Recent Progresses of the GMC Theory and Its Application

Abstract

To recognize the real world, there are three fundamental sciences as the bases or tools of all the practical sciences. One is philosophy, one is mathematics and one is statistics. Different from the first two, statistics is to study the general logical thinking and methodology of how to infer the real world through the data obtained by observing the world, including how to observe the world and how to analyze the data so that the conclusion obtained by inferring can close to the real world as efficient and exact as possible. Experimental design is a branch of statistics, which studies how efficiently and economically to observe a real world by planning experiments and how scientifically to analyze the experimental data.

In this talk, a optimality theory in the field of fractional factorial designs, called general minimum lower order (GMC) theory, will be introduced, which was developed in recent years (see Zhang, Li, Zhao and Ai (2008). In the first part, a overview of the GMC theory will be given: first we introduce some basic points of the GMC theory, including the motivation of the study, the notion of AENP and GMC criterion, how the GMC to unify the existing criteria and a review of some other results of the GMC theory obtained in two years ago.

In the second part, some progresses of the GMC theory in these two years will be presented. The first work is related to how to arrange factors in practical experiments. For a given design, in order to optimally arrange the factors, we proposed a pattern, called factor aliased effect number pattern (F-AENP), for measuring its columns and give a criterion for ranking columns. The F-AENP is used in the two-level GMC designs. The F-AENPs of all the GMC $2^{n-m}$ designs with $5N/16 + 1 \leq n \leq N - 1$ and their column ranks are obtained. And then we introduce the results about construction of GMC $2^{n-m}$ designs with $n \leq \frac{N}{4}$, B$^1$-GMC $2^{n-m}$ : $2^r$ designs with $\frac{N}{4} + 1 \leq n \leq \frac{5N}{16}$ and B-GMC $2^{n-m}$ : $2^r$ designs with $\frac{5N}{16} + 1 \leq n \leq N-1$. 

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