Hybrid Analog and Digital Precoding in Millimeter Wave Massive MIMO Systems with Realistic Hardware and Channel Constraints

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Abstract

Millimeter-Wave (mmWave) systems recently attracted attention as one of the key enablers for the Fifth Generation (5G) networks. The small wavelength at mmWave frequencies enables deploying massive Multiple Input Multiple Output (MIMO) antenna arrays with reasonable form factor. However, Massive MIMO mmWave systems suffer from a lot of practical limitations, specifically due to channel and hardware characteristics at such high frequencies. In this poster we propose multiple solutions to design a realistic massive MIMO cellular system that takes into account the imposed limitations and achieves considerable gains in terms of spectral efficiency.

Research Objectives

- Transmit Beamforming
  - Different Architectures (Digital, Analog Hybrid)
- Channel Estimation
  - Spatial sparsity of channel – Compressive Sensing
- Course Quantization
  - Analog to Digital Converters (ADCs) with quantization and/or over-sampling
- Antenna Array
  - Directive Antennas to compensate for severe pathloss

System & Channel Model

- Simulation Chain Architecture
  - Multi-User (MU) MIMO system with User Equipments (UEs) each equipped with antennas.
  - The transmitting Base Station (BS) is equipped with antennas & serving each UE with streams.
  - The received signal vector $y$ is given as follows (we omit the UE index $k$ for clarity):

$$y = \sum_{k=1}^{K} y_k = \sum_{k=1}^{K} H_{k} x_{k} + n$$

- Sum Capacity Comparison

Initial Results

- User Equipment (UE) Design
  - Street Canyon
  - METIS TC2 (Madrid Grid)
  - Antenna Array Structure
  - Downlink Scenarios

MHESTIA: Millimeter-Wave Multi-user Massive MIMO Hybrid Equipment for Sounding, Transmissions and hardware Implementations.

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