

A New Fourier Spreading for Achieving Low PAPR, High Throughput and High Performance OFDM System

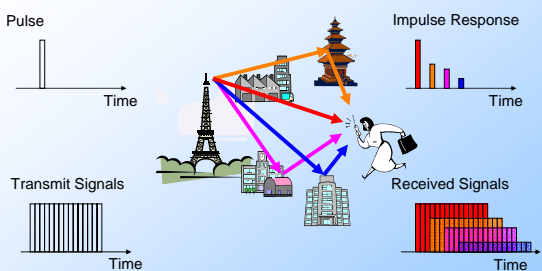
Khoirul Anwar
 Communications Laboratory
 6th COE Technical Presentation
 September 29, 2005

Presentation Outline

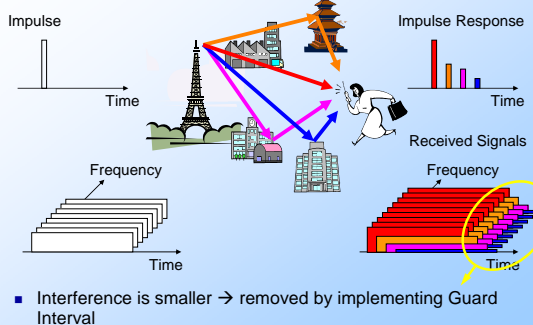
- Background
- OFDM System
- Peak-to-Average Power Ratio (PAPR) Problem
- Fourier Spreading
- Proposed New Fourier Spreading
- Numerical Results
- Conclusions
- Future Works

ISI Problem

- ISI: Inter-Symbols Interference

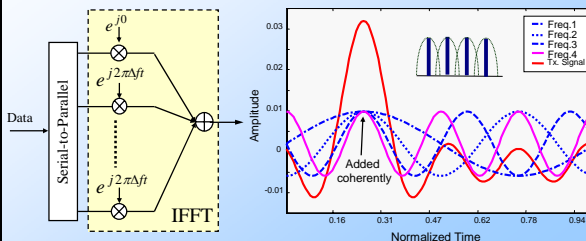


Solution by OFDM

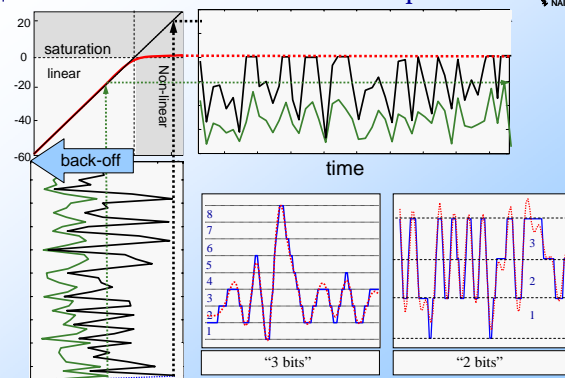


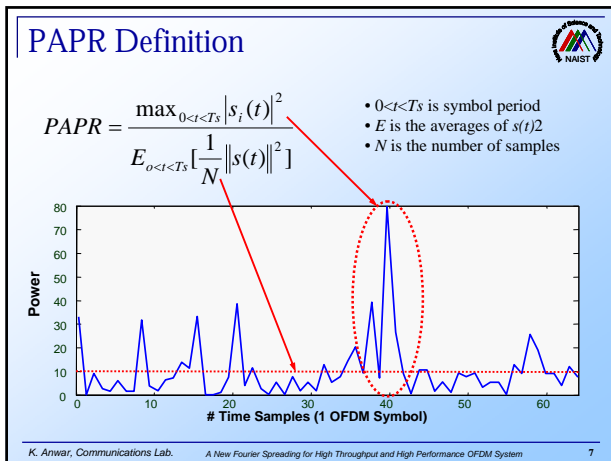
OFDM System and High Peak Problem

- OFDM : technology for high-data rate applications and robust to against frequency selective fading effects.
- OFDM is a candidate of 4G System's core technology [IEEE PIMRC and MC-SS2005, Germany].
- One **disadvantage** of OFDM is its **high PAPR**.



Effect of Nonlinear Power Amp.





Objectives of this Research

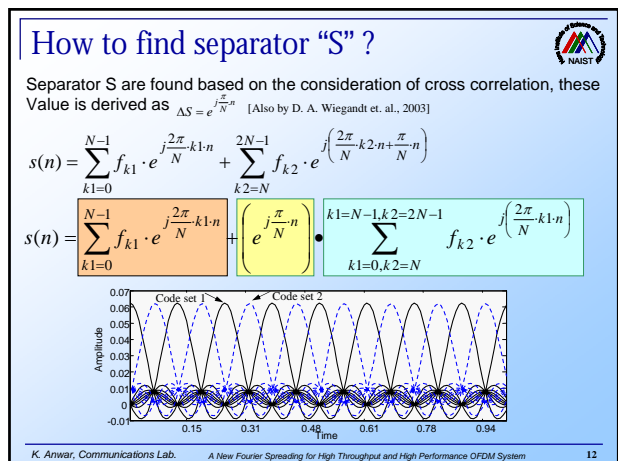
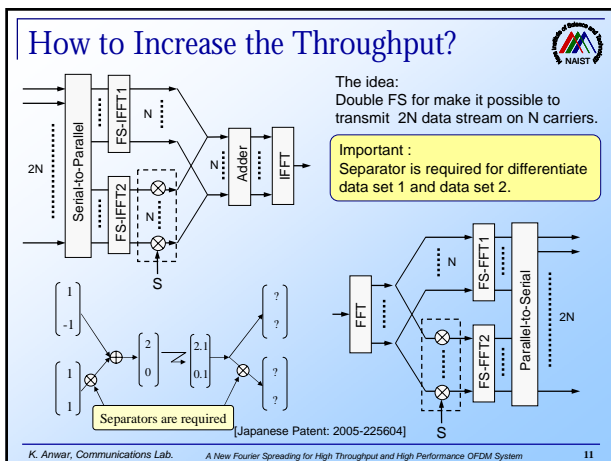
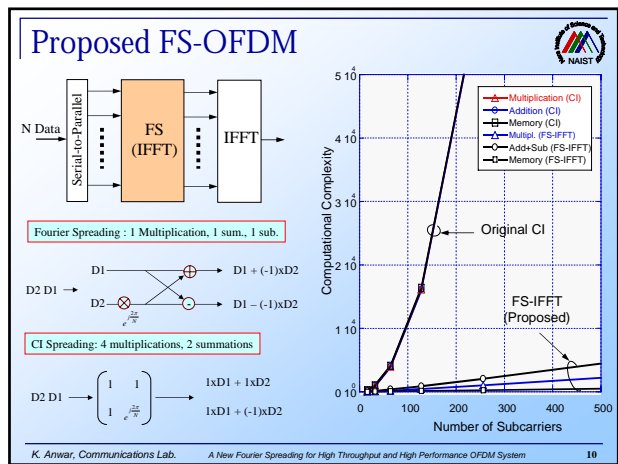
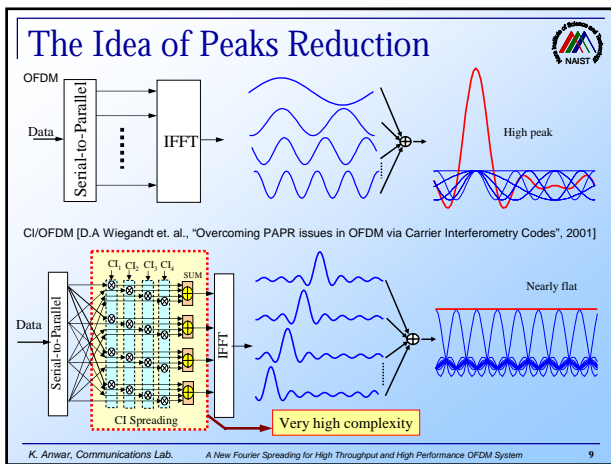
- Reducing the Peak Power of OFDM System
 - Reduce ADC/DAC Complexities
 - Reduce Effect of Non-linear Amplifier
- Increase the Throughput of OFDM System
 - For supporting higher bit-rate
- Improve the Bit-Error-Rate (BER) Performance in Frequency Selective Fading Channels

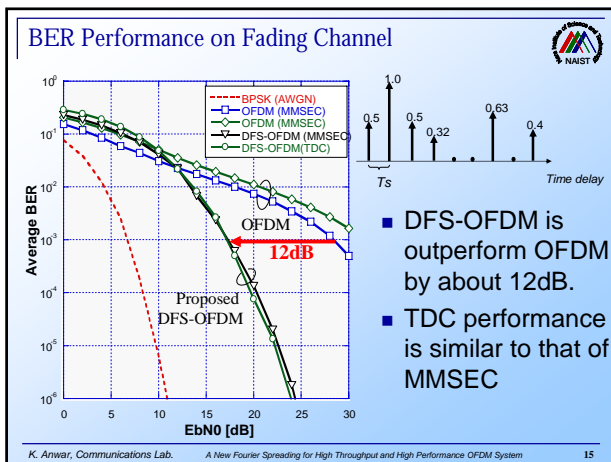
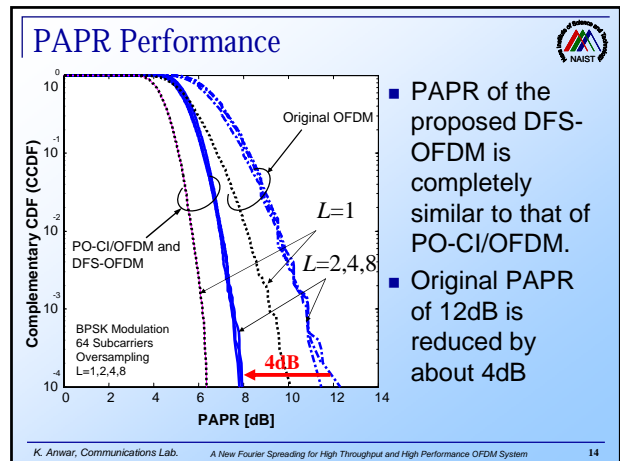
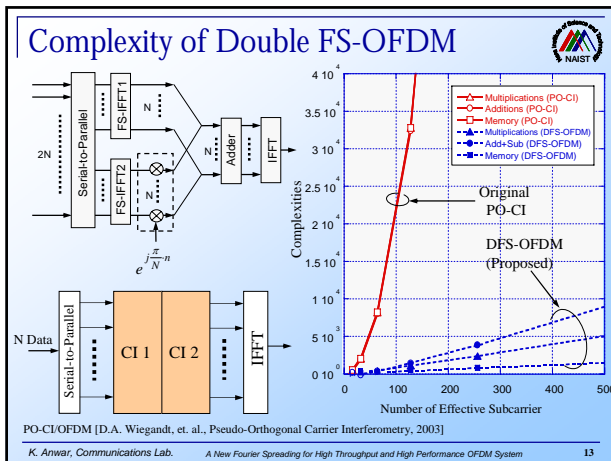
DAC: Digital-to-Analog Converter
ADC: Analog-to-Digital Converter

↓

Propose Fourier Spreading(s) for OFDM System (called FS-OFDM)

K. Anwar, Communications Lab. A New Fourier Spreading for High Throughput and High Performance OFDM System 8





Conclusions

- A New Fourier Spreading (FS) for OFDM has been proposed.
- Benefits :
 - PAPR is reduced up to 8dB from the Original 12dB.
 - High throughput (bit rate) is possible to be doubled by employing Double Fourier Spreading (DFS).
 - BER performance is 6dB better than that of Traditional OFDM in Frequency Selective fading channels.
 - With Fourier Spreading (FS and DFS), computational complexity is very low when compared to CI/OFDM and PO-CI/OFDM (saving cost more than 90% (for $N>64$)).

K. Anwar, Communications Lab. A New Fourier Spreading for High Throughput and High Performance OFDM System 16


 Thank you very much
 for your kindly attention !

Some parts of this paper has been presented in :

1. IEEE APWCS 2005, Hokkaido, Japan
2. IEEE MC-SS 2005, Oberpfaffenhofen, Germany
3. Japanese Patent No. 2005-225604