Proposal: Master Thesis

Subject: Enhanced Joint Equalization and Decoding With High-Order Constellations

Description: A common task in digital transmission is the equalization of intersymbol interference (ISI) introduced by the transmission channel (i.e., wireless-channel). This ISI can be represented with a finite-impulse response (FIR) filter. A well-known approach to counteract the ISI problematic at the receiver is to use equalization techniques such as decision feedback equalization, zero-forcing linear equalization or maximum-likelihood sequence estimation (MLSE).

Here, a convolutional encoder is applied which introduces redundancy into the transmit signal. At the receiver-side the information sequence can be regained by a MLSE, i.e. Viterbi algorithm.

\[
\begin{align*}
u[k] & \rightarrow \text{mod } 2 \\
\text{mod } 2 & \rightarrow \text{Mapper} \\
& \rightarrow h[0] \rightarrow h[1] \rightarrow h[2] \\
& \rightarrow r[k]
\end{align*}
\]

A new approach enables an efficient receiver structure which jointly equalizes and decodes the received signal by merging the ISI-channel and the convolutional encoder. As a result, MLSE can be performed with significantly less states.

In this thesis the existing 4-ary ASK approach shall be extended to higher-order modulation schemes, such as 16QAM or 64QAM. Also bit error performance evaluations, as well as complexity vs. performance trade-off are of interest.

Prerequisites: digital transmission, Viterbi algorithm, MATLAB, C/C++ (helpful)

Supervisor: Dipl.-Ing. Fabian Schuh, schuh@LNT.de, Raum 5.26, Tel. 85-27115