English Summary

In this study, we determine a kind of decomposability of divisible designs. A divisible design is a special form of incidence structure. We introduce the so called *block-decomposition* and its weaker form, the *nearly block-decomposition* of a divisible design, and recognize that several existing concepts like $\mathcal{A}$-resolvability, large sets of disjoint DDs, $(\lambda, \alpha; k)$-frames, (k, λ)-semiframes, DDs induced by a generalized frame and sums of DDs all are special cases of block-decomposition (cp. chapter 2).

We present some examples (of constructions) of DDs which are at least nearly block-decomposable, but whose inner structure cannot be described by any of the other concepts (cp. chapter 3). It is possible to divide the described constructions into those which use a method developed by R.-H. Schulz and A.G. Spera [82] and the so called construction (A) which generalizes and extends this method. In construction (A), some properties of a finite affine space, especially its translation group, are used to create a DD by embedding its *starter design* and unifying translates which are isomorphic to this starter design. Starting from any given (s, k, λ)-DD with v points and b blocks, we are able to construct for every $i \in \mathbb{N}$ a $(s \cdot q^i, k, \lambda \cdot q^{i\,(n-2-d)})$-DD with q a prime power and $n \in \mathbb{N}$ chosen appropriately such that $(q^{n+1} - 1)(q - 1)^{-1} \geq v$ holds whereas d is given by construction (s. p.71). If the starter design is t-balanced ($t \geq 2$), we get a larger t-DD provided some conditions (s. Lemma 3.2.18) hold. For $t = 3$, it is always possible to construct a larger 3-DD by construction (A).

In many cases, this construction preserves the structure of the starter design. Hence, depending on this structure by construction (A) we get series of multiple block-decomposable DDs, $\mathcal{A}$-resolvable DDs, $(\lambda, \alpha; k)$-frames, large sets of DDs (provided the conditions of Lemma 3.2.40 hold), $(\lambda, \alpha; k)$-semiframes which are a generalization of (k, λ)-semiframes (s. Def. 3.2.35) or another new structure, a generalization of a generalized frame, a so called generalized λ-frame (s. Def. 3.2.38). Hence construction (A) is a multifaceted tool to systematically generate DDs with a specific inner structure.

A block-decomposable DD can possess another structure which we call an *outer divisible design*. We characterize those DDs which have an outer DD and recognize that most of the DDs presented in this work have one.

Another common ground of nearly all of the presented DDs is the property of an elementary abelian full *dual translation group* which is a special automorphism group of a DD characterizing its DD as isomorphic to a substructure of a finite affine space.

In the last chapter, we use the connection of DDs and CW-codes to carry forward our results to coding theory.

Erklärung

Hiermit versichere ich, dass ich alle Hilfsmittel und Hilfen zur Erstellung der vorliegenden Arbeit angegeben habe.
Ich versichere, dass ich die vorliegende Dissertation auf Grundlage der angegebenen Hilfsmittel und Hilfen selbständig angefertigt habe.

Berlin, den 17.7.2005 Sabine Giese