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A recursive construction of linking systems of difference sets

Group difference sets are symmetric designs having a regular automorphism group. Difference sets in abelian groups correspond to multi-dimensional arrays over the alphabet $\{1, -1\}$ having all out-of-phase periodic autocorrelations zero, and these arrays have a wide range of applications in digital communications including synchronization, coded aperture imaging, and optical image alignment.

In 2014, Davis, Martin and Polhill introduced the concept of a linking system of difference sets, which is a collection of related difference sets having advantageous mutual properties. Such systems provide examples of systems of linked symmetric designs, as studied by Cameron and Seidel in 1973. The central problems are to determine which groups contain a linking system of difference sets, and how large such a system can be. Examples have been previously found using Galois rings, partial difference sets, a product construction, and group difference matrices.

I shall describe a new recursive construction of linking systems of difference sets in 2-groups. This is joint work with Shuxing Li and Samuel Simon.