# Package 'umfpackr'

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**Type** Package

**Title** Sparse linear algebra with UMFPACK

**Version** 0.4

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**Description** This package contains methods for solving linear and non-linear systems of equations using the sparse linear algebra package UMFPACK.

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**LinkingTo** Rcpp

**Imports** Rcpp

**Depends** methods, Matrix

**RoxygenNote** 6.1.1

**Suggests** testthat

## R topics documented:



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`umf_solve` *Solves the system of linear equations $Ax = b$ using UMFPACK*

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### Description

Solves the system of linear equations $Ax = b$ using UMFPACK

## Usage

```
umf_solve(a, b)
```

## Arguments

| | |
|---|---|
| a | an object of class dgCMatrix (see dgCMatrix-class) |
| b | the vector $b$ |

## Value

the solution $x$

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umf_solve_nl *Solves a system of non-linear equations $F(x) = 0$ using UMFPACK*

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## Description

Solves a system of non-linear equations $F(x) = 0$ using UMFPACK

## Usage

```
umf_solve_nl(start, fn, jac, ..., control = list(), global = c("no",
  "cline"))
```

## Arguments

| | |
|---|---|
| start | initial guess of the solution $x$ |
| fn | the function $F$ |
| jac | a function returning the Jacobian of the function as a dgCMatrix object |
| ... | arguments passed to fn and jac |
| control | a list with control parameters. See Details. |
| global | The global strategy. Possible values are "no" (no global strategy, the default) and "cline" (cubic line search) (cubic line search) |

## Details

**Control options:** Argument control is a named list containing one or more of the following components:

ftol The function value tolerance. Convergence is reached if the largest function value is smaller than ftol. The default value is 1e-8.

xtol The relative step size tolerance. When the relative step size is smaller than xtol, then the iteration is stopped. The default value is 1e-8.

maxiter The maximum number of iterations. The default is 20.

trace A logical. If TRUE then the progress of the iteraton is printed. The default is FALSE.

`silent` A logical. If `TRUE` then all output is suppressed. The default is `FALSE`.

`cndtol` The tolerance of the test for ill conditioning of the Jacobian. If less than the machine precision it will be silently set to the machine precision. When the estimated inverse condition of the Jacobian matrix is less than or equal to the value of `cndtol` then the iteration is stopped if the `allow_singular` option is set to `FALSE`. The default value is 1e-12.

`allow_singular` A logical value (default `FALSE`) indicating if a small correction to the Jacobian is applied when it is singular or too ill-conditioned. The method used is similar to a Levenberg-Marquardt correction and is explained in Dennis and Schnabel (1996) on page 151. The correction is only applied if the estimated inverse condition of the Jacobian is smaller than `cndtol`.

`acc_cnd` A logical (default `FALSE`) indicating if the inverse condition is estimated accurately or approximately. For large matrices an accurate calculation can require a lot of time.

## Value

a list with the following components:

| | |
|---|---|
| `solved` | A logical equal to `TRUE` if convergence of the function values has been achieved. |
| `iter` | the number of iterations |
| `x` | the final values of $x$ |
| `fval` | the function value |
| `message` | A string equal to `"ok"` if a solution has been found. Otherwise it describes the reason why the iteration was stopped without success |

## Examples

```
library(umfpackr)

dslnex <- function(x, c) {
   y <- numeric(2)
   y[1] <- x[1]^2 + x[2]^2 - c
   y[2] <- exp(x[1]-1) + x[2]^3 - c
   y
}

jacdsln <- function(x, c) {
   n <- length(x)
   Df <- matrix(numeric(n*n),n,n)
   Df[1,1] <- 2*x[1]
   Df[1,2] <- 2*x[2]
   Df[2,1] <- exp(x[1]-1)
   Df[2,2] <- 3*x[2]^2

   return(as(Df, "dgCMatrix"))
}


xstart <- c(2,3)
print(umf_solve_nl(xstart, dslnex, jacdsln, c = 2,
                   control = list(trace = TRUE)))
```

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