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Algebraic hypergraph decompositions

We examine edge decompositions of complete uniform hypergraphs whose parts are permuted transitively by a permutation of the vertex set. We present an algebraic method for constructing such a hypergraph decomposition which is related to the well known Paley graph construction. The construction is derived from a partition of the cosets of a group and a function from the power set of the vertex set into this group. Several examples will be constructed using different groups and we discuss the symmetry and other properties of the hypergraphs we obtain.