

Orthogonal Arrays: With or Without Additional Structure or Properties

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The family of orthogonal arrays (OAs) enjoys a fascinating mathematical structure. In statistics one direct application of an OA is in the formation of fractional factorial designs (FFD), perhaps the most useful experimental designs in practice. In constructing optimal FFDs, an important result is that an OA of strength t is a universally optimal resolution $-(t + 1)$ design. If in an experimental investigation, factorial effects based on the same number of factors are equally important, then designs based on OAs are preferred. In some practical situations, however, some of the factorial effects, albeit involving the same number of factors, could be more important than others. In this direction, Hedayat (1990) introduced the concept of OAs of strength $t+$. Later some other researchers investigated the D-optimality of two-level factorial designs for main effects and selected two-factor interactions. Moving forward in this direction, we shall introduce a generalization of OAs, namely Cluster Orthogonal Arrays (COAs) in this paper. Some properties and construction methods for COAs will be discussed. A connection between COAs and optimal FFDs will also be established.