Abstract

Constructing t-designs with prescribed automorphism groups

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In order to reduce the number of possibilities and to enable a construction of a t-(v, k, λ) design exhaustively, it is natural to assume an action of an automorphism group on the design. For the very general setting of the Kramer-Mesner method developed for such a situation, it is in addition necessary to assume an action of the group on the set of points.

The other known constructive method, which uses the fact that the point and block orbits of the design form a tactical decomposition, can be carried out if the action of the group on the set of points as well as on the set of blocks has been assumed properly. To show the role of the tactical decomposition, we show what happens if we assume for a design to admit only a tactical decomposition but no group action.

We explain how to combine these two methods, applying the additional knowledge achieved from the coefficients of the tactical decomposition matrix in building the Kramer-Mesner matrix. We give examples which show how the number of columns of the Kramer-Mesner matrix can be largely reduced. We discuss the size of the problem of constructing t-designs with such kind of constraints, which depends on the group size and structure, hoping to be able to fill some gaps for the existence problems for t-designs by combining these two mentioned methods.