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NEWSLETTER

INSTITUTE OF MATHEMATICS OF THE POLISH ACADEMY OF SCIENCES



Banach Center Simons Semesters upcoming events 2019/2020

Title	Date	Organizers	Place
12th Semester: Geometry and analysis in function and mapping theory on Euclidean and metric measure spaces	01.09-30.11.2019	T. Adamowicz, T. Cieślak, N. Shanmugalingam	Będlewo & Warsaw
Workshop in Geometry and Analysis (workshop)	07-18.10.2019	T. Adamowicz, T. Cieślak, A. Kijowski, M. Szumańska	Warsaw
Latest in Geometric Analysis. Celebration of Pekka Koskela's 59th birthday (conference)	24-30.11.2019	T. Adamowicz, T. Cieślak, N. Shanmugalingam	Będlewo
Selected Topics from Simons Semesters (conference)	16-20.12.2019	J. Buczyński, P. Gwiazda, Ł. Stettner	Warsaw

Banach Center selected upcoming events 2019/2020

Title	Date	Organizers	Place
Multivariate and Mixed Linear Models (research group)	10-16.11.2019	A. Markiewicz, K. Filipiak	Będlewo
Cartan C*-Subalgebras and Noncommutative Dynamics (conference)	24-29.11.2019	B. Kwaśniewski, A. Skalski	Warszawa
XLV Konferencja Statystyka Matematyczna (conference)	02-06.12.2019	K. Furmańczyk	Będlewo
Mathflows2020 (conference)	08-13.03.2020	R. Danchin, P. Mucha, T. Piasecki	Będlewo
Probabilistic Aspects of Harmonic Analysis (conference)	10-16.05.2020	W. Cygan, E. Damek, P. Dyszewski, A. Hejna, E. Kania, M. Preisner, W. Świątkowski, G. Świderski	Będlewo
Nonlocal diffusion problems, nonlocal interface evolution (conference)	20-23.05.2020	P. Rybka, A. Kubica, M. Łasica, K. Ryszewska	Warsaw
Nilpotent structures in topological dynamics, ergodic theory and combinatorics (conference)	07-13.06.2020	P. Candela, N. Frantzikinakis, Y. Gutman, B. Szegedy	Będlewo
High Dimensional Probability (conference)	14-19.06.2020	R. Adamczak, N. Gozlan, R. Latała, M. Madiman	Będlewo

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History of mathematical statistics and applied probability at IM PAN

Teresa Ledwina

The history of mathematical statistics and applied probability at IM PAN goes back to the very beginning of the present Institute, which originated from the State Institute of Mathematics, established on November 20, 1948. Until 1950 the Institute was divided into two Departments: the Department of Theoretical Mathematics (consisting of 8 groups) and the Department of Applied Mathematics (6 groups). Two groups of the latter (the General Applications Group, and the Technical Applications Group) were located in Wrocław, while the remaining ones (Actuarial, Mathematical Apparatuses, Graphical Methods, Statistical Control and Production Quality) were located in Warsaw. Since 1950 the situation has changed dynamically: the division into the two Departments was canceled, the Groups evolved, new divisions were created, etc. Below, we briefly summarize the history of two groups that were part of this process and functioned until 2004: the Department of Mathematical Statistics and Its Applications, and the Department of Applied Probability. On April 1, 2004, the two departments were combined and the Department of Mathematical Statistics was established.

THE DEPARTMENT OF MATHEMATICAL STATISTICS AND ITS APPLICATIONS

The Department of Mathematical Statistics and Its Applications, located in Wrocław, stemmed from the General Applications Group, headed by Hugo Steinhaus, and the Technical Applications Group, directed by Jan Mikusiński. Later on, these two groups formed the Department of Applications for Biology, Economics and Technology, directed by Hugo Steinhaus until his retirement in 1960. Julian Perkal (1960-1965) and Stefan Zubrzycki (1965-1968) were later directors. The Department played a very important role in the Wrocław scientific community, in particular through many collaborations with various professionals and

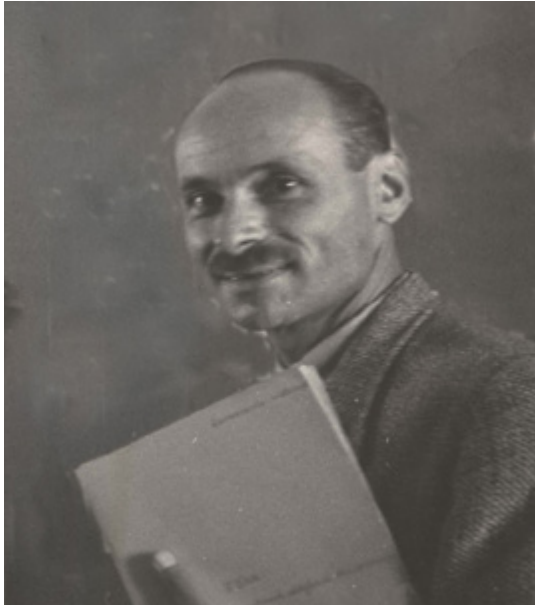
through educational work in applied probability and statistics. The journal *Zastosowania Matematyki* (the subtitle *Applicationes Mathematicae* added in 1965), founded by Hugo Steinhaus in 1953, with help of Jan Oderfeld, was a significant platform for the activity of the group. This activity was further supported by Julian Perkal, who founded the *Listy Biometryczne* journal in 1964. The journal is currently published as *Biometrical Letters*.

From 1968 to 1991 the Department was headed by Witold Klonecki and was renamed as the Department of Mathematical Statistics and Its Applications in 1973. At that time, the main activity was focused on PhD studies in modern statistical methodology, initially with the kind aid of colleagues from Wrocław University. The scientific interests of the Group concentrated on general linear models, decision theory, robust inference, and sequential estimation of parameters of stochastic processes. Members of the group participated



Prof. Hugo Steinhaus (foto: archiwum IM PAN).

very actively in the organization of a series of conferences, beginning with the one in Wisła in 1973. Many of these conferences were international. A symposium in honour of Jerzy Neyman (1974), the European Meeting of Statisticians (1981) and the Banach Center Semester on Nonparametric and Robust Methods (1984) are prominent examples. Witold Klonecki was also one of the founders of the Probability and Mathematical Statistics journal (1980).



Prof. Jan Oderfeld (foto: archiwum IM PAN).

From 1991 until 2004 the Department was headed by Tadeusz Bednarski. The work of the group focused on robust procedures, data-driven tests, intermediate efficiency of tests, and moderate deviations. Apart from research in mathematical statistics, much attention was paid to direct applied work.

THE DEPARTMENT OF APPLIED PROBABILITY

The Department of Applied Probability, located in Warsaw, originated from a long process rooted in the Department of Applied Mathematics of the State Mathematical Institute. Two Warsaw-based groups of this department were its forerunners. Specifically, these were the Group of Statistical Quality Control and Production Quality, and the Actuarial Group. In accordance with the changing interests of the members, the Group of Statistical Quality Control and Production Quality was renamed as the Industrial Applications Group in 1962. In the period from 1952 to 1970 these groups were directed by Jan Oderfeld, with a short break in 1959 when Czesaw Rajski was in charge of them.

At that time, the research was mainly focused on statistical quality control, operations research and reliability theory. The Actuarial Group evolved into the Mathematical Statistics Group. In 1951, Oskar Lange was put in charge of the group and he led it until 1958. In 1958-1960 Marek Fisz was the leader, while later on the Group was headed by Wiesław Sadowski. Interests of the group were focused on statistics, decision making and econometry.

These two evolving groups were the predecessors of the Applied Probability Department, formally founded in 1972.

The Department was headed by Robert Bartoszynski, Ryszard Zielinski and Tomasz Rychlik in the periods 1972-1985, 1985-2002 and 2002-2004, respectively. In the early seventies, the scientific interests of the group switched to probabilistic modelling (mostly, but not only, of biological phenomena), controlled Markov chains, stochastic approximation and random search. In the Eighties and Nineties, various issues of mathematical statistics, including robust statistics, fixed precision estimation and moment bounds, became major focuses of the Department's research.

The Department was active in the organization of courses in applied mathematics, enhancing education in a wide spectrum of applied probability. Also, starting from 1971, Eugeniusz Fidelis annually organized the very popular National Conferences on Applications of Mathematics. Moreover, members of the group organized many international conferences in statistics, including Banach Center Semesters on Mathematical Statistics (1976), and Sequential Methods in Statistics (1981), among others.

THE DEPARTMENT OF MATHEMATICAL STATISTICS

Since 2004 the Department has been headed by Teresa Ledwina. According to the current policy of the Institute, in recent years the Department has been visited mostly by young researches who completed their PhD studies or spent their stays on intensive scientific work. Tomasz Rychlik has organized a series of conferences and workshops on ordered statistical data, which have attracted many young participants. See <https://www.impan.pl/en/insitute/structure/departments#stat> for more details. There one can also find lists of representative papers on statistics and applied probability, published by members of the above discussed evolving structures within the period 1951-2018.

Machine Learning at IM PAN

Piotr Miłoś & Łukasz Kuciński

AWARElab, a new machine learning group in Poland, was established in early 2018 as part of the Institute of Mathematics of the Polish Academy of Sciences and is based in Warsaw. Our team is led by two senior research scientists, Łukasz Kuciński and Piotr Miłoś, whose combined expertise spans over multiple research areas ranging from theoretical mathematical physics to financial risk modelling. At the moment the group consists also of three graduate students and a number of master students. The lab's mission is to make scientific contributions to AI research, by designing algorithms that advance systems for automated acquisition of problem-solving skills. We are fully committed to opensource our research, to allow other scientists to validate and possibly benefit from our work.

The launch of the lab marks the Institute's comeback to the familiar territory of the forefront of information technology. Having left its mark on the history of computer development in the 50s (by designing a digital computing electronic machine named XYZ), IM PAN is now aiming to

make a strong contribution in the field of artificial intelligence (AI). Many believe, ourselves included, that emergence of autonomous AI systems may be one of the most significant scientific breakthroughs, possibly leading to unprecedented progress in almost every area of human life and the solution of critical global problems.

While we have a firm theoretical background, we fully acknowledge the importance of engineering proficiency in AI research. Recognizing that, we leverage our academic know-how and programming experience, to build an efficient and stimulating working environment. This includes a stable end-to-end pipeline that enables smooth transitions between research and engineering stages. Furthermore, the members of our group are selected to be competent programmers and have experience in algorithms design. Finally, an access to computational resources has been secured (we mainly use the PLGRID infrastructure, including the most powerful Polish supercomputer, located at the AGH University of Science and Technology).

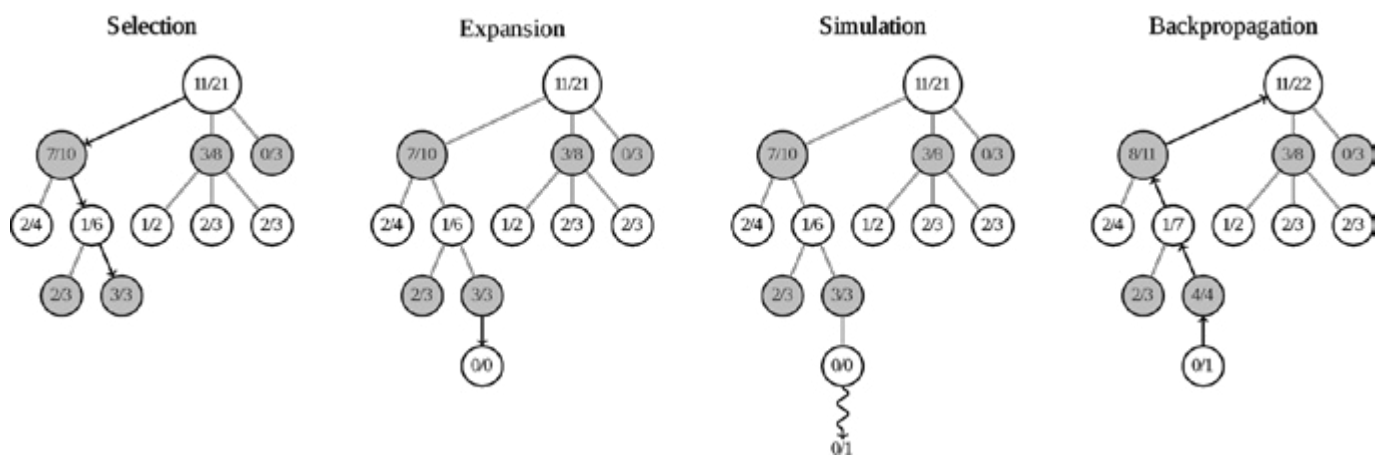


Fig 1. An example of a Monte-Carlo tree search (MCTS) execution. MCTS is one of the strongest general purpose planning paradigms.

Currently, the group focuses on reinforcement learning (RL). Our RL research is a part of the aforementioned mission, we will gradually extend the scope of research to encompass other areas of AI. RL is an area of AI research concerned with solving sequential decision problems. It is one of the three fundamental pillars of machine learning (alongside supervised learning and unsupervised learning). It is our strong conviction that RL will be among key driving forces leading to design of powerful AI systems.

The group runs several projects on the model-free and model-based RL. One of them aims to develop planning methods for challenging domains with combinatorial complexity. This a fundamentally important problem and progress in this area can impact areas such as healthcare, climate change, finance, power grids and traffic control infrastructures, etc. We use Sokoban as a testbed

We recognize that now, perhaps more than ever, it is vital to cooperate with other academic institutions and engage in research projects with domestic and foreign partners. Our team has a broad spectrum of connections with multiple research institutions, including: Department of Mathematics, Informatics and Mechanics of the University of Warsaw, a leading computer science and mathematics centre in Poland; Department of Psychology of the University of Warsaw, our partner in cognitive research, and Google Brain (Mountain View and Zurich offices), a global leader in AI research. We also collaborate with domestic companies: deepsense.ai and nomagic.ai.

Finally, we carry out the Institute's mission of promoting knowledge. We launched a new Reinforcement Learning research seminar in October 2018. The seminar gained quite a lot of traction and thanks to live streaming, enabled

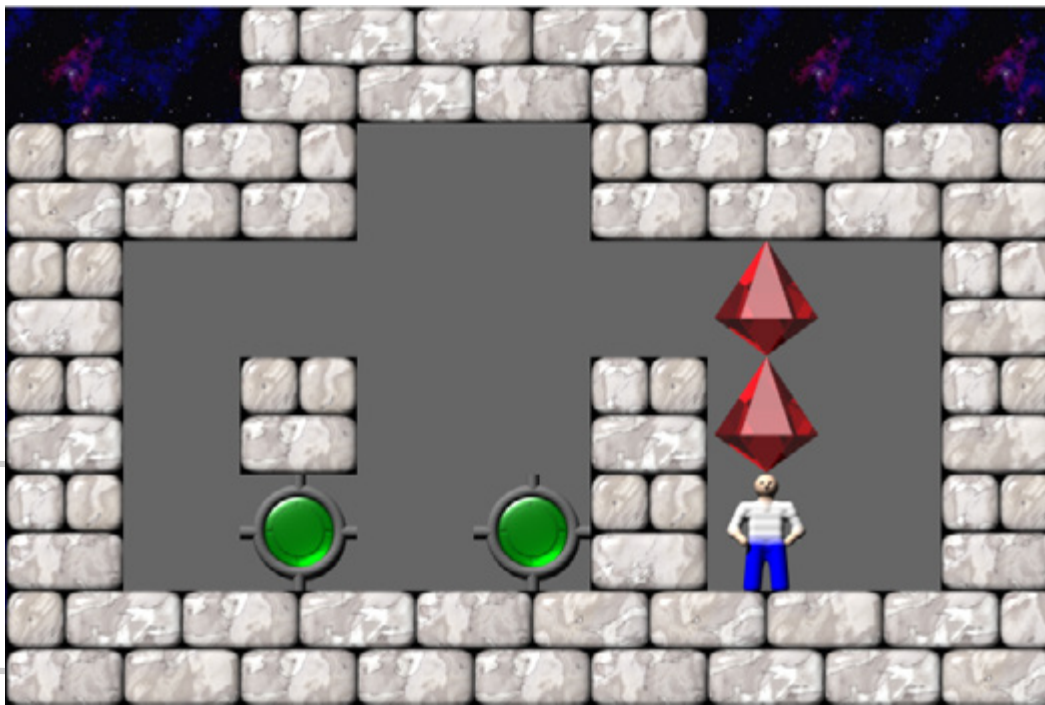


Fig 2. Illustration of the Sokoban environment. The aim of the player is to push the diamonds into the green spots. Looking deceptively simple, Sokoban is a complex domain, proved to be NP-hard. It is generally acknowledged as a testbed for combinatorially hard problems.

environment. Sokoban is a classic planning problem that has recently joined the suite of important RL environments. We propose several novel methods for planning. We plan to combine seemingly unrelated ideas developed recently: uncertainty modelling using ensembles, Hindsight Experience Replay, curriculum learning and Monte Carlo tree search, with the hope that it will lead to new state-of-the-art methods.

remote participation for people from different corners of Poland and Europe. The seminar created also a meeting space for RL professionals, facilitating spontaneous discussions and flow of ideas over a cup of coffee. Indirectly the initiative strengthened the integrity of the Polish RL scene and, more broadly, contributed to Warsaw's vivid and fast-developing machine-learning community.



A new professor at the Institute: Adam Skalski

The interview with Adam Skalski was conducted by Yonatan Gutman.

On the 17th of May 2019 the President of Poland conferred upon Adam Skalski the title of Professor. **Congratulation!**

A.S.: Thank you.

Please tell us about your academic itinerary. When did you realize that you wanted to become a mathematician?

A.S.: I was familiar with some aspects of mathematical research from early childhood, as first my mother and then my older sister were mathematicians (by the way – this also means I knew very early that this is definitely a subject where women can and should succeed!). Still we never really talked about mathematics at home. In high school I did not take part in any mathematical competitions and was not at all convinced this is where my future would lie. History or English literature were serious possibilities, but then I decided that I should study physics; but to do physics, one should first learn mathematics... So I did master degrees both in physics and in maths, at the University of Łódź. Formal abstract mathematics seemed to me very appealing, and physics turned out to be too difficult, if one did not have the right intuition. So I decided to continue with a PhD in mathematics, first in Łódź, and then, partly by a happy coincidence, in Nottingham (UK). There I completed doctoral studies under the supervision of Martin Lindsay in 2006. Later I was an EPSRC Postdoctoral Fellow in Lancaster (UK), and in 2010 came (via a short postdoc in Tokyo) to IM PAN, as a Marie Curie fellow - so an international visitor. Then for a few years I worked at a joint position between IM PAN and the University of Warsaw, and finally since 2016 I have held a permanent position at our Institute.

Please tell us about your field of mathematics.

A.S.: I work in the area of operator algebras and their applications, with a particular focus on problems

related to topological quantum groups. The theory of operator algebras is a part of functional analysis, but with plenty connections to several other fields.

In which result of yours are you especially proud?

A.S.: I would like to talk about two sets of results, as they are of a very different nature. One is contained in a very short paper published in 2011 in Ergodic Theory and Dynamical Systems, concerning the noncommutative notion of topological entropy introduced by Voiculescu in 1995. The notion applies to automorphisms of C^* -algebras, and on one hand is defined in 'quantum' terms, but on the other for many years in all examples where it was computed it always equalled the supremum of (classical) topological entropies over classical subsystems. I showed that if one considers Powers bitstream shifts which are sufficiently chaotic, this is no longer the case, thus proving that Voiculescu entropy is genuinely noncommutative.

The second achievement I would like to mention is contained in a long article which appeared in Crelle in 2016, treating the notion of the Haagerup property for quantum groups. This property, well-studied for classical groups, and first established by Haagerup for the free groups, has both analytic and geometric flavours. In our joint work with Daws, Fima and White we showed that the same richness of structure – so in particular equivalence of various possible definitions – persists also in the quantum world. This gave rise to several new questions, concerning both quantum groups and general operator algebras.

In what directions is your field going? What are the important problems one should tackle?

A.S.: The field of operator algebras has a complicated and rich history; it started in 1940s with Gelfand, Naimark, Murray and von Neumann, then was 'almost finished' by the 1960s, only to see a big revival in the late 1970s and 1980s, due partly to the groundbreaking results of Connes on the classification of von Neumann algebras (for which he was awarded the Fields medal), partly due

to the K-theory developments initiating Elliott's classification of C^* -algebras, and finally due to the noncommutative geometry perspective, again provided by Connes. Late 1980s and 1990s brought the breakthroughs regarding quantum groups and connections to knot invariants (recognized by the Fields medal of Jones). In the recent two decades we have seen new impetus in the classification problems both in von Neumann algebras – with plenty of connections to group theory and ergodic theory – and in C^* -algebras, where the noncommutative dimension theories have started playing a central role. There are some huge open problems remaining from the very early days, for example the one related to the (non?) isomorphism of von Neumann algebras of free groups. On the other hand it is clear that the theory of operator algebras is nowadays often not an isolated subject, but an area which benefits very strongly from interactions with dynamical systems, geometric group theory, probability (random matrices), combinatorics, set theory. And these interactions bring what is in my view the most interesting about the subject and what guarantees its longevity.

How is it working at IM PAN?

A.S.: It is a very lively institution, with a variety of activities, many visitors and plenty of opportunities to talk about mathematics. Its scale makes it on one hand big enough to provide a rich scientific environment, and on the other small enough so that one can get to know most colleagues. A great, and often underappreciated aspect of the place is that it is to a large extent run by mathematicians themselves. So even if there are things one does not like (which might always be the case), there is a good chance that they can be discussed and decisions will be taken by people who know mathematical life and research themselves.

You serve as Deputy Director for Scientific Matters at IM PAN. How do you see the future of IM PAN?

A.S.: IM PAN has changed a lot within the last 10 years; it has become more international, younger

and vibrant. These changes, very positive, have also brought their own challenges. I believe that now it would be very good to achieve a certain level of stability regarding how we function. One should also bear in mind that IM PAN plays in a sense a double role, on one hand as one of the leading European research centres, and on the other as a pivotal institution in the Polish mathematical community. Finding a way in which these two roles can support and strengthen each other, rather than become conflicting forces, is central for the future of our institute.

Finally, what would be your advice for a young PhD student?

A.S.: Here I could talk and talk. There are many things in the life of a researcher that might be surprising (and still surprise me today!). First, think about the choice of your mentor – is it someone who is research active, and who is active in the community? Do you understand each other well? If yes, this is already a good start. Try to learn many different things - they might be useful, but also this will help you to maintain interest in mathematics. Learning can be done on various levels: go to seminars (even those outside of your area), read books (there will be less and less time for that as you get older), solve small open problems to get a good feeling where the genuine difficulties lie. On the other hand look for attractive questions, and do not be afraid to waste your time on trying something difficult! Even if you fail to get the main treasure in the end, there will be some jewels lying along the road.

But, perhaps most importantly: try to find your own way. Speak to your advisor, but also speak to other people. Gather advice and think about it. Remember that being an academic is a job, and the duties that come with that need to be treated responsibly – and these include the duties to the mathematical community, and not only these which seem to be directly relevant to your career. And in all that remember to enjoy what you are doing!



New grants at the Institute: Geometric and Measured Group Theory 2

Damian Osajda

The grant „Geometric and Measured Group Theory 2” („Geometryczna i Miarowa Teoria Grup 2”) executed at IM PAN is funded according to contract UMO-2018/30/M/ST1/00668 in the framework of „HARMONIA 10” program of the Polish National Science Center (Narodowe Centrum Nauki). The principal investigator is Dr Damian Osajda (IM PAN and IMUWr.), and the main foreign partner is Prof. Daniel T. Wise (McGill University, Montreal, Canada). Besides them co-investigators include Prof. Piotr Przytycki and Prof. Marcin Sabok (both from McGill), Polish and Canadian post-docs and PhD students, as well as other collaborators — 20 researchers in total. The amount of funding is 462000 PLN, and the duration period is 4.04.2019-3.04.2022.

The scientific project focuses on the study of groups — which are a priori algebraic objects — using the methods coming from geometry and measure theory. This is quite a new field, which has been developed within the last thirty years, drawing on problems and methods from differential geometry, algebraic topology and combinatorial group theory, among others. Roughly speaking, one is trying to endow a group with a metric or measure structure in order to deduce some algebraic properties of the group using the latter structure. This situation is a beautiful example of when two seemingly unrelated approaches to a problem — geometric and algebraic — used together give very strong tools. Indeed, looking at groups as geometric objects has led to breakthrough discoveries concerning their structure, for example in the case of outer automorphisms of free groups.

In this project we concentrate on several important classes of groups. Coxeter groups are a generalization of groups of reflection symmetries in the Euclidean space. They form a very important source of examples both in group theory and, for example, in differential geometry. Artin groups are groups, which include for example the braid groups. Artin groups have been intensely studied for a long

time and, conjecturally, have a series of interesting properties, however they hold their secrets very well guarded. Polynomial automorphisms groups of the affine space are important objects in algebraic geometry. Great progress in their study has been achieved recently using the methods of geometric group theory. Groups which are hyperbolic in the sense of Gromov form an enormous class of groups containing many classical objects, which were previously studied separately. It contains, for example, both the non-abelian free groups and the fundamental groups of closed negatively curved manifolds.

The above mentioned classes of groups will be studied from several different angles. The Coxeter groups will be endowed with a structure, which will allow to show biautomaticity. This is a very strong algorithmic property, which has many algebraic consequences and, conjecturally, is true for all Coxeter groups. This has been proved, however, only in a few cases. Another goal is to show that the Isomorphism Problem is solvable in the class of Coxeter groups. On the other hand, constructions of new examples of Coxeter groups with exotic properties will be attempted. For other classes of groups the so-called Tits Alternative will be proved. This is a property that is believed to be possessed by all so-called non-positively curved groups. This was established, however, only in a very few special cases.

Finally, measure-theoretic properties of groups and their measurable actions on probability spaces will be studied. This part is related to logic and an old problem of Tarski concerning the squaring of the circle. Methods of measurable group theory will be used to give general necessary and sufficient conditions for when two measurable subsets (e.g. a disc and a square) of the same measure are equidecomposable with respect to an action of a discrete group acting on the space where the subsets are located.

2019 Simons semesters: Stochastic Modeling and Control Simons semester

Łukasz Stettner

The 10th Simons semester on „Stochastic Modeling and Control” took place between January 2nd and March 31st, 2019. The organizers were J. Jakubowski (University of Warsaw), M. Niewęglowski (Warsaw Technical University), M. Rasonyvi (Renyi Institute) and Ł. Stettner (IM PAN). The idea of the semester was to bring together specialists in stochastic modeling, stochastic control and its applications. The activities consisted of:

- Workshop on Recent problems of stochastic control theory: 28.01- 02.02.2019, Warsaw.
- Conference on Stochastic modeling (in finance and insurance): 11.02-15.02.2019, Bedlewo.
- Graduate school on Industrial applications of stochastic modeling: 11.03-15.03.2019, Warsaw.
- 144th European Study Group with Industry (ESGI): 18.03-22.03.2019, Warsaw.
- Conference on Portfolio theory and derivative pricing: 27.03-29.03.2019, Warsaw.

The first two months were devoted more to theory, while in March various applications were considered in particular in banking (risk management), cryptography and in mining (modern stochastic and time series modeling). There were series of lectures given by senior leaders:

- Vivek Borkar (IIT Mumbai), Controlled Markov Processes,
 - Andrzej Świąch (Georgia Tech), Viscosity solutions: Theory and applications in stochastic optimal control,
 - Artur Ekert, (Univ. of Oxford & Centre for Quantum Technologies, National University of Singapore, Fellow of Royal Society), From randomness to quantum computing,
- and junior leaders:
- Teemu Pennanen (Kings College), Incomplete markets,
 - Miklos Rasonyi (Renyi Institute HAS), Utility maximization without using the dual problem,
 - Michał Zając (University of Tartu/Clearmatics Ltd.), How to prove with zero knowledge. A zero-knowledge

proofs primer. During the semester we also had the 144th ESGI organized in cooperation with Dr Kulesza (who in fact was the main organizer). The idea of ESGI is to invite representatives of industry to identify their problems and try to solve them with the help of young researchers and PhD students. The ESGI was initiated with a panel on Mathematics of Artificial Intelligence, Automatization, Machine Learning and Cybersecurity, which consisted of various specialists including Profs. Hilary and John Ockendon from Oxford. The 144th ESGI was organized under the honorary patronage of the British Embassy and opened by the UK Ambassador to Poland, Jonathan Knott. The Semester ended with a mini conference on portfolio theory and derivative pricing organized jointly with the Systems Research Institute PAS (Profs. I. Kaliszewski and D. Gałtarek). The number of participants of the semester varied between 25 and 80 depending on the type of activities, among them we had PhD students (from Poland, Ukraine, Hungary and India), postdocs and professors (mainly from Europe and USA). There will be a special volume of Banach Center Publications dedicated to this semester. More information about the semester can be found on the Banach Center web page (see in particular <https://www.impan.pl/en/activities/banach-center/conferences/19-simons-x>).



Participants of the 144th ESGI. From left: Prof. Łukasz Stettner (IM PAN), Dr. Marcin Pitera (UJ) and Damian Jelito (UJ).

Geometric and Analytic Group Theory Simons semester

Piotr Nowak

The 11th Simons Semester on Analytic and Geometric Group Theory took place between 1 April and 15 July, 2019. It was divided into three, roughly month-long, themes: Cohomological methods, Nonpositive curvature and Rigidity.

During each thematic month there were weekly activities. Each week there was a lecture course by an invited lecturer, aimed at junior participants postdocs and students. For instance, Michael Davis from Ohio State University gave a course on non-positively curved complexes, Denis Osin of Vanderbilt University gave a course on acylindrically hyperbolic groups, Roman Sauer (Karlsruhe Institute for Technology) gave a course on Betti numbers, Uri Bader of the Weizmann Institute gave a course on arithmeticity of lattices and Aaron Brown from the University of Chicago gave a course on his recent proof of the Zimmer conjecture.

Each week there were two seminar talks, at which speakers were selected from the junior participants, who in this way gained an opportunity to present their work. There was also a weekly colloquium, organized jointly with the Algebraic Topology Seminar at the University of Warsaw, taking place at the Department of Mathematics of the University.

During each of the three thematic months at IM PAN, a week-long conference was hosted on a corresponding topic. These conferences gathered around 80-90 participant each, with distinguished speakers coming from all over the world to present their latest results.

The semester hosted a large group of young participants, who particularly benefited from the mixture of introductory courses and research level talks.

Senior Simons Professors:

Victor Chepoi (Aix-Marseille Université)
Yves Cornuier (CNRS Lyon)
Michael W. Davis (Ohio State University)
Denis Osin (Vanderbilt University)
Pierre Pansu (Paris Sud)
Genevieve Walsh (Tufts University)

Junior Simons Professors:

Łukasz Grabowski (Lancaster University)
Thomas Koberda (University of Virginia)
Alessandro Sisto (ETH Zurich)
Jingyin Huang (Ohio State University)
Mikael de la Salle (ENS Lyon)

Organizers:

Uri Bader (Weizmann Institute of Science)
Pierre-Emmanuel Caprace (Université Catholique de Louvain)
Tadeusz Januszkiewicz (Uniwersytet Wrocławski and IM PAN)
Piotr Nowak (Uniwersytet Warszawski and IM PAN)
Damian Osajda (Uniwersytet Wrocławski and IM PAN)
Piotr Przytycki (McGill University)



Participants of the Simons Semester on Analytic and Geometric Group during one of the lectures.

Obituary: Professor Bogdan Bojarski (1931-2018)

Łukasz Stettner

On December 22nd 2018 Prof. Bogdan Bojarski passed away. He was a great mathematician and long term (1986-2002) Director of IM PAN.



Professor Bogdan Bojarski .

Prof. Bojarski was born in 1931. He studied first at University of Łódź and then at Moscow University, where he received his PhD in 1954. He got habilitation in 1959 at the Steklov Institute in Moscow. He became full professor in 1968, corresponding

member of PAS in 1974 and ordinary member of PAS in 1986. In 1970-1981 he was a director of the Institute of Mathematics at the Faculty of Mathematics, Informatics and Mechanics University of Warsaw.

As a director of IM PAN Prof. Bojarski founded and developed the Mathematical Research and Conference Center in Będlewo and built 3 new floors in the main facility of the Institute at Śniadeckich 8 in Warsaw.

Prof. Bojarski created a strong school in partial differential equations in Warsaw. His main research topics were: elliptic partial differential equations, boundary value problems of complex function theory, singular integral equations, quasiconformal mappings, geometric theory of Sobolev function spaces, global analysis.

There are many scientific contributions of prof. Bojarski. He is well known for his works on the interplay between PDEs and quasiconformal mappings, in particular for the Morrey, Ahlfors, Bers, Bojarski integrability theorem, nonlinear Beltrami type systems in higher dimensions (jointly with T. Iwaniec). Prof. Bojarski also found inequalities characterizing Sobolev functions without first order derivatives (jointly with P. Hajłasz), which resulted in intensive works on analysis in metric spaces with measures.



Obituary: Professor Andrzej Granas (1929-2019)

Feliks Przytycki

On March 15, 2019, the famous Polish mathematician Professor Andrzej Granas passed away.

He was born in Łódź in Poland on April 5, 1929. He earned a master's degree in mathematics at the University of Warsaw in 1952. In 1958 he earned a PhD at the Lomonosov University in Moscow upon presenting the dissertation „Applications of the Antipodal Theorem in the Topology of Function Spaces”, under the direction of Lazar Aronovich Lyusternik and Karol Borsuk.

In 1956-68 he worked at IM PAN. He founded a laboratory of IM PAN at Sopot – in consequence, the Gdańsk branch of IM PAN was created.

In 1962 he became docent at IM PAN, and professor a couple of years later.

In 1968 he received the Stefan Mazurkiewicz Prize of the Polish Mathematical Society.

After 1968 he left Poland and in 1970-1991 he was professor at the Department of Mathematics and Statistics of the University of Montreal. He regularly invited Polish mathematicians to Montreal, which quite often included offering them accommodation in his house.

After his retirement, he returned to Poland and worked at the Nicolaus Copernicus University in Toruń (1991-1996), where he founded the „Julius P. Schauder Center for Nonlinear Studies”. Later he worked at the University of Warmia and Mazury in Olsztyn.

He was a frequent visitor at IM PAN, interested in its well-being.

He supervised 16 doctoral dissertations, the first three in Poland: Kazimierz Gęba (1962), Cezary Bowszyc (1969), Lech Górniewicz (1977), the others in Canada. The number of his scientific descendants according to the mathematics genealogy project is 82.

His area of research was topology and its applications in nonlinear analysis and differential equations. He was the author of about 90 articles.

The most cited ones are „The Leray-Schauder index and the fixed point theory for arbitrary ANRs” 1972, „Nonlinear boundary value problems for ordinary differential equations” 1985, „Théorèmes d'existence pour des inclusions différentielles sans convexité” (with M. Frigon) 1990, „Some general existence principles in the Carathéodory theory of nonlinear differential systems” (with R.B. Guenther and J. Lee) 1991, „On the homotopy method in the fixed point index theory of multi-valued mappings of compact absolute neighborhood retracts” (with L. Górniewicz and W. Kryszewski) 1991.

He was the coauthor of the famous monograph „Fixed point theory” written jointly with James Dugundji (PWN 1982; 2nd edition, completely revised and augmented, Springer 2003). In 1993 he founded, jointly with K. Gęba and L. Górniewicz, the journal „Topological Methods for Nonlinear Analysis” and was its first editor-in-chief. In 2007 he founded the „Journal of Fixed Point Theory and Applications.”

The text is based partially on the obituary by the Polish Mathematical Society.



Professor Andrzej Granas.

New act on higher education in Poland and Doctoral Schools

Tomasz Adamowicz

The new Act on Higher Education, the so-called „Act 2.0”, was officially signed by the President of the Republic of Poland and set into motion on October 1st, 2018. The drafting of the act was accompanied by public consultations with academia members, lasting for more than a year and organized in form of several conferences and meetings with the representatives of the Ministry of the Higher Education. The act introduces several major changes to the system of universities in Poland, including undergraduate and graduate education, internal organization of departments and universities, and also new algorithms of financial support for public universities. The act does not apply per se to the institutes of the Polish Academy of Sciences which are governed by separate acts. However, one of the changes introduced in Act 2.0 is that in order to maintain the ability to run a doctoral school, the department or the institute has to include at least two different disciplines (e.g., mathematics and physics, mathematics and computer science, etc.). If this condition is not satisfied, then the department or the institute needs to find a scientific partner and create a joint doctoral school.

This is the case of our Institute, which represents only one discipline. As a consequence IM PAN decided to join two doctoral schools:

(1) Appealing to the long lasting tradition of applied mathematics going backward to such an illustrious figure as Hugo Steinhaus, IM PAN joined the International Environmental Doctoral School (IEDS) created together with the University of Silesia in Katowice, the Institute of Geophysics of the Polish Academy of Sciences and the Institute of Oceanology of the Polish Academy of Sciences.

(2) Based on the tradition of the Warsaw school of

mathematics and the fruitful cooperation with the University of Warsaw, IM PAN and the Department of Mathematics, Mechanics and Computer Science of the University of Warsaw created the Warsaw Doctoral School of Mathematics and Computer Science (WDSMSC).

Let us briefly introduce both doctoral schools. The IEDS originates from the Center for Polar Studies at the University of Silesia. One of the main goals of doctoral education in IEDS is to develop skills in modern science and technology leading to interdisciplinary understanding of global climate change. Furthermore, graduates of the IEDS will be skilled in public communication of science, due to its vital importance.

The WDSMSC is designed to educate top quality PhD students from Poland and abroad. Our aim is to create an environment supportive for mathematical development and to close scientific interactions between PhD advisors and students. In addition we intend to make sure that our students will not be overwhelmed by taking too many courses, but instead will have time for research, and scientific mobility.

Since IM PAN and the University of Warsaw employ world experts in all areas of modern mathematics and computer science, our PhD students will get an opportunity to study in a vivid scientific community, and interact with, discuss and gain knowledge from a wide spectrum of researchers.

Prizes awarded by IM PAN in 2019

Renata Podgórska-Zajac

IM PAN SCIENTIFIC PRIZE

The IM PAN Scientific Prize is conferred annually for exceptional accomplishments in the field of Mathematics. The laureate is chosen by a Jury made up of 7 members appointed by the Director of IM PAN after consulting the Scientific Council of IM PAN. The 2019 IM PAN Scientific Prize was granted to Prof. **Dariusz Buraczewski** from the Institute of Mathematics, University of Wrocław. The prize was awarded for a monograph and a series of important works on stochastic properties of differential equations and their applications to random matrix products and random walks in a random environment.

Left: Prof. Dariusz Buraczewski during the award acceptance.

THE KURATOWSKI AWARD

The Kuratowski Award awarded yearly by IM PAN and the Polish Mathematical Society for young mathematicians (age limit: 30) for outstanding results, was awarded in 2019 to Dr. **Joachim Jelisiejew** for results in algebraic geometry concerning the Hilbert scheme of points and a generalizing of the Białynicki-Birula decomposition.



New Faculty Autumn 2019

OPEN CALLS FOR TEMPORARY RESEARCH POSITIONS

3—7 years positions:

- Piotr Achinger, adiunkt position, Algebra and Algebraic Geometry
- Tomasz Klimsiak, professor of IM PAN position, Probability Theory,
- Bartosz Trojan, adiunkt position, Functional Analysis,
- Piotr Miłoś, professor of IM PAN position, Numerical Analysis.

½ - 2 years positions:

- Benoît Guerville-Ballé, adiunkt position, Algebra and Algebraic Geometry,
- Michael Levin, professor of IM PAN position, Topology,
- Zohren Ravanpak, adiunkt position, Mathematical Physics and Differential Geometry,
- Jorge Castillejos, adiunkt position, Mathematical Physics and Differential Geometry
- Bartosz Wcisło, adiunkt position, Foundations of Mathematics,
- Łukasz Kuciński, adiunkt position, Numerical Analysis,

1-2 YEARS POSITIONS FOR YOUNG MATHEMATICIANS

- Léonard Cadilhac, adiunkt position, Functional Analysis,
- Krystian Kazaniecki, adiunkt position, Functional Analysis,

- Hanieh Keneshlou, adiunkt position, Algebra and Algebraic Geometry,
- Michał Łasica, assistant position, Differential Equations,
- Ruxi Shi, adiunkt position, Dynamical Systems,
- Jakub Siemianowski, adiunkt position, Differential Equations,
- Leticia Pardo Simon, assistant position, Dynamical Systems.

OPEN CALLS FOR PERMANENT PROFESSOR POSITIONS IN SPECIAL FIELDS

- Karol Palka, professor of IM PAN position, Algebra and Algebraic Geometry,
- Yonatan Gutman, professor of IM PAN position, Dynamical Systems.

OPEN CALLS FOR TEMPORARY PROFESSOR POSITIONS IN SPECIAL FIELDS

- Tatiana Shulman, professor of IM PAN position, Noncommutative Geometry.

POSITIONS IN THE FRAMEWORK OF NCN GRANTS

- Jacinta Torres, adiunkt position, Functional Analysis, MAESTRO grant.

POSITIONS IN THE FRAMEWORK OF ERC GRANTS

- Marcin Lara, adiunkt position, Algebra and Algebraic Geometry,
- Alexander Youcis, adiunkt position, Algebra and Algebraic Geometry,

Banach Center selected upcoming events

2020/2021

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Title	Date	Organizers	Place
IMPANGA 20 (conference)	21-27.06.2020	C. Eyrat, G. Kapustka, M. Kapustka, P. Pokora, P. Pragacz, H. Tutaj-Gasińska	Będlewo
Model Theory Conference in celebration of Ludomir Newelski's 60th birthday (conference)	21-27.06.2020	J. Dobrowolski, J. Gismatullin, D. Hoffmann, G. Jagiella, P. Kowalski, K. Krupiński, T. Rzepecki, R. Wencel	Szklarska Poręba
9th Euro-Japanese Workshop on Blow-up (conference)	28.07-03.07.2020	M. Fila, G. Karch, M. Sierżęga	Będlewo
19th WORKSHOP: Noncommutative probability, noncommutative harmonic analysis and related topics, with applications (conference)	05-11.07.2020	M. Bożejko, J. Wysoczański, A. Wysoczańska-Kula, W. Młotkowski, B. Das, W. Ejsmont, R. Lenczewski	Będlewo
Summer school Algebraic Combinatorics, Krakow 2020 (conference)	06-10.07.2020	M. Dołęga, M. Kowalski, T. Szemberg, P. Śniady	Cracow
On geometric complexity of Julia sets – II (conference)	12-17.07.2020	A. Dudko, P. Gałązka, F. Przytycki	Będlewo
Approximation and geometry in high dimensions (conference)	16-22.08.2020	L. Plaskota, J. Prochno, S. Szarek, M. Ullrich, T. Ullrich	Będlewo
Conference on elementary and analytic number theory (ELAZ 2020) (conference)	23-28.08.2020	Ł. Pańkowski, M. Radziejewski	Poznań
Projection Algorithms: Stefan Kaczmarz 125th Birthday Anniversary (conference)	31.08-05.09.2020	A. Cegielski, R. Zalas	Będlewo
Recent trends in nonlinear and dispersive equations: equilibria, stability, dynamics (conference)	06-12.09.2020	P. Bizoń, J. Jendrej, M. Kowalczyk, J. Mederski	Będlewo
8th Polish Combinatorial Conference (conference)	13-19.09.2020	S. Antoniuk, J. Grytczuk, J. Jaworski, P. Naroski, K. Rybarczyk-Krzywdzińska	Będlewo
Independence and Conditional Aspects of Probability (conference)	27.09-02.10.2020	P. Józiać, B. Kołodziejek, W. Matysiak, K. Szpojankowski	Będlewo
Numerical analysis and applications of SDEs (conference)	04.-10.10.2020	M. Hefter, P. Przybyłowicz, M. Szölgvényi, L. Yaroslavtseva	Będlewo
Rajchman, Zygmund, Marcinkiewicz (conference)	18-24.10.2020	P. Strzelecki, M. Wojciechowski, T. Adamowicz, P. Goldstein, A. Zatorska-Goldstein, Y. Tomilov	Będlewo
Dynamical Systems and Applications in Life and Social Sciences (conference)	15-20.11.2020	J. Banasiak, M. Lachowicz, M. Piotrowska, G. Rempala, K. Szymańska-Dębowska, A. Bloch, K. Zora	Będlewo
Applied Topology in Będlewo 2021 (conference)	27.06-03.07.2021	W. Marzantowicz, Z. Błaszczyk, P. Dłotko	Będlewo