

# CMMSE: Joint analysis of Structured orthogonal families

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## Abstract

The models for symmetric stochastic matrices that we consider in this study are developed using the spectral analysis of the respective mean matrices. The adjustment and validation of the models require the usage of the estimated structure vectors. The information enclosed in these matrices can be condensed into the pair consisting of the estimated structure vectors and the sum of squares of residuals. The results obtained allow for cross-sectional and longitudinal inference. For models of degree greater than one, it is also considered the possibility of truncating the model when eigenvalues are much higher than the others. A direct consequence of the adopted methodology is the application of the degree-one models to cross-product matrices and Hilbert-Schmidt scalar product matrices. In addition to these models, structured family models were also considered. The models of these families are associated with the treatments of a base design. The action of the factors considered in the base design on the structure vectors is also analyzed. In structured families with orthogonal base design, the designs are associated to partitions, and the hypotheses formulated are associated with the spaces of these partitions. We carry out ANOVA-like analysis for the action of the factors in the base design, on homolog components on estimated structure vectors, considering that the estimator's structure vectors have, approximately, the same covariance matrix. To apply our results, we assume the factors in the base design to have fixed effects and that the base design has orthogonal structure. The action of factors in the base design is studied. An application is given, using a data set from a breeding program of durum wheat (*Triticum turgidum L.*, Durum Group) conducted in Portugal. The results show that our methodology is fully applicable to complete and incomplete data sets, often observed in multi-environmental trials.

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