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Partial A-optimal balanced fractional 2^m factorial designs with $6 \leqq m \leqq 8$

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1. Introduction

A balanced array (B-array), which is a generalization of an orthogonal array, was first studied by Chakravarti [2] under the name of "partially B-array". A connection between a B-array and a balanced fractional factorial (BFF) design has been investigated so far by, e.g., Srivastava [31], Yamamoto, Shirakura and Kuwada [41], Kuwada [20] and Kuwada and Nishii [22]. The characteristic roots of the information matrix of a 2^m-BFF design of resolution V were obtained by Srivastava and Chopra [33]. By use of the triangular multidimentional partially balanced (TMDPB) association scheme and its algebra, Yamamoto, Shirakura and Kuwada [42] extended their results to a 2^m-BFF design of resolution $2\ell+1$. The concept of the MDPB association scheme was introduced by Bose and Srivastava [1] and Srivastava [30] as a generalization of the ordinary association scheme.

A- and/or D-optimal 2^m-BFF designs of resolution V or VII were obtained by Srivastava and/or Chopra [4–9, 11–14, 34, 35] and Shirakura [24, 26]. More precise tables of Srivastava-Chopra optimal designs of resolution V have been presented by Nishii and Shirakura [23] for $4 \leqq m \leqq 6$, and Chopra, Kipngeno and Ghosh [10] for $7 \leqq m \leqq 10$. Some optimal fractional 2^m factorial (2^m-FF) designs were obtained by Cheng [3] and Kuwada [21]. Optimal 2^m-BFF designs of even resolution derived from B-arrays were obtained by Shirakura [25–27]. A necessary and sufficient condition for a B-array of strength 2ℓ to be a 2^m-BFF design of resolution 2ℓ was obtained by Shirakura [28]. Yamamoto and Hyodo [38, 39] introduced an extended concept of resolution, which includes the results due to Shirakura [25–28]. By utilizing the characterization of the information matrix, Yamamoto and Hyodo [38–40], Hyodo and Yamamoto [17–19] and Hyodo [15, 16] have shown that there are so many designs having various type resolution including both odd and even resolution as special cases.

Consider a two-symbol B-array of strength 6, m constraints, index set $\{\mu_0^{(6)}, \mu_1^{(6)}, \ldots, \mu_6^{(6)}\}$ and frequency set $\{z_0^{(m)}, z_1^{(m)}, \ldots, z_m^{(m)}\}$, where $z_j^{(m)}$ are the number of row vectors with weight j in the array. Such an array is traditionally denoted as a $\mathrm{BA}(N, m, 2, 6)\{\mu_0^{(6)}, \mu_1^{(6)}, \ldots, \mu_6^{(6)}\}$, where N is the total number of assemblies. We, however, denote it here as