering the best possible quality of service (QoS) to the consumer with the least cost.

The problem of allocating time slots, subcarriers, rates, and power to the different users in an OFDMA system has been an area of active research in recent years. Previous research efforts in OFDMA resource allocation have typically focused on maximizing instantaneous performance, i.e. the allocation decisions are performed for the current time instant subject to the current resource constraints, which is unable to fully utilize the time-varying nature of the wireless channel to improve the communication performance of the system. This book focuses instead on maximizing time-averaged rates, allowing us to exploit the temporal dimension to improve performance.

Furthermore, due to the difficult combinatorial nature of the problem, many researchers in the past have focused on developing sub-optimal heuristic algorithms. This book proposes a unified algorithmic framework based on dual optimization techniques that have complexities that are linear in the number of subcarriers and users, and that achieve negligible optimality gaps in standards-based numerical simulations. Adaptive algorithms based on stochastic approximation techniques are also proposed, which are shown to achieve similar performance with even much lower complexity.

Finally, it was assumed in previous work that perfect channel state information (CSI) is available at the transmitter, which is quite unrealistic due to inevitable channel estimation errors and feedback delay. This book develops algorithms assuming that only imperfect CSI is available, such that allocation decisions are made while explicitly considering the error statistics of the CSI.



<http://www.springer.com/978-0-387-74944-0>

Resource Allocation in Multiuser Multicarrier Wireless
Systems

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2008, XVIII, 122 p., Hardcover

ISBN: 978-0-387-74944-0