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ON SOME NEW CLASSES OF SEMIFIELD PLANES

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1. Introduction

In [9] Hiramine, Matsumoto and Oyama introduced a construction method that associates with any translation plane of order q^2 (q odd) and kernel $K\cong GF(q)$, translation planes of order q^4 and kernel $K'\cong GF(q^2)$. In this article we study the class of semifield planes of order q^4 obtained from this method and show that with a few exceptions, the members of this class are new semifield planes. This class includes some recently constructed classes of planes; namely the class presented by Boerner-Lantz in [4] and the one by Cordero in [6].

2. Notation and preliminary results

Let $\mathcal{S}=(S, +, \cdot)$ be a finite semifield which is not a field. We denote by $\pi(\mathcal{S})$ the semifield plane coordinatized by $\mathcal{S}$ with respect to the points (0), (∞), (0, 0) and (1, 1). The dual translation plane of $\pi(\mathcal{S})$ is also a semifield plane and it is coordinatized by the semifield $\mathcal{S}^*=(S, +, *)$, where $a*b=b\cdot a$. Let q be an odd prime power, $\mathcal{F}=GF(q^2)$ and $x^\tau=\bar{x}=x^q$ for $x\in\mathcal{F}$. Let π be a semifield plane obtained by the construction method of Hiramine, Matsumoto and Oyama. Then π admits a matrix spread set of the form

$$\mathcal{M}=\left\{M(u,v)=\begin{bmatrix} u & v \\ f(v) & \bar{u}\end{bmatrix} : u, v\in\mathcal{F}\right\}$$

where $f: \mathcal{F}\to\mathcal{F}$ is an additive function. π is coordinatized by the semifield $\mathcal{P}=\mathcal{P}_f=(\mathcal{P}, +, \cdot)$, where $\mathcal{P}=\mathcal{F}\times\mathcal{F}$ and

$$(x, y)\cdot(u, v)=(x, y)\begin{bmatrix} u & v \\ f(v) & \bar{u}\end{bmatrix}.$$

We shall denote this plane by π_f. We define the following classes:

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