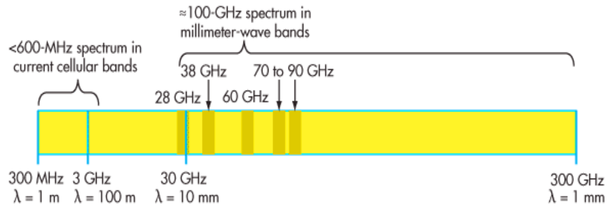
MILLIMETER WAVE DOWNLINK SYSTEM

MILLIMETER WAVE SYSTEM

The goal is to design a low complexity analog system for millimeter wave communication robust to imperfect channel state information. The system model incorporates NOMA such that it maximizes the system throughput.



The optimization objective is,

$$max \quad \sum_{k=1}^{K} R_k$$

$$s.t \sum_{k=1}^{K} \mathrm{p_k} \le P_s\,,\ |h_1|^2 \le |h_2|^2 \le \cdots\cdots\cdots\cdots \le |h_K|^2,$$

$$p_1 \ge p_2 \ge \cdots\cdots\cdots\cdots \ge p_K,$$

$$|f_{RF_i}|^2 \le 2\ ;\ i = 1,\cdots\cdots\ N_{BS}.$$

CHALLENGES

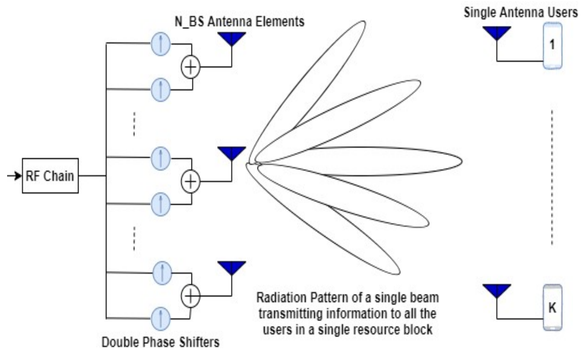
- Huge path loss
- Highly sparse channel resulting in reduced diversity.
- Need of large antenna arrays to produce beams with high SNR.
- High penetration loss and very poor diffraction.

ADVANTAGES

- Large available bandwidth.
- Ability to carry massive amounts of data with low latency.
- Drastic reduction in the size of the antenna resulting in compact antenna packaging.
- High gains of the high dimensional antennas.

TRANSCEIVER ARCHITECTURE

- The transmitter architecture is a fully analog structure with double phase shifters at each of the N_{BS} antenna elements connected to a single RF chain. This transmitter sends information to K-single antenna users.



CHANNEL MODEL

The channel model incorporating channel estimation error is

$$h = \hat{h} + \epsilon$$

where,

- $\hat{h}$ is the Saleh Valenzuela model as shown below with β being the complex gain, ϕ being the azimuth angle and $a(\phi)$ being the array steering vectors.

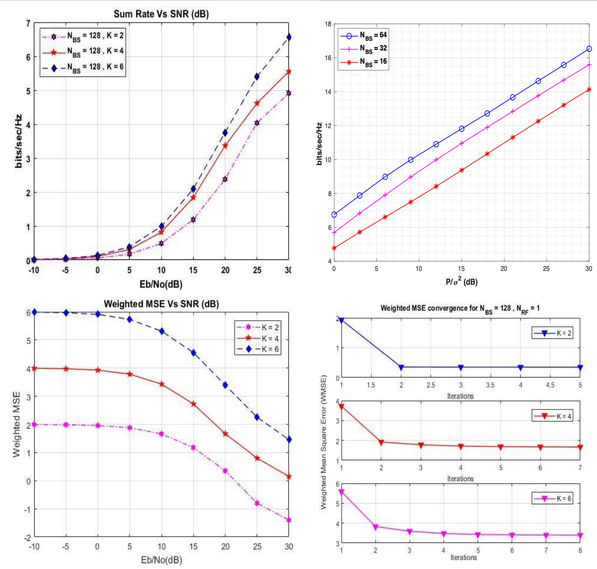
$$\hat{h} = \beta^{(0)} a\left(\phi^{(0)}\right) + \sum_{m=1}^{L} \beta^{(m)}\, a\left(\phi^{(m)}\right)$$

- ϵ is the channel estimation error that is modeled using Gaussian distribution.

OBJECTIVE

- The objective is to design a robust multiuser transmission system that has low hardware complexity.
- This is achieved using fully analog architecture and NOMA to reduce the hardware complexity and to enable multiuser transmission in the system, respectively.

RESULTS



PUBLICATIONS

- K. K. Kota and P. Ubaidulla, "Optimal Precoder Design and Power Allocation for NOMA-based mmWave Downlink," 2020 IEEE 91st Vehicular Technology Conference (VTC2020-Spring), Antwerp, Belgium, 2020.
- Deepa Jagyasi and P. Ubaidulla, "In-Band Full-Duplex Relay- Assisted Millimetre-Wave System Design", IEEE Access, Vol. 7, pp. 2291-2304, Jan. 2019.

Authors: Kali Krishna Kota, Dr. P. Ubaidulla Research Center Name: SPCRC