Systèmes MIMO pour la 5G

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Projet

Filtered multi-carrier waveforms are an attractive alternative to OFDM waveforms, much better localized in the frequency domain, more robust to asynchronisms and offering a better potential spectral efficiency than the latter. For these reasons they are promising candidates for 5G mobile networks in particular [1].

Among filtered multicarrier waveforms we may cite Filter-Bank MultiCarrier (FBMC) waveforms using either OQAM (FBMC-OQAM) or QAM (FBMC-QAM) [2] constellations, Generalized Frequency Division Multiplexing (GFDM) waveforms [3], Universal Filtered Multicarrier (UFMC) waveforms [4], Faster than Nyquist (FTN) multi-carrier waveforms [5] or Lapped OFDM [6] waveforms among others.

In recent years, filtered multi-carrier waveforms have attracted a lot of interest and many equalization and synchronization methods have been proposed for SISO systems corrupted by frequency selective propagation channels [7].

However, if multiple antennas are incorporated at both ends of the link, MIMO communications can be designed to boost the performance, in terms of reliability or bit rate, as shown in [8].

Nevertheless, for MIMO systems using filtered multi-carrier waveforms such as FBMC-OQAM, FBMC-QAM, GFDM, MC-FTN or Lapped-OFDM, Inter-Carrier Interference (ICI) is present at reception and the way to reach the full potential of MIMO schemes for non-orthogonal multi-carrier waveforms remains an open topic. This is true for both closed loop MIMO systems, which use channel state information (CSI) at transmission [9], and open loop MIMO systems, which do not use CSI at transmission. The latter systems concern MIMO schemes which implement spatial multiplexing at transmission or spatio-temporal block coding.

Some transceiver-receiver designs have been proposed these last years for open loop MIMO systems using filtered multi-carrier waveforms, for spatial multiplexing [10] and for space time block code [11]. However, these techniques have all serious drawbacks. In this context, the purpose of this thesis is to study and develop new MIMO schemes and MIMO receivers for non-orthogonal filtered multicarrier waveforms, to optimize their implementations and to analyse their performance.

A comparison of the proposed schemes with respect to multiple criteria such as performance, complexity, latency... should bring some answers about the best MIMO filtered multicarriers systems for 5G.


Enjeux

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Ouverture à l'international

We will collaborate with other research teams involved in the same field such as CTTC in Barcelona, UCL Louvain la neuve, Ilmenau university, ...

Remarques additionnelles

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