

Spreading Codes for Radio Resource Management in MC-CDMA

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Motivation

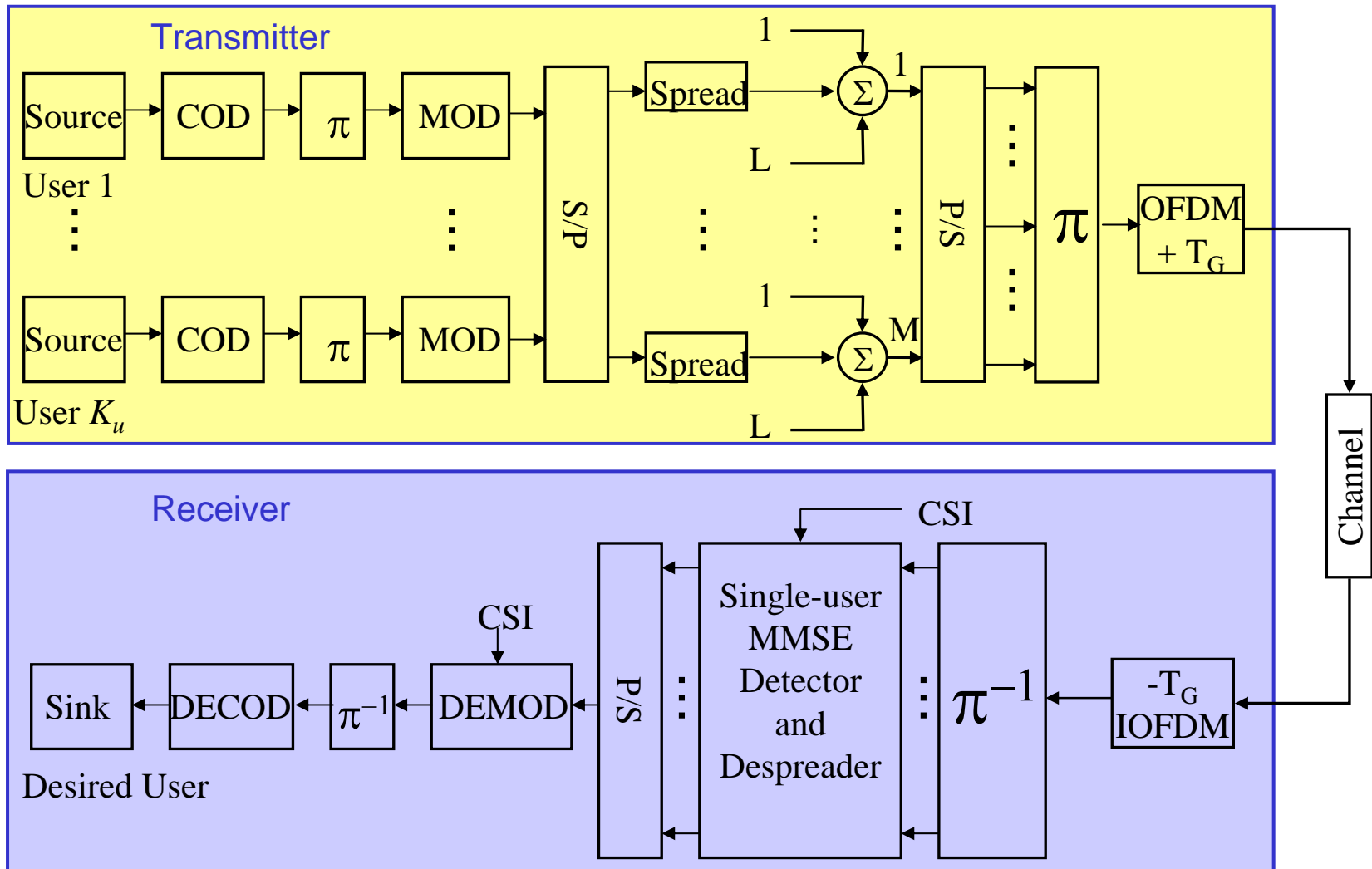
- Pure OFDMA offers orthogonality between sub-carriers
 - ➔ radio resource management is possible
- In MC-CDMA, spreading codes offers also orthogonality
 - ➔ radio resource management possible?



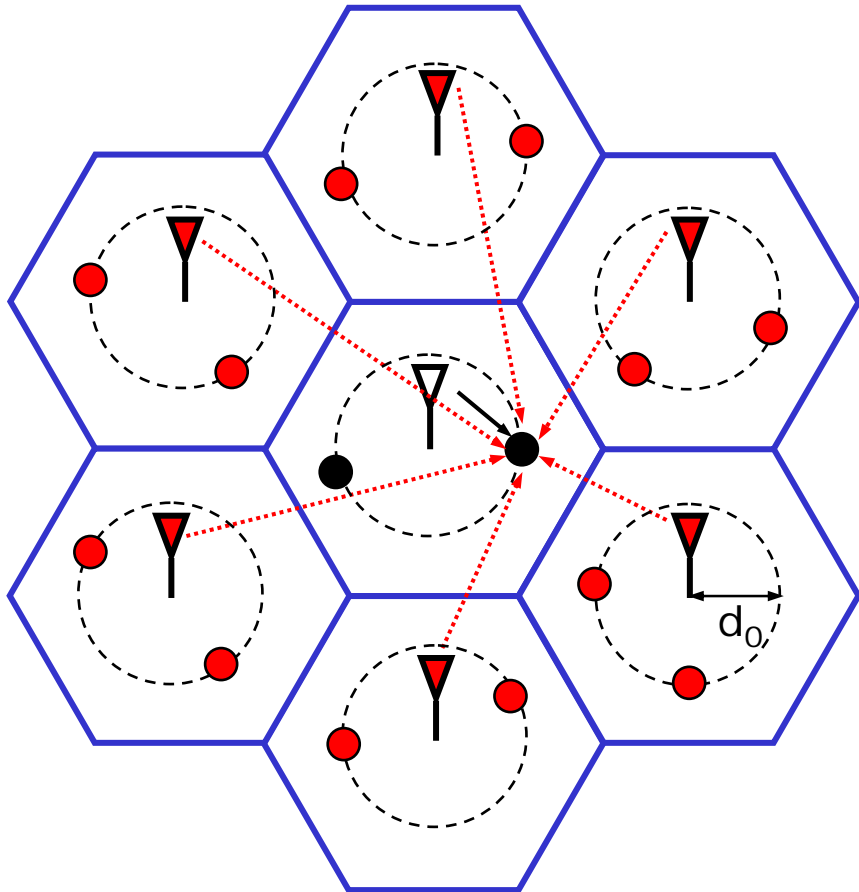
Outline

- MC-CDMA Downlink System
- Multi-Cell Environment
- Correlated Rayleigh Fading Channel
- Radio Resource Management with Spreading Codes
- Simulation Results and Conclusions

MC-CDMA Downlink System

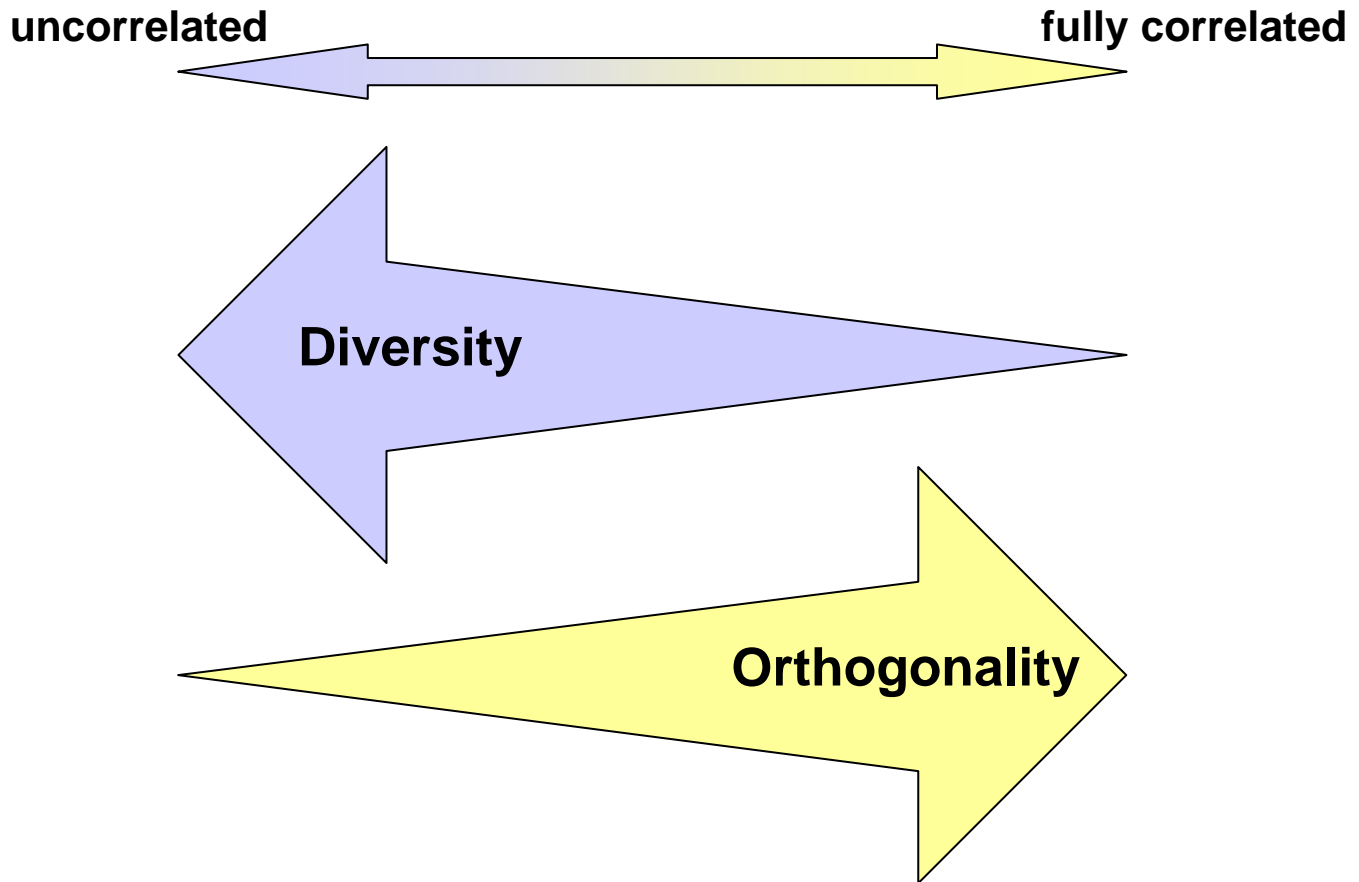


Multi-Cell Environment

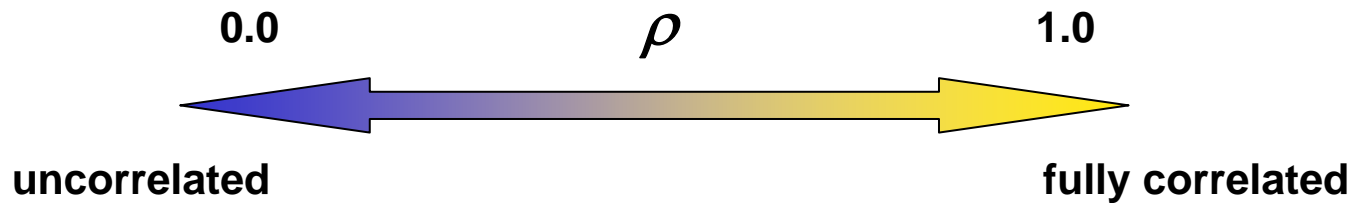
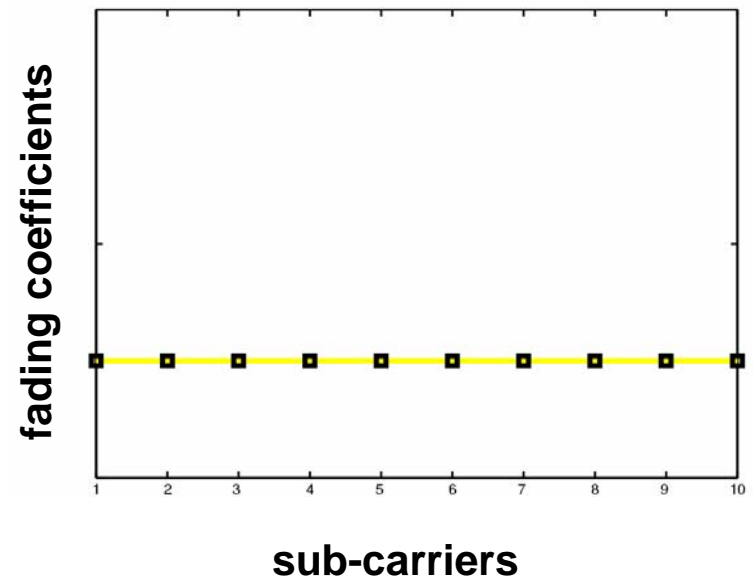
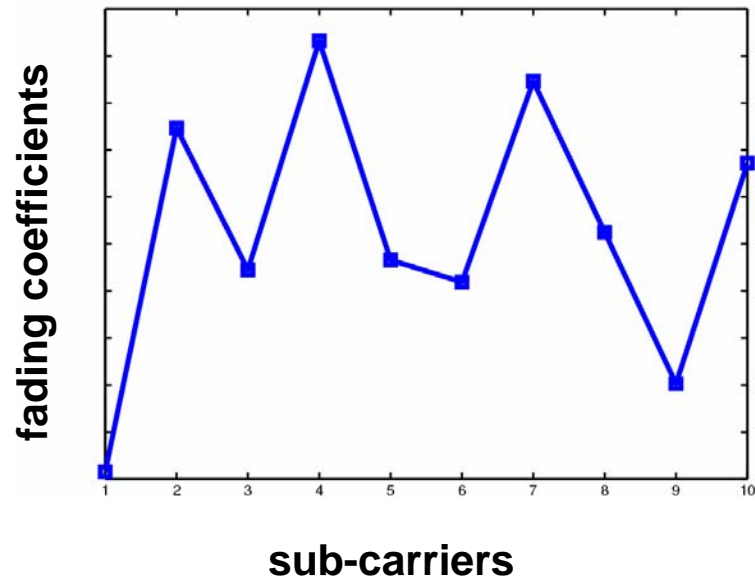


- Fully-synchronized system between the base stations (BS) and the mobile station (MS)
- Distance dependent propagation model
- All users are power-controlled and are located at a distance d_0 to their BSs
- Cells are equally loaded

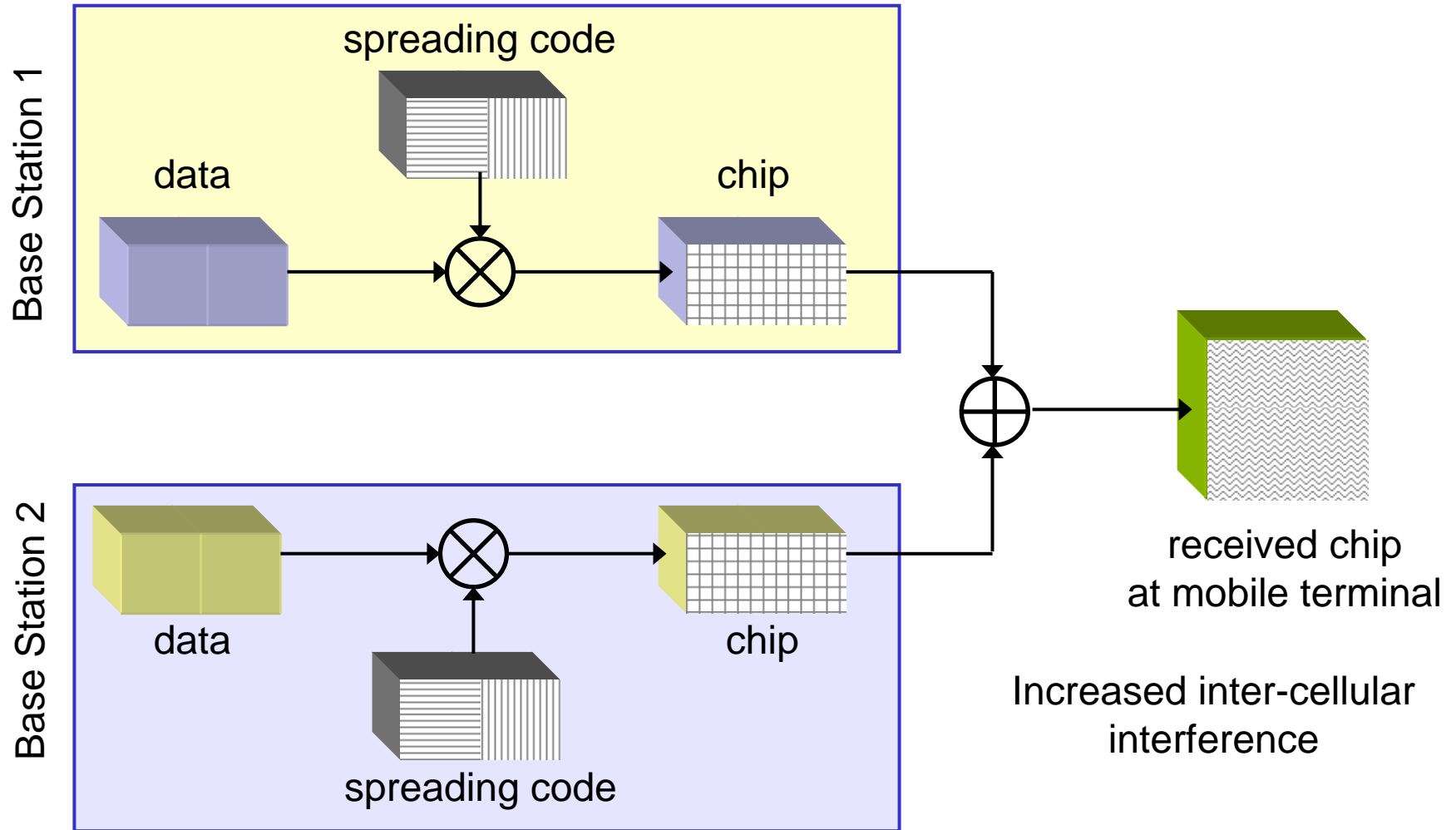
Correlation Properties - Contrariness of Diversity and Orthogonality



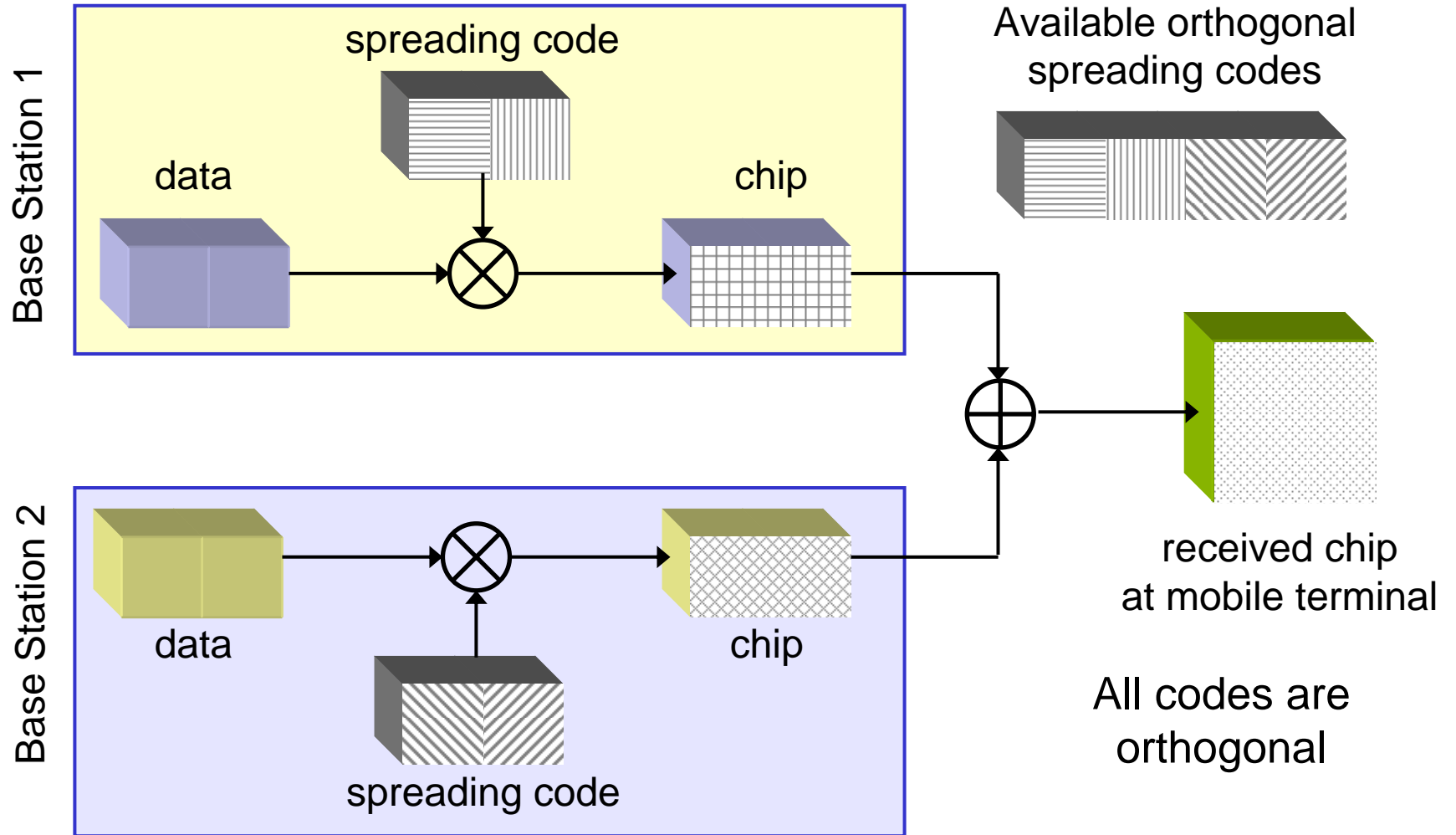
Correlated Rayleigh Fading Channel



Without Radio Resource Management



Radio Resource Management with Spreading Codes

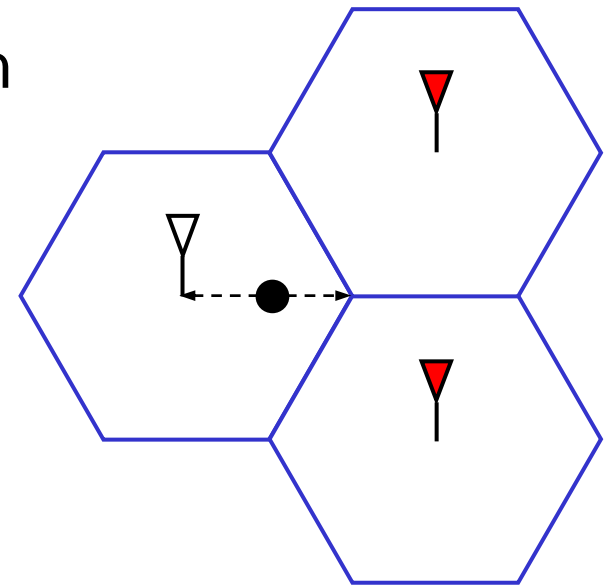




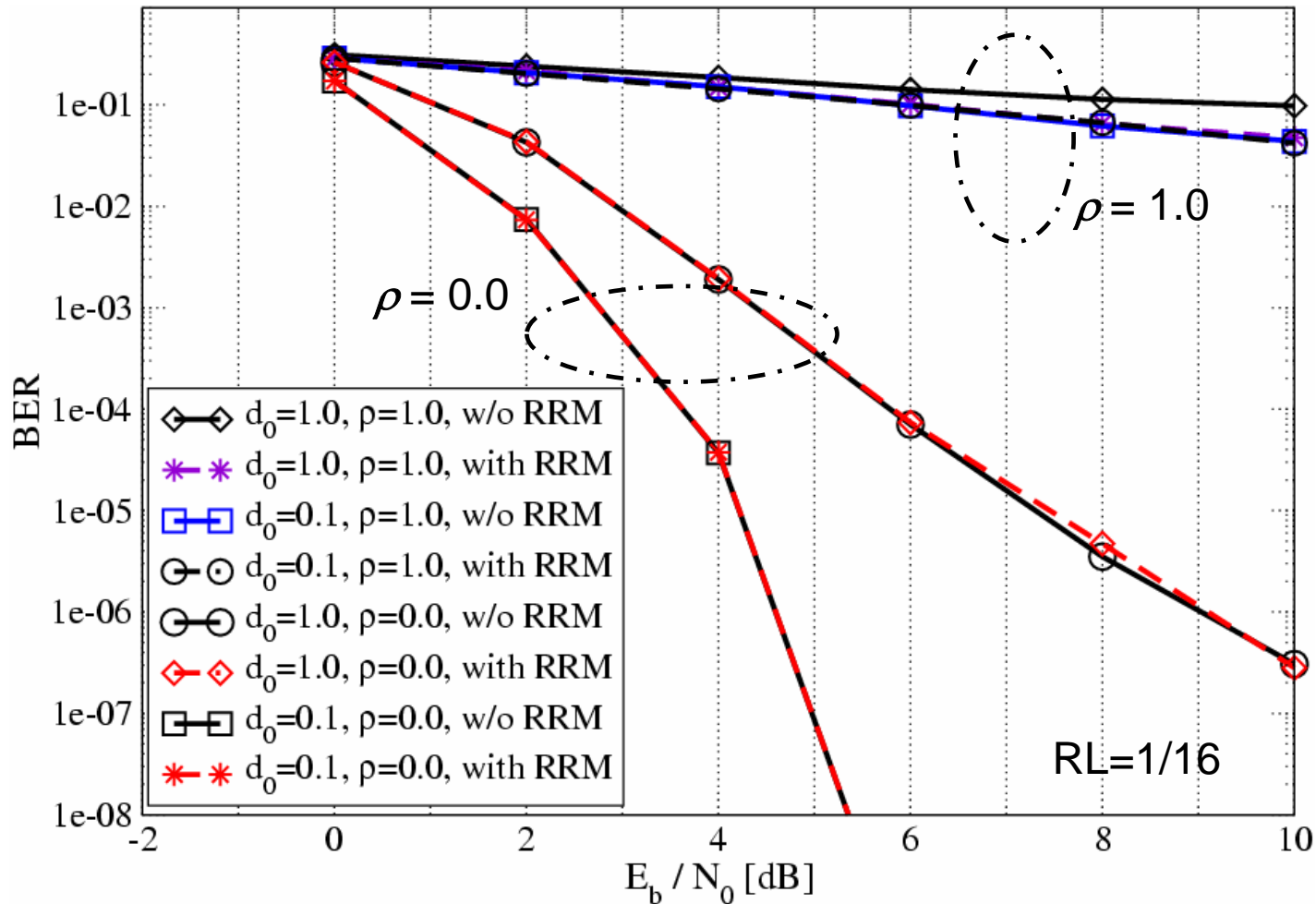
Simulation Results

Simulation Parameter

- 6 interfering cells (whole tier)
- Perfect channel state information
- QPSK
- Spreading length is 16
- Convolutional code with rate $\frac{1}{2}$
- If not stated:
 - $E_b/N_0 = 10$ dB
 - $d_0 = 1.0$ (cell edge)

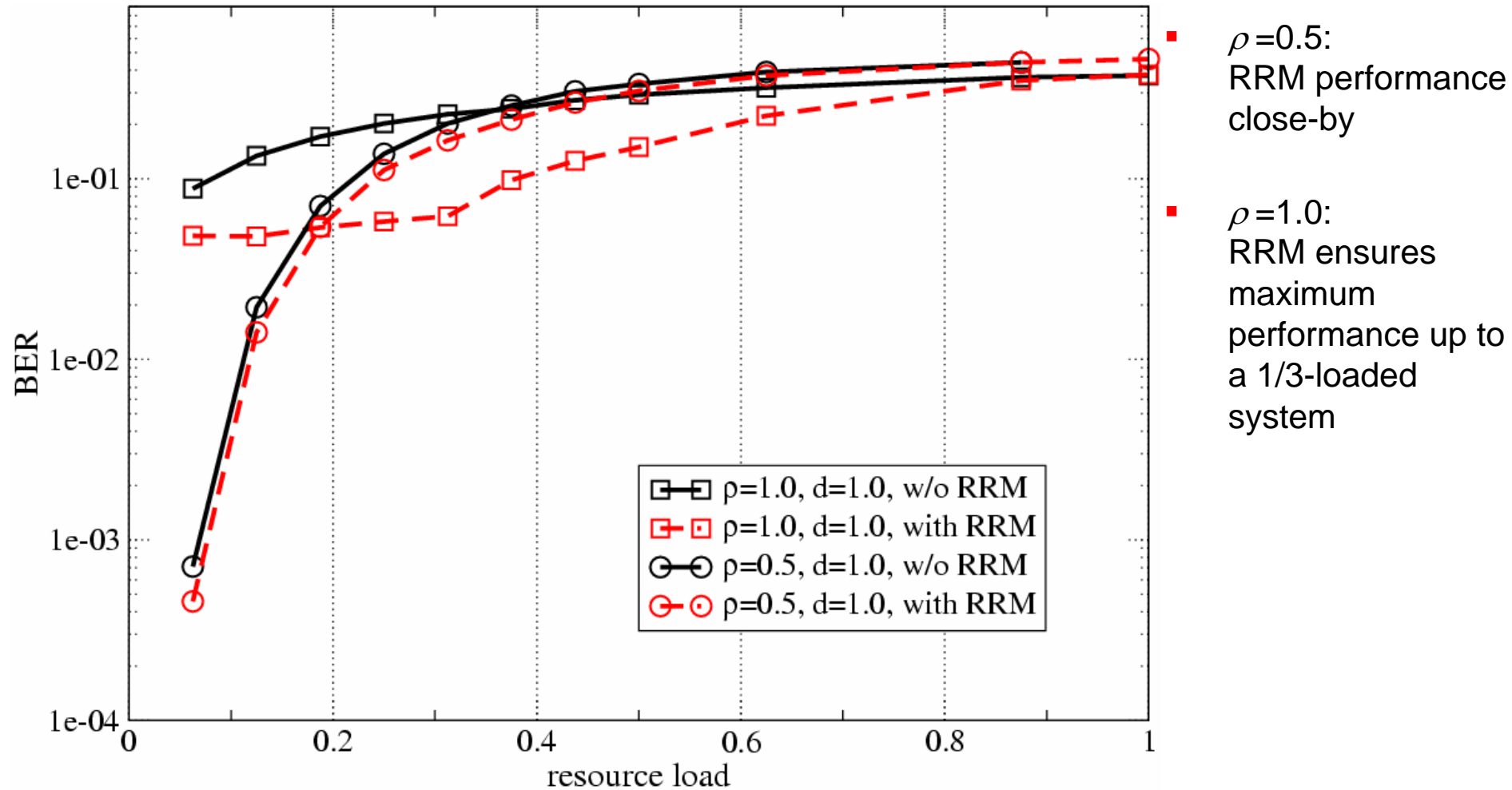


Error Performance

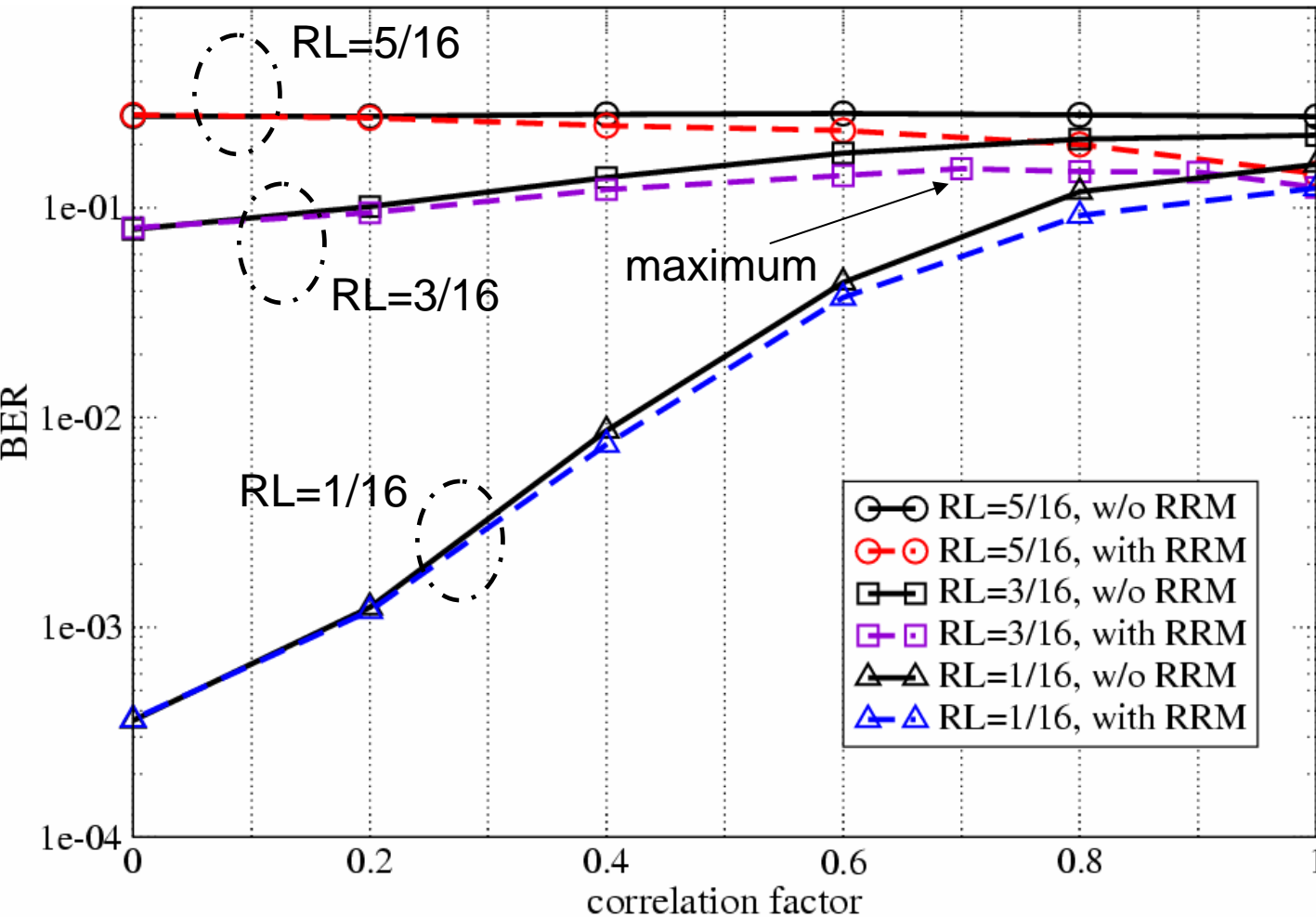


- Uncorrelated case:
No gain with RRM
- Fully-correlated case:
Total avoidance of interference with RRM
→ 2dB gain at the cell edge

Influence of Resource Load



Influence of Correlation



- Maximum shows trade-off between diversity and orthogonality gain
- RRM enhances performances for $\rho > 0.2$



Conclusions

- Trade-off between diversity and orthogonality
- Possibility of using an RRM over spreading codes
- Real multi-path propagation environments offer degree of correlation

➔ RRM can be applied