

Bent partitions, vectorial dual-bent functions, and association schemes

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The recently introduced generalized semifield spreads are bent partitions of $\mathbb{F}_{p^m} \times \mathbb{F}_{p^m}$, which are constructed from presemifields with a certain property, called right $\mathbb{F}_{p^k}$ -linearity. Bent partitions have similar properties as spreads. In particular they yield a large number of bent functions and amorphic association schemes. We show that with right $\mathbb{F}_{p^k}$ -linear presemifields, one can obtain a large variety of vectorial dual-bent functions, which yield association schemes that are not necessarily amorphic. More generally, we show that for $1 < s \leq m$, vectorial dual-bent functions from $\mathbb{V}_{2m}^{(p)}$ to $\mathbb{V}_s^{(p)}$, whose components are either all regular or all weakly regular but not regular, give rise to p^s -class association schemes on $\mathbb{V}_{2m}^{(p)}$.