

# Package ‘reformulas’

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**Title** Machinery for Processing Random Effect Formulas

**Version** 0.4.4

**Description** Takes formulas including random-effects components (formatted as in 'lme4', 'glmmTMB', etc.) and processes them. Includes various helper functions.

**URL** <https://github.com/bbolker/reformulas>

**License** GPL-3

**Encoding** UTF-8

**Imports** stats, methods, Matrix, Rdpack

**RdMacros** Rdpack

**Suggests** lme4, tinytest, glmmTMB, Formula

**RoxygenNote** 7.3.3

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**NeedsCompilation** no

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**Repository** CRAN

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anySpecial	<i>Detect whether there are any 'specials' in a formula term</i>
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### Description

Detect whether there are any 'specials' in a formula term

### Usage

```
anySpecial(term, specials = findReTrmClasses(), fast = FALSE)
```

### Arguments

term	formula term
specials	values to detect
fast	(logical) use quick (syntactic) test for presence of specials?

### Value

logical value

### Examples

```
## should only detect s as the head of a function, s(...)
anySpecial(~diag(1))
anySpecial(~diag)
anySpecial(~diag[[1]])
anySpecial(~diag[1])
anySpecial(~s)
anySpecial(~s(hello+goodbye,whatever))
```

---

expandDoubleVerts	<i>Expand terms with '   ' notation into separate '   ' terms</i>
-------------------	---

---

**Description**

From the right hand side of a formula for a mixed-effects model, expand terms with the double vertical bar operator into separate, independent random effect terms.

**Usage**

```
expandDoubleVerts(term)
```

**Arguments**

term	a mixed-model formula
------	-----------------------

**Value**

the modified term

**See Also**

[formula](#), [model.frame](#), [model.matrix](#).

Other utilities: [mkReTrms\(\)](#), [nobars\(\)](#), [subbars\(\)](#)

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expandGrpVar	<i>apply operator expansion (e.g. a/b -&gt; a + a:b) to a formula term</i>
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---

**Description**

apply operator expansion (e.g. a/b -> a + a:b) to a formula term

**Usage**

```
expandGrpVar(f)
```

**Arguments**

f	a language object (an atom of a formula)
---	--

**Examples**

```
expandGrpVar(quote(x*y))  
expandGrpVar(quote(x/y))
```

---

findReTrmClasses	<i>list of specials – taken from enum.R</i>
------------------	---

---

**Description**

list of specials – taken from enum.R

**Usage**

```
findReTrmClasses()
```

---

formatVC	<i>Format the 'VarCorr' Matrix of Random Effects</i>
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---

**Description**

"format()" the VarCorr matrix of the random effects – for print()ing and show()ing

**Usage**

```
formatVC(
  varcor,
  digits = max(3, getOption("digits") - 2),
  corr_digits = max(2, digits - 2),
  maxdim = 10,
  comp = "Std.Dev.",
  formatter = format,
  useScale = attr(varcor, "useSc"),
  ...
)
```

**Arguments**

varcor	a VarCorr (-like) matrix with attributes.
digits	the number of significant digits for standard deviations and variances.
corr_digits	the number of significant digits for correlations.
maxdim	maximum dimensions (numbers of standard deviations/variances and number of rows of correlation matrices) to report per random effects term.
comp	character vector of length one or two indicating which columns out of "Variance" and "Std.Dev." should be shown in the formatted output.
formatter	the <a href="#">function</a> to be used for formatting the standard deviations and or variances (but <i>not</i> the correlations which (currently) are always formatted as "0.nnn").
useScale	whether to report a scale parameter (e.g. residual standard deviation).
...	optional arguments for formatter(*) in addition to the first (numeric vector) and digits.

**Value**

a character matrix of formatted VarCorr entries from varcor.

---

format_sdvar	<i>Format columns corresponding to std. dev. and/or variance.</i>
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**Description**

Format columns corresponding to std. dev. and/or variance.

**Usage**

```
format_sdvar(
  reStdDev,
  use.c = "Std.Dev.",
  formatter = format,
  digits = max(3, getOption("digits") - 2),
  ...
)

format_corr(x, maxdim = Inf, digits = 2, maxlen = 10, ...)

get_sd(x, ...)
```

**Arguments**

reStdDev	a vector of standard deviations.
use.c	a character vector indicating which scales to include.
formatter	formatting function.
digits	digits for format
...	additional parameters
x	a square numeric matrix
maxdim	maximum number of rows/columns to display
maxlen	maximum number of rows to display

isNested *Is f1 nested within f2?*

---

### Description

Does every level of f1 occur in conjunction with exactly one level of f2? The function is based on converting a triplet sparse matrix to a compressed column-oriented form in which the nesting can be quickly evaluated.

### Usage

```
isNested(f1, f2)
```

### Arguments

f1	factor 1
f2	factor 2

### Value

TRUE if factor 1 is nested within factor 2

### Examples

```
if (requireNamespace("lme4")) {  
  data("Pastes", package = "lme4")  
  with(Pastes, isNested(cask, batch)) ## => FALSE  
  with(Pastes, isNested(sample, batch)) ## => TRUE  
}
```

---

mkReTrms *Create list of structures needed for models with random effects*

---

### Description

From the result of [findbars](#) applied to a model formula and the evaluation frame, create the model matrix, etc. associated with random-effects terms. See the description of the returned value for a detailed list.

**Usage**

```
mkReTrms(
  bars,
  fr,
  drop.unused.levels = TRUE,
  reorder.terms = TRUE,
  reorder.vars = FALSE,
  calc.lambdat = TRUE,
  sparse = NULL
)
```

**Arguments**

<code>bars</code>	a list of parsed random-effects terms
<code>fr</code>	a model frame in which to evaluate these terms
<code>drop.unused.levels</code>	(logical) drop unused factor levels?
<code>reorder.terms</code>	arrange random effects terms in decreasing order of number of groups (factor levels)?
<code>reorder.vars</code>	arrange columns of individual random effects terms in alphabetical order?
<code>calc.lambdat</code>	(logical) compute Lambdat and Lind components? (At present these components are needed for lme4 machinery but not for glmmTMB, and may be large in some cases; see Bates <i>et al.</i> 2015)
<code>sparse</code>	(logical) set up sparse model matrices?

**Details**

Lambdat, Lind, theta, lower are likely to be useful only for lme4; the other terms can be generally useful for constructing mixed-effect models

**Value**

a list with components

<code>Zt</code>	transpose of the sparse model matrix for the random effects
<code>Ztlist</code>	list of components of the transpose of the random-effects model matrix, separated by random-effects term
<code>Lambdat</code>	transpose of the sparse relative covariance factor
<code>Lind</code>	an integer vector of indices determining the mapping of the elements of the theta to the "x" slot of Lambdat
<code>theta</code>	initial values of the covariance parameters
<code>lower</code>	lower bounds on the covariance parameters
<code>flist</code>	list of grouping factors used in the random-effects terms
<code>cnms</code>	a list of column names of the random effects according to the grouping factors

Gp	a vector indexing the association of elements of the conditional mode vector with random-effect terms; if nb is the vector of numbers of conditional modes per term (i.e. number of groups times number of effects per group), Gp is $c(0, \text{cumsum}(nb))$ (and conversely nb is $\text{diff}(Gp)$ )
nl	names of the terms (in the same order as Zt, i.e. reflecting the <code>reorder.terms</code> argument)
ord	an integer vector giving the relationship between the order of the terms in the formula and the terms in the final object (which are ordered by the number of levels in the grouping variable, if <code>reorder.terms</code> is TRUE)

## References

Bates D, Mächler M, Bolker B, Walker S (2015). “Fitting Linear Mixed-Effects Models Using lme4.” *Journal of Statistical Software*, **67**(1), 1–48. doi:10.18637/jss.v067.i01.)

## See Also

Other utilities: [expandDoubleVerts\(\)](#), [nobars\(\)](#), [subbars\(\)](#)

## Examples

```
## (silly/impractical formula, for illustration only)
form <- mpg ~ 1 + (1|gear) + (factor(cyl)|gear) + (1 + hp | carb)
fr <- model.frame(subbars(form), data = mtcars)
rterms <- mkReTrms(findbars(form), fr)
names(rterms)
## block sizes (latent variables per block) of each term
(nperblock <- lengths(rterms$cnms))
## latent variables per term
(nperterm <- diff(rterms$Gp))
with(rterms, identical(unname(nl*nperblock), nperterm))
## illustrate reordering of terms
dd <- expand.grid(a = 1:7, b = 1:3, c = 1:5, d = 1:9)
dd$y <- 1
form2 <- y ~ 1 + (1|a) + (1|b) + (1|c) + (1|d)
rterms2 <- mkReTrms(findbars(form2), dd, reorder.terms = TRUE)
## reorder elements into original formula order
with(rterms2, cnms[order(ord)])
## reorder splitForm output to match mkReTrms components
ss <- splitForm(form2)
ss$reTrmFormulas[rterms2$ord]
```

---

nobars

*Omit terms separated by vertical bars in a formula*

---

## Description

Remove the random-effects terms from a mixed-effects formula, thereby producing the fixed-effects formula.

**Usage**

```
nobars(term)
```

```
nobars_(term)
```

**Arguments**

term                    the right-hand side of a mixed-model formula

**Value**

the fixed-effects part of the formula

**Note**

This function is called recursively on individual terms in the model, which is why the argument is called `term` and not a name like `form`, indicating a formula.

**See Also**

[formula](#), [model.frame](#), [model.matrix](#).

Other utilities: [expandDoubleVerts\(\)](#), [mkReTrms\(\)](#), [subbars\(\)](#)

**Examples**

```
nobars(Reaction ~ Days + (Days|Subject)) ## => Reaction ~ Days
```

---

no_specials	<i>Drop 'specials' from a formula</i>
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---

**Description**

Drop 'specials' from a formula

**Usage**

```
no_specials(term, specials = c("|", "||", "s"))
```

**Arguments**

term                    a term or formula or list thereof

specials                function types to drop

**Value**

a call or language object (or list) with specials removed

**Examples**

```
no_specials(findbars_x(~ 1 + s(x) + (f|g) + diag(x|y)))
no_specials(~us(f|g))
no_specials(~us(f|g, extra_arg))
```

---

randint	<i>Remove all random slopes from a formula, while retaining random intercepts.</i>
---------	--

---

**Description**

Remove all random slopes from a formula, while retaining random intercepts.

**Usage**

```
randint(form)
```

**Arguments**

form	A formula
------	-----------

**Value**

The new formula

**Examples**

```
f <- ~ 1 + a + b + (a | f) + (1 + a | g) + (a + b | h) + (1 + a + b | i)
randint(f)
```

---

RHSForm	<i>extract right-hand side of a formula</i>
---------	---

---

**Description**

extract right-hand side of a formula

**Usage**

```
RHSForm(form, as.form = FALSE)
```

**Arguments**

form	a formula object
as.form	(logical) return a formula (TRUE) or as a call/symbolic object (FALSE) ?

**Value**

a language object

**Examples**

```
RHSForm(y ~ x + (1|g))
```

---

subbars	<i>"Substitute bars"</i>
---------	--------------------------

---

**Description**

Substitute the '+' function for the '|' and '||' function in a mixed-model formula. This provides a formula suitable for the current model.frame function.

**Usage**

```
subbars(term)
```

**Arguments**

term            a mixed-model formula

**Value**

the formula with all | and || operators replaced by +

**Note**

This function is called recursively on individual terms in the model, which is why the argument is called term and not a name like form, indicating a formula.

**See Also**

[formula](#), [model.frame](#), [model.matrix](#).

Other utilities: [expandDoubleVerts\(\)](#), [mkReTrms\(\)](#), [nobars\(\)](#)

**Examples**

```
subbars(Reaction ~ Days + (Days|Subject)) ## => Reaction ~ Days + (Days + Subject)
```

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