ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

Invitation to a Guest Lecture

Dr Tekgül Kalaycı
Sabanci University, Istanbul

“New results on vectorial dual-bent functions, bent partitions and association schemes”

N.2.35 | Wednesday, 7 February 2024 | 10:00 a.m.

Abstract

We recall that a partition of an n-dimensional vector space $\mathbb{V}_n^{(p)}$ over the prime field $\mathbb{F}_p$ into an $n/2$-dimensional subspace U and subsets $A_1, \ldots, A_K$, is called a bent partition if every function f from $\mathbb{V}_n^{(p)}$ to $\mathbb{F}_p$ with the following properties is a bent function: Every $c \in \mathbb{F}_p$ has precisely K/p of the sets A_i in its preimage set and f is constant on U. In particular, a generalized semifield spread is a bent partition of $\mathbb{F}_{p^m} \times \mathbb{F}_{p^m}$ into (p^k+1) sets, where k is a divisor of m with special properties. We recall that generalized semifield spreads do not arise from any spread in general and show that one obtains not only p-ary and vectorial bent functions, but also bent functions into finite abelian groups of order p^s, $s \leq k$, from generalized semifield spreads. We obtain conditions on an isotopism between two (pre)semifields such that the corresponding partitions are equivalent bent partitions. By using (pre)semifield isotopisms that do not satisfy these particular conditions, we obtain inequivalent bent partitions, hence different classes of bent functions. We use a version of the Bannai-Muzychuk criterion to prove that vectorial dual-bent functions from $\mathbb{V}_n^{(p)}$ to $\mathbb{V}_m^{(p)}$ for which all components are regular (weakly regular but not regular), give rise to p^m-class and sometimes to

(p^m+1)-class association schemes on $\mathbb{V}_n^{(p)}$. This explains some classes of (p^k+1)-class amorphic association schemes on $\mathbb{F}_{p^m} \times \mathbb{F}_{p^m}$ we previously obtained from generalized semifield spreads, as fusions of (non-amorphic) (p^m+1)-class association schemes on $\mathbb{F}_{p^m} \times \mathbb{F}_{p^m}$.
This is joint work with Nurdagül Anbar and Wilfried Meidl. This work is supported by TÜBİTAK Project under Grant 120F309.

Wilfried Meidl and the Department of Mathematics look forward to seeing you at the talk!