ROHINI
COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
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CEC335/ANTENNA DESIGN

Maximum Signal-to-Interference Ratio (MSIR)

Definition

- **The Maximum Signal-to-Interference Ratio (MSIR) technique aims to adjust the antenna array weights such that the power of the desired signal is maximized relative to the power of interfering signals.**

Working Principle

- Smart antennas receive signals from multiple directions.
- Desired and interfering signals arrive from different angles.
- By appropriately choosing the antenna weights, the array:
- Forms a **main beam** toward the desired signal
- Creates **nulls** in the directions of interference
- The algorithm focuses **only on signal and interference**, often ignoring noise.

Mathematical Formulation

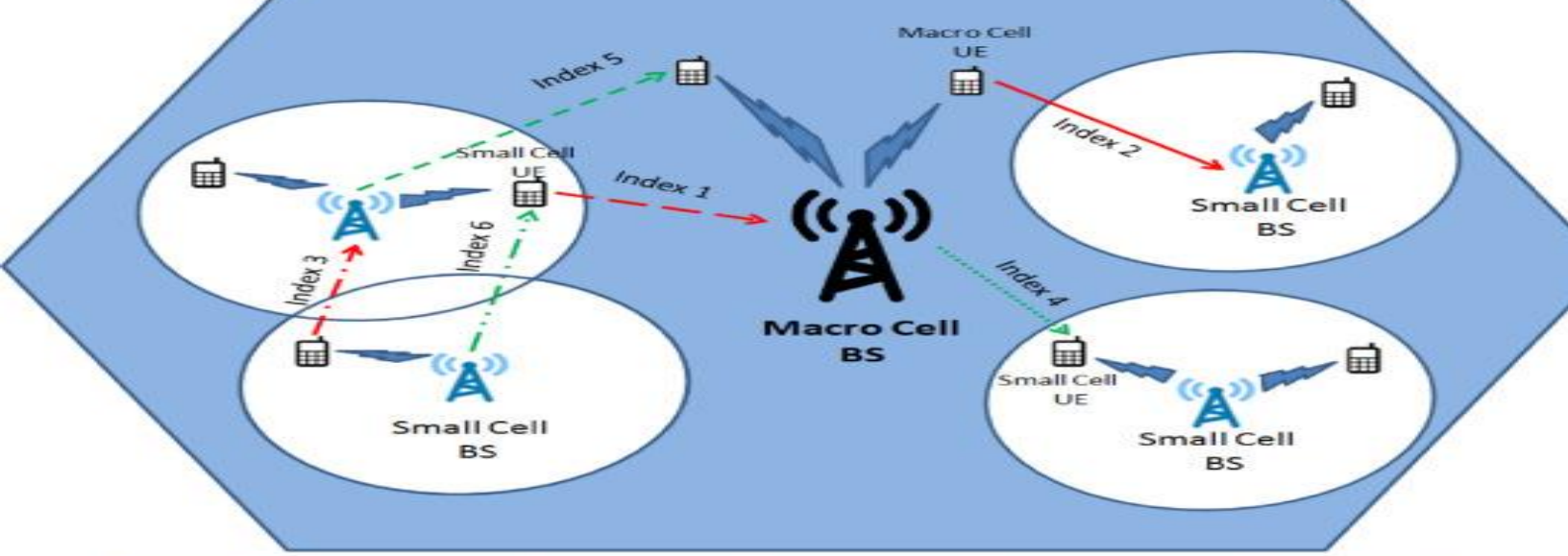
The Signal-to-Interference Ratio (SIR) is given by:

$$\text{SIR} = \frac{w^H R_s w}{w^H R_i w}$$

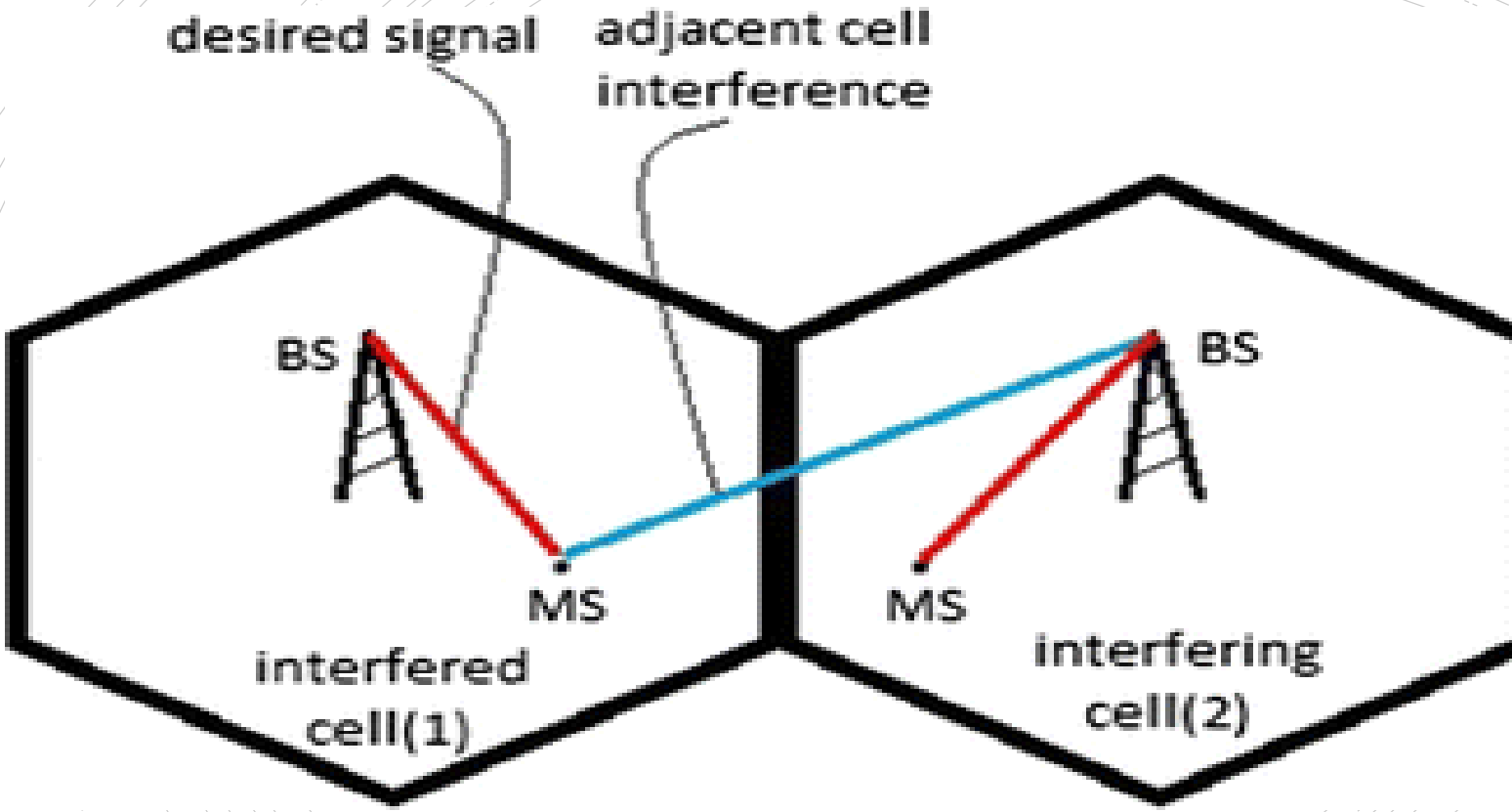
where:

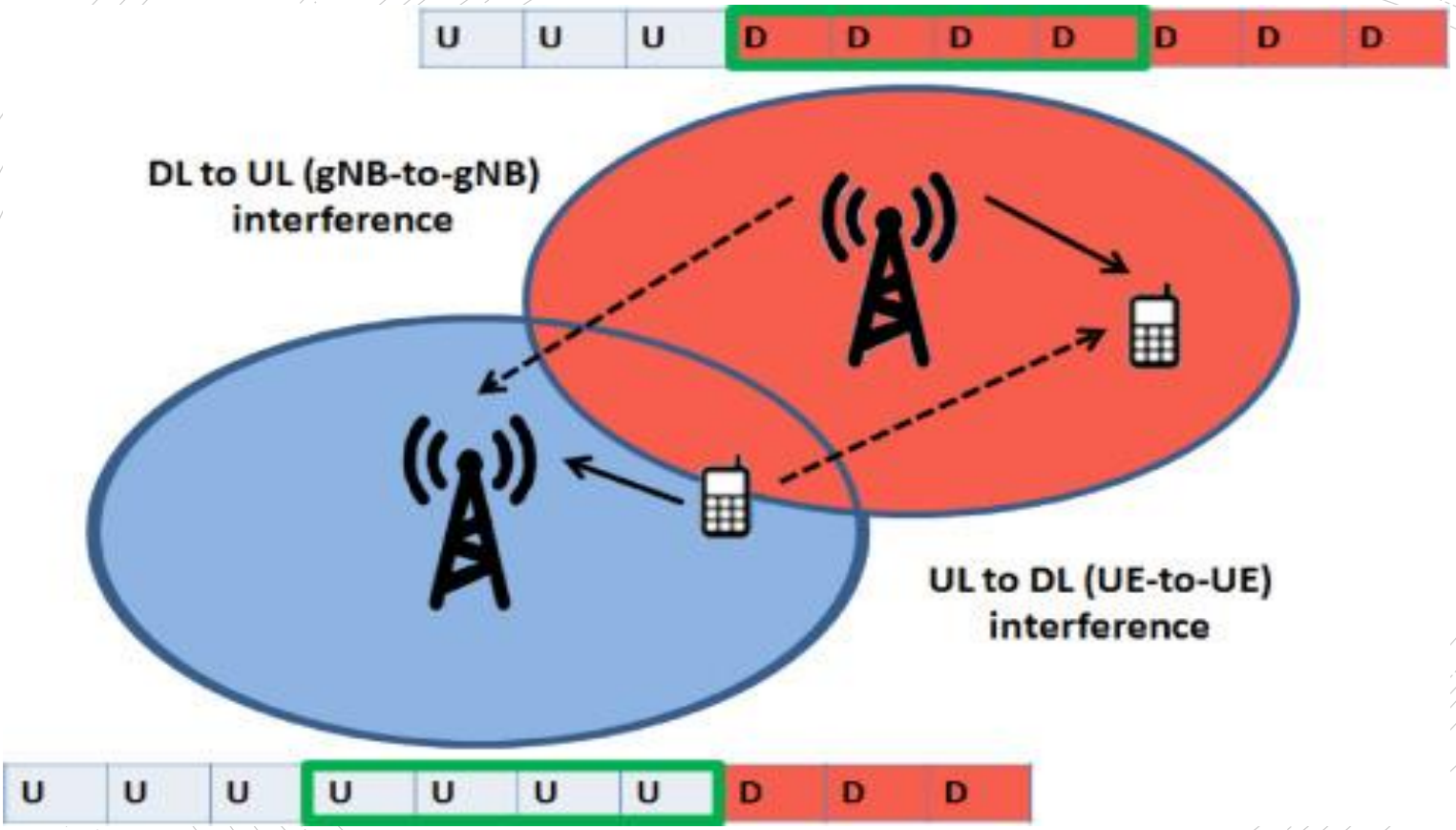
- w = complex weight vector
- R_s = covariance matrix of the desired signal
- R_i = covariance matrix of interference
- H = Hermitian transpose

The optimal weight vector is obtained by solving a generalized eigenvalue problem.



Index	Aggressor	Victim	Interference type	Transmission mode	Symbol
1	Small cell UE	Macro Cell BS	Cross-tier	Uplink	
2	Macro cell UE	Small Cell BS	Cross-tier	Uplink	
3	Small Cell UE	Small Cell BS	Co-tier	Uplink	
4	Macro Cell BS	Small Cell UE	Cross-tier	Downlink	
5	Small Cell BS	Macro Cell UE	Cross-tier	Downlink	
6	Small Cell BS	Small Cell UE	Co-tier	Downlink	


desired signal
adjacent cell
interference
BS
BS
MS
MS
interfered
cell(1)
interfering
cell(2)


U U U D D D D D D D
DL to UL (gNB-to-gNB)
interference
UL to DL (UE-to-UE)
interference
U U U U U U U D D D

Applications

- Adaptive beamforming
- Interference-limited wireless networks
- Cellular base stations