Mathematical Institute SAS

January 2012 – December 2015

Basic Information I

- Director: Anatolij Dvurečenskij, 2012 – 2014
  Karol Nemoga, 2015
- Deputy Director: Anatolij Dvurečenskij, 2015
-                 Karol Nemoga, 2012 – 2014
- Scientific Secretary: Marek Hyčko, 2015
- Head of Scientific Board: Ľubica Holá

Basic Information II

- Branches (number of persons with university degree):
  - Main building, headquarters, Bratislava, Štefánikova 49,
  - Departments of Informatics,Bratislava, Dúbravská cesta 9,
  - Košice, Grešákova 6
  - Banská Bystrica, Ďumbierska 1

Basic Information II

Basic Information III

- Number of Employees (number/FTE):
  - University degree 54.8/30.4
  - PhD students 9.3/7.7
  - Other 12.4/12.4 (editorial office, staff, accounting, ...)
  - Common support staff with the Inst. Geography SAS
- Salary budget
  - 505.1 kEUR institutional
  - 31.4 kEUR other

Mission I - basic research

- mathematics (logic and set theory, number theory, algebraic and topological structures, quantum structures, quantum information theory, discrete mathematics, real and functional analysis, dynamical systems, differential equations, probability theory and mathematical statistics),

- computer science (theory of algorithms and computational complexity, formal languages, automata and numerical systems).

Mission II

- Scientific organization, budgetary economy
- Founded March 1, 1953
- Except of basic research
  - PhD studies, in cooperation with Comenius University Bratislava (also 3 foreign students in 10 years)
  - advisory and expert analysis concerning the main scientific activity
  - applications of mathematical methods, e.g. complex pipeline/gas dynamics systems solutions, ...

Teams, leaders/results I

- **A. Dvurečenskij and S. Pulmannová**, uncertainty modeling, quantum structures, and fuzzy sets

  this team was recently recognized by the Slovak evaluation agency ARRA as a top team in the Slovak Academy of Sciences comparable with the world top teams.

- **Ľ. Holá**, general topology, function spaces, set-valued mappings, cardinal invariants, hyperspace topologies

- **S. Jakubec, K. Nemoga**, algebraic number theory, uniform distribution theory, distribution functions of sequences, cryptography, post-quantum methods

Teams/results II

- **R. Frič**, generalized probability, categorical methods, MV algebras, fuzzy sets, real functions,

- **G. Okša**, dynamic ordering for the parallel for one side block Jacobi SVD algorithm, EVD/SVD for large and dense matrices, parallel matrix algorithms

- **G. Jirásková**, descriptional complexity of formal systems, regular languages, discrete data structures

- **G. Wimmer**, discrete and continuous probabilistic models and their applications, quantitative linguistics

- **R. Nedela,** graph theory, combinatorics, geometric representations and symmetries of graphs

Teams/results III

- **T. Žáčik**, gas pipeline systems, optimization, leak detection and localization, security of gas transport, gas dynamics for pipelins systems

- **M. Fečkan**, bifurcation theory, dynamics of differential equations, oscillating systems, nonlinear systems

Teams/results IV

- A. Jenčová, *Extremal generalized quantum measurements, Linear Algebra and its Applications **439** (2013), 4070-4079.*

  Contribution to the mathematical theory of measurements of quantum network/channel and protocols for measurements. Very important part for quantum cryptology. There are running projects for such quantum communication channels (e.g. Beijing-Shanghai, NATO projects, ..)

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Teams/results V

- M. Botur, A. Dvurečenskij, *State-morphism algebras - general approach, Fuzzy Sets and Systems **218** (2013), 90-102.*

  A complete characterization of basic stone bricks - subdirectly irreducible elements of BL-algebras with state-morphisms. Diagonal state-morphism algebras are defined and it is showed that every state-morphism algebra can be embedded into a diagonal one.

  This method is frequently used in mathematics – embedding of some structures into another one with known properties.

Teams/results VI

- FIALOVÁ, J. - MIŠÍK, L. - STRAUCH, O., *An asymptotic distribution function of the three-dimensional shifted van der Corput sequence, Applied Mathematics* **5** *(2014), 2334–2359.*

  Concrete form of the distribution function $g(x,y,z)$ of the 3-dimensional sequences, connected with the von Neuman-Kakutani transformation. The limit of of the sum F(x(n),x(n+1),(x(n+2)) is computed as the Riemann-Stieltjes integral F(x,y,z) over g(x,y,z).

  The knowledge of distribution functions for sequences are of high importance for Monte Carlo methods and for the cryptology.

Indicators I, publications

Total; Average; /FTE

- Monographs abroad/SK: 3/4; 0.75; 1
- Chapters in monographs abroad: 12; 3; 0.079
- Scientific papers Current Contents: 151; 37.8; 0.991
- WOS, Scopus, not above: 96; 24; 0.63
- Other journals: 28; 7; 0.184
- Proceedings: 60; 15; 0.394

Indicators II, citations

	2011	2012	2013	2014	Total	Average	year & FTE
WOS	459	488	659	565	2171	543	14.25
Scopus	59	118	159	128	464	116	3.05
Other	46	79	149	105	379	94.8	2.49
Total	564	685	967	798	3014	753.8	19.79

Monographs I

- *PAŠTÉKA, Milan.*

  On Four Approaches to density, SPECTRUM SLOVAKIA Series, Volume 3. Frankfurt am Main, Germany: Peter Lang, 2013.

- *CHOVANEC, Ferdinand.*

  Difference Posets and their Graphic Representation. L. Mikuláš, 2013 (in Slovak)

- *WIMMER, Gejza - PALENČÁR, R. - WITKOVSKÝ, V. - ĎURIŠ, S. :*

  Evaluation of Measurement Devices Calibrations: Statistical Methods for Uncertainty Analysis in Metrology. STU, 2015. (in Slovak)

Monographs II

- *DVUREČENSKIJ, Anatolij - PULMANNOVÁ, Sylvia*.
  New Trends in Quantum Structures. Dordrecht: Kluwer Academic, 2000. 541+xvi. pp. ISBN 0-7923-6471-6, reedited by Springer-Science+Business Media, B.V. in 2013 and 2014, ISBN 978-90-481-5525-5, ISBN 978-94-017-2422-7 (eBook)

- *DVUREČENSKIJ, Anatolij*.
  Gleason's Theorem and Its Applications, Kluwer Academic Publisher, Dordrecht/Boston/London, 1993, 325+xv. , reedited by Springer-Science+Business Media, LLC in 2013, ISBN 978-90-481-4209-5, ISBN 978-94-015-8222-3 (e-Book)

Monographs III

- *STRAUCH, Oto, PORUBSKÝ, Štefan*:

  Distribution of Sequences. A Sampler Peter Lang, 2005, electronic, revisited and extended version, 2013

- *STRAUCH, Oto*:

  Unsolved Problems, Tatra Mt. Math. Publ. **56** (2013), 109-229, 121 pages.

Projects

- **VEGA**: 32 projects, in cooperation with
    - Institute of Measurements SAS,
    - Institute of Physics SAS
    - FMPI UK Bratislava
    - Facultu of Education, Trnava University
    - Faculty on Natural Sciences, Univ. Matej Bel, Banská Bystrica
    - PJŠ University, Košice
    - University of Žilina, Univ. Selye, Komárno
- **APVV**: 6 projects, in cooperation with
    - PJŠ University, Košice
    - Institute of Measurements SAS, Institute of Electrical Engineering SAS
    - FMPI UK Bratislava
    - Faculty on Natural Sciences, Univ. Matej Bel, Banská Bystrica
    - Faculty of Education, Trnava University

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Projects III

- **meta-QUTE Center of excellency of quantum technologies**, IMTS 26240120022, 3/2010 –5/2013, Role Coordinator. A. Dvurečenskij. SF, joint project with Institute of Physics SAS, Prof.V. Bužek was the PI.

- **EUROGIGA**, ESF-EC-0009-10, 5/2011–4/2014, R. Nedela –investigator.

- **Center of excellency SAS - Quantum Technologies**, A. Dvurečenskij, joint project with Institute of Physics SAS, 2009-2013, Prof. V. Bužek was the PI.

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Journals

- **Mathematica Slovaca**

  Springer Verlag, DeGruyter from 2015, SJR 2011-2014 Q3, 2015 Q2, (0.489, 0.661,0.515,0.552)

- **Tatra Mountains Mathematical Publications**

  DeGruyter Open, SJR 2011-2013 Q4, 2014 Q3, (0.272)

- **Uniform Distribution Theory**

  (with BOKU University, Vienna), DeGruyter Open

- **ZentralblattMath, Slovak Unit of the**

  The world's most comprehensive and longest-running abstracting and reviewing service in pure and applied mathematics, distributed by Springer

International Conferences

- **26th, 27th, 28th, 29th Summer Conference on Real Functions**, 2012, 2013, 2014, 5015

- **12th, 13th, 14th, 15th Central European Conference on Cryptology**, 2012, 2013, 2014, 5015

- **21st, 22nd Czech and Slovak International Conference on Number Theory**, 2013, 2015

- **Uniform Distribution Conference**, 2012- 2015

- **FSTA** 2012, 2014, **IQSA** 2014

- **Descriptional Complexity of Formal Systems**, 2012 - 2015

- **Parallel Matrix Algorithms and Applications** 2012 – 2015

- **Spring Conference on Computer Graphics** 2014, 2015

- **Graph Embeddings and Maps on Surfaces,** 2013

National Cooperation I

- Slovak Academy of Sciences
  - Institute of Measurements SAS
  - Institute of Physics SAS
  - Institute of Electrical Engineering SAS
  - Institute of Normal and Pathological Physiology SAS

National Cooperation II

- Universities
  - Faculty of Mathematics, Physics and Informatics, UK Bratislava
  - Faculty of Electrical Engineering and Information Technology, STU Bratislava
  - Faculty of Civil Engineering, STU Bratislava
  - Faculty of Education, Trnava University
  - Faculty of Science, PJŠU Košice
  - Faculty of Humanities and Natural Sciences, University of Presov
  - Faculty of Natural Sciences, MBU Banská Bystrica
  - Pedagogical Faculty, Catholic University in Ružomberok
- Secondary Schools, Elementary Schools

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National Cooperation III

- Industry, applied fields
  - eustream, a. s., Bratislava,
    - Optimization of gas transport, The simulation of high-dynamic turbulent gas flow in pipelines
    - Flow imbalance problems, Depressurization of modules
  - ttc, Ltd., Nitra
    - Security of gas transport (for U.K., Yemen)
  - VUJE (Research Institute for Nuclear Energy), Trnava
    - Diagnostic systems in the primary circuits of nuclear power plants
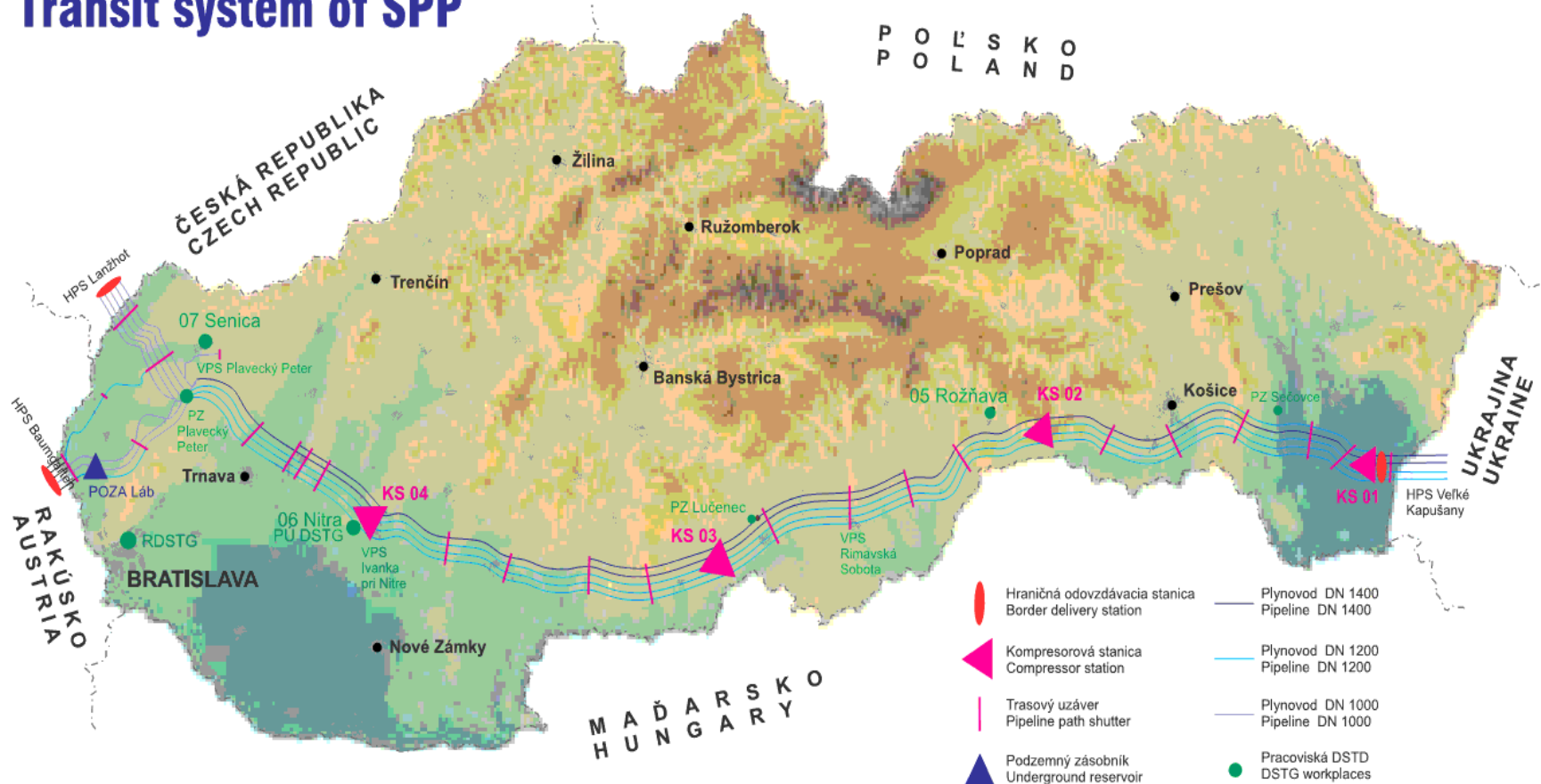 - Defense Ministry of the SR
    - Cryptology methods

National Cooperation III
eustream pipeline system

Tranzitný systém SPP
Transit system of SPP

International Cooperation

Every researcher from the Institute is cooperating with many colleagues from abroad, **A.D.+K.N**.:

- Universities/Institutes in Prague, Brno, Ostrava, Olomouc, Bergen, Tel Aviv, Katowice, Warsaw, Wroclaw, Poznan, Budapest, Debrecen, Vienna, Salzburg, Graz, Louven, Munich, London, St. Etienne, Boca Raton, Salerno, Firenze, Pavia, Univ of Malta, Naples, Perugia, Cagliari, Tehran, Nashville, Melbourne, Xian, Turku, Amherst, Seoul, Boulder, Col., TUBITAK Gebze, Ankara

International Cooperation,

International Cooperation, A.D.+K.N.

Educational Activities I PhD

Summary table for PhD students

	2012	2013	2014	2015
Supervisors	16	16	17	17
Internal/ Defended	11/1	9/2	9/1	8/1
External/Defended	1/0	1/0	1/0	2/0
Other	7/1	8/0	10/0	11/2

Educational Activities II

Summary table Universities lectures/Practicum/…

	2012	**2013**	**2014**	**2015**
Lectures (hours)	827	982	811	772
Practicum (hours)	567	648	658	681
Supervised Bc or Master	22	42	35	42
Supervised PhD.	18	19	17	12

Popularization

	2012	2013	2014	2015	Total	
Articles	27	15	5	12	59	
TV, radio	5	2	4	1	12	
Public lectures	10	10	13	14	47	

Within Week of Science: Day of Open Door, around 150 participants, mainly from secondary schools

Moreover lectures for basic schools (13 years pupils, 250 participants).

Coeditors of Obzory matematiky, fyziky a informatiky – for teachers and students.

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Management/ human resources

Personnel	2012	2013	2014	2015
Research employees	55	57	54	53
FTE Res.	31.6	29.47	29.71	30.88
Average age	52.4	52.5	52.1	52.1

	<30	31-34	35-39	40-44	45-49	50-54	55-59	60-64	>65
DrSc./Prof.							4	3	7
IIa./Assoc. Prof.			1	1	3	4	2	3	
PhD/CSc	2	3	6	2	3	1	3	1	1
Assoc. Prof.							2	1	1

Management/human resources II internal funding

- **Schwarz fund**

- **Mgr. E. Vinceková PhD**., 2009-2013

- **Mgr. N. Dilna, PhD.** since 2009, in the present she is at her maternal leave.

- **Mgr. Ľ. Török, PhD.,** 2010-2013

- **Mgr. B. Novotný, PhD**., 2014-2017

Management/human resources III external funding

- **SAS** Mgr. *Andrea Zemánková*, PhD. SAS fellowship since 2013 – for young researchers who returned from the abroad long-term stay.

- **SASPRO** Dr. *Giselle Antunes Monteiro*, Brasil, she gained in 2015 a one-year fellowship at Mathematical Institute, start April 2016.

- **CVTI** Mgr. *Tibor Macko*, PhD., fellowship for experts after 10 years abroad, start August 2016

Research infrastructure

- Free access to the main publication sources
  - Springer, ScienceDirect, Wiley, …
  - ZentralblatMath, MathSci
- OpenAccess policy in publications (problems with EU policy – public money=public access to the results)

Research strategy and future development

- Number Theory and Cryptography
- Uncertainty modeling by statistical methods, quantum structures, and fuzzy sets, categorical methods in probability
- Ordered algebraic structures and discrete structures
- Dynamical systems, real and functional analysis, and topology
- Computer science and data processing
- Applications of mathematical research in praxis
- Participation at PhD studies and pedagogical activities

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Research strategy of the Institute

- **Tradional directions, recognised trends**
- **PhD studies**

- Applications, traditional directions plus new trends (gas dynamics, healthcare applications)
- Active policy in fundraising (grants, projects, EU projects, industrial projects)
- European projects, 1 submitted (4.5 M EUR, with O2)

Thank You for Your Attention