

## CoCoA-5 - Feature #200

### add modules and module operations

29 Jun 2012 18:53 - Anna Maria Bigatti

<b>Status:</b>	Closed	<b>Start date:</b>	29 Jun 2012
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assignee:</b>	Anna Maria Bigatti	<b>% Done:</b>	100%
<b>Category:</b>	CoCoA-4 function to be added	<b>Estimated time:</b>	27.00 hours
<b>Target version:</b>	CoCoA-5.1.0 Easter14	<b>Spent time:</b>	27.05 hours
<b>Description</b>			
We have modules in CoCoALib. Just mimick ideals to add modules..... will it be that easy?  Probably we'll have some surprises with module operations... cross fingers!!			
<b>Related issues:</b>			
Related to CoCoALib - Design #297: Modules design: brainstorming		<b>In Progress</b>	<b>25 Jan 2013</b>
Related to CoCoALib - Feature #304: Module ordering and grading (and shifts)		<b>Closed</b>	<b>11 Feb 2013</b>
Related to CoCoALib - Design #305: FreeModule: unique copy?		<b>In Progress</b>	<b>12 Feb 2013</b>
Related to CoCoA-5 - Feature #330: Syzygy for modules: homogeneous module		<b>Closed</b>	<b>15 Mar 2013</b>
Related to CoCoA-5 - Feature #388: port optimized resolutions to CoCoA-5		<b>New</b>	<b>23 Jul 2013</b>
Related to CoCoALib - Feature #387: implement algorithm(s) for resolutions		<b>New</b>	<b>23 Jul 2013</b>
Related to CoCoA-5 - Support #341: Remove/replace the word "vector" in the ma...		<b>Closed</b>	<b>17 Apr 2013</b>
Related to CoCoA-5 - Bug #509: SyzOfGens (CoCoA-5) does not have correct shifts		<b>Closed</b>	<b>03 Apr 2014</b>
Related to CoCoA-5 - Feature #702: Add more operations for modules		<b>New</b>	<b>15 May 2015</b>
Related to CoCoALib - Design #703: Add more operations between modules (CoCoA...		<b>New</b>	<b>15 May 2015</b>

### History

#### #1 - 22 Jan 2013 17:17 - Anna Maria Bigatti

- Status changed from New to In Progress
- % Done changed from 0 to 10

added types MODULE and MODULEELEM.  
added functions: NewFreeModule, arithmetics for type MODULEELEM.

#### #2 - 22 Jan 2013 18:17 - Anna Maria Bigatti

- Category set to CoCoA-4 function to be added
- Assignee set to Anna Maria Bigatti
- Target version set to CoCoA-5.0.3

added zero(module), BaseRing(module), RingOf(module), RingOf(ModuleElem)  
added stub documentation

#### #3 - 23 Jan 2013 15:52 - Anna Maria Bigatti

- % Done changed from 10 to 20

#### #4 - 12 Feb 2013 11:03 - Anna Maria Bigatti

added LPP, LPosn, LT, wdeg

#### #5 - 13 Feb 2013 10:13 - Anna Maria Bigatti

added **FirstNonZeroPosn**, **homog(ModuleElem)** (for GradingDim=1)

#### #6 - 20 Feb 2013 18:04 - Anna Maria Bigatti

Added **SyzOfGens** for an **ideal** both in **cocoalib** and **cocoa-5** (and manual in **cocoa-5**).

This is still quite rough as there is no control on the module in which the output resides (this is automatically created in the raw C++ code). There should be at least the possibility of passing the free module so that two successful computation reside in the same module.

```
/**/ I := Ideal(x, x, y);  
/**/ SyzOfGens(I);  
submodule(FreeModule(...), [[1, -1, 0], [0, y, -x]])
```

#### #7 - 21 Feb 2013 17:20 - Anna Maria Bigatti

added **GensAsRows**, **GensAsCols** (and manual)  
added **NewFreeModuleForSyz** + consequences

#### #8 - 21 Feb 2013 18:13 - Anna Maria Bigatti

- Estimated time changed from 10.00 h to 20.00 h

#### #9 - 22 Feb 2013 13:42 - Anna Maria Bigatti

added **GenRepr** in packages/hilop

#### #10 - 08 Apr 2013 15:52 - John Abbott

New module fns to add:

- rank
- **IsIn**
- equality test

#### #11 - 31 May 2013 18:04 - Anna Maria Bigatti

- % Done changed from 20 to 30

#### #12 - 04 Jun 2013 07:24 - Anna Maria Bigatti

John Abbott wrote:

- **IsIn**
- equality test

added **IsElem**, **IsContained** for (sub)modules, and then **IsIn** and **equality test**

**#13 - 31 Jul 2013 15:53 - Anna Maria Bigatti**

- Target version changed from CoCoA-5.0.3 to CoCoA-5.0.9

- % Done changed from 30 to 50

added **v[i]** where v is a ModuleElem (real miracle in Interpreter.[HC], **indexedByBigInt**),  
added **IsHomog(M)**, **IsZero(M)**, **LT** for M (sub)module.  
currently working on HilbertSeries.

**#14 - 31 Jul 2013 16:39 - Anna Maria Bigatti**

added **NumCompts** for MODULE and MODULEELEM

**#15 - 01 Aug 2013 15:49 - Anna Maria Bigatti**

added **LC** and **DivAlg**, fixed manual entries.  
renamed LPos into **LPosn**.

**#16 - 25 Mar 2014 17:37 - John Abbott**

- Target version changed from CoCoA-5.0.9 to CoCoA-5.1.0 Easter14

**#17 - 28 Mar 2014 09:08 - Anna Maria Bigatti**

Added **MinGens**

**#18 - 08 Apr 2014 17:54 - Anna Maria Bigatti**

- % Done changed from 50 to 60

added **submodule(gens)**

where gens is a non-empty vector of ModuleElem in the same Module.

**#19 - 08 Apr 2014 20:14 - Anna Maria Bigatti**

added **shifts(FreeModule)**

**#20 - 11 Apr 2014 15:03 - Anna Maria Bigatti**

- Status changed from In Progress to Closed

- % Done changed from 60 to 100

Most operations have been implemented by now.  
Remaining functions will be under their own "issue".

**#21 - 15 May 2015 09:02 - Anna Maria Bigatti**

- Estimated time changed from 20.00 h to 27.00 h