Capacity Limits and Estimation of Massive MIMO Systems

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ABSTRACT

The use of large-scale antenna arrays can bring substantial improvements in energy and/or spectral efficiency to wireless systems due to the greatly improved spatial resolution and array gain. Recent works in the field of massive multiple input multiple-output (MIMO) show that the user channels decorrelate when the number of antennas at the base stations (BSs) increases, thus strong signal gains are achievable with little inter-user interference. Since these results rely on asymptotic, it is important to investigate whether the conventional system models are reasonable in this asymptotic regime. This paper considers a new system model that incorporates general transceiver hardware impairments at both the BSs (equipped with large antenna arrays) and the single-antenna user equipments (UEs). As opposed to the conventional case of ideal hardware, we show that hardware impairments create finite ceilings on the channel estimation accuracy and on the downlink/uplink capacity of each UE.

Keywords: Capacity bounds, channel estimation, energy efficiency, massive MIMO, pilot contamination