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Unbiased Orthogonal Designs

Let D_1, D_2 be orthogonal designs of order n and type (s_1, \dots, s_u) in variables x_1, \dots, x_u . D_1 and D_2 are *unbiased with parameter α* if α is a positive real number and there exists a $(0, 1, -1)$ -matrix W such that

$$D_1 D_2^\top = \frac{s_1 x_1^2 + \dots + s_u x_u^2}{\sqrt{\alpha}} W.$$

The study of unbiased orthogonal designs provides a unified approach to the study of a variety of unbiased matrices.

Upper bounds, an asymptotic existence result, and some methods of construction will be presented. The application includes the proof of the existence of mutually quasi-unbiased weighing matrices with various parameters.

This is joint work with Sho Suda.