

Small weight codewords in the (dual) LDPC codes arising from $T_2^*(\mathcal{K})$

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In 2001, Kou et al. ([1]) examined classes of LDPC codes defined by incidence structures in finite geometries. Since then, other LDPC codes have been produced based on various incidence structures in discrete mathematics and finite geometry. In particular, Vontobel and Tanner ([2]) considered the LDPC codes generated by generalized polygons, focusing on generalized quadrangles. The classification of small weight codewords in LDPC codes arising from classical generalized quadrangles was done in 2006 by Kim, Mellinger and Storme ([3]).

In this talk, new results concerning the minimum distance and small weight codewords of the (dual) codes of $T_2^*(\mathcal{K})$ are presented. These results are proved using only geometric methods. First we present a new lower bound for the minimum distance and a number of cases in which this lower bound is sharp. Then we take a closer look at the case $T_2^*(\Theta)$ with Θ a hyperoval and characterize codewords of small weight. Finally, we characterize the codewords of small weight of the dual code of $T_2^*(\Theta)$ by investigating the geometric structure of $T_2^*(\Theta)^D$.

References

- [1] Y. Kou, S. Lin and M.P.C. Fossorier, Low-density parity-check codes based on finite geometries: a rediscovery and new results, *IEEE Trans. Inform. Theory*, 47 (7) (2001) 2711–2736.
- [2] P. O. Vontobel and R. M. Tanner, Construction of codes based on finite generalized quadrangles for iterative decoding, *Proceedings of 2001 IEEE Intern. Symp. Inform. Theory, Washington, DC*, (2001) 223.
- [3] J. Kim, K. E. Mellinger, L. Storme, Small weight codewords in LDPC codes defined by (dual) classical generalized quadrangles. *Des. Codes Cryptography* 42 (1) (2007) 73–92