Statistica Sinica **33** (2023), 1-15
doi:https://doi.org/10.5705/ss.202021.0024

ON CONSTRUCTION OF NONREGULAR TWO-LEVEL FACTORIAL DESIGNS WITH MAXIMUM GENERALIZED RESOLUTIONS

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Abstract: The generalized resolution was introduced and justified as a criterion for selecting nonregular factorial designs. Although there has been extensive research conducted on other aspects of nonregular designs, few works have investigated the construction of nonregular designs with maximum generalized resolutions, as we do in this study. To date, our knowledge of nonregular designs with maximum generalized resolutions is predominantly computational, except for very few theoretical results. We derive lower bounds on relevant J-characteristics and present the construction results. With the assistance of the lower bounds, many of the constructed designs are shown to have maximum generalized resolutions.

Key words and phrases: Good Hadamard matrix, orthogonal array, Paley construction, tensor product.

1. Introduction

Nonregular factorial designs are not regular and, therefore, cannot be specified by defining relations. The generalized resolution, introduced by Deng and Tang (1999), provides a concise characterization for a two-level nonregular design, just as the resolution does for a two-level regular design. As a design selection criterion, the generalized resolution is justifiable from two points of view, one from the properties of projection designs, and the other from the biases on the estimation of the main effects. An extension of the concept to multi-level designs was examined by Evangelaras et al. (2005) and Grömping and Xu (2014).

Studies on nonregular designs started as early as the 1940s, when Plackett and Burman (1946) introduced a class of main-effect plans for run sizes that are multiples of four. However, such studies were rare until Lin and Draper (1992), Wang and Wu (1995), Cheng (1995) and Box and Tyssedal (1996) investigated the projection properties of nonregular designs. There have been extensive research activities since, with much of the later work centered around the minimum

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