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Goethals-Seidel difference families with symmetric or skew base blocks

We introduce a class of difference families that we call Goethals-Seidel (GS) difference families. They consist of four subsets (base blocks) of a finite abelian group of order v, which can be used to construct Hadamard matrices via the well-known Goethals-Seidel array. We consider the special class of these families in cyclic groups, where each base block is either symmetric or skew. The case where all four blocks are symmetric (Williamson matrices) has been studied extensively and we focus on the remaining three cases. By extending the previous computations by several authors, we complete the classification of GS-difference families of this type for odd $v < 50$.

Joint work with Dragomir Z. Djokovic.