Geometric constructions of quantum codes

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Abstract

Calderbank, Rains, Shor and Sloane (see [1]) showed that error-correction is possible in the context of quantum computations. Quantum stabilizer codes are a class of additive quaternary codes in binary projective spaces, which are self-orthogonal with respect to the symplectic form. Quantum caps correspond to the special case of quantum stabilizer codes of distance $d = 4$ when the code is linear over $GF(4)$. We describe several recursive constructions for quantum caps and construct in particular quantum 36-and 38-caps in $PG(4, 4)$. This yields quantum codes with new parameters $[[36, 26, 4]]$ and $[[38, 28, 4]]$. Besides we have solved the open problem about the spectrum of pure linear quantum [[n,n-10,4]]-codes, proving the non-existence for $n = 11, 37, 39$.

References

[1] A. R. Calderbank, E. M. Rains, P. M. Shor, N. J. A. Sloane: *Quantum error-correction via codes over $GF(4)$*, *IEEE Transactions on Information Theory* **44** (1998), 1369-1387.