

## Research group on *Commutative Algebra*

**IMAR Participants:** S. Basarab, D. Popescu, N. Popescu, M. Cipu, C. Ionescu, N. Bonciocat

**Romanian Cooperations:** Bucharest University, "Ovidius" University constanta. Several junior Romanian mathematicians (post-doctoral researchers and PhD and master students) have been joined to the group either for direct research activity or for training in research.

**International Cooperations:**

Germany: Kaiserslautern University, Oldenburg University, Essen University

Italy: Messina University

**Workpackages involved:** A1, B1, B2, C3.

**Post-doctoral fellows at IMAR:** Giancarlo Rinaldo spent 2 months at IMAR with a 2 months post-doc fellowship, in february-march 2003. He previously finished a thesis at the University of Messina under the supervision of Prof. G. Restuccia. During his stay at IMAR, he studied Rees algebras of modules, beginning to write a paper which is at the present submitted for publication.

**Doctoral research:**

1. N. Bonciocat has finished his PhD thesis under the supervision of D. Popescu, working with the research group on Commutative Algebra in Oldenburg University.
2. Students Etienne Lafond and Philippe Hesse (Ecole Normale Supérieure de Cachan) had a scientific joint work with Dr. Mihai Cipu (IMAR) on Groebner Basis.

**Scientific Objectives:**

1. Combinatorics and commutative algebra.
2. The study of Maximal Cohen-Macaulay modules
3. Symmetric algebras of modules of finite projective dimension.
4. The SINGULAR symbolic calculus.

**Main Scientific Results:**

1. C. Baciuc, V. Ene, G. Pfister, D. Popescu: *Rank two Cohen-Macaulay modules over singularities of type  $x_1^3+x_2^3+x_3^3+x_4^3$* , preprint 338/2004 Kaiserslautern University.
2. Nicolae Ciprian Bonciocat: *Upper bounds for a number of factors for a class of polynomials with rational coefficients*, accepted to be published by *Acta Arithmetica*.
3. Mihai Cipu: *Upper bounds for norms of products of binomials*, London Mathematical Society Journal of Computation and Mathematics, 7 (2004), 37-49.
4. Mihai Cipu: *Cyclic quadrilaterals determined by incenters of a triangulation of the square*, submitted.

**Research Activity:**

- *Combinatorics and Commutative Algebra*. This was a direction of common research of D. Popescu (IMAR) and J. Herzog (Essen University) and led to future collaboration in the frame of the programm FP6 - Marie Curie Intra-European Fellowships (contract FP6-501046). This collaboration involved also the young Ph. D. student(at that time) M. Vladoiu, who is continuing the activity in this domain.
- *Maximal Cohen-Macaulay modules*. This was the subject of the collaboration between D. Popescu (IMAR) and G. Pfister (Kaiserslautern University). The complete description of MCM modules of rank 2 on the hypersurface  $x_1^3+x_2^3+x_3^3+x_4^3$  was given. This was materialized in a preprint (338/2004-Univ. Kaiserslautern).
- *Symmetric algebras of modules of finite projective dimension*. It was the main theme of the collaboration between C. Ionescu (IMAR) and G. Restuccia (Messina University), began during the visit of G. Restuccia at IMAR and continued during a visit of C. Ionescu at the Univ. Messina. A paper with the title *Fitting conditions for symmetric algebras of modules of projective dimension 2* was started and is going to be finished in the near future.

- M. Cipu from IMAR spent two weeks at Kaiserslautern University (October 28 - November 11, 2001). During his visit he collaborated with Profs. G.-M. Greuel and G. Pfister on some specific problems concerning the symbolic calculus system "SINGULAR". Their work has been concerned with some specific utilizations of this system in connection with problems from commutative algebra.
- Nicolae Ciprian Bonciocat studied in a joint work with Nicolae Manolache some techniques to investigate subobjects in an arbitrary category.

### Conferences, talks, seminars:

1. The conference *Castelnuovo-Mumford regularity*" given by Dorin Popescu at the Algebraic Geometry Seminar of the Barcelona University (May 2002)
  2. The conferences:  
*"Bass-Quillen conjecture and Artin approximation property"*  
*"Cohen-Macaulay representation on hypersurface rings"*  
 given by Dorin Popescu at the Commutative Algebra Seminar of the Institute of Mathematics of the University of Barcelona (May 2002).
  3. Nicolae Bonciocat (IMAR) gave the conference *"Congruences for the convolution of divisor sum function"* in the Algebra/Geometry Seminar of the Department of Mathematics of the Oldenburg University (May 2002).
  4. Serban Basarab (IMAR) has participated at the Euro-Conference on Model Theory and Applications (Ravello, May 2002) and has presented the poster *"Arboreal structures on groups"*.
  5. Winfried Bruns (Osnabruck University): *Unimodular covers of lattice polytopes*, at IMAR (August 2003).
  6. Cristodor Ionescu (IMAR) gave the talk *Some remarks on evolutions* at the joint AMS-RSME meeting at Sevilla University (June 2003).
  7. Mihai Cipu (IMAR) presented some of his results on the occasion of the *International Congress of Mathematicians*, Beijing (August 2002),
  8. Invited lecture by Mihai Cipu at Universite Louis Pasteur, Strasbourg (France), 2003.
- Organization of the **National School on Algebra**; J. Herzog (Univ. Essen) was in the organizing committee and the main person in the scientific committee of the 2 Summer Schools organized in Eforie:
    - *Homological and Combinatorial Aspects of Koszul Algebras*, Eforie June 3-8, 2002
    - *Monomial algebras*, Eforie, September 8-14, 2003.
 These schools were followed by many young people: graduate students, master students, Ph. D. students from Romania but also from China, Germany, Italy and this increased the request for optional courses, Master and Ph. D. programs in Commutative Algebra.

### Lecture Series:

1. Yann Bugeaud (Univ. Strasbourg): 6 lectures on *Approximation by algebraic numbers*, at IMAR in September – October 2001.
2. Henri Bonnel (Univ. La Reunion): 6 lectures on *Approximation in Vector Optimization*, at IMAR in October – November 2001.
3. Maurice Mignotte (Univ. Strasbourg): 6 lectures on *Polynomials in Computer Algebra*, at IMAR in May – June 2002.
4. Jurgen Herzog (Univ. Essen): 4 lectures on *Koszul algebras and modules*, at IMAR in September 2002.
5. Jurgen Herzog (University of Essen): 4 lectures on *Lectures on monomial algebras*, at IMAR in August - September 2003.
6. Gaetana Restuccia (Messina University): 4 lectures on *Groebner basis and symmetric algebras*, at IMAR in February 2004.