



# Opportunities in 5G Networks: A Research and Development Perspective

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**Opportunities in 5G Networks: A Research and Development Perspective** uniquely focuses on the R&D technical design of 5th-generation (5G) networks. It is written and edited by researchers and engineers who are world-renown experts in the design of 5G networks. The book consists of four sections: The first section explains what 5G is, what its real uses are, and the effects of 5G for mobile operators. It provides an overview of the evolution from 4G to 5G and discusses the services, visions, requirements, and key enabling technologies for 5G networks.

The second section covers the nuts and bolts of 5G design, including cellular network deployment policies, directional antennas for cellular networks, and vertical sectoring. It discusses the development of quality-of-service management principles at the network level in the new Third Generation Partnership Project releases and their implementation in 5G networks. It covers massive multiple-in multiple-out systems? a key enabling technology for 5G, and looks at issues associated with channel estimation and channel feedback in massive multiple-in multiple-out. It also addresses converged management of radio and optical resources.

The third section provides an overview of candidate physical layer technologies for 5G systems, nonorthogonal multiple access, and Nyquist signaling rates. The final section covers the centimeter-wave (cmWave) concept (below 30 GHz), the 5G cmWave concept for small cells, fundamental technology components such as optimized frame structure, dynamic scheduling of uplink/downlink transmission, interference suppression receivers, and rank adaptation. Finally, it examines millimeter-wave (mmWave) models along with medium access control design, 5G mmWave communications, and high-directional new medium access control mechanisms for directional mmWave wireless systems.

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### Editorial Review

About the Author

**Dr. Fei Hu** is currently a professor in the Department of Electrical and Computer Engineering at the University of Alabama, Tuscaloosa, Alabama. He earned his PhD degrees at Tongji University, Shanghai, China, in the field of signal processing in 1999 and at Clarkson University, New York, USA, in electrical and computer engineering in 2002. He has published over 200 journal/conference papers and books. Dr. Hu's research has been supported by the U.S. National Science Foundation, Cisco, Sprint, and other sources. His research expertise is primarily in the areas of security, signals, and sensors.

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