

Preface

The explosive increase of mobile data services and the use of smart phones require the fifth generation (5G) network to support higher spectral efficiency, higher energy efficiency, and higher mobility. The currently employed modulation techniques based on the multiple-input multiple-output orthogonal frequency division multiplexing (MIMO-OFDM) paradigm unfortunately fail to satisfy this requirement. The MIMO modulation achieves high spectral efficiency for a configuration of massive antennas, but brings about unsatisfactory energy efficiency due to scalable power consumption of radio frequency (RF) chains. The OFDM modulation is prone to intercarrier interference caused by Doppler effects and suffers from high peak-to-average power ratio (PAPR). New groundbreaking modulation technologies are therefore very demanding. The recently emerging index modulation techniques provide a breakthrough to the bottleneck. Index modulation refers to a family of modulation techniques that rely on the indices of some medium to convey additional information. The medium can be either practical such as antenna, subcarrier, and frequency carrier, or virtual such as time slot, space-time matrix, and antenna activation order. Unlike conventional modulation techniques, the information carried by index modulation is embedded into the actual transmitted signal, consuming little or even no power.

This monograph includes transceiver design, system optimization, and performance analysis of index modulation techniques in space, space-time, and frequency domains. The chapters of this monograph are relatively independent with each other. The readers can go directly to the chapter(s) of interest. This monograph starts with the motivation and a brief review of index modulation techniques in Chap. 1. The receiver-side spatial modulation and virtual spatial modulation techniques are introduced, followed by the applications to cooperative communications in Chap. 2. Both transmitter-side and receiver-side differential spatial modulation systems are studied, followed by the applications to cooperative communications in Chap. 3. Basic and enhanced index modulated OFDM systems are investigated, followed by the verification of their strong capabilities in high-mobility communications in Chap. 4. Finally, this monograph highlights some open problems and discusses future research directions in Chap. 5.

This monograph is designed for researchers in the field of wireless communications.

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