

**Newsletter No. 6**  
of the  
**European RTN Network RAAG**  
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January 2, 2003

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 and about matters of interest to the Network's researchers. 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**

A very sad event was the unexpected death of Professor Lojasiewicz, the Local Coordinator of the Polish Network team, on November 14. Professor Wieslaw Pawlucki is the new Local Coordinator of the Polish team, Krzysztof Nowak will continue as Deputy Local Coordinator for the Polish team. W. Pawlucki sent the following text about Professor Lojasiewicz's life and work:

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**Stanislaw Lojasiewicz, 1926 - 2002**

Stanislaw Lojasiewicz was born on October 9, 1926, in Warsaw. As a teenager he was particularly interested in music and mathematics, and eventually he decided to become a mathematician. He completed his mathematical studies in 1945-47 at the Jagiellonian University in Cracow. From that time on his career was connected with the Jagiellonian University, as well as with the Mathematical Institute of the Polish Academy of Sciences.

The magnitude of his mathematical achievements sets him in the rank of the most outstanding mathematicians of the twentieth century. His printed output counts 70 items and concerns differential equations, theoretical mechanics, differential analysis, distribution theory and analytic geometry.

At the beginning he was under the influence of Professor Tadeusz Wazewski, so he dealt with differential equations, mainly ordinary, studying, in particular, asymptotic effects. He defended his PhD thesis entitled *Sur l'allure asymptotique des intégrales du système d'équations différentielles au voisinage de point singulier* in 1950.

Then he turned his interests towards distribution theory, the systematic description of which was created in the first half of the 1950s by Laurent Schwartz. First works of Lojasiewicz in this direction concerned the fixation of variables in distributions. During his first stay abroad, in Paris in 1957, he achieved a great success solving a very difficult problem of division of distributions by analytic functions, posed by L. Schwartz. His solution, published in 1958 in *Comptes Rendus de l'Académie des Sciences* had a great significance for the development of the theory of partial differential equations, differential analysis and analytic geometry. Independently, in the same year, Lars Hörmander published his result about the division of distributions by polynomials. Lojasiewicz's solution was based on a fundamental property of real analytic functions, which is now widely known as the *Lojasiewicz inequality*.

The careful analysis of the method of the proof of this inequality led Stanislaw Lojasiewicz to create a new geometry, i.e., *semianalytic geometry*, which studies the subsets of euclidean spaces described locally by a finite number of analytic equalities and inequalities, and to initiate a generalization, called now *subanalytic geometry*, that was developed by Gabrielov, Hironaka and others, and deals with proper images of semianalytic sets by analytic maps. Since many mathematical problems lead to studying such objects, semi- and subanalytic geometry became a useful tool in many branches of analysis, such as approximation theory, control theory, and also in logic in connection with model theory.

In 1958-60 Stanislaw Lojasiewicz visited universities in Kingston (Ontario), in Chicago, in Berkeley, and also the Institute of Advanced Studies in Princeton. In 1962 he obtained a professorship at the Jagiellonian University. In the same year he was invited by Aldo Andreotti to Pisa where he elaborated his famous *theorem on triangulation of semianalytic sets*. In 1964, invited by UNESO, he gave a course at the University in Buenos Aires about the division problem and triangulation. Lojasiewicz spent the years 1964-65 at the University of Paris, where he presented his first systematic elaboration of semianalytic geometry, published as a well-known monograph, *Ensembles semi-analytiques*. During his next stay in France, in 1967-68

at the *Institut des Hautes Etudes Scientifiques*, he dealt with problems of differential analysis, first of all in connection with the *Malgrange-Mather Preparation Theorem*. The result of his studies was a beautiful and surprisingly short proof of this important theorem, which was presented at the *Singularity Symposium* in Liverpool in 1970, together with other results about Whitney fields and determinacy of jets. In 1970 Stanislaw Lojasiewicz was invited to deliver a plenary lecture about semianalytic geometry at the International Congress of Mathematicians in Nice.

In 1971 Professor Lojasiewicz was elected to the Polish Academy of Sciences as a correspondent member and became a full member in 1980.

In the seventies he continued his lively collaboration with mathematicians from Italy (University of Pisa) and from France. In the academic year 1976/77 he worked at the Instituto de Matematica Pura et Aplicada in Rio de Janeiro. From the late seventies on he studied mainly subanalytic geometry, as well as complex analytic geometry to which he devoted the monograph *An introduction to complex analytic geometry*. This monograph as well as two others, *An introduction to the theory of real functions* and (mentioned above) *Ensembles semi-analytiques* are masterpieces of mathematical precision and conciseness.

The intense scientific and didactic activity of Professor Lojasiewicz attracted many students and eventually created a mathematical school, representatives of which are not only in Cracow, but also in Warsaw, Gdansk, Lodz and in many centers abroad: in France, Italy, Spain, Germany, The Netherlands, the USA, Canada, and Japan. In 1983 he was distinguished by being elected to the Pontifica Academia Scientiarum, and – in 1989 – to the Academia Europea.

Stanislaw Lojasiewicz died on November 14, 2002 from a heart attack during his trip home to Cracow after the Plenary Session of the Pontifica Academia Scientiarum.

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Marcus Tressl (Regensburg, Germany) continues to be responsible for the preprint server; his new deputy is Vincent Astier (also at Regensburg).

Francesca Acquistapace coordinates the Network's activities for the young researchers. Her deputy is Helene Pennaneac'h ([pennanea@ dm.unipi.it](mailto:pennanea@dm.unipi.it)).

## The website

The Network's website is the primary means by which the Network presents itself to the general public. The website has been developed under the responsibility of Frederic Mangolte ([Frederic.Mangolte@univ-savoie.fr](mailto:Frederic.Mangolte@univ-savoie.fr)); his deputy is Didier D'Acunto ([Didier\\_Dacunto@mat.ucm.es](mailto:Didier_Dacunto@mat.ucm.es)). 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.

A new feature of the website is a *forum*, which has been designed and is being managed by Didier D'Acunto. The forum offers an opportunity for informal exchange

of information, experiences and opinions. Everyone is invited to register as a user and to contribute to its future development. The forum can be reached through the menu of the website.

## Young researchers

On December 16, 2002, Benoit Bertrand (Rennes) defended his thesis *Hypersurfaces et intersections complètes maximales dans les variétés toriques*. The thesis advisor was I. Itenberg.

The thesis of Savvas Pericleous, entitled, "Complexity bounds of cylindrical cell decompositions for sub Pfaffian sets", supervised by Nicolai Vorobjov, has been accepted at Bath University. The examiners were Angus Macintyre and Daniel Richardson. The main result of the thesis is a new technique for effective construction of cylindrical decomposition for sub Pfaffian sets restricted to the unit cube. The main ideas used come from Morse theory, and the method of Gabrielov for effective construction of closure of a semi Pfaffian set. The complexity bounds obtained are doubly exponential in  $O(N^2)$ , where  $N$  is the number of variables.

## Training and appointments

The training of young researchers is one of the main purposes of the Network. An important part of the training programme is to offer positions and fellowships to young researchers, giving them an opportunity to work with leading real geometers and participate in research of the highest quality.

### Current appointments:

- Dr. Hervé Perdry from France does post-doctoral work with Laureano Gonzalez-Vega in Santander, from July 1, 2002, to March 31, 2003.
- Dr. Markus Schweighofer from Konstanz, Germany, works as a post-doc in Rennes, from September 1, 2002, to August 31, 2003.
- M. Dumnicki from Poland works as a pre-doc with Jacek Bochnak in Amsterdam, from September 1, 2002, to August 31, 2003.
- Helene Pennaneac'h from France is a post-doc fellow at the Univerità di Pisa, where she works with Francesca Acquistapace and Fabrizio Broglia, from September 1, 2002, to August 31, 2003.
- Remi Soufflet from France is a post-doctoral Network fellow at the Uniwersytet Jagiellonski in Kraków, where he works with Wieslaw Pawlucki, from September 15, 2002, to September 14, 2003.
- Igor Klep from Slovenia has as a pre-doc position in Regensburg, from October 1, 2002, to September 30, 2003.
- Didier D'Acunto from Chambéry, France, is a post-doc at the Universidad Complutense in Madrid, October 1, 2002, to May 31, 2003.

- Olivier Ruatta from France is a post-doc fellow at the Università di Pisa to work with Francesca Acquistapace and Fabrizio Broglia, from October 1, 2002, to March 31, 2003.
- Artur Piekosz from Poland works as a post-doc with Alex Wilkie at Oxford University, October 1, 2002, to May 31, 2003.

**Expired appointments:**

- José F. Fernando from the Universidad Complutense, Madrid, did post-doctoral work with Claus Scheiderer in Duisburg, from March 1 to August 31, 2002. After the end of his term he returned to Madrid.

**Future appointments:**

Several positions for young researchers are available within the next few months; it is expected that more positions will be added 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 deadline for some positions has expired; the successful candidates are:

- A post-doc position in Amsterdam for work with J. Bochnak, beginning January 1, 2003. Dr. M. Karas will be appointed to this position for 7 months.
- A post-doc position in Pisa for work with Francesca Acquistapace and Fabrizio Broglia, beginning March 1, 2003. Dr. J. Fernando will be appointed to this position for 6 months.

**Vacancies**

A post-doc position in Kraków, Poland. The successful candidate is expected to study metric properties in o-minimal structures and Lipschitz stratifications, in collaboration with Professor Wieslaw Pawlucki. The position is available for 9 months, beginning on October 1, 2003. The application deadline is May 31, 2003. Applications should be sent to

Prof. Dr. Wieslaw Pawlucki

Instytut Matematyki

Uniwersytet Jagiellonski

ul. Reymonta 4

30-059 Kraków

Poland

e-mail [pawlucki@im.uj.edu.pl](mailto:pawlucki@im.uj.edu.pl)

**Other positions and opportunities**

The Research Unit "Algebra & Logic" of the University of Saskatchewan at Saskatoon (<http://math.usask.ca/fvk/alg.htm>) has money to support graduate students from Canada or from abroad, at the Master's or Ph.D. level. Suitable candidates are encouraged to apply.

The members of the Research Unit "Algebra & Logic" are

- Murray Bremner ([bremner@math.usask.ca](mailto:bremner@math.usask.ca))
- Franz-Viktor Kuhlmann ([fvk@math.usask.ca](mailto:fvk@math.usask.ca))
- Salma Kuhlmann ([skuhlman@math.usask.ca](mailto:skuhlman@math.usask.ca))
- Murray Marshall ([marshall@math.usask.ca](mailto:marshall@math.usask.ca))

Details about the graduate program, the funding, application forms and deadlines may be obtained by contacting any one of the members of the Research Unit, or

- Patrick Browne ([browne@math.usask.ca](mailto:browne@math.usask.ca)), Graduate Chair of the Mathematical Sciences Group. Postal address  
University of Saskatchewan  
McLean Hall  
106 Wiggins Road  
Saskatoon, SK S7N 5E6  
Canada

Besides the regular financial support (teaching fellowships, university scholarships), all members of the Mathematical Sciences Group hold NSERC Grants (NSERC: National Science and Engineering Research Council of Canada) which may be used to support their graduate students with additional funds. Moreover, graduate students can earn money through marking or by working in the Math Help Center.

NSERC offers several scholarships and fellowships programs for students and fellows from abroad who wish to study at a Canadian University (<http://www.nserc.ca>). In particular, the NSERC-NATO SCIENCE FELLOWSHIPS are very attractive and are intended to support Post-Doctoral Fellows from the former East European Block to study at a Canadian University for two years. In last year's competition, the Algebra & Logic Group at the University of Saskatchewan was successful in getting such a NATO Fellowship.

The Algebra & Logic Group has been very active in the last few years, and will continue to be so. Its main research interests are:

- Real Algebraic Geometry and Semialgebraic Geometry,
- Quadratic Form Theory,
- Valuation Theory and its various applications,
- Model Theory of Fields (Valued Fields, Ordered Fields, Hardy Fields),
- Ordered Algebraic Structures

The group's Algebra & Logic Seminar has been running since 1997; the schedule, topics and speakers can be found on the seminar's homepage (<http://math.usask.ca/fvk/algsem.htm>). Other past and future activities of the group include

- An active colloquium: <http://math.usask.ca/fvk/colloqg8.htm>
- The International Conference and Workshop on Valuation Theory, 1999
- The Annual Colloquiumfest, a series of short conferences taking place each year in March, the Fourth Annual Colloquiumfest coming up in March 2003: <http://math.usask.ca/fvk/mb4.htm>
- Invitations to outside researchers for short or long term visits.

The atmosphere in the group is very supportive of research.

Finally, Saskatoon is a very pleasant city, with lots of nature around and a fair amount of cultural events. The Campus is one of the nicest in North America. Saskatoon is a rather inexpensive place to live, so usually the funding provided by the Research Unit is sufficient to cover a moderate way of living for students.

## Visits and lectures

- Wieslaw Pawlucki visited the Università di Trento from December 8 to December 15, 2002; he gave two lectures.
- Vicki Powers of Emory University in Atlanta currently spends a year at the Universidad Complutense in Madrid.
- Murray Marshall will visit Paris from January 2 to March 7, 2003. His hosts are D. Gondard (Paris 6) and M. Dickmann (Paris 7).
- Vincent Astier is in Regensburg from September 1, 2002, to August 20, 2003, to work with Marcus Tressl.
- Tadeusz Mostowski will visit Nice for one month, in February 2003.
- E. Shustin will be in Rennes for one month, in March 2003.
- E. Bierstone will be in Nice for one month, in June and July 2003.

## Network meetings

The Network organizes a large number of meetings: every year an Annual General Conference and several workshops in areas of active research, as well as schools that offer introductory courses about special topics. The future meetings that have been scheduled so far are:

- January 6 –12, 2003, in Aussois, France,  
Network school on  
Spaces of arcs, motivic integration, real and analytic sets, arc-symmetric sets and blow-analytic equivalence  
Organizers are Coste, Kurdyka, Parusinski.
- March 31 – April 5, 2003, in Pisa, Italy,  
Annual General Network Conference (RAAG 2003)  
Organizers are Acquistapace, Broglia, Schwartz  
For the Second Announcement: See below
- June 25 – 28, 2003, in Lisbon, Portugal,  
Network school on  
o-minimal structures  
Organizers are Edmundo, Richardson et al.
- June 29 – July 5, 2003, in Rennes, France,  
Network school on

Computer applications of real geometry

Organizers are Coste, Gonzalez-Vega, Roy

- October 23 – 25, 2003, in Dortmund, Germany,  
Network workshop on  
Real Algebra

Organizers are Prestel, Scheiderer, Schwartz

- Annual General Network Conference RAAG 2004: Spain  
Organizers are Andradas, Schwartz et al.

- Annual General Network Conference RAAG 2005: Germany  
Organizers are Schwartz et al.

Information about these meetings, including links to, and addresses of, the websites and home pages, can be found on the Network's website (<http://www.ihp-raag.org/>) as they become available.

The Second Announcement for the Annual General Network Meeting RAAG 2003 was published on December 9, 2003:

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REAL ALGEBRAIC AND ANALYTIC GEOMETRY- RAAG03  
Annual Meeting of the Network RAAG  
March 31-April 5 2003  
Pisa, Italy

S e c o n d   A n n o u n c e m e n t

Dear Colleague,

the 2003 annual meeting on Real Algebraic and Analytic Geometry will be held in Pisa, at the Dipartimento di Matematica "L.Tonelli", from March 31 till April 5, in the framework of the special bimester "Topics on Complex and Real Geometry" of the Centro di Ricerca Matematica Ennio De Giorgi (<http://www.crm.sns.it/geometry/>):

March 31 is the arrival day; lectures are scheduled from April 1 until April 5 noon; participants are expected to leave in the afternoon of April 5 or on April 6.

Accommodation:

We have reserved the whole Hotel S.Croce in Fossabanda in order to get a special price; it is a 3 stars hotel situated in an ancient convent, 15 minutes walk from the Department of Mathematics.

The availability of places is the following:

- N. 34 places in double rooms:                    41.5 Euros
- N. 22 places in single rooms (large bed)        62 Euros
- N. 13 places in single room                        53 Euros

Prices are per person and per day, breakfast included.

Lunches, provided in 2 restaurants not far from the Department, will be partially supported (50%) by the Centro De Giorgi. Participants are expected to pay by cash about 8 Euro per lunch. We need to know in advance how many people are interested, so, please fill in the enclosed form.

In case you are interested in attending the meeting and/or would like to receive the third announcement you are kindly requested to return the enclosed registration form not later than January 15, 2003, to the address:

- by e-mail (strongly recommended) to the address raag03@dm.unipi.it
- by fax with the indication "RAAG Meeting 2003 Attention of Prof. Broglia", fax number: +39 050 2213224

Acceptance will be confirmed prior to the third announcement which is planned to be issued during February 2003 and will contain a preliminary list of participants and contributions.

Please do not hesitate to contact any of the local organizers, at the above addresses for any further information you might need.

Sincerely yours

F. Acquistapace, F. Broglia, A. Parusinski, T. Recio, N. Schwartz  
(The Scientific Committee)

Local Organizers

Francesca Acquistapace ([acquistf@dm.unipi.it](mailto:acquistf@dm.unipi.it))

Fabrizio Broglia ([broglia@dm.unipi.it](mailto:broglia@dm.unipi.it))

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REGISTRATION FORM

NAME:

ADDRESS:

e-mail:

phone:

fax:

ROOM	Single	Double
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Please, indicate the name of a person you would like to share the room with:

LUNCH (8 Euro /day to be paid by cash)

Monday	YES	NO
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Tuesday	YES	NO
Wednesday	YES	NO
Thursday	YES	NO
Friday	YES	NO
Saturday	YES	NO

TALK

Do you plan to give a talk: YES NO

If YES, please include a tentative description:

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**Other events**

There are several meetings and events coming up in, or related to, RAAG that are not organized by the Network.

- A meeting on tropical algebraic geometry, *Tropical days*, took place at the Université Paris 6 on December 13 – 14, 2002. The organizer was J.J. Risler. Lectures were given by O. Viro, J.-E. Pin, H. Rullgard; M. Kontsevich, G. Mikhalkin, E. Shustin.
- A bimester on *Topics in Complex and Real Geomerty*, to be held in Pisa, Italy, from March 15 to May 15, 2003, organized by Broglia and Tomassini; web-address: [www.crm.sns.it](http://www.crm.sns.it).
- A Special Session on RAAG as part of the Joint Meeting of the AMS and the Spanish Math Society, June 18 – 21, 2003, in Sevilla, Spain, organized by Andradas, Diaz, Powers, Sottile; webadress: visit the AMS' website.
- A Special Semester on *Topological Aspects of Real Algebraic Geometry*, January – May 2004, at the MSRI in Berkeley, USA, organized by Akbulut, Mikhalkin, Powers, Shapiro, Sottile, Viro; webaddress: visit the MSRI's website at [www.msri.org](http://www.msri.org).
- The Fourth Annual Colloquiumfest, this time about the topic *Model Theory and Ordered Structures*, March 21 – 22, 2003, at the University of Saskatchewan, Saskatoon, Canasda, organized under the roof of the Research Unit Algebra and Logic of the University of Saskatchewan (<http://math.usask.ca/fvk/alg.htm>) by F.-V. Kuhlmann ([fvk@math.usask.ca](mailto:fvk@math.usask.ca)), S. Kuhlmann ([skuhlman@math.usask.ca](mailto:skuhlman@math.usask.ca)), M. Marshall ([marshall@math.usask.ca](mailto:marshall@math.usask.ca)).  
The preliminary list of speakers includes:

- Lou van den Dries (University of Illinois, Urbana, USA)
- Philip Ehrlich (Ohio University, Athens, Ohio, USA)
- Tobias Kaiser (University of Illinois, Urbana, USA)
- Klaus Keimel, (Technische Universität Darmstadt, Germany)
- Margarita Otero (Universidad Autónoma Madrid, Spain)
- Thomas Rohwer (University of Illinois, Urbana, USA)
- Thomas Scanlon (University of California, Berkeley, USA)
- Patrick Simonetta (Université Paris 7, France)
- Patrick Speissegger (University of Wisconsin, Madison, USA)
- Charles Steinhorn (Vassar College, Poughkeepsie, New York, USA)

Further information is available on the Valuation Theory Homepage: (<http://math.usask.ca/fvk/Valth.html>)

Links to the websites of all these events are also available on the Network's website at <http://www.ihp-raag.org/>.

### **Note on the reimbursement of travel expenses**

A considerable part of the Network's budget is dedicated to travel expenses. As a rule, only Network researchers can be supported by Network money. Some exceptions are possible, but they must be approved in advance by the Network Coordinator. Considering the extensive meetings program and other traveling activities of Network researchers, it will be impossible to satisfy all requests for reimbursement of travel expenses. The organizers of Network meetings are always encouraged to look for supplementary funding. If and when the Network runs out of travel money, the individual researchers themselves will have to search for other sources of support. The Network does not accept a legal or moral obligation to pay all expenses of all its researchers.

### **New preprints and publications**

Marcus Tressl ([Marcus.Tressl@mathematik.uni-regensburg.de](mailto:Marcus.Tressl@mathematik.uni-regensburg.de)) and his deputy Vincent Astier ([Vincent.Astier@mathematik.uni-regensburg.de](mailto:Vincent.Astier@mathematik.uni-regensburg.de)) are responsible for posting preprints and publications on the Network's website. Their preprint server can be reached via a link on the Network's website (<http://www.ihp-raag.org/>), or directly at [http://www.uni-regensburg.de/Fakultaeten/nat\\_Fak\\_I/RAAG/](http://www.uni-regensburg.de/Fakultaeten/nat_Fak_I/RAAG/). 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:

- A. Diaz-Cano, *Orderings and maximal ideals of rings of analytic functions*. Preprint

- Mario J. Edmundo, *Another fixed point theorem for o-minimal expansions of fields*. Preprint
- Mario J. Edmundo, *A general cohomology theory for o-minimal structures*. Preprint
- Mario J. Edmundo, *o-minimal cohomology and definably compact definable groups*. Preprint
- Frédéric Chazal, Rémi Soufflet, *Stability and finiteness properties of medial axis skeleton*. Preprint
- J.F. Fernando, R. Quarez, *Some remarks on the computation of Pythagoras numbers of real irreducible algebroid curves through Gram matrices*. To appear: Journal of Algebra
- J.F. Fernando, *Analytic germs of minimal Pythagoras number*. To appear: Mathematische Zeitschrift
- M. Dickmann, F. Miraglia, *Elementary properties of the Boolean hull functor*. To appear: Journal of Symbolic Logic
- M. Dickmann, F. Miraglia, *Bounds for the representation of quadratic forms*. To appear: Journal of Algebra

### **Next newsletter**

The next issue of the Newsletter will be published on March 1, 2003.