

CoCoALib - Feature #125

Matrix equation solving; linear system solving

05 Apr 2012 14:23 - John Abbott

Status:	In Progress	Start date:	05 Apr 2012
Priority:	Normal	Due date:	
Assignee:	John Abbott	% Done:	50%
Category:	New Function	Estimated time:	0.00 hour
Target version:	CoCoALib-0.99880	Spent time:	11.35 hours
Description			
Add code for solving linear systems. There are several subcases:			
<ul style="list-style-type: none">• generic case over a field• full rank and not full rank• over finite fields• fast version over QQ			
Generic full-rank is probably the most urgent as it would allow other code to proceed (though perhaps at reduced speed).			
Related issues:			
Related to CoCoALib - Feature #206: Matrix equation solving: LinKer		In Progress	10 Jul 2012
Related to CoCoALib - Feature #147: Buchberger-Moeller: impl via modular redu...		In Progress	01 May 2012
Related to CoCoALib - Feature #872: LinSolve for matrices over FFp		In Progress	26 Apr 2016
Related to CoCoALib - Feature #1444: HNF: Hermite Normal Form		New	10 Mar 2020

History

#1 - 13 Apr 2012 14:30 - John Abbott

- Assignee set to John Abbott

- % Done changed from 0 to 20

JAA has an impl of the generic case (over a field).
JAA has written a test for this first impl.
No example, and no doc yet. Nothing checked in yet.

#2 - 13 Apr 2012 18:29 - John Abbott

Added some doc in MatrixArith.txt, and a new test test-matrix3.C.
No new example program yet.
New fns not yet available in CoCoA-5.

#3 - 16 Apr 2012 10:45 - John Abbott

What names should we use for the fns which find a solution to a linear system? The name may be related to the name for the fns which find the kernels of linear systems.

In CoCoA-4 the fn is called LinSol, and the fn for finding the kernel is called LinKer.

In my first prototype in CoCoALib I used the name solve (and also SolveByGauss, SolveByHNF, SolveByModuleRepr). The name solve is very generic -- is this a good or a bad thing?

Another possible candidate is LinSolve. As usual if we decide to break backward compatibility, it should be for a good reason (e.g. choosing a much better name for the fns).

#4 - 16 Apr 2012 10:50 - John Abbott

As mentioned in the previous post, currently I have used several fn names for solving linear systems: a generic fn, and the other dictating the method to use. It would also be possible to design solve to accept a parameter which indicates the method to use -- if I recall well, Maple has adopted an approach like this.

Which approach do we prefer?

#5 - 20 Apr 2012 12:19 - John Abbott

While speaking to Renzo about choosing the name, I realised that solving a linear system is slightly different from solving a (linear) polynomial system. In the first case I would expect a matrix as the result, in the second I'm not sure what I would expect... a finite set of vectors?

Of course, a finite set of vectors can be represented as a matrix, but to my mind it is **not** a matrix.

If we opt for different return types when solving a matrix equation and when solving a zero-dimensional polynomial system then I think I'd prefer different names.

Here is another candidate for the matrix equation solver MatSolve.

Opinions?

#6 - 27 Apr 2012 15:06 - John Abbott

- % Done changed from 20 to 30

A quick count using Google suggests that **LinSolve** is about twice as popular as **MatSolve**. Anna points out that **LinSolve** is "almost backward compatible" with CoCoA-4. These two reasons combine to make **LinSolve** the victor and **MatSolve** the runner-up.

The related fn to compute the kernel of a matrix was called **LinKer** in CoCoA-4, and will probably retain this name in CoCoA-5. This way the two fns have a common prefix -- possibly a mnemonic aid to users.

JAA will implement the name change. The related solving fns will also have the prefix **LinSolve**...

#7 - 27 Apr 2012 16:29 - John Abbott

Implemented the chosen names.

Created/corrected CoCoALib doc for the new fns.

Added CoCoALib example program **ex-matrix3.C**

Made **LinSolve** fn available in CoCoA-5; added manual entry.

#8 - 08 Feb 2013 18:18 - John Abbott

- Category set to New Function

- Priority changed from Normal to Urgent

Check compatibility of fn names with those in CoCoA-5 (see [#206](#)).

Need fast lin sys solving over QQ for Buchberger-Moeller (see [#147](#)).

This task will need "fast" matrices over SmallFp, and some form of lifting.

#9 - 01 Apr 2014 17:35 - Anna Maria Bigatti

- Target version set to CoCoALib-0.99533 Easter14

#10 - 08 Apr 2014 18:16 - John Abbott

- Target version changed from CoCoALib-0.99533 Easter14 to CoCoALib-0.99534 Seoul14

#11 - 10 Jul 2014 13:45 - John Abbott

- Status changed from New to In Progress

- % Done changed from 30 to 50

#12 - 31 Jul 2014 11:29 - John Abbott

- Target version changed from CoCoALib-0.99534 Seoul14 to CoCoALib-1.0

#13 - 11 May 2015 14:08 - John Abbott

- Priority changed from Urgent to Normal

#14 - 26 Apr 2016 19:06 - John Abbott

- Related to Feature #872: LinSolve for matrices over FFp added

#15 - 10 Mar 2020 15:43 - John Abbott

- Related to Feature #1444: HNF: Hermite Normal Form added

#16 - 10 Mar 2020 15:49 - John Abbott

- Target version changed from CoCoALib-1.0 to CoCoALib-0.99850

#17 - 18 Mar 2024 10:00 - John Abbott

- Target version changed from CoCoALib-0.99850 to CoCoALib-0.99880