Abstract

The Classification of $(42, 6)_8$ Arcs

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An $(n, s)_q$ arc in PG$(2, q)$ is a set of n points such that some s, but no $s + 1$ of them are collinear. It gives rise to a linear code with parameters $[n, 3, n - s]_q$. Let $m_s(2, q)$ denote the largest value of n for which an (n, s)-arc exists in PG$(2, q)$. An $(n, s)_q$ arc is largest if $n = m_s(2, q)$.

We present the classification of $(42, 6)_8$ arcs. These arcs are largest. We use methods from the theory of linear spaces and symmetric designs, the constructive theory of finite group actions, as well as geometric reasoning to determine all such arcs up to projective equivalence. There are five such arcs. One of them is a Mason arc [1].

The situation when $q = 9$ has been explored by the fourth author together with Kikui and Yoshida [2]. In this case, there is only one largest arc.

References

[1] J.R.M. Mason. A Class of $((p^n - p^m)(p^n - 1), p^n - p^m)$-Arcs in PG$(2, p^n)$. *Geometriae Dedicata*, **15** (1984) 355–361.

[2] Tatsuya Maruta, Ayako Kikui and Yuri Yoshida. On The Uniqueness of $(48, 6)$-Arcs in PG$(2, 9)$. *Advances in Mathematics of Communications*, **3**:1 (2009) 29–34.