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Summary. We provide a data-driven method for modelling the conditional, within subject, covariance matrix arising in linear mixed models (Laird and Ware, 1982). Given an agreed structure for the between subject covariance matrix we use a regression equation approach to model the within subject covariance matrix. Using an EM algorithm we estimate all of the parameters in the model simultaneously and obtain analytical expressions for the standard errors. By re-analyzing Kenward's (1987) cattle data, we compare our new model with classical menu-selection-based modelling techniques, demonstrating its superiority using the Bayesian Information Criterion (BIC). We also conduct a simulation study which confirms our observational findings. The paper extends our previous covariance modelling work (Pan and MacKenzie, 2003, 2006) to the conditional covariance space of the linear mixed model (LMM).

Keywords: Cholesky decomposition; Conditional covariance, EM Algorithm, Joint mean-covariance models; Linear mixed models; Longitudinal data.

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