

Identification of dispersion effects from partially replicated two-level factorial designs

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It has been emphasized on the variation reduction in industrial product or process quality improvement. Thus, well designed experiments are usually needed to identify both location and dispersion effects so as to control the quality characteristic of interest around a target value with a minimal variation. Analysis of dispersion effects typically requires pure replicates on treatment combinations. This can lead to a costly experiment due to a large number of experimental runs. Thus, several methods have been proposed to analyze dispersion effects from unreplicated factorial designs. However, the use of unreplicated designs can be inherently difficult in the identification of the truly active effects since location and dispersion effects are possibly confounded. In this study, we promote compromised designs with partial replications. Based on the concepts of generalized p -values, we develop a statistical testing procedure to identify significant dispersion effects from partially replicated designs. The proposed procedure is evaluated through a detailed simulation study, and the simulation result strongly supports that it can be recommended in practical use. In addition, a catalogue of partially replicated designs with practical run-sizes is provided for applications.