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3. Number Theory and Arithmetic Algebraic Geometry

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Higher levels of Z/p^lZ and cyclotomy

In this work are first studied the d^{th} levels of the prime finite fields F_p, defined as

$$s_d(F_p) = \min\left\{s \mid -1 = a_1^d + \cdots + a_s^d, a_i \in F_p\right\}$$

where $p \neq 2$ is a prime number, $d \geq 2$ is an even rational integer and $d \mid p-1$ without loss of generality.

The main result establishes that $s_d(F_p)$ is the minimal s for which $(1+s(p-1)/d)\alpha_s-(s+1)\alpha_{s+1} \neq 0$, where $\alpha_i, 1 \leq i \leq d$, are the coefficients of the Gauss period equation of degree d, resolvent of the cyclotomic equation $X^p - 1 = 0$.

Similarly, $s_d(Z/\,p^lZ)$ for $l \geq 1$ is obtained in terms of the coefficients of generalized period equations, while $s_d(Z/2^lZ), l \geq 1$ is found in an elementary way.

References: E. Becker, M. del P. Canales, *Higher levels of Z/p^lZ and period equations* (submitted)