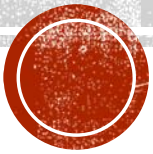
SPREADING SEQUENCE ARRAY WEIGHTS

Smart Antennas & CDMA Systems



INTRODUCTION

- • Used in CDMA-based smart antenna systems
- • Combines spatial processing with spreading sequences
- • Improves interference suppression and capacity

CDMA SIGNAL MODEL

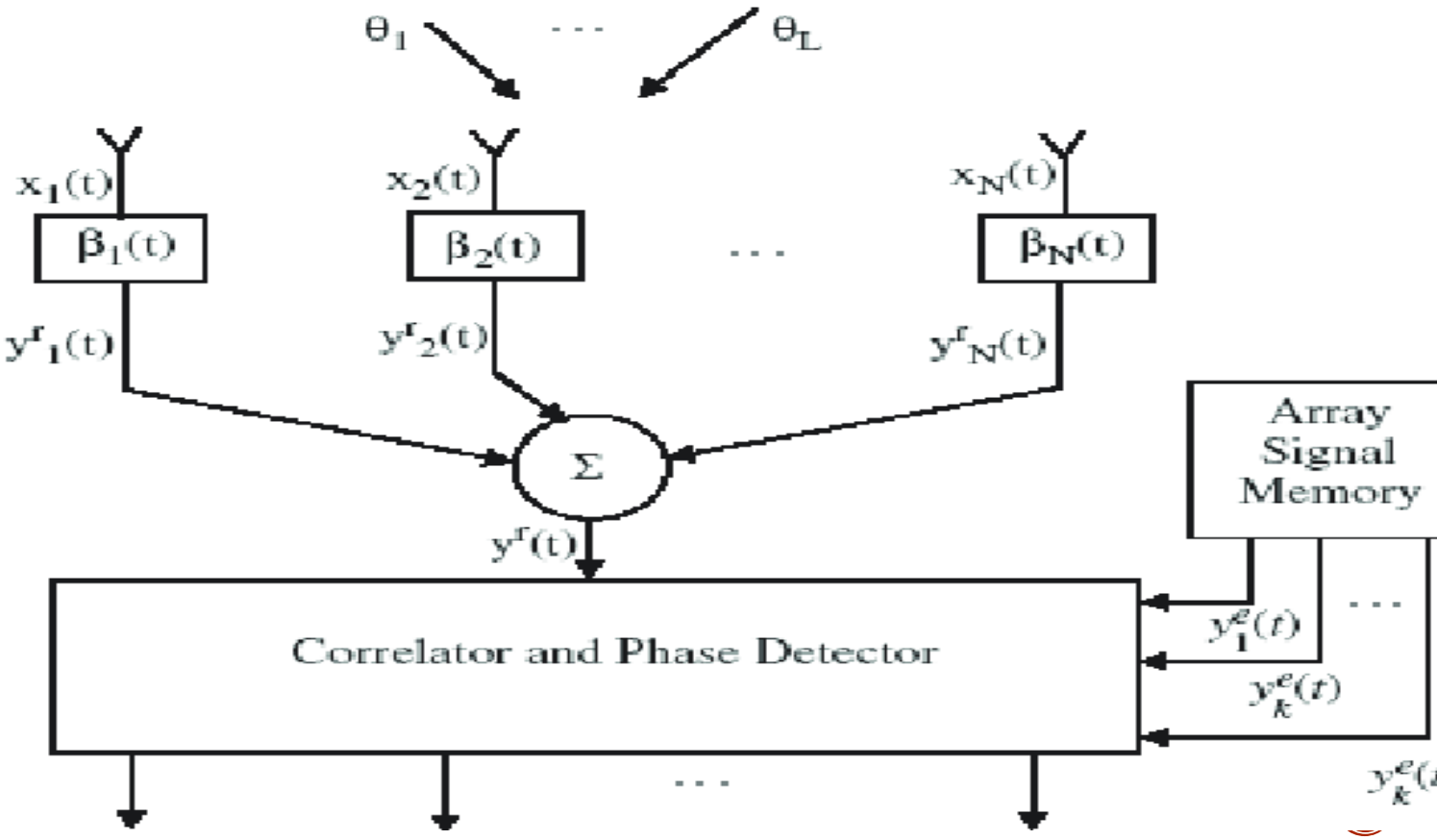
- • Each user has a unique spreading sequence
- • Transmitted signal is spread over wide bandwidth
- • Receiver despreads desired user signal

ARRAY SIGNAL REPRESENTATION

- • x(n): received array snapshot
- • Includes desired user, MAI, and noise
- • Spreading sequences known at receiver

SPREADING SEQUENCE ARRAY WEIGHTS

- • Weights depend on user spreading sequence
- • Joint spatial–temporal processing
- • Exploits code orthogonality and spatial diversity


θ1
θL
x1(t)
x2(t)
xN(t)
β1(t)
β2(t)
βN(t)
yr1(t)
yr2(t)
yrN(t)
Σ
yr(t)
Array Signal Memory
Correlator and Phase Detector
ye1(t)
yek(t)

WEIGHT VECTOR FORMATION

- • Effective weight = spatial weight × spreading code
- • Matched to desired user sequence
- • Suppresses multiuser interference (MAI)

MMSE-BASED ARRAY WEIGHTS

- • Minimize mean square error
- • Uses spreading sequence as reference
- • Optimal trade-off between noise and interference

ADAPTIVE IMPLEMENTATION

- • LMS / RLS algorithms
- • Update weights using despread signal
- • Suitable for time-varying channels

ADVANTAGES

- • Enhanced interference suppression
- • Increased system capacity
- • Improved SINR performance

LIMITATIONS

- • Requires knowledge of spreading sequence
- • Higher computational complexity
- • Sensitive to synchronization errors

APPLICATIONS

- • CDMA cellular systems
- • Smart antenna base stations
- • Multiuser detection

SUMMARY

- • Combines spreading sequences with array processing
- • Effective for multiuser interference suppression
- • Key technique in CDMA smart antennas