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RATE SPLITTING FOR MULTI-ANTENNA DOWNLINK

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Abstract

In our work, we have studied the performance of rate splitting, and proposed efficient stream selection algorithms to reduce the complexity while maintaining the rate performance of the general rate splitting scheme

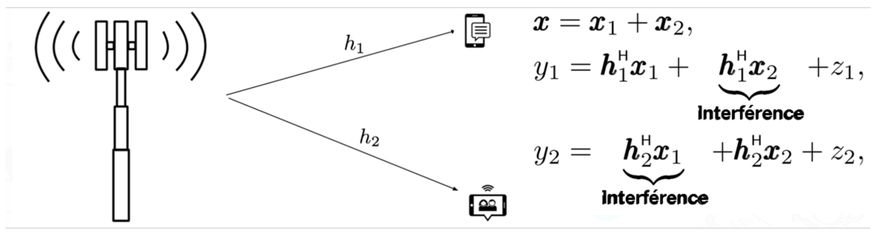
1 CONTEXT

We consider multi-antenna broadcast channel (BC) with independent private messages

	DPC	ZF/MMSE
optimality	capacity achieving	max. DoF
complexity	non-linear, "hard"	linear, "easy"

Is it possible to design a linear precoding scheme with low complexity and good performance close to the capacity?

2 BROADCAST CHANNEL



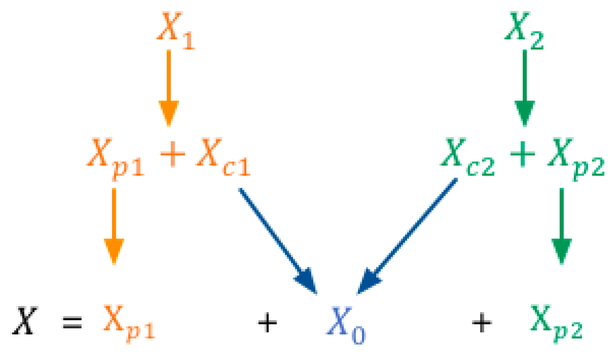
Generally, there are two ways to deal with the interference:

- Fully treat the interference as noise
- Fully decode the interference

What if we decode a part of the interference?

3 RATE SPLITTING (RS)

- Each individual message is split into private and common parts that are encoded independently
- Common parts should be decodable by both receivers
- Private parts are treated as noise by the unintended receivers

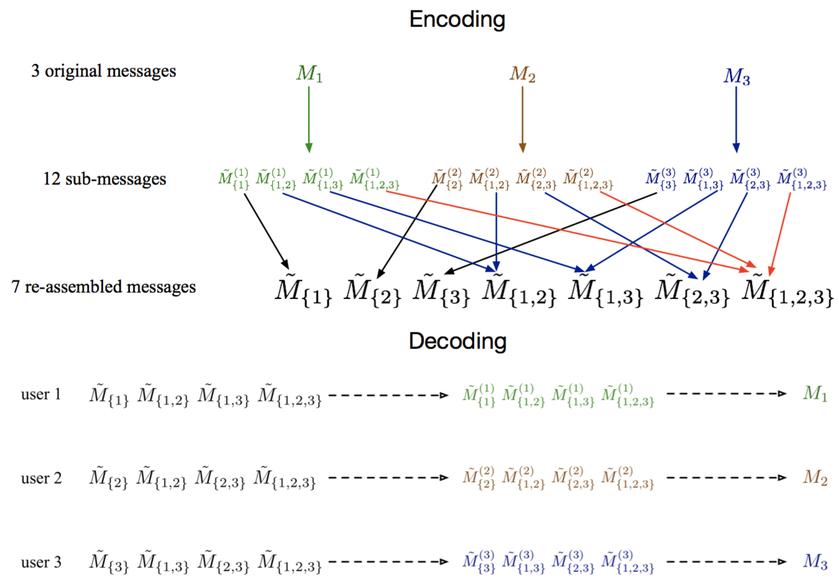


In two-user case, using RS with a simple power allocation, one can achieve the sum capacity to a constant gap for any channel realization [1]

4 PROBLEM WITH RS

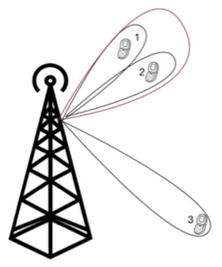
The general RS for K-user BC brings a high complexity:

- K private messages are split into $K \times 2^{K-1}$ sub-messages
- The sub-messages are re-assembled into $2^K - 1$ new messages
- Totally $2^K - 1$ signals for transmission and $2^{2^{K-1}}$ rate constraints on the signals



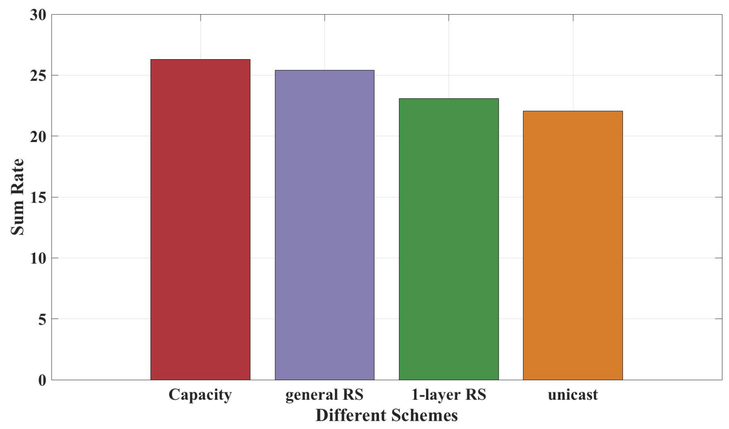
5 STREAM SELECTION ALGORITHMS

Are all the $2^K - 1$ messages useful?



if a user (user 3) is sufficiently well separated from the others (users 1 and 2) in the space domain, no common message should be shared between this user and the others. In this example, $M_{\{1,3\}}$, $M_{\{2,3\}}$, and $M_{\{1,2,3\}}$ should be eliminated.

We study stream selection algorithms to reduce the precoded signals but maintain the performance [2]



References

[1] Zheng Li, Sheng Yang, and Shlomo Shamai (Shitz). On linearly precoded rate splitting for MIMO broadcast channels. *Available on arxiv.org*.

[2] Sheng Yang and Zheng Li. A constant-gap result on the multi-antenna broadcast channels with linearly precoded rate splitting. In *2018 IEEE 19th International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, pages 1–5. IEEE, 2018.

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