

# Abstract

Wireless communication has emerged as one of the largest and fastest growing sectors of the telecommunication industry. One of the major advances in this field has been the shift from Single-Input Single-Output (SISO) paradigm to Multi-Input Multi-Output (MIMO) scheme. LTE-Advanced acquired the official designation of International Mobile Telecommunications-Advanced (IMT-Advanced), to achieve the requirements for 4G standards.

Research work concentrates on the capacity analysis of MIMO systems and Throughput optimization techniques for LTE-A Downlink Physical Layer. To demonstrate the theoretical advances in MIMO Communication, Rapid Prototyping and field trials are essential. Basic Hardware Architecture for MIMO Communication system and System Design methodology for development of MIMO Wireless Platform is presented in this work.

The MIMO Channel Estimation in LTE-A Downlink Physical Layer is carried out using Artificial Neural Network (ANN) architectures as they consist of learning ability to solve real-world problems. ANN architectures designed for MIMO Channel Estimation are analyzed by means of simulation using MATLAB based Vienna LTE-A Link Level Simulator. To further enhance the LTE-A Link Level Throughput the ANN weights are optimized using Genetic Algorithm (GA).

Fuzzy Logic (FL) Decision model is developed for switching between MIMO modes to maximize the throughput of LTE-A Downlink Physical Layer. Based on the Channel Condition Number and Receive SNR at the receiver, decision can be made to select the appropriate MIMO mode to enhance the throughput of the system. The FL decision model is capable of selecting the MIMO mode based on the channel conditions to maximize the throughput of the system. Simulations are carried out for performance analysis of proposed FL Decision model using LTE-A Link Level Simulator.

Proposed techniques are implemented on Xilinx Atlys Spartan 6 Development kit and TMS320C6713 DSK in close-loop simulation with LTE-A Link Level Simulator in order to perform the real time implementation. Comparative analysis between MATLAB Simulation, FPGA and DSP implementation results is carried out based on the throughput for LTE-A Downlink Physical Layer.