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*The use of graph decompositions for variance-balanced designs in the presence of correlated errors*

Designs have a long tradition in statistical experiments. A standard model is

$$y_{ij} = \theta_i + \beta_j + \epsilon_{ij},$$

where $y_{ij}$ is an observed value for treatment $i$ in block $j$, $\theta_i$ is a treatment effect, $\beta_j$ is a block effect, and $\epsilon_{ij}$ are i.i.d. errors.

The covariance matrix for the least-squares estimator $\widehat{\theta}$ is computed from the design incidence matrix. When a BIBD is used for the model, $\mathrm{Cov}(\widehat{\theta})$ is a linear combination of $I$ and $J$, something statistically desirable.

This research explores graph decompositions in place of BIBDs when $\epsilon_{ij}$ are correlated, say for spatial or temporal reasons.