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Spatial channel pairing based coherent combining for relay networks

Key words: Spatial channel pairing, Coherent combining, Alternating iterative structure, Symbol error rate, Distributed space-time block coding

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Motivation

- Distributed space-time block coding (DSTBC), maximum ratio combining (MRC), and their combination, have been proposed to exploit cooperative diversity in relay networks.
- The spatial channel pairing that maximizes the sum-rate was designed for multi-pair two-way relay networks to substantially improve the sum-rate performance.
- But spatial channel paring has not been introduced to combining schemes to improve the system performance.

Main idea

- Introduce spatial channel paring (SCP) to a coherent combining (CC) scheme at an RS to improve the performance of symbol error rate (SER) by exploiting the SCP gain.
- The closed-form expression for the optimal CC (OCC) is derived given SCP, whereas the approximate analytical solution is given for a fixed CC.
- Design an alternating iterative structure (AIS) between SCP and OCC.

Method

1. The optimization problem of maximizing the SNR over SCP and OCC is formulated and established.
2. Reduce the joint NP-hard problem to two individual subproblems.
3. For a given SCP, the optimal closed-form expression of OCC is derived in a novel way.
4. Fixing the OCC, we present a sub-optimal closed-form SCP method by approximation techniques.
5. An AIS is introduced between them to further optimize the system performance.

Major results

- The proposed iterative structure has rapid convergence and the convergence speed of the proposed method decreases with the increase of SNR.

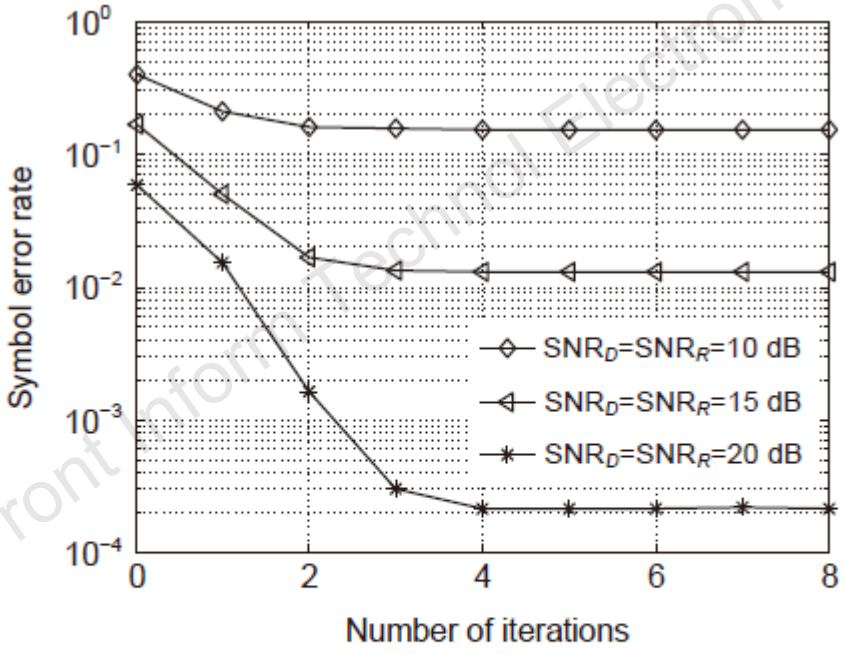

Fig. 3 Curves of the symbol error rate versus the number of iterations for the proposed AIS with 16-QAM (SNR_D=SNR_R)

Major results

- The proposed AIS between SCP and OCC shows a substantial improvement in SER over existing MRC plus MF, MRC plus AS and DSTBC due to the SCP gain.

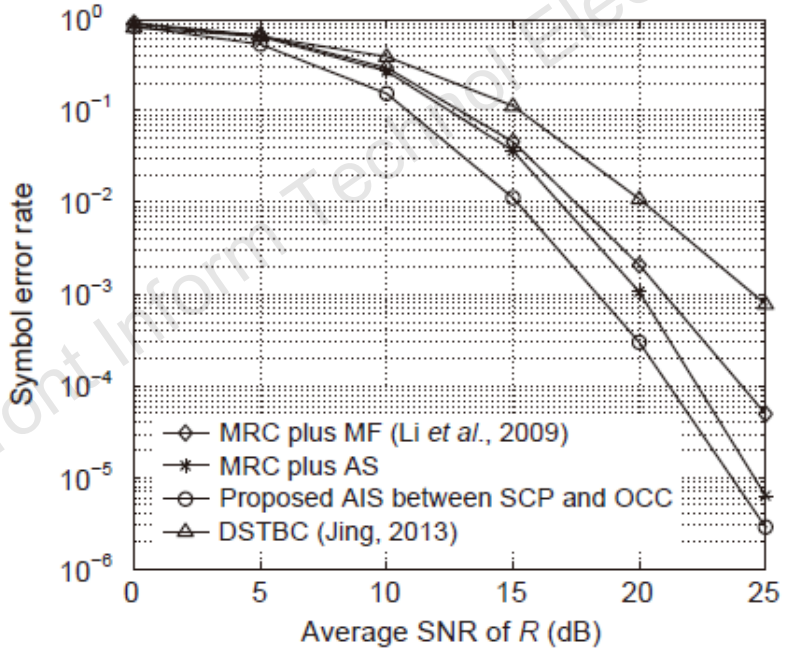

Fig. 5 Curves of the symbol error rate versus the average SNR_R with 16-QAM (SNR_D=SNR_R)

Conclusions

- An AIS between SCP and OCC is proposed for relay networks.
- Based on simulation and analysis, the proposed AIS performs much better than existing schemes (MRC plus MF, MRC plus AS, and DSTBC) in both SER and rate senses because of the use of SCP and the iterative structure.
- The SNR gain provided by SCP is rather attractive with a reasonable complexity.
- The proposed AIS can be applied to future wireless communications like 5G.