RF BEAMFORMING FOR MILLIMETER WAVE MIMO-OFDM SYSTEMS

By

Yahia Ramadan Ahmed Mohamed Ramadan

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
ELECTRONICS AND COMMUNICATIONS ENGINEERING

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Title of Thesis:

RF Beamforming for Millimeter Wave MIMO-OFDM Systems.

Key Words:
RF; Beamforming; Millimeter Wave; Spatial Diversity; Outage Probability; BER; Physical Layer Security

Summary:
In this thesis, we design the RF beamformers for novel criteria. First, we propose a novel spatial diversity scheme to mitigate the human-blockage which is critical issue for mmWave communications. The proposed spatial diversity scheme distributes the energy efficiently over the L strongest paths. For partial channel knowledge at the transmitter, where the transmitter has knowledge only of the angles of departure of the propagation paths, we design the RF precoder to minimize the outage transmission probability or minimize the average bit error rate (BER). The proposed schemes outperform the conventional beamforming schemes with full spatial diversity order. Finally, we design the RF precoder for physical layer security for both full and partial channel knowledge at the transmitter. We propose algorithms that outperform the conventional secrecy schemes with different computational complexities.

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Yahia Ramadan Ahmed Mohamed Ramadan

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