Summary: BLUP Animal Model

Model: $y = X\beta + Zu + e$

- y: observations
- $X\beta$: fixed effects
- Zu: random breeding values of all animals in pedigree
- e: random residuals

Expected values:

$$E\begin{bmatrix} y \\ u \\ e \end{bmatrix} = \begin{bmatrix} X\beta \\ 0 \\ 0 \end{bmatrix}$$

Variance-Covariance Matrices:

$$\text{var}\begin{bmatrix} y \\ u \\ e \end{bmatrix} = \begin{bmatrix} V & ZG & R \\ GZ' & G & 0 \\ R & 0 & R \end{bmatrix}$$

with $G = A \cdot \sigma_u^2$

$R = I \cdot \sigma_e^2$

$V = ZGZ' + R$

Solution with MME:

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

data

$A^{-1}\sigma_u^{-2}$ ⇒ pedigree