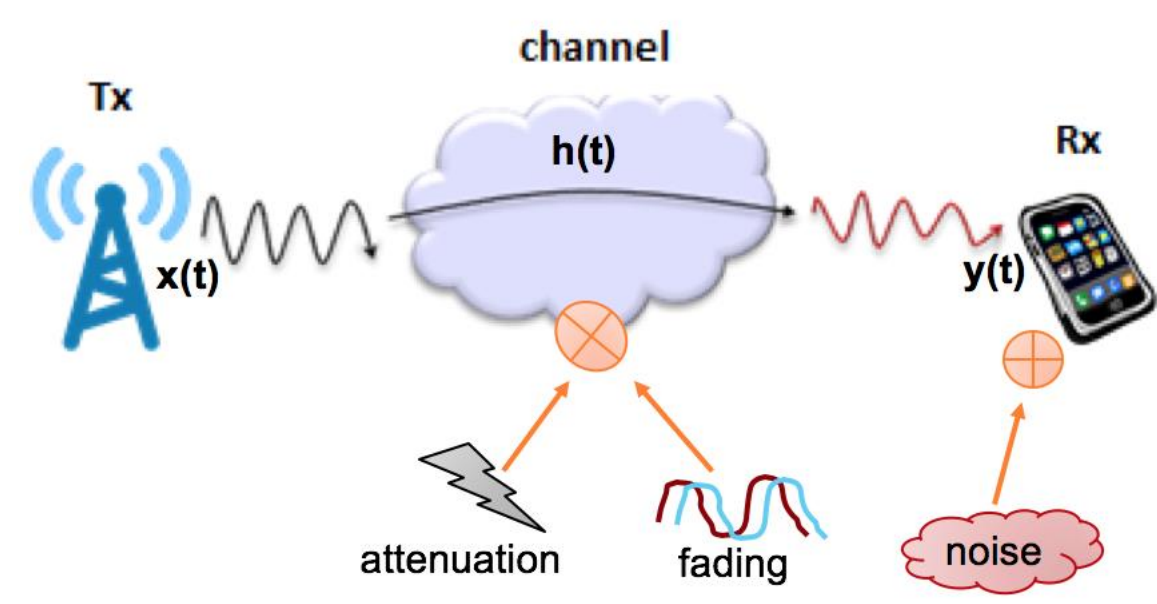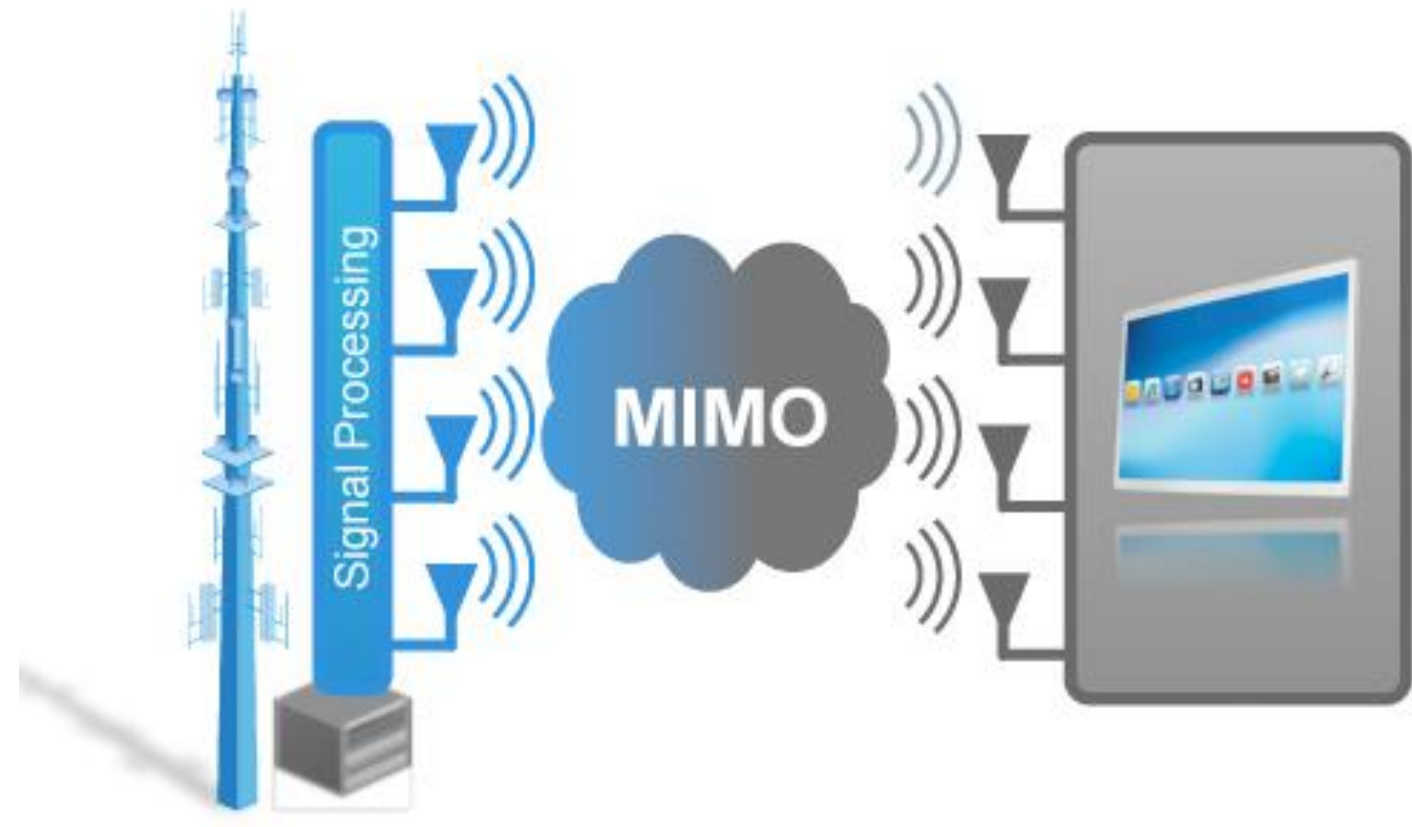# Compressed Sensing based Channel Estimation Algorithm for MIMO-OFDM System

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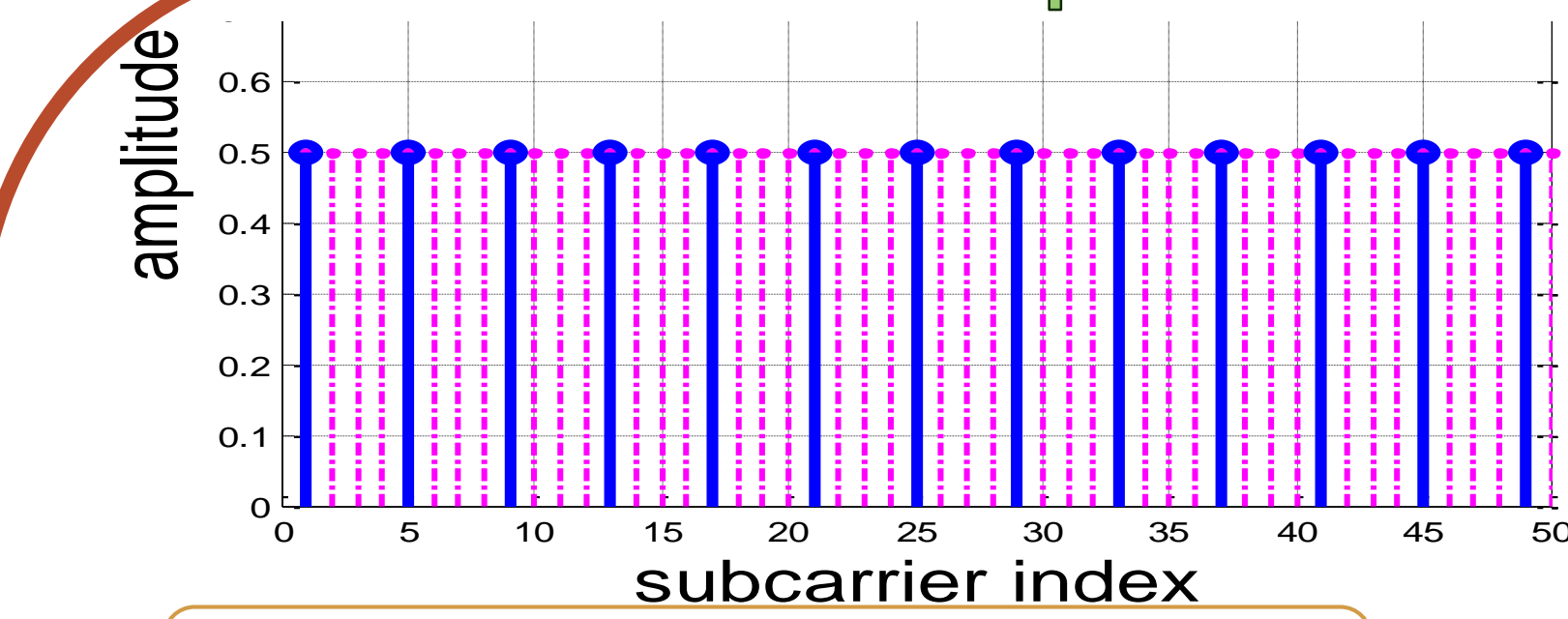
Introduction

Channel Estimation in MIMO-OFDM

A multiple-input multiple-output (MIMO) communication system combined with the orthogonal frequency division multiplexing (OFDM) modulation technique can help in mitigating the effects of multipath fading and achieve reliable high data rate transmission over broadband wireless channels.
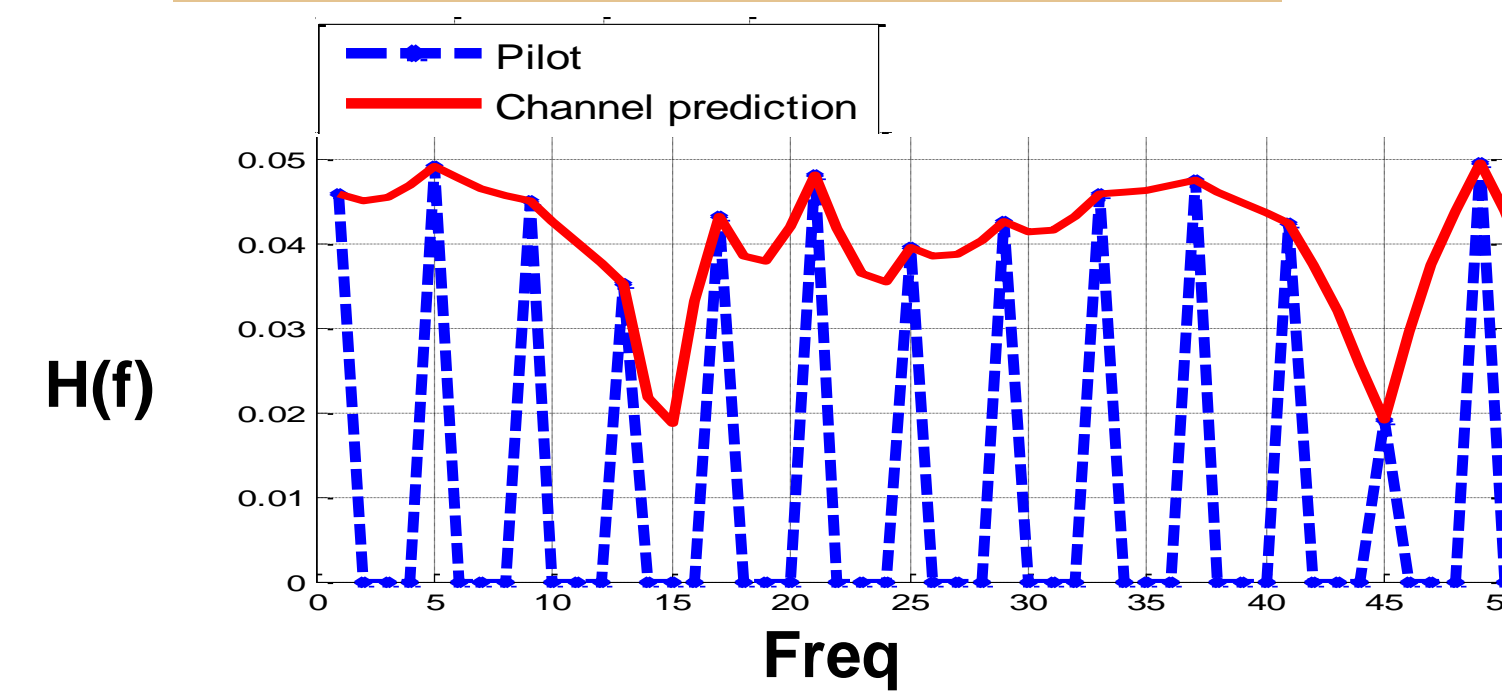
For MIMO-OFDM system, the channel estimation has an important role in determining the quality of the data transmission from transmitter to receiver.

Compressed Sensing

$$CSI \text{ at pilots} = \frac{Received\ value\ pilots}{Known\ value\ pilots}$$

Interpolation Method

❖ Advantage :
  ➢ Low complexity

❖ Problem :
  ➢ Performance impacted by noise power
  ➢ Needs larger number of pilots to achieve good performance.
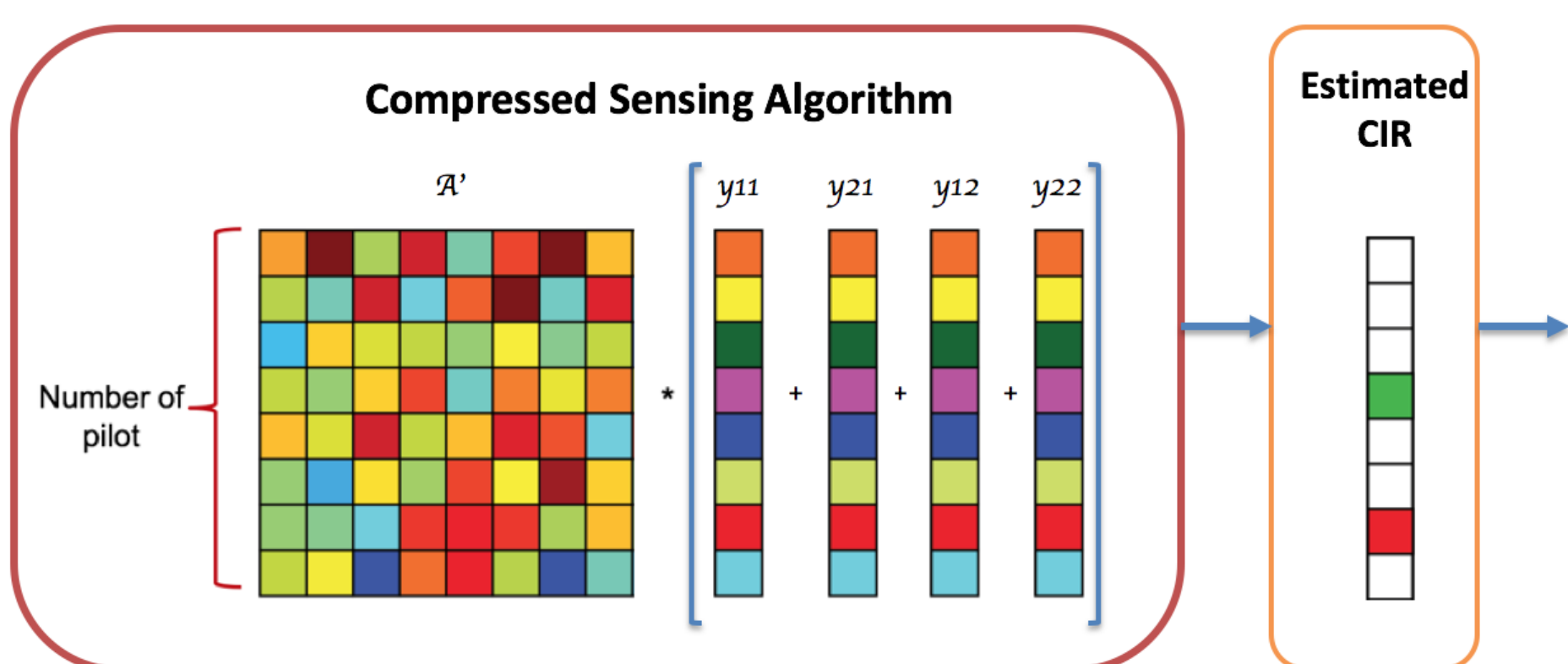
Solution

COMPRESSED SENSING

y = known received vector
Φ = measurement matrix ($M < N$)
x = unknown sparse vector and most value are zero.
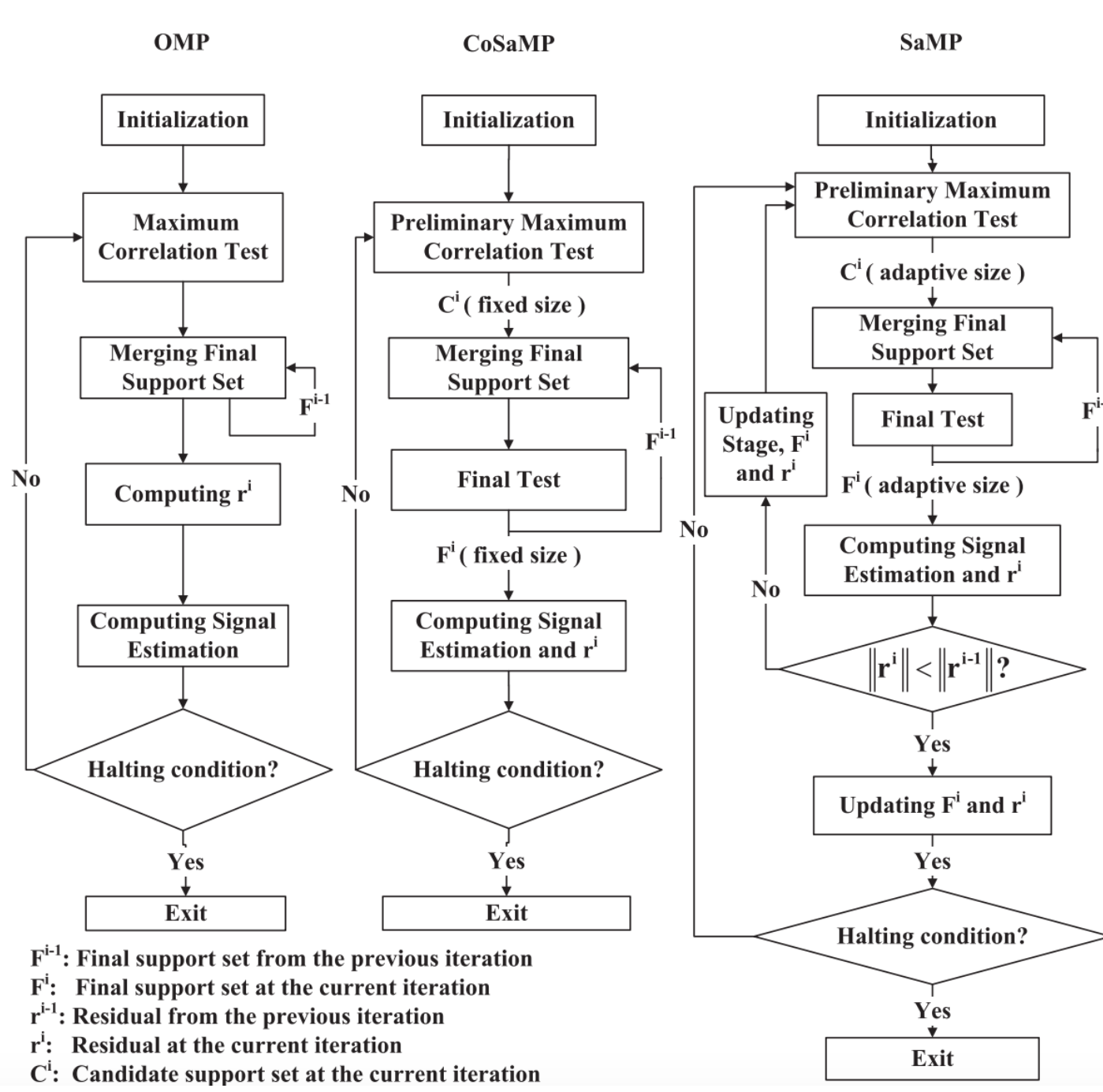
Why Compressed Sensing?

❖ Compressed sensing design to estimate the sparse of **x**

❖ Advantage :
  ➢ Can achieve higher correctness of channel status using small number of pilots.
  ➢ Easier to measure because CIR visible in time domain.

❖ Requirement:
  ➢ The measurement matrix should have small correlation to achieve low complexity.
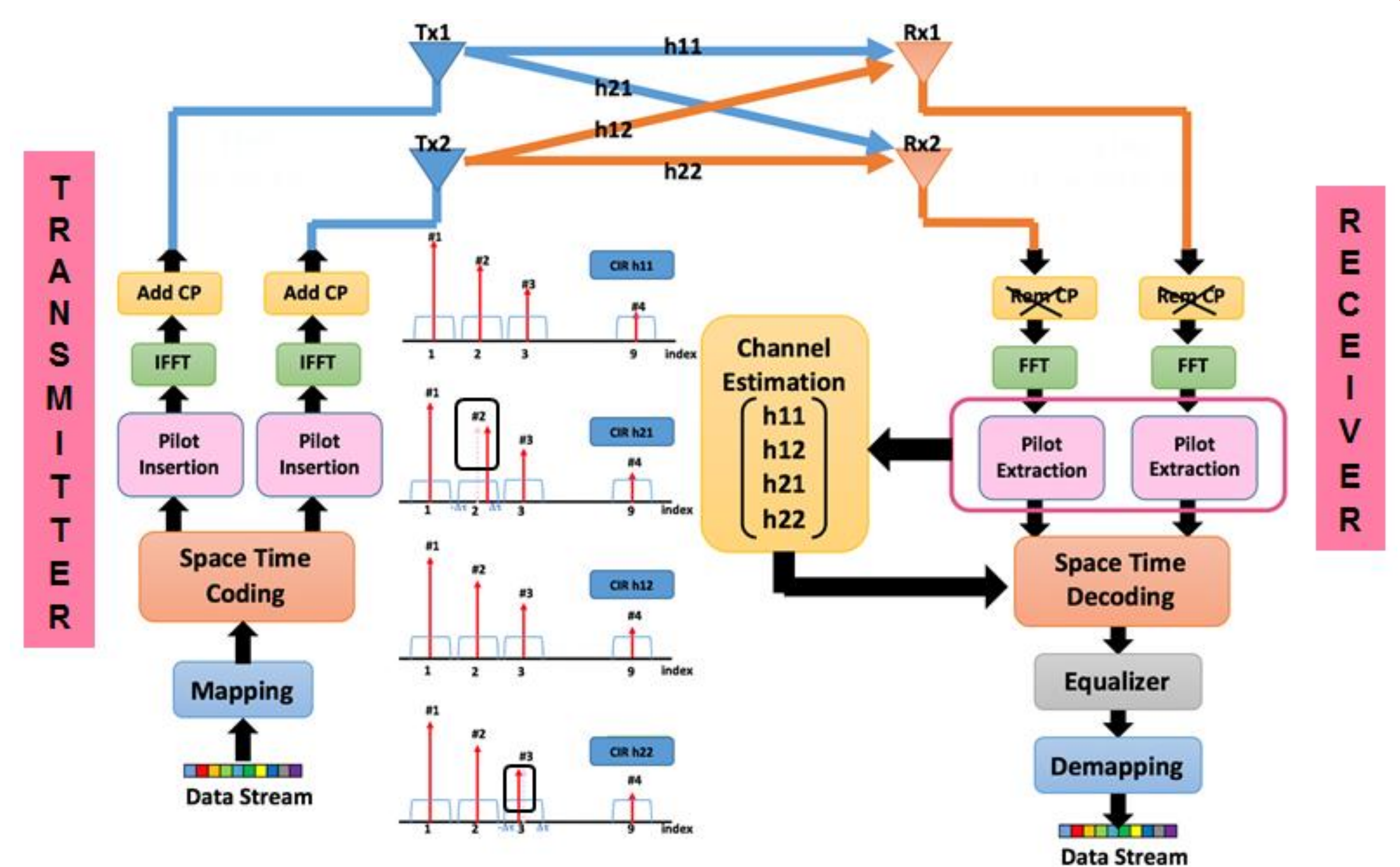
Proposed CS Algorithm

➢ Large number of pilots cause large size measurement matrix high complexity.
➢ **The proposed method is to reduce the complexity of compressed sensing based channel estimation but achieve good BER performance by randomly selecting small number of pilots**
➢ Existing algorithm for CS problem are OMP, SaMP, CoSaMP, etc.
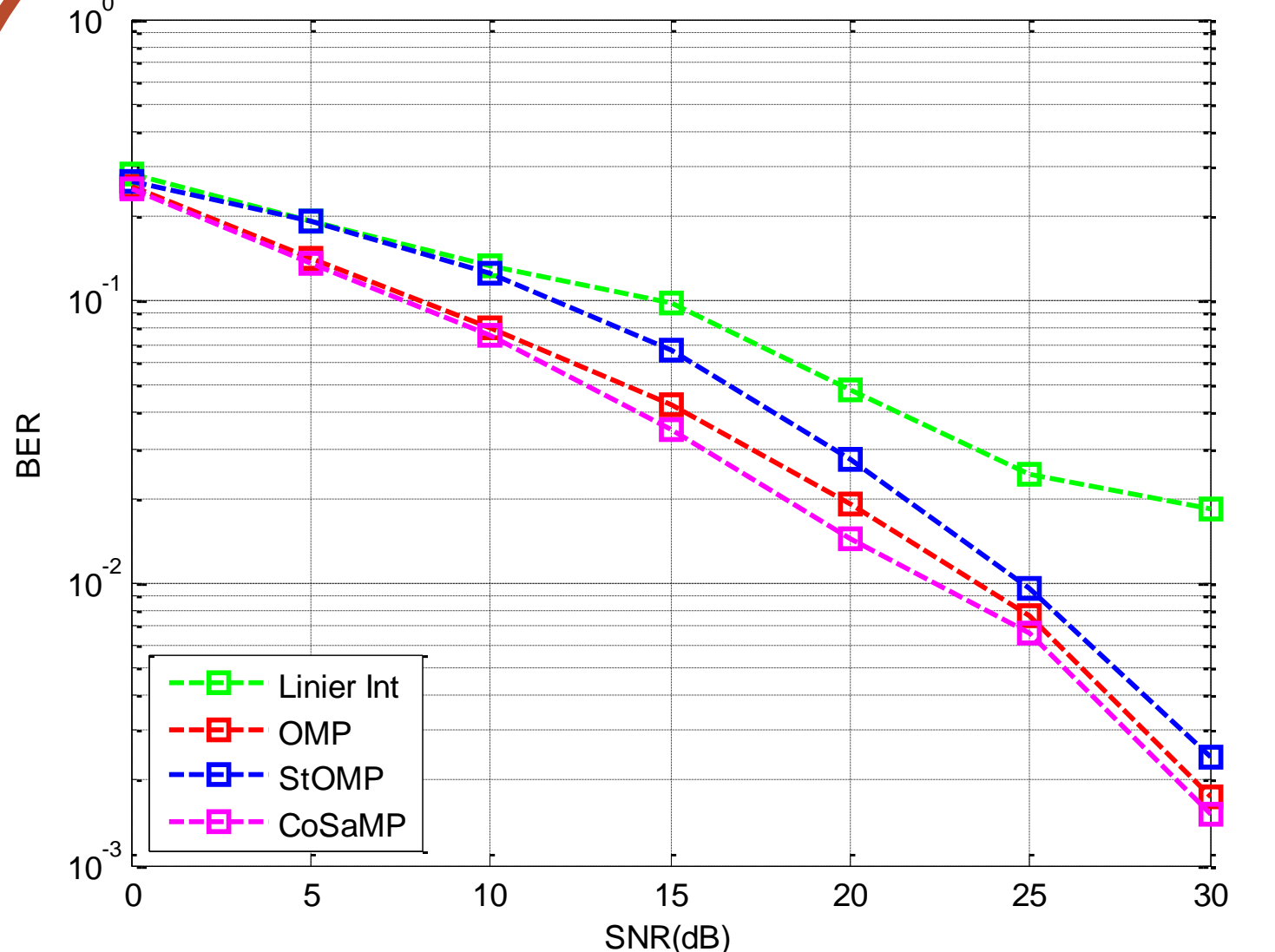
Yi Zhang, Ramachandran Venkatesan, Octavia A. Dobre, and Cheng Li. "Novel Compressed Sensing-Based Channel Estimation Algorithm and Near-Optimal Pilot Placement Scheme". IEEE Transactions on Wireless Communication, Vol. 15, No. 4. April, 2016.
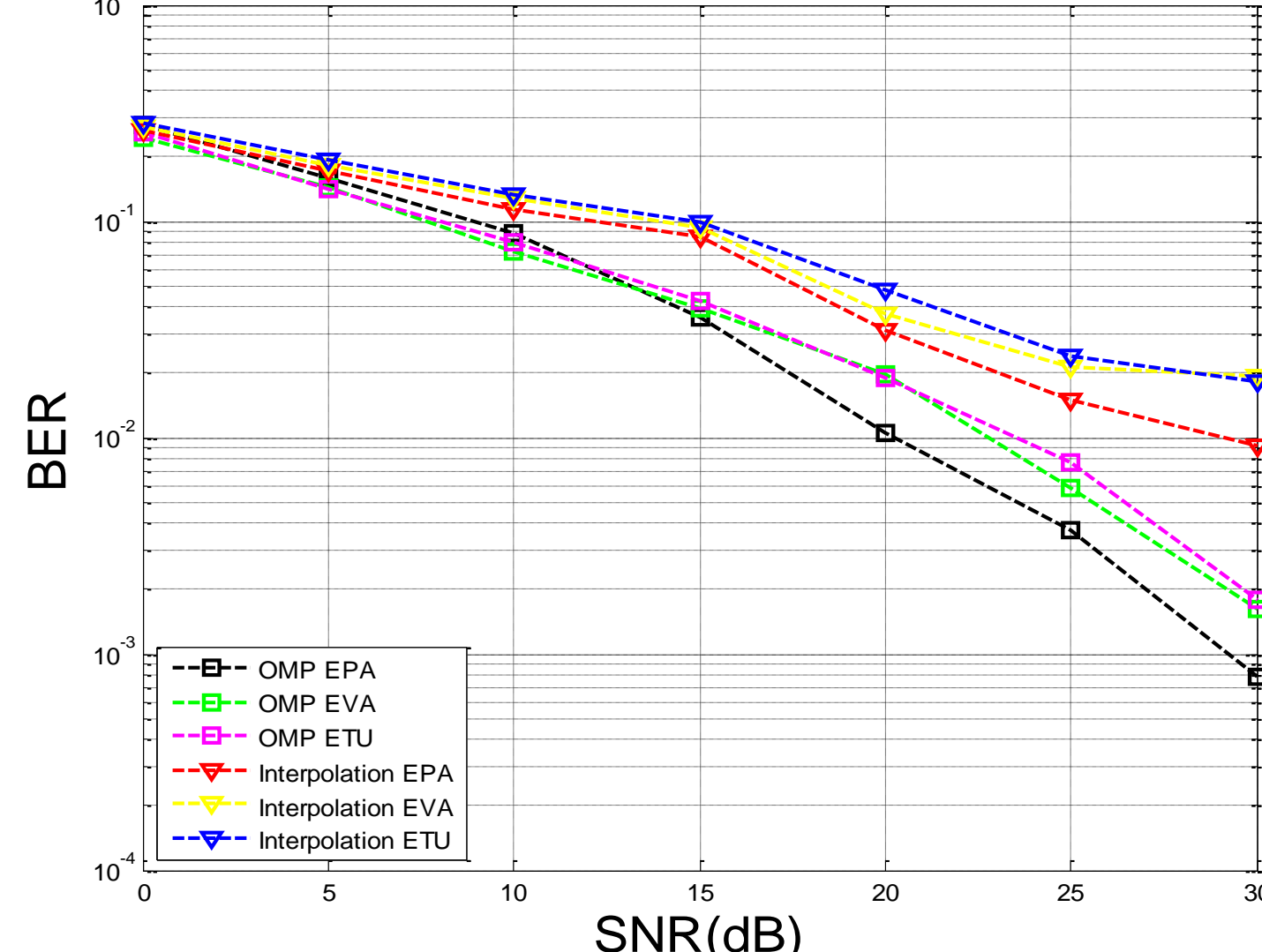

Proposed MIMO-OFDM Systems
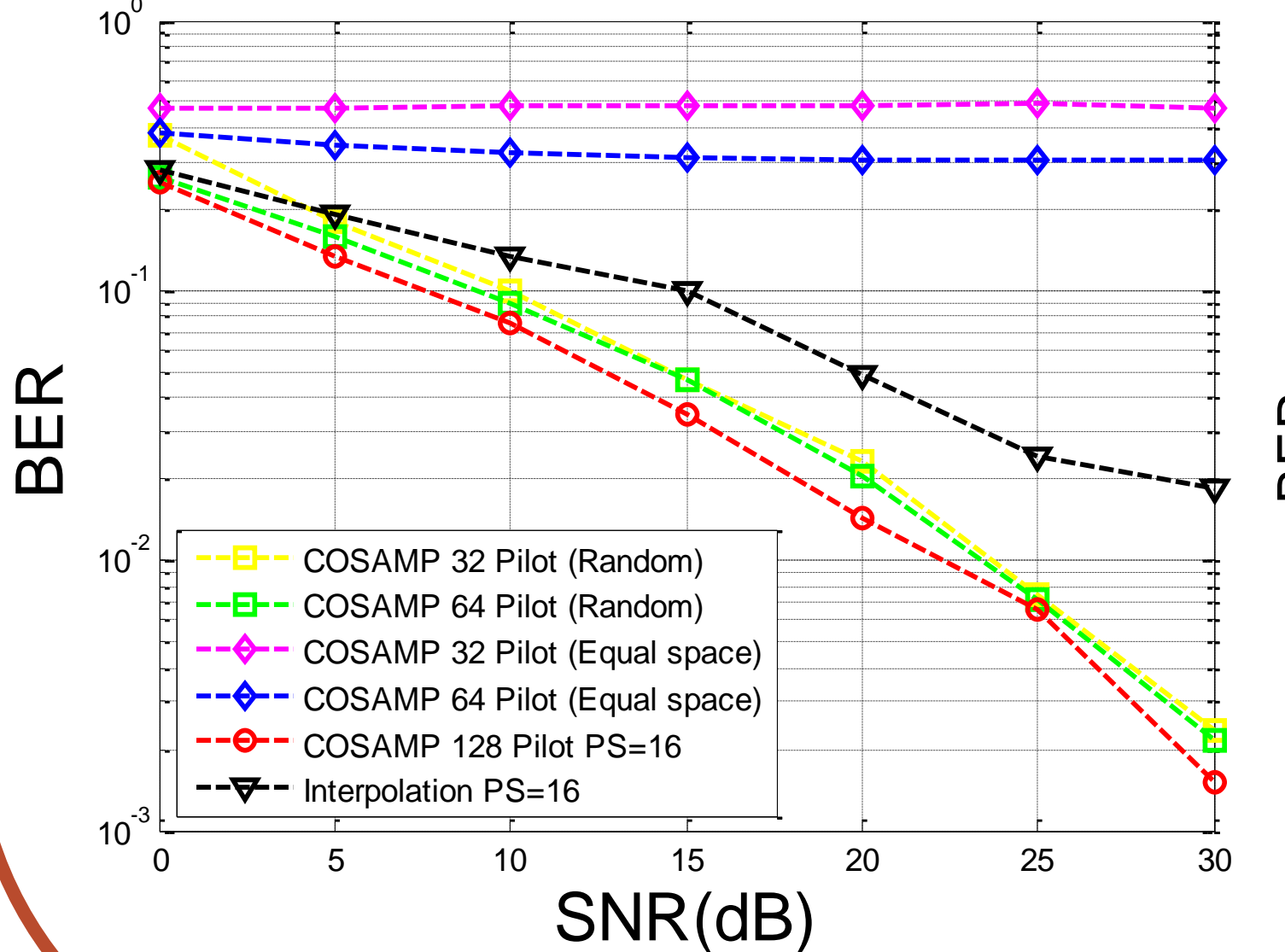

Simulation Result
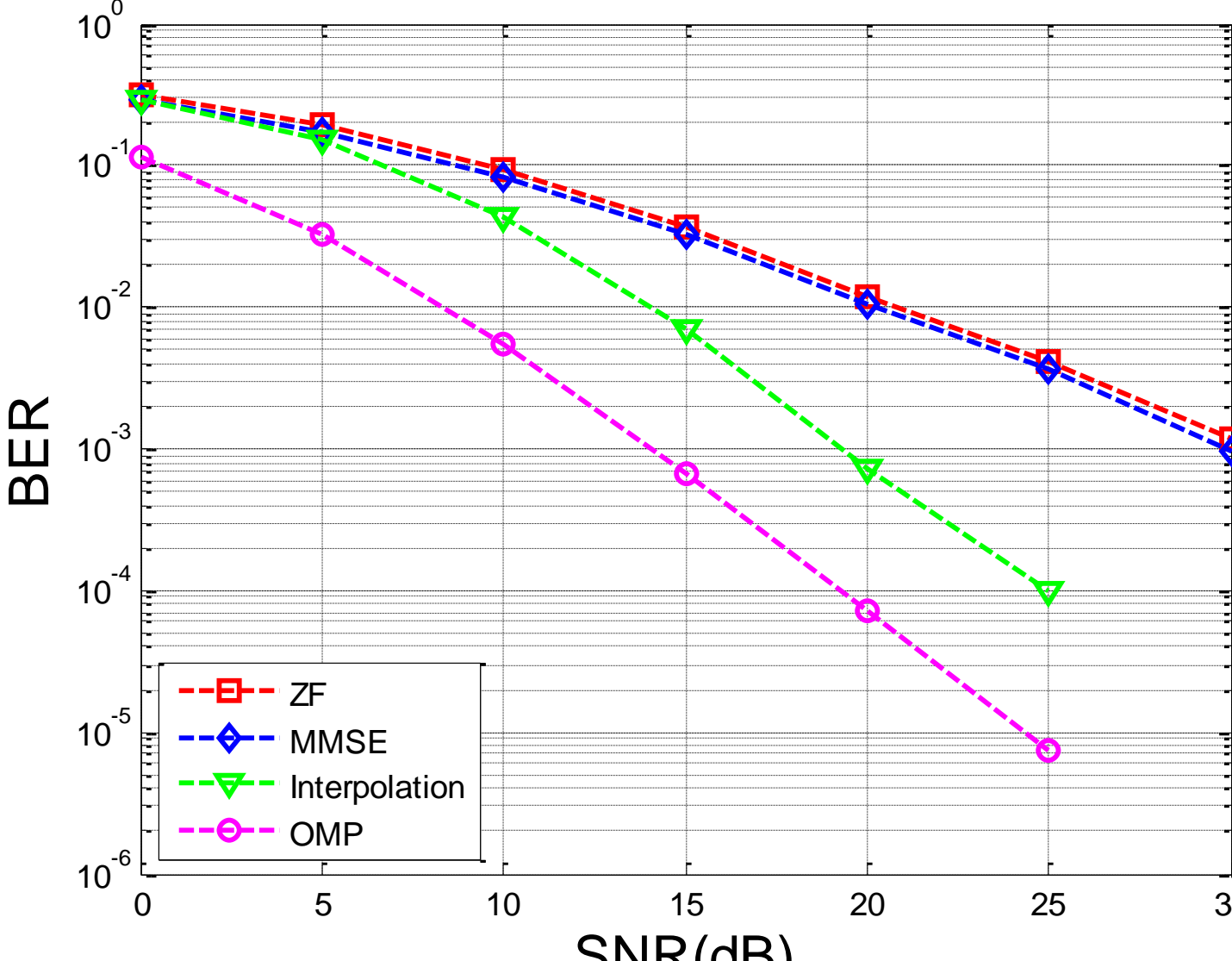

BER curve for Linnier Int, OMP, StOMP, CoSAMP

Comparation BER OMP & Interpolation (PS=16)

BER CoSaMP ETU Channel Model

BER curve MIMO 2x2

Conclusions and Future Research

Conclusions

❖ We confirmed that our proposed Compressed Sensing algorithm for channel estimation with randomly selected small number of pilots at the receiver side, can achieve almost same BER performance to that of the conventional OMP algorithm with large number of pilots.

❖ Using proposed Compressed Sensing algorithm by selected small number of pilots, we can reduced computational complexity because measurement matrix largely reduced.

Future Research

❖ We will proposed which the best performance by select randomly pilots in different CS method to reduce the complexity