Energy efficiency – spectral efficiency optimization with distributed interference alignment strategies in 4G cellular networks and beyond

Jean-Marie Gorce*(1), Paul Ferrand (1), and Leonardo Cardoso(1)
(1) Université de Lyon, INRIA, INSA-Lyon, CITI-INRIA, F-69621, Villeurbanne, France,

LTE-advanced and beyond cells are required to serve an increasing capacity despite their densification and small cells deployment. Tri-sectorial BS with full-reuse (1x3x1) is usually admitted, where each sector behaves as an independent cell, to maximize the user (UE) capacity as well as to simplify the tedious planning phase. As a consequence, the whole time-frequency OFDMA frame is exploitable by each cell but edge users in turns pay the most and suffer from strong interference. The global capacity is anyhow affected when homogeneous traffic is effective (uniform rate condition).

Therefore, reducing interference for edge UE may provide a strong benefit to the cell as a whole and may contribute to improve significantly the achievable *energy efficiency-spectral efficiency* (EE-SE) achievable region. To reach this goal, we developed and extended the interference alignment principle for downlink cells proposed in 2011 (C. Suh, M. Ho and D.N. C. Tse, IEEE TCOM, 59(9) 09-2011).
Let be considered a MIMO-OFDMA precoded system divided in independent coding blocks of size $N=N_d x K$, on K independent subcarriers sparsely selected and N_d spatial dimensions. Each BS uses a sub-space precoder allowing to restrict its transmission space. Thanks to this restriction, each mobile subject to a strong interference possesses a sub-space where this interference is null. By construction, this sub-space is observable and stable.

In this talk, we analyze different scheduling strategies considering QoS priorities as well as channel gains and interference alignment constraints to multiplex a maximum number of streams while privileging interference freed directions for critical UE. We discuss different algorithms and also show a theoretical gain exploiting a modified SINR.