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# Optimal fractional factorial split-plot designs when the whole plot factors are important

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## Abstract

In practice, fractional factorial split-plot (FFSP) designs are widely used when the levels of some factors are very difficult or expensive to be changed or controlled. The factors of an FFSP design are divided into two groups, the whole plot (WP) and subplot factors. Under the circumstances that the experimenter has some prior information about the significance of the WP factors, the paper gives a new optimal criterion for selecting designs, that is, the minimum aberration of type WP (WP-MA). Construction of optimal fractional factorial split-plot designs with respect to the WP-MA criterion is considered. The WP-MA FFSP designs with 8, 16, and 32 runs are tabulated.

*MSC:* primary 62K15; secondary 62K05

*Key words:* Fractional factorial design; Split-plot design; Minimum aberration

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## 1 Introduction

Fractional factorial (FF) designs are widely used in industrial and agricultural experiments because they can reduce the number of experimental times and lower the costs. When an FF experiment is performed, it is required that the experimental runs are completely randomized. However, it is sometimes impractical to perform the experimental runs in a completely random order since it is very difficult or expensive to change or control the levels of some factors. Then, a fractional factorial split-plot (FFSP) design, which involves a two-phase randomization, may represent a practical design option to meet the special demands.

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