Performance Evaluation of Single Carrier/Frequency Domain Equalization and Carrier Interferometry/OFDM

COE Technical Presentation
September 22, 2006

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BACKGROUND: OFDM vs Single Carrier

- Both methods carry the same amount of data
- But in case of an accident, only ¼ data of the OFDM trucking will suffer
- Although both do the same thing, they respond differently to the interference

Problem

- As OFDM uses many carriers, causes the high Power to Average Power Ratio (PAPR)
- Many researches has been done on the PAPR reduction technique (eg; CI/OFDM, SLM, dll)
- Finally there is an idea that Single carrier is simpler

PAPR Definition

\[
PAPR = \frac{\max_{t \in [0, T_s]} |s(t)|}{E_{\text{ave}} \left[ \frac{1}{N} \sum_{n=0}^{N-1} |F(n)|^2 \right]}
\]

\(0 < t < T_s\) is symbol period
\(E\) is the averages of \(|s(t)|^2\)
\(N\) is the number of samples

CI/OFDM and Single Carrier

Is CI/OFDM is Single Carrier?
Research Objectives
- Investigate the bit error rate (BER) performance and computational complexity of SC/FDE and CI/OFDM

SC/FDE
- SC-FDE is an alternative equalization approach, which eliminates PAPR problem
- SC-FDE approach delivers performance similar to OFDM.
- Single carrier uses a single carrier so the PAPR is smaller.

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Signal Mapping
- CP: CP Insertion
- Channel
- CP: CP Insertion
- Detection
- CP: CP Insertion

Carrier Interferometry
- Improve performance through full frequency diversity
- Besides that, eliminates the problem of high Peak-to-Average ratio introduced by OFDM

Concept of CI/OFDM
- Additional phase offset is applied to the sub carriers and each bit is transmitted across all the sub carriers

CI/OFDM Continue
- Bit 1 on all carriers
- Bit 2 on all carriers
- Bit k on all carriers

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\[ s_k(t) = \frac{1}{\sqrt{N}} \sum_{i=0}^{N-1} a_i \cos(2\pi f_i t + \Delta \theta_k) \]
BER Performance of OFDM and SC-FDE

CI/OFDM is outperform OFDM by about 15dB.

Overview of PAPR performance of CI/OFDM and OFDM

The concept of SC/FDE and CI/OFDM is presented
SC/FDE and CI/OFDM both reduce some of the disadvantages of the OFDM signals, especially the high PAPR

REFERENCES