

# Package ‘Ryacas0’

October 12, 2022

**Version** 0.4.3

**Title** Legacy 'Ryacas' (Interface to 'Yacas' Computer Algebra System)

**Maintainer** Mikkel Meyer Andersen <mik1@math.aau.dk>

**Encoding** UTF-8

**Description** A legacy version of 'Ryacas', an interface to the 'yacas' computer algebra system (<<http://www.yacas.org/>>).

**Depends** R (>= 3.3.0)

**Imports** methods, Rcpp (>= 0.12.0), stats, settings, xml2

**LinkingTo** Rcpp

**Suggests** devtools, exams, knitr, Matrix, pkgload, rmarkdown, igraph, testthat

**License** GPL-2

**URL** <https://github.com/r-cas/ryacas0>, <http://www.yacas.org>

**BugReports** <https://github.com/r-cas/ryacas0/issues>

**RoxygenNote** 7.1.0

**VignetteBuilder** knitr

**NeedsCompilation** yes

**Author** Mikkel Meyer Andersen [aut, cre, cph],  
Rob Goedman [aut, cph],  
Gabor Grothendieck [aut, cph],  
Søren Højsgaard [aut, cph],  
Grzegorz Mazur [aut, cph],  
Ayal Pinkus [aut, cph],  
Nemanja Trifunovic [cph] (UTF-8 part of yacas  
(src/yacas/include/yacas/utf8\*))

**Repository** CRAN

**Date/Publication** 2020-09-29 18:50:03 UTC

**R topics documented:**

Ryacas0-package	2
as.Sym.character	3
as.Sym.matrix	4
bodyAsExpression	4
Eval	5
getSyms	6
get_output_width	6
root	7
Ryacas_options	7
set_output_width	8
stripvar	8
syacas	9
Sym	9
yacas	10
yacasTranslations	14
yacas_evaluate	15
yacmode	16
y_ls	17

<b>Index</b>	<b>18</b>
--------------	-----------

---

Ryacas0-package	<i>R interface to yacas computer algebra package</i>
-----------------	--

---

**Description**

Ryacas0 allows one to use the yacas computer algebra package entirely from within R. It takes an R expression, an R one line function or a yacas string and returns an R expression or a variety of other formats. It can be used for symbolic mathematics, exact arithmetic, ASCII pretty printing and R to TeX conversions. The main command is yacas and ?yacas provides some information on installation and startup.

**Details**

The following are sources of information on "Ryacas0":

DESCRIPTION file	library(help = Ryacas0)
List of demo files	demo(package = "Ryacas0")
Demo file	demo("Ryacas0")
Demo	demo("Ryacas0-PrettyPrinter")
Demo	demo("Ryacas0-Function")
Demo	demo("Ryacas0-Sym")
Demo	demo("Ryacas0-Expr")
List Vignettes	vignette(package = "Ryacas0")
Vignette	vignette("Ryacas0")
This File	package?Ryacas0

Help files	?yacas, ?yacasTranslations, ?yacmode, ?Sym
Help files - Windows	?yacasInstall
News	RShowDoc("NEWS", package = "Ryacas0")
Acknowledgements	RShowDoc("THANKS", package = "Ryacas0")
Wish List	RShowDoc("WISHLIST", package = "Ryacas0")
Home page	<a href="https://github.com/r-cas/ryacas0/">https://github.com/r-cas/ryacas0/</a>

**Note**

There is a note in the help file of the `yacas` command that discusses a number of installation and startup issues.

**Examples**

```
print(yacas(expression(integrate(1/x, x))))
print(yacas("Integrate(x)1/x"))
x <- Sym("x"); Integrate(1/x, x)
acos(Sym("1/2"))
```

---

as.Sym.character	<i>Convert character vector to yacas object</i>
------------------	---

---

**Description**

Simple and raw conversion to yacas

**Usage**

```
## S3 method for class 'character'
as.Sym(x, ...)
```

**Arguments**

<code>x</code>	An R character vector.
<code>...</code>	Not used

**Examples**

```
x <- c("a", "2", "4", "c", "d", "6")
x
y <- as.Sym(x)
y
Eval(y, list(a = 3, c = 3, d = 3))
```

---

as.Sym.matrix	<i>Convert character matrix to yacas object</i>
---------------	---

---

### Description

Simple and raw conversion to yacas

### Usage

```
## S3 method for class 'matrix'
as.Sym(x, ...)
```

### Arguments

x	An R character matrix.
...	Not used

### Examples

```
x <- matrix(c("a", "2", "4", "c", "d", "6"), 3, 2)
x
y <- as.Sym(x)
y
Eval(y, list(a = 3, c = 3, d = 3))
```

---

bodyAsExpression	<i>Get body of function as an expression.</i>
------------------	---

---

### Description

Get body of function as an expression.

### Usage

```
bodyAsExpression(x)
```

### Arguments

x	An R function.
---	----------------

### Details

This function is similar to the R body function except that function returns a call object whereas this one returns an expression usable in Ryacas calculations.

**Value**

An expression.

**See Also**

[body](#)

**Examples**

```
# construct an R function for the Burr probability density
# function (PDF) given the Burr cumulative distribution function (CDF)
BurrCDF <- function(x, c = 1, k = 1) 1-(1+x^c)^-k

# transfer CDF to yacas
yacas(BurrCDF)

# create a template for the PDF from the CDF
BurrPDF <- BurrCDF

# differentiate CDF and place resulting expression in body
body(BurrPDF) <- yacas(expression(deriv(BurrCDF(x,c,k))))[[1]]

# test out PDF
BurrPDF(1)
```

---

Eval

*Evaluate a yacas expression.*

---

**Description**

Evaluate a yacas expression.

**Usage**

```
Eval(x, env = parent.frame(), ...)
```

**Arguments**

x	Object to be evaluated.
env	Environment or list in which to perform evaluation.
...	Not currently used.

## Examples

```
Eval(yacas(expression(x*x)), list(x=2))

# same
x <- 2
Eval(yacas(expression(x*x)))
```

---

getSyms	<i>List Sym() objects</i>
---------	---------------------------

---

## Description

Lists all Sym() objects in the global environment (.GlobalEnv)

## Usage

```
getSyms(all.names = FALSE)
```

## Arguments

`all.names` a logical value. If TRUE, all object names are returned. If FALSE, names which begin with a . are omitted.

## Examples

```
getSyms()
xs <- Sym("x")
getSyms()
```

---

get_output_width	<i>Get width of yacas output</i>
------------------	----------------------------------

---

## Description

Get width of yacas output

## Usage

```
get_output_width()
```

---

root	<i>Root function</i>
------	----------------------

---

**Description**

The  $y$ 'th root of  $x$ , i.e.  $x^{(1/y)}$ .

**Usage**

```
root(x, y)
```

**Arguments**

x	Number to take $y$ 'th root of
y	Root

**Value**

The root  $y$ 'th root of  $x$

---

Ryacas_options	<i>Set or get options for the Ryacas package</i>
----------------	--

---

**Description**

Set or get options for the Ryacas package

**Usage**

```
Ryacas_options(...)
```

**Arguments**

... Option names to retrieve option values or [key] = [value] pairs to set options.

**Supported options**

The following options are supported

- `module_matvec_enabled` (default TRUE): Print yacas `List()`'s as vectors and `List(List(), ...)`'s as matrices.
- `prettyform_default` (default FALSE): Print yacas as `PrettyForm()` as default.

---

set_output_width	<i>Set width of yacas output</i>
------------------	----------------------------------

---

**Description**

Set width of yacas output

**Usage**

```
set_output_width(w)
```

**Arguments**

w	Width in number of characters
---	-------------------------------

---

stripvar	<i>Removes part of expression containing variable</i>
----------	---

---

**Description**

Yacas' Solve(eq, x) can return e.g.  $x == \text{expr}$  and  $\{x == \text{expr1}, x == \text{expr2}, \dots\}$ . Some usages are easier if the initial  $x ==$  part is removed. This is the purpose of this function.

**Usage**

```
stripvar(expr, var)
```

**Arguments**

expr	Expression where $x == \text{expr}$ should be replaced to expr
var	Name of variable, e.g. x

**Value**

Expression with left-hand side removed



---

syacas	<i>yacas interface – silent version</i>
--------	---

---

**Description**

Similar to `yacas()` but silent. This can be useful when working with yacas directly.

**Usage**

```
syacas(x, ...)
```

**Arguments**

<code>x</code>	A yacas character string or an R expression without terminating semicolon to be processed by yacas.
<code>...</code>	Additional arguments ultimately passed down to <code>yacas.character</code> .

**See Also**

`yacas`

---

Sym	<i>Sym</i>
-----	------------

---

**Description**

The Symbol interface to yacas.

**Usage**

```
Sym(...)  
Expr(x)
```

**Arguments**

<code>...</code>	An R character string or object that can be coerced to a character string.
<code>x</code>	An R expression.

**Details**

An object of class "Sym" is internally a yacas character string. An object of class "Expr" is internally an R expression. One can combine such objects using the Math and Ops R operators (see `help(Math)` and `help(Ops)` for a list). Also there are methods for a number of R generics: `as.character.Sym`, `as.expression.Sym`, `determinant.Sym`, `deriv.Sym` and `print.Sym` and yacas-oriented functions: `Clear`, `Conjugate`, `Expand`, `Factor`, `Factorial`, `I`, `Identity`, `Infinity`, `Integrate`, `Inverse`, `InverseTaylor`, `Limit`, `List`, `N`, `Newton`, `Pi`, `Precision`, `PrettyForm`, `PrettyPrinter`, `Set`, `Simplify`, `Solve`, `Subst`, `Taylor`, `TeXForm`, `Transpose`, `Ver` and "%Where%" all of which have the same meaning as the corresponding yacas commands. Try `vignette("Ryac-Sym")` for many examples. Get Sym objects with `getSyms()`.

**Value**

Sym returns a "Sym" object and Expr returns an "Expr" object.

**Note**

Currently the only Expr methods implemented are `as.character.Expr`, `deriv.Expr`, `Math.Expr`, `Ops.Expr` and `print.Expr`.

**See Also**

[as.Sym.matrix\(\)](#)

**Examples**

```
x <- Sym("x")
x*x
Integrate(x*x, x)
Sym("%") %Where% list(x = 10)

acos(Sym("1/2"))

y <- Exprq(x)
y*y
deriv(y*y, y)
Exprq(acos(1/2))
```

---

yacas

*yacas interface*

---

**Description**

Interface to the yacas computer algebra system.

**Usage**

```
yacas(x, ...)
## S3 method for class 'character'
yacas(x, verbose = FALSE, method,
      retclass = c("expression", "character", "unquote"),
      addSemi = TRUE, ...)
```

**Arguments**

x	A yacas character string or an R expression without terminating semicolon to be processed by yacas.
...	Additional arguments ultimately passed down to yacas.character.
verbose	A logical value indicating verbosity of output or "input" to only show input to yacas but not output from yacas or "output" to only show output from yacas but not input to yacas.
method	method used to communicate with yacas. If "socket" is specified then the same yacas session is used on a sequence of calls. If "system" is specified then a new instance of yacas is used just for the period of that call. "system" does not require that the system be configured to support telnet/sockets and so may be useful in some instances. If no value is specified the default is taken from getOption("yacas.method") and if that is not specified "socket" is used. "socket" and "system" may be abbreviated.
addSemi	If TRUE a semicolon is added to the character string sent to yacas. This can be set to FALSE if its known that the character string already has a trailing semicolon. It is ignored if retclass="expression".
retclass	The class of the first component of the yacas structure. It defaults to "expression" but may be specified as "character" or "unquote". "unquote" is the same as "character" except that if the character string returned would have otherwise had quotes in the first and and last positions then they are stripped.

**Details**

The user supplies an R expression, an R function name corresponding to a function with a single line body, a formula or a yacas input string. In the case of a formula it is regarded as an expression represented by the right hand side of the formula while the left hand side, if any, is ignored.

Note the silent version [syacas\(\)](#).

**Value**

An R object of class "yacas" is returned. If `PrettyPrinter("OMForm")` is in effect, which it is by default, then the first component is an R expression and the OMForm component contains Open-Math XML code. In other cases the first component is NULL and the YacasForm or PrettyForm components have display information.

Generally an expression. Refer to details.

**Note**

Windows Installation. On Windows one can install Ryacas by issuing the commands:

```
install.packages("Ryacac", dep = TRUE)
library(Ryacac)
yacacInstall()
```

or by using the Packages | Install package(s) menu in place of the first command. The second command downloads `scripts.dat` and `yacas.exe` from the internet and installs them into `R_HOME/library/Ryacac/yacdir` where `R_HOME` is the location of your R installation.

Normally the default locations of `yacas`, its initialization file and the scripts file are sufficient but, if necessary, they can be overridden via the environment variables: `YACAS_HOME`, `YACAS_INIT` and `YACAS_SCRIPTS`. The `YACAS_INVOKE_STRING` environment variable discussed in the next section overrides all three of these.

All OS Installation. The `YACAS_INVOKE_STRING` environment variable can be used to override the invocation string for `yacas`. Normally it is not used. If it does need to be used then a typical use might be:

```
library(Ryacac)
# only need to do the file.copy command once
file.copy(system.file("yacdir/R.ys", package = "Ryacac"), "~/yacsrc")
# this needs to be done once per session
Sys.setenv(YACAS_INVOKE_STRING = "yacac -pc --server 9734")
demo(Ryacac) # test it out
```

`yacmode`. There is also a utility `yacmode` which is called without arguments and just turns R into a terminal into `yacas` until one quits out of it (and back to R) by entering `stop`, `end`, `quit`, `exit` or `e`.

Startup. `yacas` starts up when `yacasStart()` is called or the first time `yacas` is called. `yacas` is shut down when `yacasStop()` is called or when the package is detached using the `detach()` R command. On Windows, when `yacas` is shut down, the `yacas` process is terminated on Windows XP Pro but not on other versions of Windows. In those cases there will be a dangling process that the user must terminate manually.

Translation. The translation process occurs in several steps. If the input to the `yacas` function is an expression then it is translated to a valid `yacas` character string (otherwise, it is sent to `yacas` unprocessed). `Yacas` then processes the string and if `retclass="expression"` it is translated back to an R expression (otherwise it is sent back unprocessed). Examples of translations are:

R	<code>yacas</code>
<code>sin(x)</code>	<code>Sin(x)</code>
<code>deriv(sin, x)</code>	<code>Deriv(x)Sin(x)</code>
<code>log(x)</code>	<code>Ln(x)</code>

## References

<http://yacac.sourceforge.net>

**Examples**

```

yacas(expression(Factor(x^2-1)))
exp1 <- expression(x^2 + 2 * x^2)
exp2 <- expression(2 * exp0)
exp3 <- expression(6 * pi * x)
exp4 <- expression((exp1 * (1 - sin(exp3))) / exp2)
print(yacas(exp4))

print(yacas("Version()")) # yacas version

# see demo("Ryacac-Function")

```

---

yacasTranslations      *Yacas translations*

---

**Description**

Translations from R to the yacas computer algebra system.

**Note**

The translation process occurs in several steps. If the input to the yacas function is an expression then it is translated to a valid yacas character string (otherwise, it is sent to yacas unprocessed). Yacas then processes the string and if `retclass="expression"` it is translated back to an R expression (otherwise it is sent back unprocessed). Currently supported translations are:

**CONSTANTS**

R	yacas
=	=====
pi	Pi

**OPERATORS**

R	yacas
=	=====
$7 \% \% 3$	Mod(7, 3)
$7 \% \wedge \% 3$	Div(7, 3)

**FUNCTIONS**

R	yacas
=	=====
sin(x)	Sin(x)
cos(x)	Cos(x)

tan(x)	Tan(x)
asin(x)	ArcSin(x)
acos(x)	ArcCos(x)
atan(x)	ArcTan(x)
exp(x)	Exp(x)
sqrt(x)	Sqrt(x)
log(x)	Ln(x)
choose(n, k)	Bin(n, k)
gamma(x)	Gamma(x)
deriv(sin, x)	Deriv(x)Sin(x)
integrate(f, a, b)	Integrate(x, a, b)f(x)
list()	List()
factorial(n)	n!

Note the Limit example in demo(Ryacas0) for adding translations on the fly.  
The complete table under development.

#### Author(s)

Rob J Goedman

#### References

<http://yacas.sourceforge.net>

---

yacas_evaluate	<i>Evaluate yacas expression</i>
----------------	----------------------------------

---

#### Description

This is a low-level function for evaluating yacas expression represented as string.

#### Usage

```
yacas_evaluate(expr)
```

#### Arguments

expr	Yacas expression
------	------------------

#### Value

Result of evaluating expr by yacas in OpenMath format and side-effects of the evaluation

#### Examples

```
yacas_evaluate("D(x)Sin(x^2)")
```

---

`yacmode`*yacmode interface*

---

**Description**

Interactive interface to the yacas

**Usage**

```
yacmode(enable_history = TRUE)
```

**Arguments**

`enable_history` Use R history such that previous yacas commands can be used. Default is TRUE.

**Details**

The user types valid yacas input and presses return. Type 'quit' to return to R prompt.

**Value**

Output of yacas is returned.

invisible NULL

**Note**

Note that command will use R `history()` and modify it by default. Yacas is given a limited amount of time to complete, otherwise `\[1\]` `CommandLine(1)` : User interrupted calculation is returned. E.g. `Taylor(x,0,5) 1/(1+x)` will work, but `Taylor(x,0,12) 1/(1+x)` is likely to take too long.

**References**

<http://yacas.sourceforge.net>

**Examples**

```
## Not run:
yacmode()
(x+y)^3-(x-y)^3
Simplify(%)
q

## End(Not run)
```



---

y\_ls

*Get Yacas variables*

---

**Description**

Get Yacas variables

**Usage**

y\_ls()

**Value**

Vector of variables defined in yacas

# Index

- \* **programming**
  - Ryacas0-package, 2
- \* **symbolmath**
  - bodyAsExpression, 4
  - Eval, 5
  - stripvar, 8
  - Sym, 9
  - yacas, 10
  - yacasTranslations, 14
  - yacmode, 16
- %Where% (Sym), 9
- addSemi (yacas), 10
- as.character.Expr (Sym), 9
- as.character.Sym (Sym), 9
- as.character.yacas (yacas), 10
- as.Expr.formula (Sym), 9
- as.expression.Sym (Sym), 9
- as.expression.yacas (yacas), 10
- as.language (bodyAsExpression), 4
- as.Sym (Sym), 9
- as.Sym.character, 3
- as.Sym.matrix, 4
- as.Sym.matrix(), 10
- body, 5
- bodyAsExpression, 4
- CharacteristicEquation (Sym), 9
- Clear (Sym), 9
- Conjugate (Sym), 9
- deriv.Expr (Sym), 9
- deriv.Sym (Sym), 9
- determinant.Expr (Sym), 9
- determinant.Sym (Sym), 9
- EigenValues (Sym), 9
- Eval, 5
- Expand (Sym), 9
- Expr (Sym), 9
- Exprq (Sym), 9
- Factor (Sym), 9
- Factorial (Sym), 9
- FindRoots (Sym), 9
- get\_output\_width, 6
- getSyms, 6
- I (Sym), 9
- Identity (Sym), 9
- Infinity (Sym), 9
- Integrate (Sym), 9
- Inverse (Sym), 9
- InverseTaylor (Sym), 9
- Limit (Sym), 9
- List (Sym), 9
- Math.Expr (Sym), 9
- Math.Sym (Sym), 9
- N (Sym), 9
- Newton (Sym), 9
- OpenMath2R (Sym), 9
- Ops.Expr (Sym), 9
- Ops.Sym (Sym), 9
- Ops.yacas.symbol (Sym), 9
- Pi (Sym), 9
- Precision (Sym), 9
- PrettyForm (Sym), 9
- PrettyPrinter (Sym), 9
- print.Expr (Sym), 9
- print.Sym (Sym), 9
- print.yacas (Sym), 9
- root, 7
- Ryacas0-package, 2
- Ryacas\_options, 7

Set (Sym), 9  
set\_output\_width, 8  
Simplify (Sym), 9  
Solve (Sym), 9  
stripvar, 8  
Subst (Sym), 9  
syacas, 9  
syacas(), 11  
Sym, 9  
SymExpr (Sym), 9  
  
Taylor (Sym), 9  
TeXForm (Sym), 9  
trans (Sym), 9  
Transpose (Sym), 9  
transtab (Sym), 9  
  
Ver (Sym), 9  
  
y\_ls, 17  
yacas, 3, 10  
yacas(), 9  
yacas.symbol.value (Sym), 9  
yacas\_evaluate, 15  
yacasTranslations, 14  
yacmode, 16  
yAssignFunction (yacas), 10  
yDeriv (Sym), 9  
yFactorial (Sym), 9  
yIntegrate (Sym), 9  
yLimit (Sym), 9  
ynext (yacas), 10  
yparse (yacas), 10  
yrewrite (Sym), 9  
ySequence (yacas), 10  
ysub (yacas), 10  
yUnlist (Sym), 9