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On the construction of n-dimensional designs from 2-dimensional designs. (English)

Zbl 0758.05034
Australas. J. Comb. 1, 67-81 (1990).

Summary: Let H be an abelian group of order v. If $X = (f(h_1 + h_2))$ $(h_1, h_2 \in H)$ is a $v \times v$ design, then $X = (f(h_1 + h_2 + \cdots + h_n))$ is a proper n-dimensional design. A difficulty with this construction is that it can only be applied to a small number of (2- dimensional) designs. This paper develops a very general technique for generating a proper n-dimensional design from 2-dimensional designs. Indeed, it is shown that Drake's generalised Hadamard matrices, Berman's nega-cyclic and ω-cyclic (generalised) weighing matrices and both of the orthogonal designs of order 4 and type (1,1,1,1) can be extended to give proper n-dimensional designs. In addition, this technique leads to a representation of 2-dimensional designs which generalises the concept of a difference set. This representation is interesting because of its brevity and its wide applicability.

MSC:

05B30	Other designs, configurations
05B20	Combinatorial aspects of matrices (incidence, Hadamard, etc.)
05B10	Combinatorial aspects of difference sets (number-theoretic, group-theoretic, etc.)

Keywords:

n-dimensional designs; 2-dimensional designs; Hadamard matrices; weighing matrices; orthogonal designs; difference set