Algebraic Invariants of Codes on Weighted Projective Spaces

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Weighted projective spaces are natural generalizations of classical projective spaces having rich structures and exhibiting interesting algebraic geometric properties. They have been regarded in literature, see [1-3], as convenient ambient spaces to create interesting classes of linear codes over finite fields.

The purpose of this talk is to introduce these codes known as *Weighted Projective Reed–Muller codes* over a finite field, and to reveal the role of computer algebra packages to study some of the relevant combinatorial commutative algebraic invariants. We pay a particular attention on two dimensional case to obtain more explicit information about the *minimal free resolution* of the vanishing ideal of the weighted projective plane $\mathbb{P}(1, a, b)$ over $\mathbb{F}_q$. This yields to the Hilbert function giving the dimension of the code and regularity index which is crucial to eliminate trivial codes.

Keywords
linear codes, weighted projective space, free resolution, Hilbert function

References
[1] Y. AUBRY, W. CASTRYCK, S. R. GHORPADE, G. LACHAUD, M. E. O'SULLIVAN, AND S. RAM., Hypersurfaces in weighted projective spaces over finite fields with applications to coding theory. In *Algebraic Geometry for Coding Theory and Cryptography*, E. Howe, K. Lauter and J. Walker (eds.), 25–61, Springer, 2017.

[2] O. GEIL; C. THOMSEN, Weighted Reed–Muller codes revisited.*Des. Codes Cryptogr.* 66 **volume**(66), 195–220. (2013).

[3] A. B. SORENSEN, Weighted Reed–Muller codes and algebraic-geometric codes. *IEEE Trans.Inf.Theory* **volume**(38), 1821–1826. (1992).