

Newsletter No. 3/4
of the
European RTN Network RAAG
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Through a contract with the Universität Passau in Germany, the European Community has established the Research Training Network RAAG (Real Algebraic and Analytic Geometry). This bi-monthly newsletter, to be distributed among the Network researchers and other interested mathematicians by e-mail, will inform about the activities and the progress of the Network. Further information about the Network, and about RAAG in general, may be found on the Network's website at

<http://www.ihp-raag.org/>

The Network RAAG is part of the European IHP programme (Improving the Human Research Potential). General information about this programme and about RTN networks is available at

<http://www.cordis.lu/improving/home.html>

The website

<http://improving.cordis.lu/rtn/>

offers short presentations of the different networks supported by the European Community.

Management of the Network

In his capacity as Scientific Network Coordinator Niels Schwartz visited the Université de Savoie from June 28 to June 29 to work on the Network's website with Frederic Mangolte and Didier d'Acunto, as well as to discuss mathematics with the Network researchers in Chambéry.

In the future he plans to visit other Network centers to inform himself about the scientific progress of the Network and to discuss questions concerning the organization and management of the Network.

The website

The Network's website is the primary means by which the Network presents itself to the general public. The website is currently being developed under the responsibility of Frederic Mangolte (Frederic.Mangolte@univ-savoie.fr). His deputy from now on will be Didier D'Acunto (ddacu@univ-savoie.fr). Both the content and the design of the website are evolving constantly. Everybody should take a look from time to time. Criticism and suggestions concerning all aspects of the website are invited and are very welcome.

Although the website is not yet in its final form with respect to design, organization and content, a lot of work has already been done, probably much more than had been anticipated by those who actually do the work. The entire Network is indebted to those who continue to spend a lot of their time to produce a high quality public presentation of the Network.

Young researchers

D. Alessandrini has defended his thesis in Angers on June 11, 2002. The title of the dissertation is: "Les singularités à l'infini des polynômes et les compactifications toriques" (adviser: A. Parusinski).

Training and appointments

Current appointments:

- José F. Fernando from the Universidad Complutense, Madrid, does post-doctoral work with Claus Scheiderer in Duisburg, from March 1 to August 31, 2002.
- Dr. Hervé Perdry from France does post-doctoral with Laureano Gonzalez-Vega in Santander, from July 1, 2002, to March 31, 2003.

Future appointments:

Several positions for young researchers are available within the next few months; it is expected that more vacancies can be added to this list in the near future. Vacancies are usually advertised on the EC's CORDIS server at <http://improving.cordis.lu/rtn/>, in this Newsletter and on the Network's website at <http://www.ihp-raag.org/>.

The application deadlines for several vacancies have expired recently. They include:

The objective of this RAAG Workshop was to define the network vision of what is computing in Real Algebraic Geometry, what software is available and which applications inside and outside mathematics are being considered currently.

The Workshop started in the afternoon of Thursday June 13 and finished in the morning of Saturday June 15. The number of participants was 35 with participation of RAAG members coming from France, Italy, Germany, Poland and Spain. Several external experts were invited to the workshop. We gratefully thank the University of Cantabria for supporting in many ways the first event of the RAAG Network.

The main topics of the workshop were Computations in Real Algebraic Geometry, Curves and Surfaces, Robotics, Optimization, Control and Engineering. Friday morning was devoted to a visit of the headquarters of the company CANDEMAT (which builds bids and moulds for cars and planes) where the conference attendants saw how (real algebraic) geometric problems about (real) curves and surfaces are solved in practice. Two groups of 15 participants were organized in order to visit the company for two hours each: the visit was conducted by Carlos Gomez de Dios (the R&D Industrial Director of CANDEMAT) and Jesus Espinola (a joint CANDEMAT&Universidad de Cantabria researcher).

A preliminary list on conclusions and follow up activities will be shortly available on the RAAG web page together with the abstracts of the different talks.

The scientific program

June 13, Thursday Afternoon

16:00 - 16:05 Opening remarks L. Gonzalez Vega, F. Rouillier, M.-F. Roy
16:05 - 16:50 An Introduction to Computations in Real Algebraic Geometry, M.-F. Roy
16:50 - 17:35 Topology Computations in Real Semialgebraic Geometry, C. Traverso
18:00 - 18:45 Symbolic-Numeric Solvers for Geometric Applications, B. Mourrain
18:45 - 19:15 A Symbolic-Numeric Toolbox for Computer Aided Geometric Design, L. Gonzalez Vega
19:15 - 19:45 Open Discussion I

June 14, Friday Morning

9:00 – 12:00 Visit to the company CANDEMAT:

June 14, Friday Afternoon

16:00 - 16:45 Real Solving and parallel robots, F. Rouillier

- 16:45 - 17:30 Characterisation of cuspidal robots with three degrees of freedom, S. Corvez
17:30 - 18:00 Nilpotency orders of polynomial bases in car and trailers systems and their motion planning, P. Mormul
18:30 - 19:00 Mayer-Vietoris, spectral sequences, and algorithms for computing Betti numbers of semi-algebraic sets, S. Basu
19:00 - 19:30 Polynomial Images of \mathbb{R}^2 , J. Fernando
19:30 - 20:00 Infinitesimal rigidity and pseudotriangulations, D. Orden

June 15, Saturday Morning

- 9:00 - 9:30 Computations with sums of squares, H. Lombardi
9:30 - 10:15 Polynomials and semidefinite programming, P. Parrilo
10:15 - 11:00 Applications of positive polynomials to Control Theory, B. Tibken
11:30 - 12:15 Applications of Quantifier Elimination and Variants, A. Dolzmann
12:15 - 12:45 Quantifier Elimination Computations, L. Gonzalez-Vega
12:45 - 13:30 Open Discussion II

The list of participants

- 1 Marie-Francoise Roy RAAG France
- 2 Fabrice Rouillier RAAG France
- 3 Solen Corvez RAAG France
- 4 Saugata Basu External USA
- 5 Henri Lombardi RAAG France
- 6 Bernard Mourrain External France
- 7 Carlo Traverso RAAG Italy
- 8 Andreas Dolzmann RAAG Germany
- 9 Bernd Tibken External Germany
- 10 Pablo Parrilo External Switzerland
- 11 Jose Fernando RAAG Spain
- 12 Tomas Recio RAAG Spain
- 13 Ioana Necula RAAG Spain
- 14 Laureano Gonzalez-Vega RAAG Spain
- 15 Piotr Mormul RAAG Poland
- 16 Neila Gonzalez-Campos RAAG Spain
- 17 Pilar Velez Melon RAAG Spain
- 18 Alberto Zanoni RAAG Italy
- 19 Markus Schweighofer RAAG Germany
- 20 Antonio Diaz-Cano Ocaña RAAG Spain
- 21 Rosario Rubio San Miguel RAAG Spain
- 22 Gema Diaz Toca RAAG Spain

- On June 10, J. Bochnak lectured at the Max Planck Institut in Bonn about a recent joint result with W. Kucharz concerning the characterization of holology classes represented by real analytic sets.
- Isabelle Bonnard visited Pisa for one week in June.
- S. Basu (Georgia Tech) and A. El Khadiri (Kenitra) visited Rennes for two weeks in June.
- Niels Schwartz visited the Université de Savoie on June 28 and 29.
- M. Shiota (Nagoya) will visit Rennes for one month in September.
- J-P. Monnier will visit Duisburg in October.
- E. Bierstone (Toronto) and T. Mostowski (Warsaw) will probably visit Nice in 2002 – 2003

New preprints and publications

Marcus Tressl (Marcus.Tressl@mathematik.uni-regensburg.de) and his deputy Tobias Kaiser (tobias.kaiser@mathematik.uni-regensburg.de) are responsible for posting preprints and publications on the Network's website. All Network researchers are asked to make every new preprint available to them so that it can be added to the website. This is an important part of the intended function of the website as an information center on RAAG.

Here is a list of new preprints and publications by Network researchers:

- D. Zhang: Real Prüfer extensions of commutative rings. *manuscr. math.* 106, 405 – 409 (2001)
- D. Zhang: Schmüdgen's theorem for preorderings of higher level. *Arch. Math.* 77, 309 – 312 (2001)
- D. Grigoriev, E. Hirsch, D. Pasechnik: Complexity of semialgebraic proofs. (Symp. Theor. Aspects of Comput. Sci., Sophie-Antipolis, March 2002), *Lecture Notes Comput. Sci.*, 2002, vol. 2285, p.419-430.
- B. Chevallier: Four M-curves of degree 8. *Functional Analysis and Its Applications*, Vol.36, n°1 (2002), pp.76-78
- P. Aubry, F. Rouillier and M. Safey: Real Solving for Positive Dimensional Systems, to appear in *Journal of Symbolic Computation*.
- M.E. Alonso, H. Lombardi: Generalized Taylor formulae, computations in real closed valued fields and quantifier elimination. To appear in: *Valuation Theory and its Applications*. Vol 1. (2002)
- J. Bochnak, W. Kucharz: Analytic cycles on real analytic manifolds. Preprint, MPI für Mathematik, Bonn, June 2002
- S. Corvez, F. Rouillier: Characterization of cuspidal manipulators with 3 degrees of freedom. Preprint.

- K. Kurdyka, A. Parusinski: Quasi-convex Decomposition in o-Minimal Structures. Application to the Gradient Conjecture. Université d'Angers, preprint no. 138, October 2001
- J.-P. Henry, A. Parusinski: Invariants of bi-Lipschitz equivalence of real analytic functions, Université d'Angers, preprint no. 147, April 2002.
- A. Parusinski: Constructible Categories and the Borel-Kurdyka Theorem. University of Angers preprint no. 148, April 2002
- H. Lombardi: Constructions cachées en algèbre abstraite (4). La solution du 17ème problème de Hilbert par la théorie d'Artin-Schreier. Preprint
- H. Lombardi: Constructions cachées en algèbre abstraite (5). Principe local-global de Pfister et variantes. Preprint
- J-P. Monnier: Divisors on real curves. Preprint.
- Y. Yomdin, G. Comte: Tame Geometry with Applications in Smooth Analysis. Preprint available on the IHP-RAAG server.

The Network's Lecture Note Series

The Network intends to publish a series of lecture notes. The series will be managed by Fabrizio Broglia (broglia@dm.unipi.it) with Federica Pieroni (pieroni@mail.dm.unipi.it) as his deputy.

The intention of the series is to produce basic texts about topics in RAAG that are suitable for learning the subject up to the point where one can read current research articles and start one's own research. The editors will pay particular attention to the suitability of submitted manuscripts for this intended purpose.

The series may be seen as a continuation of the texts already published in the University of Pisa's series Dottorato di Ricerca in Matematica. One source for new texts will be the Network's schools, such as the one in Aussois in January 2003. The lecturers of all schools will be asked to provide manuscripts within half a year after the school.

State-of-the-art surveys

The Network publishes a series of state-of-the-art surveys. The editor of the series is Michel Coste (Michel.Coste@univ-rennes1.fr) with Jean-Philippe Monnier (jean-philippe.monnier@univ-angers.fr) as his deputy. After his appointment in Rennes as a young researcher, Markus Schweighofer will assist with this task.

The purpose of the state-of-the-art surveys is to provide accounts of the current state of knowledge about special topics in RAAG. Authors in this series are asked to regularly maintain and update their texts to incorporate new developments.

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Currently some texts are already accessible through the Network's website, others will be added as they become available.

Because of the summer holiday season this newsletter is a double issue. The next issue will be mailed on November 2.