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Third-Order Method For the Test of Variance Components in Linear Mixed Model

We consider the problem of testing for variance components in linear mixed models. The likelihood based on third-order asymptotic method is proposed for approximating the p-values for testing a scalar parameter, such as a random intercept or a random slope. The third-order p-values use a simple modification of the familiar first-order method, likelihood ratio test and Wald statistics. Extensive simulations show that the proposed approximations outperform the existing likelihood based methods with both maximum likelihood and restricted maximum likelihood.