Metrika (2011) 74:381–395
DOI 10.1007/s00184-010-0308-6

On the equality of the BLUPs under two linear mixed models

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Received: 16 September 2008 / Published online: 2 April 2010

Abstract In this paper we consider two mixed linear models, $\mathscr{M}_1$ and $\mathscr{M}_2$, say, which have different covariance matrices. We review some useful concepts and results on the best linear unbiased estimators (BLUEs) and on best linear unbiased predictors (BLUPs). We give new necessary and sufficient conditions, without making any rank assumptions, that every representation of the BLUP of the random effect under the model $\mathscr{M}_1$ continues to be BLUP under the model $\mathscr{M}_2$. These considerations are generalized to two linear models with new unobserved future observations.

Keywords BLUE · BLUP · Generalized inverse · Linear fixed effects model · Linear mixed effects model · Löwner ordering

1 Introduction

Much of the literature in linear statistical models has focused on best linear unbiased estimation of fixed coefficients, and to a lesser extent on equality of those coefficients under two different covariance matrices. There is also an extensive literature on mixed linear models which includes material on equality of fixed parameter estimates under two models. There is, however, an almost non-existent literature on equality of best linear unbiased predictors of random effects in mixed models. This can be an important question in animal breeding and small-area estimation, for example. The links

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