

Triples of mutually unbiased bases

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Abstract

The concept of mutually unbiased bases (MUBs) is fundamental in quantum information theory. It is well-known that pairs of MUBs correspond to complex Hadamard matrices. In this talk, I describe a systematic study of triplets of MUBs, and report some recent progress [1]. Namely, we identify the fundamental algebraic relations ("cube axioms") defining MUB-triplets in any dimension d , and provide a conjectured identity, which would prove the non-existence of quadruplets of MUBs in dimension 6, using a recent result of [2]. Numerical evidence heavily supports the validity of the conjecture, and a formal proof may be achieved with the help of the cube axioms.

References

- [1] M. Matolcsi, Á. Matszangosz, D. Varga, M. Weiner. Triples of mutually unbiased bases. *preprint on arxiv*, 2025.
- [2] Á. Matszangosz, F. Szöllősi. A characterization of complex Hadamard matrices appearing in families of MUB triplets. *Des. Codes Cryptogr.*, **92**:4313-4333, (2024).