SoA on CDMA multiple-access interference mitigation technology

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Table of contents

1. Screening Process

2. Introduction

3. MAI (Multiple-Access Interference)
   - Near-Far problem
   - Out-of-phase chips
   - Multipath channel distortion
   - Doppler effect

4. Problem Statements
   - Downlink
   - Uplink

Table of contents

5 Solutions
- CDMA Rake
  - PN codes
  - The Rake System
  - MAI mitigation
- Space-time coded (STC) CDMA systems
- Multiuser detectors (MUD)
- Common downlink solution
- Common uplink solution

6 Conclusions

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- Because the codes are orthogonal, it's possible to retreive the original message of each user

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- This might actually result in $(2 + 0.1 - 5) = -2.9$ at the receiver.

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- It results in $(1 + 1 + 1) = 3$.

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- This interacts with the signals and causes interferance.

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- This creates a continuously changing phase shift.
- As the phase keeps changing, it seems as if the signal is "spinning" to the receiver.

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- There is no orthogonalization issues.
- Usually extremely easy to make work flawlessly.

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- Users have different locations, velocities and different amplitude transmitters.
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- Data is completely incoherent and impossible to decode by the central station.
- Core limitation of CDMA, where MAI comes into play very destructively.

Solutions

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- The PN code is uniformly random in such a way that the average is 0, as each bit is encoded between 1 or -1.

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$$C_i = (C_{i \cdot n}, C_{i \cdot n+1}, \ldots, C_{(i+1) \cdot n-1})$$

and a 0 data bit will be encoded to $-C_i$. The next data bit sent, will already be encoded into C_{i+1}, and so on and so forth.

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- Finally the combiner takes each "echo" and does their weighted sum.

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- Diminishes the doppler effect as it tracks out of phase and lower amplitude replicas.

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- We can also decode messages when other antennas are obstructed

Space-time coded (STC) CDMA systems

example

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$t = 0$	c_0	c_1
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Table 1: Individual antenna transmission at time t with 2 antennas.

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- The reason for the negation is to make the sending space orthogonal.
- If each user has a multi-antenna system, STC CDMA neutralizes the near-far problem.

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- The algorithm is extremely inefficient ($O(2^k)$, when k is the number of users transmitting simultaneously.

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- They mitigate problems that come with having quasi-orthogonal codes (PN codes).

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- STC can also be used as long as the station has multiple antennas, in order for users to receive higher fidelity data.

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- Power Control to further mitigate the near-far problem.

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- The multipath channel distortion is almost completely mitigated by the Rake System, turning the "echoes" into further gain.
- For downlink transmission there is essentially no transmission issues, using welsh codes to generate orthogonal chip vectors.

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