

# Calcul formel, algorithmes certifiés, preuves constructives

## Computer Algebra, Certified algorithms, Constructive proofs

Meeting in the CIRM at Luminy, 12-16th January, 2004.

This meeting is the continuation of the seminar “Verification and constructive algebra” held in Dagstuhl from 6 to 10 January 2003.

The goal of the meeting is to bring together people from the communities of formal proofs, constructive mathematics and computer algebra (in a wide meaning).

One objective of the meeting is to bridge the gap between conceptual (abstract) and computational (constructive) mathematics, by providing a computational understanding of abstract mathematics.

It is becoming clear that many parts of abstract mathematics can be made constructive and even computational and that abstract mathematics techniques contains an underlying constructive content.

We are not only interested in algorithms however, but also in formal proofs of the correctness of these algorithms.

Computer algebra provides a variety of interesting basic algorithms, from exact linear algebra to various aspects of elimination and real root counting, which are the foundations for much more sophisticated results like nullstellensatz, quantifier elimination etc... It is remarkable that in constructive and computer algebra, progress in sophisticated algorithms often implies progress on basics.

Moreover the scope of computer algebra is now widened by the consideration of seminumerical algorithms. When such algorithms are correctly controlled, they actually deal with real and complex numbers in the constructive meaning of these objects. So computer algebra is lead to fill many objectives of computational analysis.

Providing formal proofs of correctness to the computer algebra community is very useful, specially for algorithms which are basic and used everywhere.

On the other hand, a collection of mathematically non trivial examples is very useful for the formal proof community, which needs also powerful automatic methods from computer algebra.

We observe that the Dagstuhl seminar 03021/1, which seems to have been the first meeting devoted to the topic, was a success and has been very satisfactory for the participants. They decided to create a group under the acronym

“Mathematics, Algorithms, Proofs”

and propose to organize a similar meeting on January 2004.

## Schedule

### Monday

9h-10h

SERGERAERT Francis    The status of Postnikov invariants in algebraic topology

10h30-11h30

BALLARIN Clemens    Convenient Reasoning about Substructures — Towards Instantiation of Locales

11h30-12h30

RUBIO Julio    Emulating proof-by-hand with Isabelle

14h30-15h30

COQUAND Thierry    Dynamical Methods in Algebra

16h - 17h

PERDRY Hervé    Strongly Noetherian rings and Lasker-Noether rings

17h - 17h40

YENGUI Ihsen    A constructive deciphering of a Suslin's lemma

### Tuesday

9h-10h

DOWEK Gilles    Confluence as a cut elimination property (invited talk)

10h30-11h30

SCHWICHTENBERG Helmut    Program Extraction in Constructive Analysis

11h30-12h30

GRIGORIEV Dima    Factoring and solving linear partial differential equations

14h30-15h30

BOLDO Sylvie    Formal proofs about computer arithmetic: some faithful results

16h-17h

RIOBOO Renaud    The Foc distribution

17h-18h

NIQUI Milad    Exact Real Arithmetic using Coinductive Types

### Wednesday

9h-10h

PAULE Peter    Computer-Assisted Proving and Finding in Combinatorics and Special Functions (invited talk)

10h30-11h30

MAHBOUBI Assia    Induction over real numbers

11h30-12h30

DUVAL Dominique    Diagrammatic specifications

## Thursday

9h-10h

SCHUSTER Peter    Why Formal Geometry, and How? (invited talk)

10h30-11h30

OLIVA Paulo    Bounded Functional Interpretationg

11h30-12h30

BERARDI Stefano    An intuitionistic model of Arithmetical Maps

14h30-15h30

POTTIER Loic    Quotients in type theory

16h-17h

OBUA Steven    Towards a Machine-Checked Proof of the Kepler Conjecture

17h-18h

GEBELLATO Silvia    The basic picture as invariance under transfer along a relation

## Friday

9h-10h

SAMBIN Giovanni    Putting predicative topology in algebraic terms

10h30-11h30

SPITTERS Bas    Constructive Algebraic Integration Theory without Choice

11h30-12h30

BERGER Ulrich    A computational interpretation of classical analysis

14h30-15h30

GEUVERS Herman    CCoRN, the Constructive Coq Repository at Nijmegen

16h-17h

SCHNEIDER Carsten    Proving and Finding Multisum Identities in Difference Fields

For more informations on the subject see:

– the web page of the (informal) group MAP (Mathematics, Algorithms, Proofs)

<http://map.unican.es/>

– the web page of the CIRM at Luminy <http://www.cirm.univ-mrs.fr/>