Package ‘MMeM’

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**MMeM**: Estimating the variance covariance components of the multivariate mixed effects model

### Description


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### See Also

Useful links:

- Report bugs at [https://github.com/pengluyaoyao/MMeM/issues](https://github.com/pengluyaoyao/MMeM/issues)

**MMeM_henderson3**

Multivariate Henderson3 method

### Usage

```r
MMeM_henderson3(fml, data, factor_X)
```

### Arguments

- **fml**: two-sided linear formula object describing both the fixed-effects and random-effects parts of the model, with the response on the left of a ~ operator. For univariate response, put variable name directly; for multivariate responses combine variables using concatenate operator, for example, for bivariate responses, c(var1, var2). The predictor terms are separated by + operators, on the right. Random-effects terms are distinguished by vertical bars '|' separating expressions for design matrices from grouping factors.
- **data**: data frame containing the variables named in formula.
- **factor_X**: (logical) indicating whether predictor is a factor or continuous. By default is TRUE.
Value

The function returns a list with the following objects:

- **T.estimates** is the estimated variance covariance components (T. estimates) of the variance covariance matrix of the block random effects with corresponding sampling variances (T.variance)
- **E.estimates** is the estimated variance covariance components (E. estimates) of the variance covariance matrix of the residuals with corresponding sampling variances (E.variance)

References


Examples

```r
data(simdata)
results_henderson <- MMeM_henderson3(fml = c(V1,V2) ~ X_vec + (1|Z_vec),
data = simdata, factor_X = TRUE)
```

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**MMMeM_reml**

**Multivariate REML Method**

Description

Estimating the variance components under the multivariate mixed effects model using REML methods

Usage

```r
MMeM_reml(fml, data, factor_X, T.start, E.start, maxit = 50,
tol = 1e-09)
```

Arguments

- **fml**: a two-sided linear formula object describing both the fixed-effects and random-effects parts of the model, with the response on the left of a ~ operator. For univariate response, put variable name directly; for multivariate responses combine variables using concatenate operator, for example, for bivariate responses, c(var1, var2). The predictor terms are separated by + operators, on the right. Random-effects terms are distinguished by vertical bars '|' separating expressions for design matrices from grouping factors.
- **data**: data frame containing the variables named in formula.
- **factor_X**: (logical) indicating whether predictor is a factor or continuous. By default is TRUE.
- **T.start**: the starting matrix for the variance covariance matrix of the block random effects, it has to be positive definite q by q symmetric matrix.
**E.start**
the starting matrix for the variance covariance matrix of the block random effects, it has to be positive definite q by q symmetric matrix.

**maxit**
the maximum number of iterations

**tol**
the convergence tolerance

### Details

Suppose n observational units, q variates, p fixed effects coefficients and s random effects units. The model supports multivariate mixed effects model for one-way randomized block design with equal design matrices:

\[
Y = XB + ZU + E
\]

where \( Y \) is n by q response variates matrix; \( X \) is n by p design matrix for the fixed effects; \( B \) is p by q coefficients matrix for the fixed effects; \( Z \) is n by s design matrix for the random effects; \( U \) is s by q matrix for the random effects; \( E \) is n by q random errors matrix.

The model also supports simple OLS multivariate regression:

\[
y = Xb + Zu + e
\]

where \( y \) is n by 1 response vector; \( b \) is p by 1 coefficients vector for the fixed effects; \( u \) is s by 1 matrix for the random effects.

### Value

The function returns a list with the following objects:

- **T.estimates** is the estimated variance covariance components of the variance covariance matrix of the block random effects
- **E.estimates** is the estimated variance covariance components of the variance covariance matrix of the residuals
- **VCOV** is the asymptotic dispersion matrix of the estimated variance covariance components for the block random effects and the residuals.

### References


### Examples

```r
data(simdata)
T.start <- matrix(c(10,5,5,15),2,2)
E.start <- matrix(c(10,1,1,3),2,2)
results_reml <- MMeM_reml(fml = c(V1,V2) ~ X_vec + (1|Z_vec), data = simdata, factor_X = TRUE, T.start = T.start, E.start = E.start, maxit = 10)
```
MMeM_terms

**Description**

parses formulas to creates model matrices

**Usage**

```r
MMeM_terms(fml, data, factor_X)
```

**Arguments**

- `fml`: a two-sided linear formula object describing both the fixed-effects and random-effects parts of the model, with the response on the left of a `~` operator. For univariate response, put variable name directly; for multivariate responses combine variables using concatenate operator, for example, for bivariate responses, `c(var1, var2)`. The predictor terms are separated by `+` operators, on the right. Random-effects terms are distinguished by vertical bars `|` separating expressions for design matrices from grouping factors.
- `data`: data frame containing the variables named in formula.
- `factor_X`: (logical) indicating whether predictor is a factor or continuous. By default is TRUE

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**simdata**

*simulated bivariate data*

**Description**

This is a simulated data with 2 dependent variables and one fixed effects and one random effects

**Usage**

```r
data(simdata)
```

**Details**

simulated datasets
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