Conceptual 360^0 Scanning Beamformer Design for Massive MIMO System

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Recently, the demand for data-transfer rate is increasing significantly for the current fourth generation (4G) mobile systems because people want to stay connected 24/7. As a result, it is necessary to move beyond the current frequency band (3 GHz) up to millimeter wave frequencies for cellular communication. The millimeter wave frequency band, defined from 3 GHz to 100 GHz, is regarded as a candidate for the fifth generation (5G) mobile systems due to the advantages they provide in offering larger bandwidths for improved channel capacity, as well as higher data rates. However, they suffer from increased path loss. Therefore, directional massive multiple-input-multiple-output (MIMO) systems are being investigated to compensate for this higher path loss and pushing the operating frequency to the higher end of the millimeter band.

In massive MIMO systems at millimeter wave frequencies, due to the small dimension of the antenna elements, antenna arrays with more elements can be packed at the base station to enhance the spectral efficiency. So the main challenge is how to configure the massive antennas in the millimeter wave base station to realize the massive MIMO scheme.

In this paper, a conceptual design of a beamformer network to support a massive MIMO system which can scan 360 degrees in azimuth is proposed. The beamformer consists of six faces, hexagon-shaped, each of which can employ a planar array. In order to scan a complete circle, each planar array needs to be able to cover 60 degrees in azimuth. We will demonstrate a Rotman lens inspired beamformer network that will achieve these requirements.