The André/Bruck and Bose representation in PG(2h,q): unitals and Baer subplanes

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Abstract

Many authors have used the André/Bruck and Bose representation of $PG(2, q^2)$ in $PG(4, q)$ to study objects in the Desarguesian plane with great success. This paper looks at the André/Bruck and Bose representation of the Desarguesian plane $PG(2, q^h)$ in $PG(2h, q)$ in order to determine whether this higher dimensional representation provides additional information about objects in the plane. In particular, we look at the representation of unitals and Baer subplanes in this setting.

1   Introduction: the André/Bruck-Bose representation

André[1] and Bruck and Bose[4, 5] independently developed a method for representing translation planes of order q^h with kernel containing $GF(q)$ in the projective space $PG(2h, q)$. André gave a construction based on group theory; Bruck and Bose gave an equivalent geometric construction. This geometric construction of Bruck and Bose is the form we use in this paper. We refer to this representation as the **André/Bruck-Bose representation**.

In this section we present the results of Bruck and Bose. In particular, we obtain a representation of the Desarguesian plane $PG(2, q^h)$ in the projective space $PG(2h, q)$. We also obtain a convenient and natural coordinate system for $PG(2, q^h)$ in this André/Bruck-Bose representation.

Throughout this paper we shall use the following notation. An **r−space** of $PG(n, q)$ is a subspace of dimension r. We shall use the term a subspace of

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