Internship proposal (6 months)

Practical design of multi-layer coding for HARQ in quasi static channels

Supervisor
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Research Topic

Achieving a very high throughput for high speed users is still challenging for the most recent wireless communication systems; this is the general context of the internship.

A common method for reaching high throughput is to exploit channel information knowledge at the transmitter, obtained by a feedback scheme. This feedback is operated with an uncompressible delay putting a speed limit under which the information is not obsolete, i.e., is relevant from the transmitter perspective. This speed limit is unfortunately below 30km/h for most wireless communication systems in the state of art. However, long term channel information feedback or limited feedback (such as 1-bit feedback) are often possible and require proper coding and retransmission strategies, such as ARQ or Hybrid-ARQ.

Without any feedback, information theoretic tools have been developed in order to maximize the throughput of the single-user broadcast channels, for example using superposition coding. Unfortunately, the transmissions schemes are often not practical, relying on infinite code length and Gaussian distributed codebooks, and most importantly high complexity receivers.

In this internship, we propose to first evaluate the state of art optimal superposition and extend the results to Hybrid-ARQ. We will then try to understand where these theoretical schemes take the highest of their benefit from and will derive realistic coding strategies being compliant with a practical implementation for future generations of wireless communications.

Objectives:
- Bibliographical study related to coding and Hybrid-ARQ, superposition coding, multi-layering, broadcast approach (see the references), and development of a simulation tool (Matlab)
- Optimization of practical coding schemes with superposition coding and the broadcast approach for Hybrid-ARQ systems
- Publication in class A journals/conferences or patent filling according to the nature of the results

Required knowledge:
- Digital communications : Error correction coding, basis in information theory
- MATLAB
- English: Written and spoken

Duration: 6 months

Dates: 2015

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Please send us your application (resume and cover letter) including the internship proposal reference.
References