Proposal: Bachelorthesis / Masterthesis

Subject: Investigation of the Options in Tomlinson-Harashima-type Precoding Strategies for the Broadcast Scenario

Background: Since the pioneer work of Telatar and Foschini in 1998 and 1999, respectively, it has been well known that the spectral efficiency in wireless communication systems can be increased significantly by using multiple transmit and receive antennas—leading to multiple-input multiple-output (MIMO) systems—in combination with appropriate signal processing at the transmitter side, receiver side, or both.

In the so-called broadcast scenario (downlink), i.e., transmission from a central base station equipped with multiple antennas to a number of scattered, non-cooperating mobile stations, the interference between the different users have to be taken into account at the central base station. Assuming that the channel is known to the base station, the simplest strategy to deal with this multiantenna interference is to invert the channel at the transmitter using a linear preequalizer. Therewith, the interference between the users can be completely removed. However, this strategy leads to the highest possible average transmit power and consequently to a significantly reduced signal-to-noise ratio (SNR).

According to the philosophy of “Costa precoding” the optimal transmitter has to adapt the transmit signal to the interference rather than attempting to cancel it. Tomlinson-Harashima precoding (THP)—initially proposed by Tomlinson and Harashima/Miyakawa for the temporal equalization of single-input single-output (SISO) inter symbol-interference (ISI) channels in 1971/1972—can be seen as the most simplest practical approximation of this philosophy. Thereby, the channel is inverted in a successive way including a modulo device to reduce the power enhancement.

Description: In this work, some optimization strategies concerning the applied modulo device for conventional SISO THP should be evaluated for the MIMO setup.

Prerequisites: lecture “Nachrichtentechnische Systeme” required; lectures “Digital Communications”, “Information Theory” and “Mehrbenutzerkommunikation und MIMO-Systeme” desirable;

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