

Package ‘blockmatrix’

July 22, 2025

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Title blockmatrix: Tools to solve algebraic systems with partitioned matrices

Type Package

Author Emanuele Cordano

Description Some elementary matrix algebra tools are implemented to manage block matrices or partitioned matrix, i.e. ``matrix of matrices" (http://en.wikipedia.org/wiki/Block_matrix). The block matrix is here defined as a new S3 object. In this package, some methods for ``matrix" object are rewritten for ``blockmatrix" object. New methods are implemented. This package was created to solve equation systems with block matrices for the analysis of environmental vector time series .
Bugs/comments/questions/collaboration of any kind are warmly welcomed.

Version 1.0

Repository CRAN

Date 2014-01-20

Depends R (>= 2.13)

URL <http://cri.gmpf.eu/Research/Sustainable-Agro-Ecosystems-and-Bioresources/Dynamics-in-the-agro-ecosystems/people/Emanuele-Cordano>

Collate 'as.blockmatrix.matrix.R' 'as.matrix.blockmatrix.R'
'blockmatrix.R' 'dim.blockmatrix.R' 'is.zero.blockmatrix.R'
'length.blockmatrix.R' 'matmult.blockmatrix.R'
'methods.blockmatrix.R' 'names.blockmatrix.R'
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'value.replacement.blockmatrix.R' 'zbracket[.blockmatrix.R'
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NeedsCompilation no

Date/Publication 2014-01-19 18:10:34

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as.blockmatrix	as.blockmatrix S3 method for blockmatrix, matrix and NULL object
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Description

as.blockmatrix S3 method for blockmatrix, matrix and NULL object

Usage

```
as.blockmatrix(M = NULL, ...)

## Default S3 method:
as.blockmatrix(M, adjust_zero = TRUE,
  zero_element = "0", ...)

## S3 method for class 'blockmatrix'
as.blockmatrix(M,
  adjust_zero = TRUE, add_zero_matrix = FALSE,
  zero_element = "0", ...)

## S3 method for class 'matrix'
as.blockmatrix(M, nrow = 2, ncol = 2,
  nrow = NULL, ncol = NULL, adjust_zero = TRUE,
  zero_element = "0", ...)
```

Arguments

M	a matrix or blockmatrix object
nrowe	number of rows for each block (element of the blockmatrix)
ncole	number of columns for each block (element of the blockmatrix)
nrow	number of rows for block-matrix
ncol	number of columns of blockmatrix
adjust_zero	logical value. If TRUE (Default) it replaces the zero matrices with zero_element.
add_zero_matrix	logical value. If TRUE it adds a zero-element element matrix as an object called zero_element in the blockmatrix
zero_element	see ncol_elements or nrow_elements
...	further arguments

Author(s)

Emanuele Cordano

as.matrix.blockmatrix *as.matrix S3 method for blockmatrix object*

Description

as.matrix S3 method for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'
as.matrix(x, zero_element = "0",
...)
```

Arguments

x	a blockmatrix object
zero_element	(see ncol_elements or nrow_elements)
...	further arguments (see ncol_elements or nrow_elements)

Author(s)

Emanuele Cordano

blockmatmult	<i>blockmatmult implements the implents betwwen two blockmatrix (see matmult for matrix objects)</i>
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Description

blockmatmult implements the implents betwwen two blockmatrix (see [matmult](#) for matrix objects)

Usage

```
blockmatmult(x, y, ...)
```

Arguments

x, y	blockmatrix objects
...	further arguments

Value

The inner product between x and y as a blockmatrix object

Author(s)

Emanuele Cordano

blockmatrix	<i>This function builds a blockmatrix</i>
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Description

This function builds a blockmatrix

Usage

```
blockmatrix(dim, value = NULL, names = NULL, list = NULL,
  use.as.blockmatrix = TRUE, adjust_zero = TRUE,
  add_zero_matrix = FALSE, zero_element = "0", ...)
```

Arguments

<code>dim</code>	dimension of a block-matrix
<code>value</code>	matrix containing the indices (names) of blockmatrix element. If missing, it is NULL (Default). (sse value)
<code>names</code>	character vector containing the names for each matrix-type element of the block-matrix
<code>list</code>	list containing the matrices to be inserted into the block-matrix. If NULL (Default) the matrix are taken from ...
<code>use.as.blockmatrix</code>	logical value. If TRUE (Default) the method as.blockmatrix for blockmatrix object is applied to the output blockmatrix before being returned.
<code>adjust_zero, add_zero_matrix, zero_element</code>	arguments passed to as.blockmatrix
<code>...</code>	elements of the block-matrix.

Author(s)

Emanuele Cordano

See Also[as.blockmatrix](#)**Examples**

```
rm(list=ls())
library(blockmatrix)

A <- array(rnorm(9,mean=1),c(3,3))
B <- 0 #array(rnorm(9,mean=2),c(3,3))
C <- 0
D <- array(rnorm(9,mean=4),c(3,3))
F <- array(rnorm(9,mean=10),c(3,3))

M <- blockmatrix(names=c("A","0","D","0"),A=A,D=D,dim=c(2,2))
E <- blockmatrix(names=c("0","F","D","0"),F=F,D=D,dim=c(2,2))

R <- M+E
S <- solve(R)
P <- blockmatmult(R,E)

l <- list(A=A,B=B,C=C,D=D,F=F)
mv <- array(c("A","B","C","D","F","F"),c(3,2))
BB <- blockmatrix(value=mv,list=l)
```

dim.blockmatrix	dim S3 method for blockmatrix object
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Description

dim S3 method for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'
dim(x)
```

Arguments

x a blockmatrix object

Author(s)

Emanuele Cordano

is.zero.blockmatrix	is.zero.bolockmatrix
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Description

is.zero.bolockmatrix

Usage

```
is.zero.blockmatrix(M, not.a.blockmatrix = FALSE)
```

Arguments

M a blockmatrix object
not.a.blockmatrix value to be returned in case M is not a a blockmatrix object

Value

logical value in case M is a zero blockmatrix

Author(s)

Emanuele Cordano

length.blockmatrix length *S3 method for blockmatrix object*

Description

length *S3 method for blockmatrix object*

Usage

```
## S3 method for class 'blockmatrix'
length(x)
```

Arguments

x a blockmatrix object

Author(s)

Emanuele Cordano

Math.blockmatrix Math *and Ops group of S3 methods for blockmatrix object*

Description

Math and Ops group of *S3 methods for blockmatrix object*

Usage

```
## S3 method for class 'blockmatrix'
Math(x, as.blockmatrix = TRUE,
     ...)

## S3 method for class 'blockmatrix'
Ops(e1, e2)
```

Arguments

x, e1, e2 blockmatrix objects
as.blockmatrix logical value. If TRUE (Default), the output is a blockmatrix object
... further arguments

Author(s)

Emanuele Cordano

names.blockmatrix names *S3 method for blockmatrix object*

Description

names S3 method for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'  
names(x)
```

Arguments

x a blockmatrix object

Author(s)

Emanuele Cordano

ncol.blockmatrix ncol *S3 method for blockmatrix object*

Description

ncol S3 method for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'  
ncol(M)
```

Arguments

M a blockmatrix object

Value

Number of columns of blockmatrix M

Author(s)

Emanuele Cordano

ncol_elements	<i>ncol_elements S3 method for blockmatrix object</i>
---------------	---

Description

ncol_elements S3 method for blockmatrix object

Usage

```
ncol_elements(M, zero_element = "0", ...)

## Default S3 method:
ncol_elements(M, zero_element = "0",
              ...)

## S3 method for class 'blockmatrix'
ncol_elements(M,
              zero_element = "0", ...)
```

Arguments

M	a blockmatrix object
zero_element	character value indicating a zero matrix. Default is "0"
...	further arguments

Value

The number of columns of a matrix-type element of M. It is NA if the elements has different number of columns.

Author(s)

Emanuele Cordano

nrow.blockmatrix	<i>nrow S3 method for blockmatrix object</i>
------------------	--

Description

nrow S3 method for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'
nrow(M)
```

Arguments

M a blockmatrix object

Value

Number of rows of blockmatrix M

Author(s)

Emanuele Cordano

nrow_elements	nrow_elements S3 method for blockmatrix object
---------------	--

Description

nrow_elements S3 method for blockmatrix object

Usage

```
nrow_elements(M, zero_element = "0", ...)

## Default S3 method:
nrow_elements(M, zero_element = "0",
  ...)

## S3 method for class 'blockmatrix'
nrow_elements(M,
  zero_element = "0", ...)
```

Arguments

M a blockmatrix object
 zero_element character value indicating a zero matrix. Default is "0"
 ... further arguments

Value

The number of rows of a matrix-type element of M. It is NA if the elements has different number of rows.

Author(s)

Emanuele Cordano

solve.blockmatrix	<i>solve</i>
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Description

dim S3 solve for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'
solve(a, b = NULL,
      as.blockmatrix = TRUE, ...)
```

Arguments

a	a blockmatrix or numeric object
b	a blockmatrix or numeric object. If omitted, it is NULL. See Details.
as.blockmatrix	logical value. If TRUE (Default), the output is a blockmatrix object
...	further arguments for method solve

Value

the object x such that $a * x = b$ where $*$ is the matrix product.

Note

If b is missing, i.e. NULL, it will be replaced by the corresponding identity matrix. So x is calculated as the right inverse of a . The matrix system must be nonsingular and nonhomogeneous.

Author(s)

Emanuele Cordano

t.blockmatrix	<i>t 'transpose' S3 method for blockmatrix object</i>
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Description

t 'transpose' S3 method for blockmatrix object

Usage

```
## S3 method for class 'blockmatrix'
t(x)
```

Arguments

x a blockmatrix object

Author(s)

Emanuele Cordano

value value *S3 method for blockmatrix object*

Description

value S3 method for blockmatrix object

Usage

```
value(M)

## Default S3 method:
value(M)

## S3 method for class 'blockmatrix'
value(M)
```

Arguments

M a blockmatrix object

Value

The character matrix without numerical values (e.g. only the matrix M\$value)

Author(s)

Emanuele Cordano

value<-	value<- <i>S3 Replacement method for blockmatrix object</i>
---------	---

Description

value<- S3 Replacement method for blockmatrix object

Usage

```
value(M) <- value

## Default S3 replacement method:
value(M) <- value

## S3 replacement method for class 'blockmatrix'
value(M) <- value
```

Arguments

M	a blockmatrix object
value	object replaced matrix

Value

Replaces M\$value with a new matrix value

Author(s)

Emanuele Cordano

[.blockmatrix	[<i>S3 method for</i> blockmatrix <i>object</i>
---------------	--

Description

[S3 method for [blockmatrix](#) object

Usage

```
## S3 method for class 'blockmatrix'
M[i = 1:nrow(M), j =
  1:ncol(M), numeric_value=TRUE, blockmatrix=FALSE, ...]
```

Arguments

M	a <code>blockmatrix</code> object
i, j	matrix indices (numerical or character)
numeric_value	logical value . If TRUE (Default if i, j have both length 1) and i, j have both length 1, a i, j numeric matrix is returned.
blockmatrix	logical value. If TRUE (Default if i or j have length greater than 1) a <code>blockmatrix</code> is returned.
...	further argument for <code>[]</code> method

Value

The i, j matrix as a numerical matrix if `blockmatrix` is FALSE, otherwise the return object is a `blockmatrix` object. In case i is a character vector, the method returns a list of objects with name containing in i and taken from M.

Author(s)

Emanuele Cordano

[<- .blockmatrix ' [<- ' S3 Replacement method for `blockmatrix` object

Description

' [<- ' S3 Replacement method for `blockmatrix` object

Usage

```
## S3 replacement method for class 'blockmatrix'
M[i = 1:nrow(M), j = 1:ncol(M)] <- value
```

Arguments

M	a <code>blockmatrix</code> object
i, j	matrix indices (numerical or character)
value	a <code>blockmatrix</code> object to be replaced

Value

The "replaced" `blockmatrix` object.

Note

In case i is a character vector, the elements whose names is in value is replaced.

Author(s)

Emanuele Cordano

Examples

```
rm(list=ls())
library(blockmatrix)
A <- array(rnorm(9,mean=1),c(3,3))
B <- 0 #array(rnorm(9,mean=2),c(3,3))
C <- 0
D <- array(rnorm(9,mean=4),c(3,3))
F <- array(rnorm(9,mean=10),c(3,3))
M <- blockmatrix(names=c("A","0","D","0"),A=A,D=D,dim=c(2,2))
E <- blockmatrix(names=c("0","F","D","0"),F=F,D=D,dim=c(2,2))
E[,1] <- M[,1]
```

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