

Kenward-Roger modification of the F-statistic for some linear mixed models fitted with `lmer`

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For linear mixed models a frequent task is to test for the reduction of a model by the removal of some fixed effect. For models fitted with the `lmer` function of the R package **lme4** (Bates et al., 2011) such tests can be performed by via a maximum likelihood ratio test and the approximate χ^2 distribution of the test statistic.

This approximation may yield rather anti-conservative tests (Pinheiro and Bates, 2000, p. 88) with erroneously small p-values. An alternative is to use F-tests which are exact in some balanced situations. Kenward and Roger (1997) proposed a modification of the F-test statistic possibly shrinking the statistic and adjusting the residual degrees of freedom in order to achieve a better approximation to a F-distribution. Our function implements such an approximation for linear mixed models fitted with `lmer`. The implementation is restricted to covariance structures which can be expressed as a linear combination of known matrices. Such models comprise variance component and random coefficient models.

It has been shown in simulation studies (Kenward and Roger, 1997; Spilke et al., 2005) that sometimes the Kenward-Roger modification represents a satisfactory approximation to the F-distribution. But others have argued (e.g. in a [discussion on the R help list](#)) that it is generally not clear that such an approximation holds under general circumstances.

We offer therefore additional functions to calculate a p-value via parametric bootstrap and possible improvements by the Bartlett correction of the test statistic.

In the talk we will shortly depict the theory and show some applications also pointing to some numerical problems we encounter.

The functions will be made available via the CRAN package **doBy** (Højsgaard and Halekoh, 2011).

References

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