

# System Engineering for MIMO Cellular Networks

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Tutorial

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**Abstract**

In this tutorial, we apply the fundamentals of multiuser MIMO theory and wireless cellular network design to the physical and MAC-layer design of next-generation cellular packet data systems. We present a clear, systematic description of the various MIMO technology classes and techniques (including single-user, multiuser and network MIMO) for both the uplink and downlink, and we describe a framework for MIMO cellular system design in light of practical constraints including complexity, bandwidth, power, and fairness. A unified set of system simulations highlights relative performance gains of the various MIMO techniques and provides insights into how best to utilize multiple antennas in cellular networks. Because of the fundamental nature of the tutorial, the strategies described are applicable to all next-generation cellular standards including LTE, LTE-Advanced, WiMAX, and 802.16m.

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