Field of 9 Elements and Symmetric Designs

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Abstract

Combintorial designs are discrete structures which sometimes possess many regularity and symmetry conditions not proposed in the definition itself. If the point set and the block set of a symmetric design can both be partitioned in subsets of cardinalities 1 and 9, in such a way that these two set partitions form a tactical decomposition, then one may try to realize the incidence relation of the design using the field of 9 elements and groups connected with that field. We shall show how successful this attempt can when constructing some designs of Hadamard or Menon type. In particular, we shall construct the (known) abelian difference sets in groups of order 63 and 99.