...netic Model : $y_i = \mu + u_i + e_i$

- Vectors β and u contained unknowns, and we want to estimate β and to predict u
- Using properties described by BLUP, we get to estimates $\hat{\beta}$ for the unknowns β :

$$\left.\begin{aligned} \hat{\beta} &= (X^T V^{-1} X)^{-1} X^T V^{-1} y \\ \hat{u} &= G Z^T V^{-1} (y - X\hat{\beta}) \end{aligned}\right\} \text{theory, but not usable in practice}$$

- Mixed Model Equations to get results for $\hat{\beta}$ and $\hat{u}$

General :

$$\begin{bmatrix} X^T R^{-1} X & X^T R^{-1} Z \\ Z^T R^{-1} X & Z^T R^{-1} Z + G^{-1} \end{bmatrix} \begin{bmatrix} \hat{\beta} \\ \hat{u} \end{bmatrix} = \begin{bmatrix} X^T R^{-1} y \\ Z^T R^{-1} y \end{bmatrix}$$

X, Z are given design matrices

$R = var(e)$ variance-covariance matrix of e

$G = var(u)$ variance-covariance matrix of u

- Variance Structure of MLEM

$R = var(e) = I \cdot \sigma_e^2$ — ~~scalar~~ number "error ...