Diversity Gain Analysis of SFN-STBC Digital Terrestrial TV System using Dual Polarized MIMO Antenna

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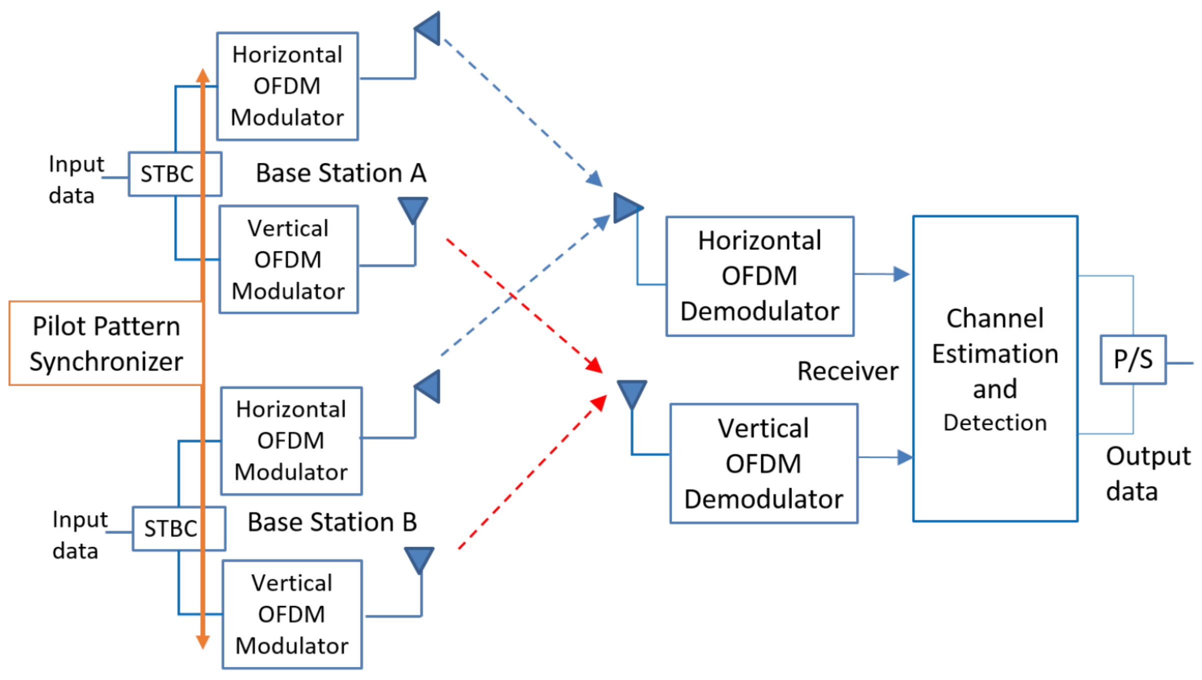
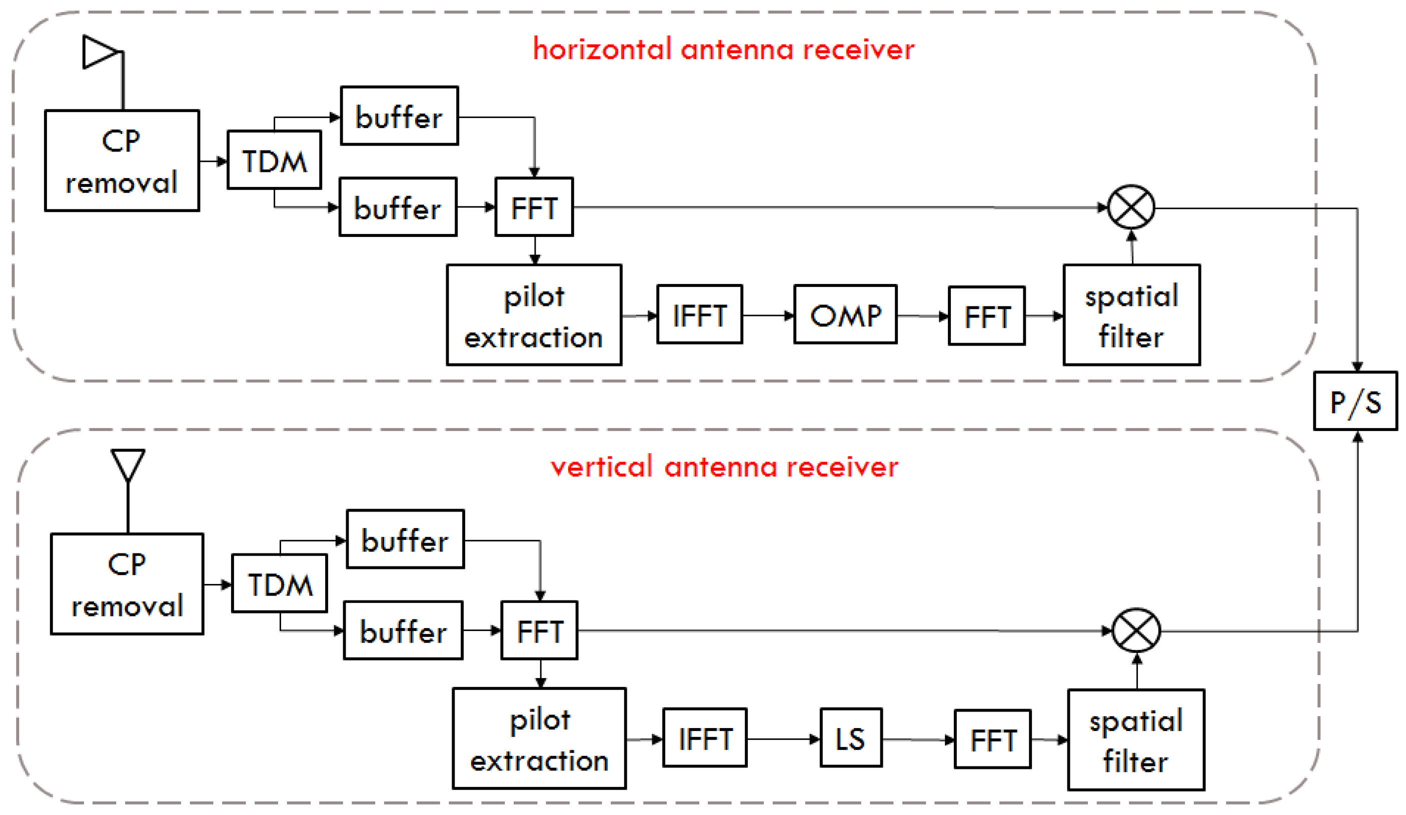
Introduction

Single Frequency Network – Space Time Block Coding (SFN-STBC) for next generation DTTV using MOMP based channel estimation is proposed in this paper.

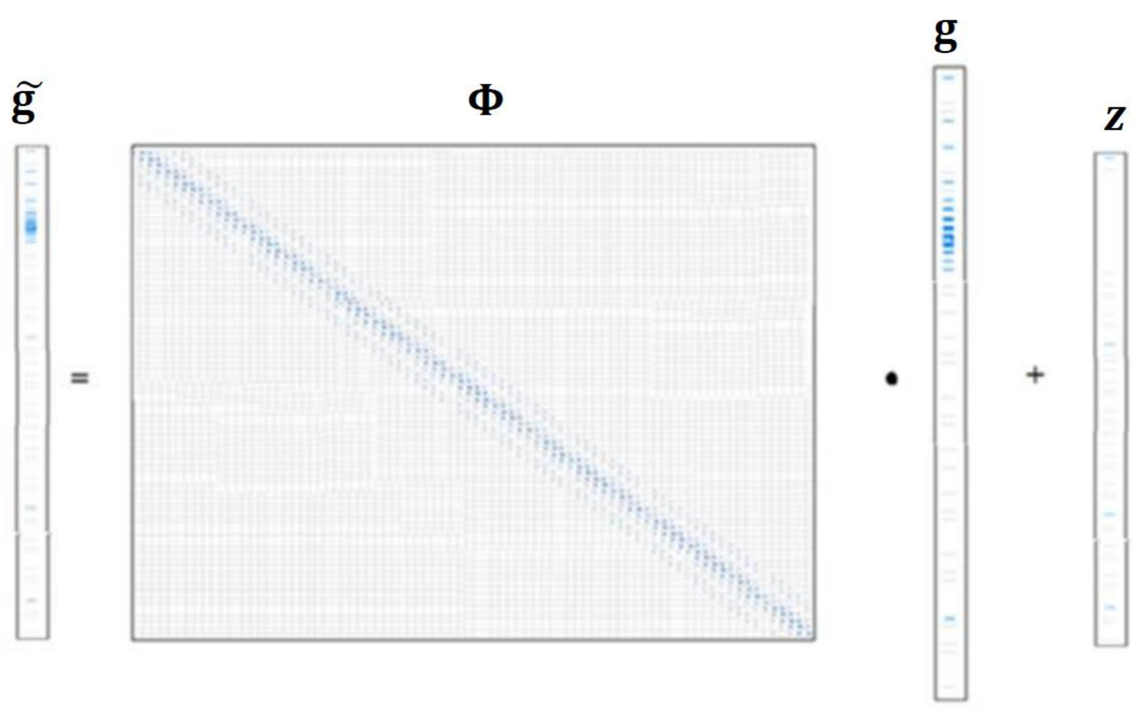


The receiver uses dual polarized antennas which can receive signals from different transmitters.



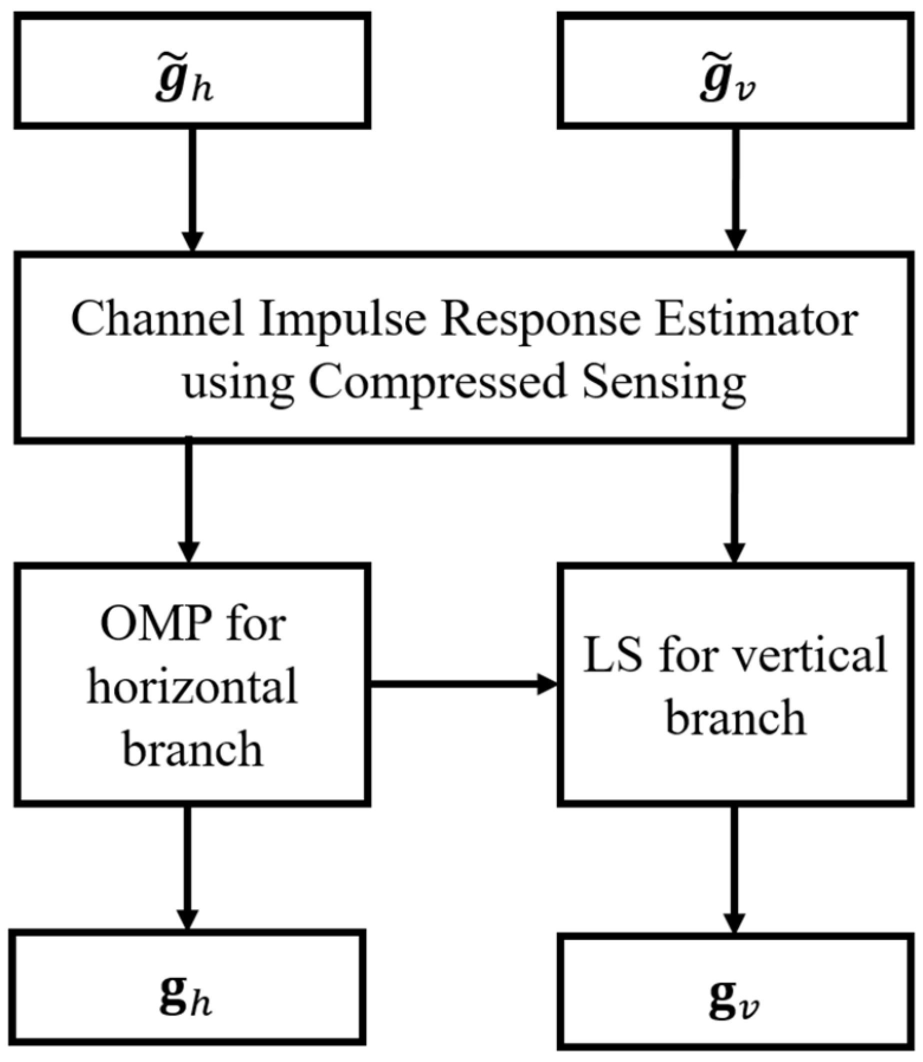
Channel Estimation

Compressed Sensing (CS) is a new methodology that allows the recovery of sparse signals from much fewer measurements than what is conventionally required. Its linear model is given by



$\tilde{\mathbf{g}}$ → observation vector
$\mathbf{\Phi}$ → measurement matrix
$\mathbf{g}$ → sparse unknown vector
$\mathbf{z}$ → noise

Modified Orthogonal Matching Pursuit (MOMP) is a low complexity algorithm for Compressed Sensing. MOMP is divided into two parts for different antenna branch. For the horizontal antenna, the conventional OMP will be implemented to estimate the channel gain and delay. Assuming that the channel delay is the same for both branches, the estimation complexity can be reduced by applying on Least Square (LS) for vertical branch.



Numerical Results

simulation parameters

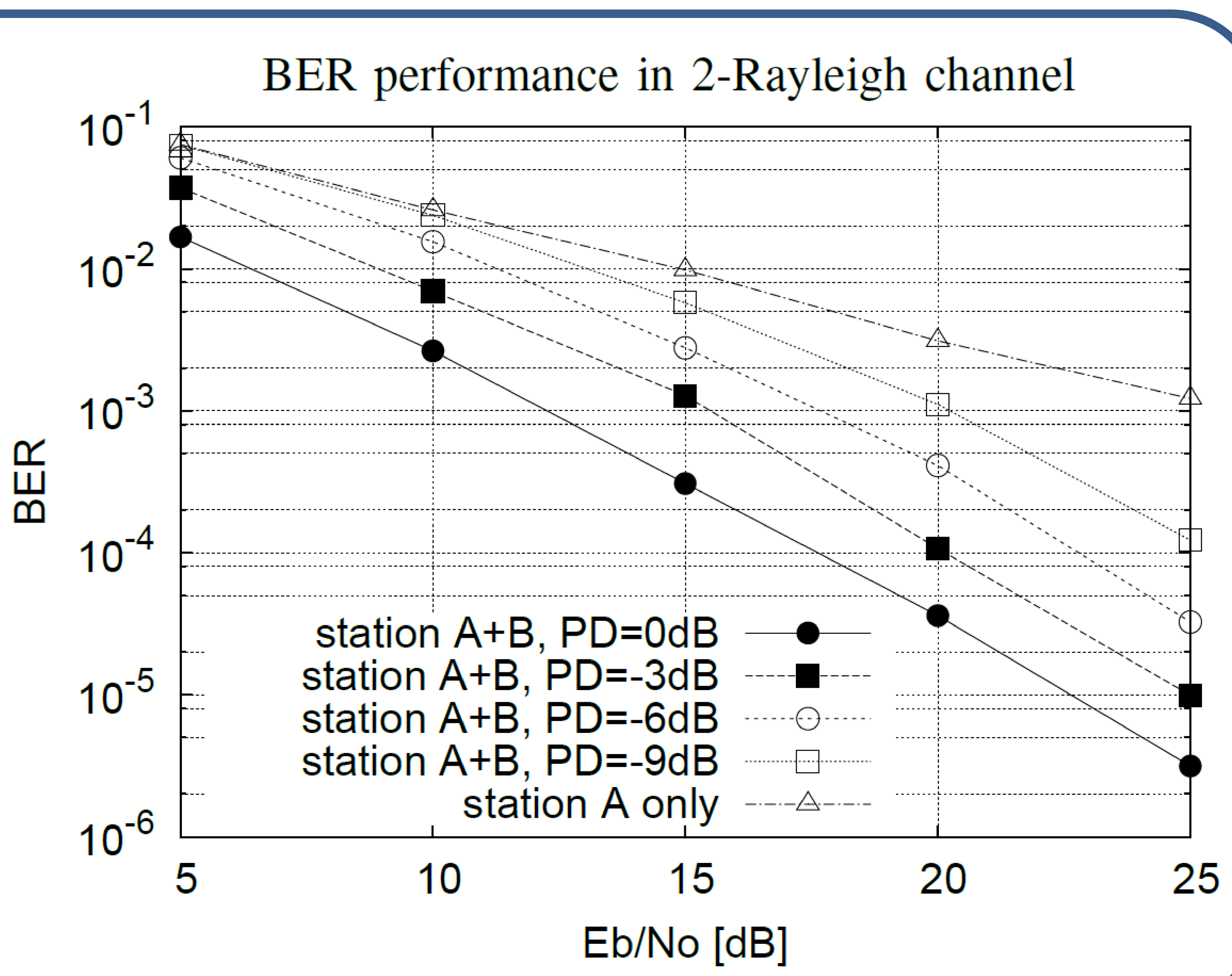
System Model	ISDB-T One-Seg
Channel Model	2 path Rayleigh
modulation type	QPSK
FFT size	512
data subcarrier	432
guard interval	1/8
bandwidth	428 kHz
pilot type	scattered type
noise type	AWGN
channel estimation	OMP, MOMP linear interpolation

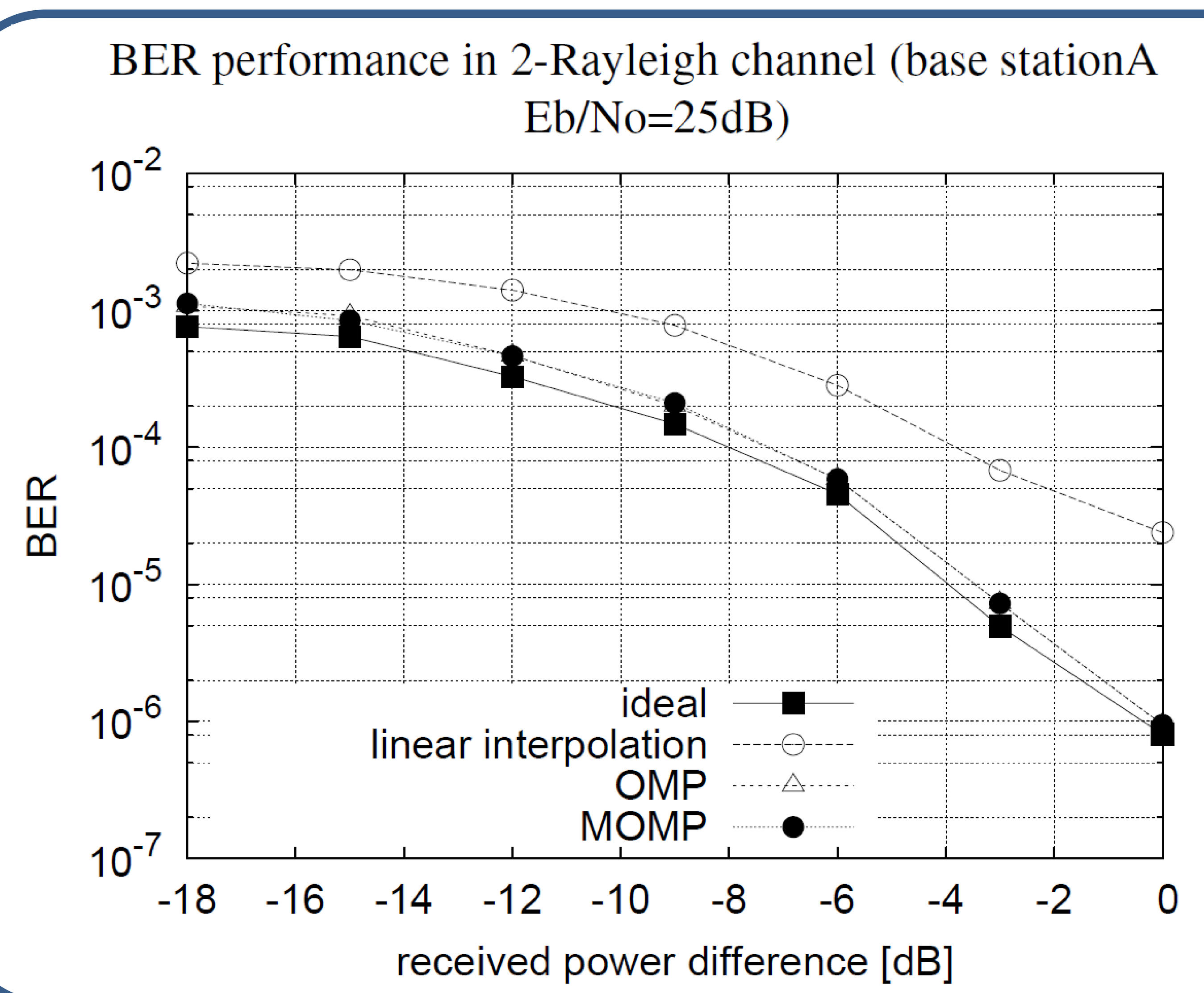
η → number of channel paths
N_{gi} → guard interval size

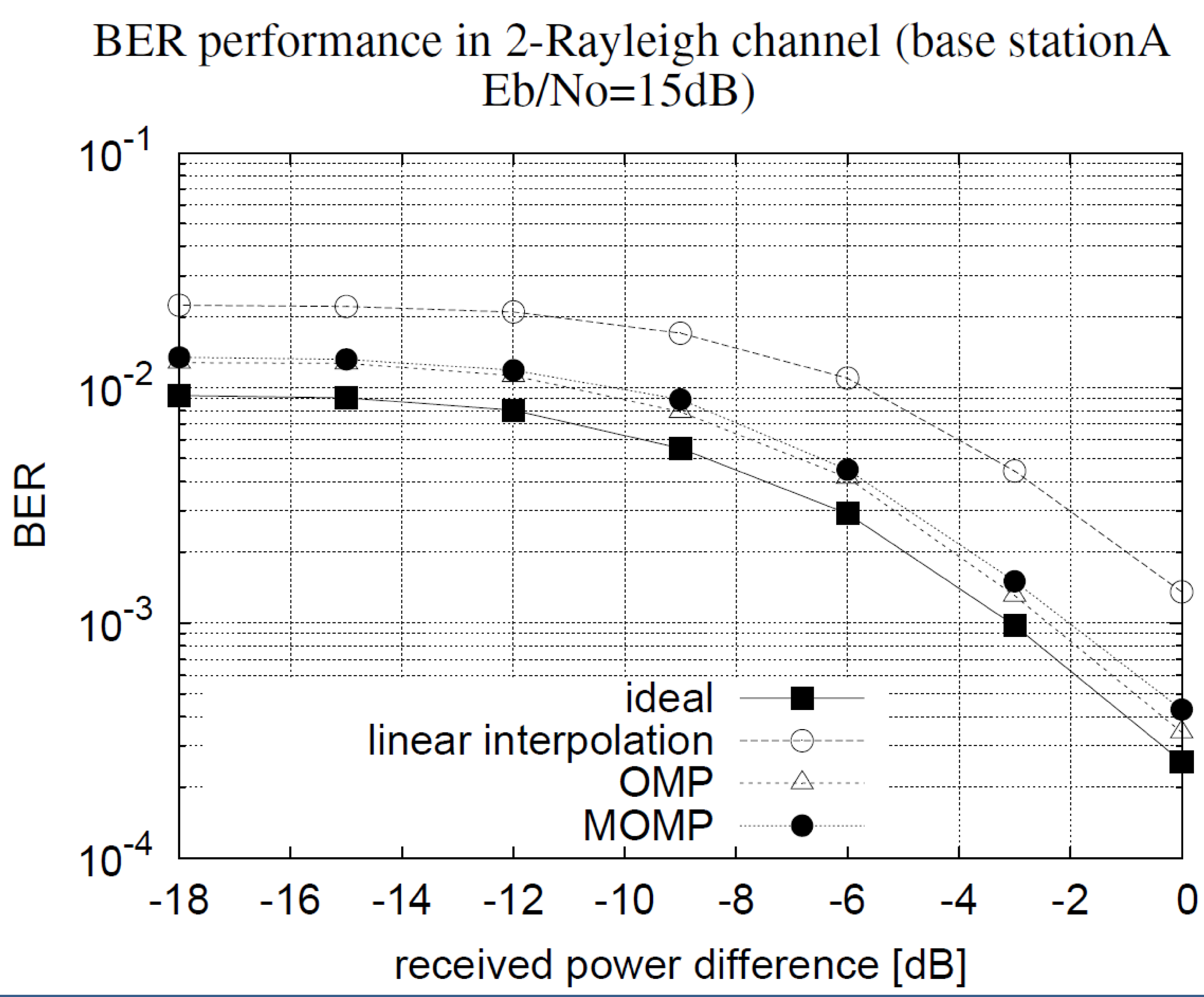
Complexity Analysis

OMP	MOMP
$O(\eta N_{gi}^2 + \eta^3 N_{gi}) + O(\eta N_{gi}^2 + \eta^3 N_{gi})$	$O(\eta N_{gi}^2 + \eta^3 N_{gi} + \eta N_{gi})$
$O(2\times 64^2 + 2^3 \times 64) + O(2\times 64^2 + 2^3 \times 64)$	$O(2\times 64^2 + 2^3 \times 64 + 2\times 64)$
17,408 FLOPS	8,832 FLOPS

$$\frac{17{,}408 - 8{,}832}{17{,}408} \times 100\% = 49.3\ \%\ \text{saving}$$







Conclusion

The simulation results shows that the BER performance improves if the both received power signals from different base stations will have the same power. In addition, the BER performance of MOMP is 1dB closer compared to perfect channel estimation in SBR Eb/No=15dB to Eb/No=25 dB.

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