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[TOP](#) > [Available Issues](#) > [Table of Contents](#) > [Abstract](#)

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## Characterization of Balanced Fractional $2^m$ Factorial Designs of Resolution $R^*({1}|3)$ and GA-optimal Designs

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**Abstract:** In this paper, based on the assumption that the four-factor and higher-order interactions are to be negligible, we consider a balanced fractional  $2^m$  factorial design derived from a simple array such that all the main effects are estimable, i.e., resolution  $R^*({1}|3)$ . In this situation, using the algebraic structure of the triangular multidimensional partially balanced association scheme and a matrix equation, we can get designs of four types of resolutions: the first is of resolution  $R({1}|3)$ , the second is of resolution  $R({0,1}|3)$ , the third is of resolution  $R({1,2}|3)$ , i.e., resolution VI, and the last is of resolution  $R({0,1,2}|3)$ , i.e., resolution VI. This paper gives the characterization of designs mentioned above, and also it gives optimal designs with respect to the generalized A-optimality criterion for  $6 \leq m \leq 8$  when the number of assemblies is less than the number of non-negligible factorial effects.

**Key words:** association algebra, BFF designs, estimable parametric functions, GA-optimality criterion, resolution, simple arrays

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