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Some Notes on Determining the Minimal Sample Size in Balanced 3-way ANOVA Models where no Exact F-Test Exists

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For the two three-way ANOVA models $A \times BB \times CC$ and $(A \succ BB) \times CC$ (doubled letters indicate random factors) an exact F -test does not exist, for testing the hypothesis that the fixed factor A has no effect. Approximate F -tests can be obtained by Satterthwaite's approximation. The approximate F -test involves mean squares to be simulated. To approximate the power of the test, we simulate data such that the null hypothesis is false and we compute the rate of rejections. The rate then approximates the power of the test.

In this talk we aim to determine the minimal sample size of the two models mentioned above given a prespecified power and we

- (i) give a heuristic that the number of replicates n should be kept small ($n = 2$). This suggestion is backed by all simulation results.
- (ii) determine the active and inactive variance components for both ANOVA models using a surrogate fractional factorial model with variance components as factors.
- (iii) determine the worst combination of active variance components for both models using a surrogate response surface model based on a Box-Behnken design. The special structure of the Box-Behnken design ensures that the used models have similar total variance.

Additionally we propose three practical methods that help reducing the number of simulations required to determine the minimal sample size.

We compare the proposed methods, present some examples and, finally, we give recommendations about which method to choose.

Keywords

ANOVA; approximate F-test; minimal sample size determination

Classification

Mainly methodology

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