Multi-Stratum Factorial Designs:
Model-Based and Model-Free Approaches

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Abstract

Multi-stratum factorial designs are widely used for screening treatment factors in experiments where the units exhibit complex structures. Such complexity, often arising from heterogeneity among experimental units, introduces multiple sources of variability and error. In this presentation, we introduce two complementary approaches to address the optimality challenges of multi-stratum factorial designs. The first approach is grounded in a mixed-effects modeling framework, while the second draws on established statistical principles from the literature. Although these approaches appear distinct, the optimal designs they yield are strikingly consistent. Both theoretical justifications and numerical evidence are presented to demonstrate the efficacy of these methods, offering a principled alternative to traditional case-by-case ad hoc solutions.

Keywords：Block design; Block structure; Minimum aberration; Partially-relaxed orthogonal block structure; Row-column design