

Preface

The classical approaches to cope with interference in wireless communication systems are based on the principle of interference avoidance and minimization. This is classically achieved through proper network planning as well as various orthogonal medium access techniques. While network planning is largely concerned with the geographic situation of a given network, relying on interference control through attenuation of wireless signals, medium access techniques exploit orthogonality in the signals themselves to keep different users separate. However, as the demands on modern wireless communication systems increase dramatically, interference still stands to become the limiting performance factor. Orthogonality, either induced by time, frequency, or space, cannot be achieved perfectly but can, at best, offer to mitigate interference. In addition to this imperfect interference control, it is known that orthogonal access techniques are suboptimal with respect to the fundamentally achievable rates in a network. In contrast to and beyond orthogonal access techniques, centralized and decentralized methods have been proposed to avoid and handle interference as well as approaches that resolve interference constructively. In fact, an exiting insight into the operation of networks is that it may be beneficial, in terms of an overall throughput, to actively create and manage interference. Thus, when handled properly, “mixing” of data in networks becomes a useful tool for operation rather than a nuisance, as it has been treated traditionally. The development of mobile, robust, ubiquitous, reliable, and instantaneous communication being a driving and enabling factor of an information centric economy, the understanding, mitigation, and exploitation of interference in networks must be seen as a centrally important task.

This book exemplarily introduces the fundamentals of various approaches to aim at these objectives. It summarizes and extends the collective scientific work that has been conducted under the umbrella of a priority program by the same name that has been supported by the Deutsche Forschungsgesellschaft (DFG) from 2009 to 2015. The chapters in this book are related to a wide range of challenges and topics, among which are ad hoc networks, analog computation in networks, cellular networks, cooperative communications, device-to-device communications, evidence-based

computation models, interference alignment, interference limited networks, interference management, mesh networks, multicasting in networks, multiple-relay networks, network coding, physical layer security, robust communications, satellite networks, and many more. With this book the authors provide an extensive and substantial overview of current research in a buoyant technological area for future wireless communication systems.

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