

HomalgToCAS

A window to the outer world

Version 2009.11.09

November 2009

Mohamed Barakat

Thomas Breuer

Simon Görtzen

Frank Lübeck

(this manual is still under construction)

This manual is best viewed as an HTML document. The latest version is available ONLINE at:

<http://homalg.math.rwth-aachen.de/~barakat/HomalgToCAS/chap0.html>

An OFFLINE version should be included in the documentation subfolder of the package.

This package is part of the homalg-project:

<http://homalg.math.rwth-aachen.de/index.php/core-packages/homalgtoacas>

Mohamed Barakat

- Email: barakat@mathematik.uni-kl.de
- Homepage: <http://wwwb.math.rwth-aachen.de/~barakat/>
- Address: Department of Mathematics,
University of Kaiserslautern,
67653 Kaiserslautern,
Germany

Thomas Breuer

- Email: sam@math.rwth-aachen.de
- Homepage: <http://www.math.rwth-aachen.de/~Thomas.Breuer/>
- Address: Lehrstuhl D für Mathematik, RWTH-Aachen,
Templergraben 64
52062 Aachen
Germany

Simon Görtzen

- Email: simon.goertzen@rwth-aachen.de
- Homepage: <http://wwwb.math.rwth-aachen.de/goertzen/>
- Address: Lehrstuhl B für Mathematik, RWTH-Aachen,
Templergraben 64
52062 Aachen
Germany

Frank Lübeck

- Email: frank.luebeck@math.rwth-aachen.de
- Homepage: <http://www.math.rwth-aachen.de/~Frank.Luebeck/>
- Address: Lehrstuhl D für Mathematik, RWTH-Aachen,
Templergraben 64
52062 Aachen
Germany

Copyright

© 2007-2009 by Mohamed Barakat, Thomas Breuer, Simon Görtzen, and Frank Lübeck.

This package may be distributed under the terms and conditions of the GNU Public License Version 2.

Acknowledgements

We are very much indebted to Max Neunhöffer who provided the first piece of code around which the package `IO_ForHomalg` was built. The package `HomalgToCAS` provides a further abstraction layer preparing the communication.

Contents

1	Introduction	4
1.1	HomalgToCAS provides ...	4
2	Installation of the HomalgToCAS Package	5
3	Watch and Influence the Communication	6
3.1	Functions	6
3.1.1	homalgIOMode	6
4	External Rings	10
4.1	External Rings: Representation	10
4.1.1	IsHomalgExternalRingRep	10
4.2	Rings: Constructors	10
4.3	External Rings: Operations and Functions	10
A	Overview of the homalg Package Source Code	11

Chapter 1

Introduction

HomalgToCAS is one of the core packages of the homalg project [ht09]. But as one of the rather technical packages, this manual is probably not of interest for the average users. The average user will usually not get in direct contact with the operations provided by this package.

Quoting from the Appendix (**homalg: The Core Packages and the Idea behind their Splitting**) of the homalg package manual (\rightarrow (**homalg: HomalgToCAS**)):

“The package HomalgToCAS (which needs the homalg package) includes all what is needed to let the black boxes used by homalg reside in external computer algebra systems. So as mentioned above, HomalgToCAS is the right place to declare the three GAP representations external rings, external ring elements, and external matrices. Still, HomalgToCAS is independent from the external computer algebra system with which GAP will communicate *and* independent of how this communication physically looks like.”

1.1 HomalgToCAS provides ...

- Declaration and construction of
 - external objects (which are pointers to data (rings, ring elements, matrices, ...) residing in external systems)
 - external rings (as a new representation for the GAP4-category of homalg rings)
 - external ring elements (as a new representation for the GAP4-category of homalg ring elements)
 - external matrices (as a new representation for the GAP4-category of homalg matrices)
- LaunchCAS: the standard interface used by homalg to launch external systems
- TerminateCAS: the standard interface used by homalg to terminate external systems
- homalgSendBlocking: the standard interface used by homalg to send commands to external systems
- External garbage collection: delete the data in the external systems that became obsolete for homalg
- homalgIOMode: decide how much of the communication you want to see

Chapter 2

Installation of the HomalgToCAS Package

To install this package just extract the package's archive file to the GAP `pkg` directory.

By default the HomalgToCAS package is not automatically loaded by GAP when it is installed. You must load the package with

```
LoadPackage( "HomalgToCAS" );
```

before its functions become available.

Please, send me an e-mail if you have any questions, remarks, suggestions, etc. concerning this package. Also, we would be pleased to hear about applications of this package.

Mohamed Barakat, Thomas Breuer, Simon Görtzen, and Frank Lübeck

Chapter 3

Watch and Influence the Communication

3.1 Functions

3.1.1 homalgIOMode

◇ `homalgIOMode(str[, str2[, str3]])` (function)

This function sets different modes which influence how much of the communication becomes visible. Handling the string `str` is *not* case-sensitive. `homalgIOMode` invokes the global function `homalgMode` defined in the `homalg` package with an “appropriate” argument (see code below). Alternatively, if a second or more strings are given, then `homalgMode` is invoked with the remaining strings `str2`, `str3`, ... at the end. In particular, you can use `homalgIOMode(str, "")` to reset the effect of invoking `homalgMode`.

<i>str</i>	<i>str</i> (long form)	mode description
""	""	the default mode, i.e. the communication protocol won't be visible (<code>homalgIOMode()</code> is a short form for <code>homalgIOMode("")</code>)
"a"	"all"	combine the modes "debug" and "file"
"b"	"basic"	the same as "picto" + <code>homalgMode("basic")</code>
"d"	"debug"	view the complete communication protocol
"f"	"file"	dump the communication protocol into a file with the name <code>Concatenation("commands_file_of_", CAS, "_with_PID_", PID)</code>
"p"	"picto"	view the abbreviated communication protocol using the preassigned pictograms

All modes other than the "default"-mode only set their specific values and leave the other values untouched, which allows combining them to some extent. This also means that in order to get from one mode to a new mode (without the aim to combine them) one needs to reset to the "default"-mode first.

Caution:

- In case you choose one of the modes "file" or "all" you might want to set the global variable `HOMALG_IO.DoNotDeleteTemporaryFiles := true`; this is only important if during the computations some matrices get converted via files (using `ConvertHomalgMatrixViaFile`), as reading these files will be part of the protocol!
- It makes sense for the dumped communication protocol to be (re)executed with the respective external system, only in case the latter is deterministic (i.e. same-input-same-output).

Code

```

InstallGlobalFunction( homalgIOMode,
function( arg )
  local nargs, mode, s;

  nargs := Length( arg );

  if nargs = 0 or ( IsString( arg[1] ) and arg[1] = "" ) then
    mode := "default";
  elif IsString( arg[1] ) then      ## now we know, the string is not empty
    s := arg[1];
    if LowercaseString( s{[1]} ) = "a" then
      mode := "all";
    elif LowercaseString( s{[1]} ) = "b" then
      mode := "basic";
    elif LowercaseString( s{[1]} ) = "d" then
      mode := "debug";
    elif LowercaseString( s{[1]} ) = "f" then
      mode := "file";
    elif LowercaseString( s{[1]} ) = "p" then
      mode := "picto";
    else
      mode := "";
    fi;
  else
    Error( "the first argument must be a string\n" );
  fi;

  if mode = "default" then
    ## reset to the default values
    HOMALG_IO.color_display := false;
    HOMALG_IO.show_banners := true;
    HOMALG_IO.save_CAS_commands_to_file := false;
    HOMALG_IO.DoNotDeleteTemporaryFiles := false;
    HOMALG_IO.SaveHomalgMaximumBackStream := false;
    HOMALG_IO.InformAboutCASystemsWithoutActiveRings := true;
    SetInfoLevel( InfoHomalgToCAS, 1 );
    homalgMode( );
  elif mode = "all" then
    homalgIOMode( "debug" );
    homalgIOMode( "file" );
  elif mode = "basic" then
    HOMALG_IO.color_display := true;

```


This is the part of the global function `homalgSendBlocking` that controls the visibility of the communication.

```

communication.
Code
io_info_level := InfoLevel( InfoHomalgToCAS );

if not IsBound( pictogram ) then
    pictogram := " ";
elif io_info_level >= 3 then
    ## add colors to the pictograms
    if pictogram = HOMALG_IO.Pictograms.ReducedEchelonForm and
        IsBound( HOMALG.color_BOE ) then
        pictogram := Concatenation( HOMALG.color_BOE, pictogram, "\033[0m" );
    elif pictogram = HOMALG_IO.Pictograms.BasisOfModule and
        IsBound( HOMALG.color_BOB ) then
        pictogram := Concatenation( HOMALG.color_BOB, pictogram, "\033[0m" );
    elif pictogram = HOMALG_IO.Pictograms.DecideZero and
        IsBound( HOMALG.color_BOD ) then
        pictogram := Concatenation( HOMALG.color_BOD, pictogram, "\033[0m" );
    elif pictogram = HOMALG_IO.Pictograms.SyzygiesGenerators and
        IsBound( HOMALG.color_BOH ) then
        pictogram := Concatenation( HOMALG.color_BOH, pictogram, "\033[0m" );
    elif pictogram = HOMALG_IO.Pictograms.BasisCoeff and
        IsBound( HOMALG.color_BOC ) then
        pictogram := Concatenation( HOMALG.color_BOC, pictogram, "\033[0m" );
    elif pictogram = HOMALG_IO.Pictograms.DecideZeroEffectively and
        IsBound( HOMALG.color_BOP ) then
        pictogram := Concatenation( HOMALG.color_BOP, pictogram, "\033[0m" );
    elif need_output or need_display then
        pictogram := Concatenation( HOMALG_IO.Pictograms.color_need_output,
            pictogram, "\033[0m" );

```

```
else
    pictogram := Concatenation( HOMALG_IO.Pictograms.color_need_command,
                                pictogram, "\033[0m" );
fi;
fi;

if io_info_level >= 3 then
    if ( io_info_level >= 7 and not need_display ) or io_info_level >= 8 then
        ## print the pictogram, the prompt of the external system,
        ## and the sent command
        Info( InfoHomalgToCAS, 7, pictogram, " ", stream.prompt,
              L{[ 1 .. Length( L ) - 1 ]} );
    elif io_info_level >= 4 then
        ## print the pictogram and the prompt of the external system
        Info( InfoHomalgToCAS, 4, pictogram, " ", stream.prompt, "..." );
    else
        ## print the pictogram only
        Info( InfoHomalgToCAS, 3, pictogram );
    fi;
fi;
```

Chapter 4

External Rings

4.1 External Rings: Representation

4.1.1 IsHomalgExternalRingRep

◇ `IsHomalgExternalRingRep(R)`

(Representation)

Returns: `true` or `false`

The internal representation of homalg rings.

(It is a representation of the GAP category `IsHomalgRing`.)

4.2 Rings: Constructors

4.3 External Rings: Operations and Functions

Appendix A

Overview of the homalg Package Source Code

The package HomalgToCAS is split in several files.

Filename .gd/.gi	Content
HomalgToCAS	the global variable HOMALG_IO and the global function homalgIOMode
homalgExternalObject	homalg external objects, homalgPointer, homalgExternalCASystem, homalgStream, ...
HomalgExternalRing	CreateHomalgExternalRing, HomalgExternalRingElement
HomalgExternalMatrix	ConvertHomalgMatrix, ConvertHomalgMatrixViaFile
homalgSendBlocking	homalgFlush, homalgSendBlocking
IO	LaunchCAS, TerminateCAS

Table: *The HomalgToCAS package files*

References

[ht09] T. homalg team. *The homalg project*, 2003-2009. <http://homalg.math.rwth-aachen.de/>. 4

Index

HomalgToCAS, [4](#)

homalgIOMode, [6](#)

IsHomalgExternalRingRep, [10](#)