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The asymptotic existence of amicable orthogonal designs

An *orthogonal design* A of order n and type $(s_1, s_2, \ldots, s_u)$, in the commuting variables $\pm x_1, \pm x_2, \ldots, \pm x_u$, denoted $\mathrm{OD}(n \,; s_1, s_2, \ldots, s_u)$, is a square matrix of order n with entries $\pm x_k$ or 0, where each x_k occurs s_k times in each row and column such that distinct rows are pairwise orthogonal. Two orthogonal designs X and Y are said to be *amicable*, if $XY^t = YX^t$.

Amicable orthogonal designs are instrumental in the construction of orthogonal matrices. Not much is known about the existence or the structure of full (no zeros) amicable orthogonal designs admitting the maximum possible number of variables. An asymptotic existence result for full amicable orthogonal designs with almost maximum number of variables will be presented.