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Review:

Beamforming techniques for massive MIMO systems in 5G: overview, classification, and trends for future research

Key words: Beamforming classifications; Massive MIMO; Hybrid beamforming; Millimetre-wave beamforming

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Motivation

- Conventional surveys did not discuss which types of beamforming techniques can be deployed for massive MIMO systems according to 5G requirements.
- Provides an in-depth overview of up-to-date research on classifications of beamforming techniques.
- Investigation of beamforming techniques effects on massive MIMO systems to determine which optimal categories can be adopted with massive MIMO system requirements.

Main idea

- Clarifying the importance of beamforming techniques in reducing and resolving many technical complications that can prevent the implementation of massive MIMO.

- Proposing an optimal beamforming technique that can provide the highest performance in massive MIMO systems. This approach is based on comprehensive overview of up-to-date research on classifications of beamforming techniques that can be deployed for massive MIMO systems.

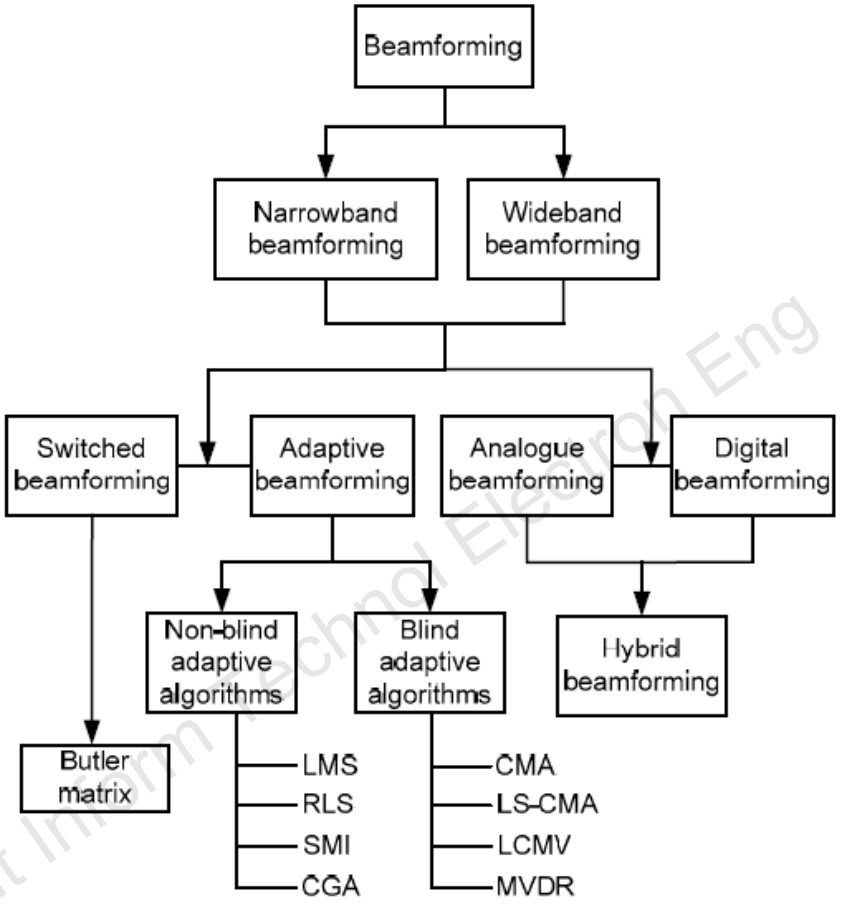

Fig. 1 General beamforming classification

LMS: least-mean-square; RLS: recursive-least-square SMI: sample matrix inversion; CGA: conjugate gradient algorithm; CMA: constant modulus algorithm; LS-CMA: least square constant modulus algorithm; LCMV: linearly constrained minimum variance; MVDR: minimum variance distortionless response

Unresolved issues and future trends

- Beamforming localization for massive MIMO systems
- Sparsity of beams
- Pilot contamination
- Channel correlation of beamforming array antennas for millimetre-waves
- Millimetre-wave hybrid beamforming

Conclusions

- A comprehensive overview of beamforming techniques in massive MIMO systems were discussed to determine which techniques are more suitable for deployment in massive MIMO systems to improve system throughput and reduce intra- and inter-cell interference.
- An optimal beamforming technique that can provide the highest performance in massive MIMO systems is proposed to meet the requirements of next-generation wireless communication systems.