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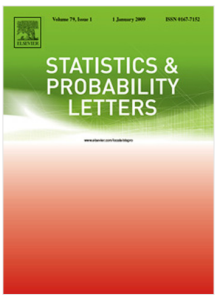

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Projection Uniformity under Mixture Discrepancy

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Abstract: The objective of this paper is to discuss the issue of projection uniformity under mixture discrepancy (MD). The uniformity pattern (UP) and minimum projection uniformity criterion are defined for two- and three-level designs under MD. It's shown that the projection uniformity under MD is better than that of other discrepancies, and there is a linear relationship between UP and generalized word-length pattern. Moreover, it is also shown that the foldover technique can increase uniformity resolution. The lower bounds of projection discrepancy for foldover designs and more general follow-up designs are also obtained for two-level designs. For three-level designs, the UP is defined through the average projection discrepancy based on level permutation of factors and its property is also discussed.

Keywords: Generalized word-length pattern; Lower bounds; Mixture discrepancy; Projection uniformity; Uniformity pattern

1 Introduction

Uniform design (UD) has been widely used in physical and computer experiments (see Fang et al. [4]). The main idea of UD is to scatter the design points uniformly on the experimental domain. As a measure of uniformity, discrepancy plays a key role in UD and various discrepancies have been proposed by using the tool of reproducing kernel Hilbert space, such as centered L_2-discrepancy (CD, Hickernell [8]), wrap-around L_2-discrepancy (WD, Hickernell [9]), discrete discrepancy (DD, Liu and Hickernell [12]) and mixture discrepancy (MD, Zhou et al. [17]).

Two- and three-level factorials are widely used and it is meaningful to consider the projection property under an assumption of effect sparsity. The projection uniformity criterion favors designs with the smallest projection discrepancy value of different dimensions. Fang and Qin [6] proposed the uniformity pattern (UP) and minimum projection uniformity (MPU) criterion under CD, and showed that it is equivalent to generalized minimum aberration (GMA) for two-level designs. The UP is defined through the projection discrepancy and can measure the projection uniformity of different dimensions. Zhang and Qin [16] established the relationship between UP with other criteria under CD for two-level designs. Qin et al. [13] and Wang and Qin [14] discussed UP for q-level and mixed-level designs under DD, respectively. However, Zhou et al. [18] pointed out the shortcoming of DD for constructing UDs with multi-level factors. In addition, Gou et al. [7] studied UP and lower bounds of projection uniformity measure for follow-up designs under CD.

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