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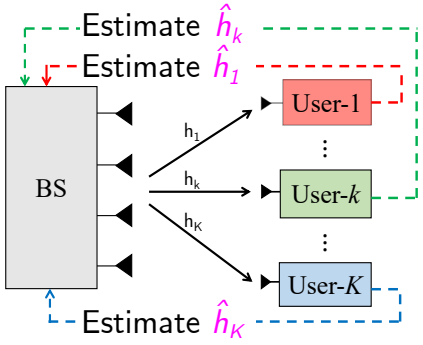
Institut für Nachrichtentechnik, Lehrstuhl für Nachrichtentechnik, Prof. Dr.-Ing. Volker Kühn

Master Thesis

Rate Splitting for a K-User Multiple-Input-Single-Output Broadcast Channel

Description:

The success of mobile communications requires the development of extremely efficient transmission strategies because a huge number of users needs to communicate over the same physical channel. This thesis shall particularly focus on the broadcast channel, i.e. the transmission from a common base station to mobile terminals. In recent years, the capacity region of broadcast channels have been accurately described and powerful transmission strategies have been developed. For single-antenna systems, superposition coding (SC) with successive interference cancellation (SIC) is the optimal transmission strategy exploiting a clear order of channel strengths from the base station to the mobile terminals. If multiple antennas are used at the base station, a strict ordering of the channel gains is generally not possible anymore. Hence, applying SC-SIC becomes suboptimal and Dirty Paper Precoding (DPC) is the optimal strategy. However, SC-SIC as well as DPC rely on perfect channel state information (CSI) and their complexity becomes very high for growing number of users.



This thesis considers a K-User Multiple-Input-Single-Output (MISO) Broadcast Channel (BC). Since channel coefficients have to be estimated, only imperfect CSIT can be assumed. Recent publications propose a new approach called Rate Splitting (RS) which finds a good balance between canceling interference and treating interference as noise. RS splits each message into a common and a private part. All common parts are packed into a single common message, which is superposed to all private messages. All mobile terminals first have to decode the common message, extract their associated piece of information and subtract

the common message from the received signal. This leads to a reduction of the interference level and the subsequent detection of the private signals is improved.

The required tasks for this thesis are:

- Familiarize with the fundamentals of broadcast channels and the idea of rate splitting by reviewing the literature
- Relate the idea to other multiple access strategies and identify similarities and differences
- Implementation of a mathematical model of the given scenario using Rate Splitting in Python
- Evaluate the performance of Rate Splitting in comparison with other transmission strategies

Chair: Prof. Dr.-Ing. Volker Kühn
Supervisor:
Dipl.-Ing. Steffen Steiner **Email:** steffen.steiner@uni-rostock.de