

Exact D -optimal Designs for Mixture Models

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The exact D -optimal design problems for regression models have been investigated in many works, especially for the polynomial regression models on a compact interval. In this work, we consider a mixture experiment with q ingredients, where the proportions of the ingredients are subject to the restriction $\sum_{i=1}^q x_i = 1, x_i \geq 0$ on the $(q - 1)$ -dimensional probability simplex S^{q-1} . The exact D -optimal design problems for mixture experiments under Scheffé quadratic model as well as the linear log contrast model are discussed. Based on results in Kiefer (1961) about the approximate D -optimal designs, the exact D -optimal for Scheffé quadratic models with two or three ingredients are obtained and numerical verifications of the conjectured exact D -optimal designs are presented for cases with ingredients between four and ten. For the linear log contrast model with three ingredients, the exact D -optimal design is also obtained, where the symmetry properties of the design are used. The cases with more than three ingredients will be discussed with numerical illustrations.

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