Curriculum Vitae
Max I. Kanovich

Education

1989	Received Doctor of Science in Physics and Mathematics, from Dept. of Computational Mathematics and Cybernetics, Moscow State (Lomonosov) University. Approved by the All-Russia Higher Attestation Commission
1972	Received Ph.D. in Physics and Mathematics (Mathematical Logic and Computer Science), from Dept. of Mechanics and Mathematics, Moscow State (Lomonosov) University (Ph.D. Supervisor: Academician-Correspondent A.A. Markov),
1968–1971	Ph.D.Student in Mathematical Logic and Computer Science, Moscow State (Lomonosov) University
1968	Graduated (M.S.) with highest honors from Dept. of Mechanics and Mathematics, Moscow State (Lomonosov) University

Current Employment

2015–Present	Professor	National Research University Higher School of Economics, Russia
2012–Present	Visiting Professor	University College London,

Previous Employment

2011–2012	Research Associate,	Queen Mary, University of London, EECS
2004–2010	Professor	Queen Mary, University of London, Dept. of Computer Science,
1999–2004	Lecturer	University of Pennsylvania, Dept. of Mathematics and Dept. of Computer and Information Science
1997–1998	Professor	Keio University, Dept. of Philosophy
1994–1995	Associate Professor	Tohoku University, Dept. of Computer and Mathematical Sciences,
1992–2001	Professor	Russian State University for the Humanities, Dept. of Theoretical and Applied Linguistics
1989–1992	Professor	Tver' State University, Division of Algorithmic Languages and System Programming
1973–1989	Associate Professor	Tver' State University, Division of Applied Algebra and Geometry
1972–1973	Associate Professor	Tula Polytechnic Institute, Division of Applied Mathematics
1971–1972	Senior Research Fellow	Lathe Research and Development Center (Moscow), Dept. of Computing

Publications

Over 100 published refereed papers at the prestigious conferences and journals, including **the most prestigious conferences of the A* level** such as LICS (*Logic in Computer Science*), POPL (*ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages*), and IJCAR (*International Joint Conference on Automated Reasoning*).

Main Publications by Max Kanovich

[1] Max Kanovich, Stepan Kuznetsov, Andre Scedrov, **Reconciling Lambek's restriction, cut-elimination, and substitution in the presence of exponential modalities**, J. Logic Comput., 30:1 (2020), 239-256

[2] Max I. Kanovich, Stepan Kuznetsov, Vivek Nigam, Andre Scedrov: **Soft Subexponentials and Multiplexing.** In: N. Peltier and V. Sofronie-Stokkermans, eds., Automated Reasoning, 10th International Joint Conference, IJCAR 2020, Paris, France, July 1-4, 2020, Proceedings, Part I, Springer LNAI Volume 12166, Springer-Verlag, 2020.

[3] Max I. Kanovich, Stepan Kuznetsov, Vivek Nigam, Andre Scedrov: Subexponentials in non-commutative linear logic. Mathematical Structures in Computer Science 29(8): 1217-1249 (2019)

[4] Musab A. AlTurki, Tajana Ban Kirigin, Max I. Kanovich, Vivek Nigam, Andre Scedrov, Carolyn L. Talcott: **A Multiset Rewriting Model for Specifying and Verifying Timing Aspects of Security Protocols.** Foundations of Security, Protocols, and Equational Reasoning 2019: 192-213

[5] Abrao Aires Urquiza, Musab A. AlTurki, Max I. Kanovich, Tajana Ban Kirigin, Vivek Nigam, Andre Scedrov, Carolyn L. Talcott: Resource-Bounded Intruders in Denial of Service Attacks. CSF 2019: 382-396

[6] Max I. Kanovich, Stepan Kuznetsov, Andre Scedrov: Undecidability of a Newly Proposed Calculus for CatLog3. FG 2019: 67-83

[7] Max I. Kanovich, Stepan Kuznetsov, Andre Scedrov: **The Complexity of Multiplicative-Additive Lambek Calculus: 25 Years Later.** WoLLIC 2019: 356-372

[8] Max I. Kanovich, Stepan Kuznetsov, Andre Scedrov: **L-Models and R-Models for Lambek Calculus Enriched with Additives and the Multiplicative Unit.** WoLLIC 2019: 373-391

[9] James Brotherston, Max I. Kanovich: **On the Complexity of Pointer Arithmetic in Separation Logic.** APLAS 2018: 329-349

[10] Max I. Kanovich, Stepan Kuznetsov, Vivek Nigam, Andre Scedrov: **A Logical Framework with Commutative and Non-commutative Subexponentials.** IJCAR 2018: 228-245

[11] Musab A. AlTurki, Max I. Kanovich, Tajana Ban Kirigin, Vivek Nigam, Andre Scedrov, Carolyn L. Talcott: **Statistical Model Checking of Distance Fraud Attacks on the Hancke-Kuhn Family of Protocols.** CPS-SPC@CCS 2018: 60-71

[12] Glyn Morrill, Stepan Kuznetsov, Max I. Kanovich, Andre Scedrov: **Bracket Induction for Lambek Calculus with Bracket Modalities.** FG 2018: 84-101

[13] Max I. Kanovich, Tajana Ban Kirigin, Vivek Nigam, Andre Scedrov, Carolyn L. Talcott: **Time, computational complexity, and probability in the analysis of distance-bounding protocols.** Journal of Computer Security 25(6): 585-630 (2017)

[14] Max I. Kanovich, Tajana Ban Kirigin, Vivek Nigam, Andre Scedrov, Carolyn L. Talcott, Ranko Perovic: **A rewriting framework and logic for activities subject to regulations.** Mathematical Structures in Computer Science 27(3): 332-375 (2017)

[15] James Brotherston, Nikos Gorogiannis, Max I. Kanovich: **Biabduction (and Related Problems) in Array Separation Logic.** CADE 2017: 472-490

[16] Max I. Kanovich, Stepan Kuznetsov, Andre Scedrov: **Undecidability of the Lambek Calculus with Subexponential and Bracket Modalities.** FCT 2017: 326-340

[17] Max I. Kanovich, Stepan Kuznetsov, Glyn Morrill, Andre Scedrov: **A Polynomial-Time Algorithm for the Lambek Calculus with Brackets of Bounded Order.** FSCD 2017: 22:1-22:17

[18] Max I. Kanovich: **The undecidability theorem for the Horn-like fragment of linear logic (Revisited).** Mathematical Structures in Computer Science 26(5): 719-744 (2016)

[19] Max I. Kanovich, Stepan Kuznetsov, Andre Scedrov: **Undecidability of the Lambek Calculus with a Relevant Modality.** FG 2016: 240-256

[20] Max I. Kanovich, Tajana Ban Kirigin, Vivek Nigam, Andre Scedrov, Carolyn L. Talcott: **Timed Multiset Rewriting and the Verification of Time-Sensitive Distributed Systems.** FORMATS 2016: 228-244

[21] Max I. Kanovich, Stepan Kuznetsov, Andre Scedrov: **On Lambek's Restriction in the Presence of Exponential Modalities.** LFCS 2016: 146-158

[22] James Brotherston, Nikos Gorogiannis, Max I. Kanovich, Reuben Rowe: **Model checking for symbolic-heap separation logic with inductive predicates.** POPL 2016: 84-96

[23] M. Kanovich, T. Ban Kirigin, V. Nigam, A. Scedrov, and C. Talcott. Discrete vs. Dense Times in the Verification of Cyber-Physical Security Protocols. In: R. Focardi and A. Myers, eds., 4th Conference on Principles of Security and Trust (POST 2015), ETAPS 2015: 11-18 April 2015, London, UK. LNCS Volume 9036, 2015, pp.259-279.

[24] M. Kanovich, T. Ban Kirigin, V. Nigam, and A. Scedrov. Bounded Memory Protocols. *Computer Languages, Systems and Structures*, 40(3-4) (2014), 137-154.

[25] M. Kanovich, T. Ban Kirigin, V. Nigam, and A. Scedrov. Bounded memory Dolev-Yao adversaries in collaborative systems. *Information and Computation*, 238 (2014) 233-261.

[26] (with T.Ban Kirigin, V.Nigam, A.Scedrov, and C.Talcott) Towards Timed Models for Cyber-Physical Security Protocols. FCS-FCC 2014, Joint Workshop on Foundations of Computer Security and Formal and Computational Cryptography, affiliated to CSF 2014, Vienna, Austria.

[27] James Brotherston and Max Kanovich. Undecidability of Propositional Separation Logic and Its Neighbours. J. ACM 61(2): 14 (2014), 43 pages.

[28] (with Timos Antonopoulos, Nikos Gorogiannis, Christoph Haase, and Joel Ouaknine). Foundations for Decision Problems in Separation Logic with General Inductive Predicates. In Proceedings of 17th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS). Held as Part of the European Joint Conferences on Theory and Practice of Software (ETAPS). 5-13 April 2014, Grenoble, France. pp.411-425.

[29] Bounded Memory Protocols and Progressing Collaborative Systems (with A.Scedrov, T.Ban Kirigin, and V.Nigam). In: J. Crampton, S. Jajodia and K. Mayes, eds., The 18th European Symposium on Research in Computer Security (ESORICS 2013), Egham, UK, September 2013. Springer LNCS, 8134, Springer-Verlag, 2013, pp. 309 - 326.

[30] (with V. Nigam, T. Ban Kirigin, A. Scedrov, C. Talcott, and R. Perovic). Towards an Automated Assistant for Clinical Investigations In: C.C. Yang, ed., 2nd ACM SIGHIT International Health Informatics Symposium (IHI 2012). Miami, Florida, USA, January 2012. ACM Digital Library

[31] M.Kanovich, T.Ban Kirigin, V.Nigam, A.Scedrov, C.Talcott, and R.Perovic. A Rewriting Framework for Activities Subject to Regulations. In: A.Tiwari, ed., 23-rd International Conference on Rewriting Techniques and Applications (RTA 2012). Nagoya, Japan, May 28-June 2, 2012. Leibniz International Proceedings in Informatics Volume 15, Schloss Dagstuhl - Leibniz Center for Informatics, 2012, pp.305-322.

[32] Max Kanovich: Light Linear Logics with Controlled Weakening: Expressibility, Confluent Strong Normalization. *Annals of Pure and Applied Logic* 163 (2012), pp. 854-874.

[33] (with N.Gorogiannis and P.O'Hearn) The Complexity of Abduction for Separated Heap Abstractions. The 18th International Static Analysis Symposium (SAS 2011), Sept 14-16, Venice, Italy

[34] (with P.Rowe and A.Scedrov) Collaborative Planning with Confidentiality. *Journal of Automated Reasoning* 46 (3-4) (2011) 389-421.

[35] (with T.Ban Kirigin, V.Nigam and A.Scedrov) Bounded Memory Dolev-Yao Adversaries in Collaborative Systems. In: P.Degano et al., eds., The 7th International Workshop on Formal Aspects of Security & Trust (FAST2010). Springer LNCS Volume 6561, Springer-Verlag, 2011, pp.18-33.

[36] (with Jacqueline Vauzeilles) Linear logic as a tool for planning under temporal uncertainty. *Theoretical Computer Science*, 412, 2011, pp.2072-2092

[37] (with T.Ban Kirigin, V.Nigam and A.Scedrov) Progressing Collaborative Systems. In: V.Cortier et al., eds., FCS-PrivMod 2010 Workshop on Foundations of Security and Privacy. July 14-15, 2010, Edinburgh, UK, 17p.

[38] (with James Brotherston) Undecidability of propositional separation logic and its neighbours, In *Proc. 25-th Annual IEEE Symposium on Logic in Computer Science, Edinburgh, Scotland, U.K,* July 2010, 10p. A preliminary version of this paper was released as Imperial College technical report DTR10-1.

[39] (with Paul Rowe and Andre Scedrov) On Decidability and Complexity of Policy Compliance in Collaborative Systems. Submitted to *Special Issue of the Journal of Automated Reasoning on Security Rewriting*, 32p.

[40] (with Paul Rowe and Andre Scedrov) Policy Compliance in Collaborative Systems. In: *22nd IEEE Computer Security Foundations Symposium (CSF),* Port Jefferson, New York, USA, July 2009. pp.218-233.

[41] Light Linear Logic with Controlled Weakening: The missing link. In: *Proc. Symposium on Logical Foundations of Computer Science, LFCS'09,* Deerfield Beach, Florida, U.S.A., January 3-6, 2009. Lecture Notes in Computer Science 5407, S.Artemov and A.Nerode (Eds.) 2009, pp.246-264.

[42] Multiset Rewriting over Fibonacci and Tribonacci Numbers. Submitted to Mints Festschrift, 21p.

[43] (with Paul Rowe and Andre Scedrov) Collaborative Planning with Privacy. In: A. Sabelfeld, ed., *20th IEEE Computer Security Foundations Symposium (CSF 20),* Venice, Italy, July 2007, pp. 265-278.

[44] (with Jacqueline Vauzeilles) Strong planning under uncertainty in domains with numerous but identical elements (a generic approach). *Theoretical Computer Science*, 379 (2007) pp.84-119.

[45] A note on Rewriting Proofs and Fibonacci Numbers. In: *Proc. Symposium on Logical Foundations of Computer Science, LFCS'07,* New York, U.S.A., June 4-7, 2007. Lecture Notes in Computer Science 4514, S.Artemov and A.Nerode (Eds.) 2007, pp.284-292.

[46] The two-way rewriting in action: Removing the mystery of Euler-Glaisher's map. *Discrete Mathematics*, 307 (2007) pp.1909-1935.

[47] (with Mitsuhiro Okada and Kazushige Terui) Intuitionistic phase semantics is almost classical. *Journal of Mathematical Structures in Computer Science*, Vol.16, pp. 1-20, 2006.

[48] (with Z.M.Shalyapina) The Formalism of R-attributes as a Universal Means of Syntactic Generation (Based on its Implementation in the RussLan System of Russian Generation) In: *Proc. Int'l Conference "Dialogue 2006" on Computational Linguistics and Intellectual Technologies,* Bekasovo, Russia, 31 May - 4 June, 2006.

[49] Finding Direct Partition Bijections by Two-Directional Rewriting Techniques. *Discrete Mathematics*, Volume 285, Issues 1-3, 2004, pp. 151-166.

[50] (with Jacqueline Vauzeilles) Coping Polynomially with Numerous but Identical Elements within Planning Problems. In: *Proc. 12th Annual Conference of the European Association for Computer Science Logic, CSL'03,* Vienna, Austria, August 25-30, 2003; Lecture Notes in Computer Science 2803, Matthias Baaz, Johann A.Makowsky (Eds.) 2003

[51] (with Mitsuhiro Okada and Andre Scedrov) Phase semantics for light linear logic. *Theoretical Computer Science* 294(3), 2003, pp.525-549.

[52] Bijections between Partitions by Two-Directional Rewriting Techniques. In: *Proc. Annual Conference of the European Association for Computer Science Logic, CSL'02,* September 22-25, 2002 Edinburgh, Scotland, Lecture Notes in Computer Science 2471, J.Bradfield (Ed.), pp. 44–58, 2002

[53] (with Z.M.Shalyapina, E.G.Borisova, A.S.Panina, Y.S.Tarasova, O.A.Shternova) RUSSLAN: A System of Russian Language Generation. In: *Proc. Fourth European Conference on Formal Description of Slavic Languages,* Potsdam, November 28-30, 2001.

[54] (with Rohit Chadha and Andre Scedrov) Inductive methods and contract-signing protocols. In: P.Samarati, ed., *Proc. Eighth ACM Conference on Computer and Communications Security,* Philadelphia, PA, November 5-8, ACM Press, 2001.

[55] The Expressive Power of Horn Monadic Linear Logic. In *Proc. 2001 Annual Conference of the European Association for Computer Science Logic,* Paris, France, September 10-13, 2001.

[56] (with Jacqueline Vauzeilles) The Classical AI Planning Problems in the Mirror of Horn Linear Logic: Semantics, Expressibility, Complexity. *Journal of Mathematical Structures in Computer Science*. (2001), vol. 11, pp. 689-716.

[57] (with Iliano Cervesato, Nancy Durgin, and Andre Scedrov) Interpreting Strands in Linear Logic. In: "2000 Workshop on Formal Methods and Computer Security", 12th Int'l Conference on Computer Aided Verification (CAV 2000) Satellite Workshop, July, 2000, Chicago, USA.

[58] (with Mitsuhiro Okada and Andre Scedrov) Specifying Real-Time Finite-State Systems in Linear Logic In: "2-nd International Workshop on Constraint Programming for Time-Critical Applications and Multi-Agent Systems (COTIC)", Nice, France, September, 1998, 14 pp.

[59] (with Takayasu Ito) Temporal linear logic specifications for concurrent processes. In *Proceedings of the Twelfth Annual IEEE Symposium on Logic in Computer Science*, June 29 - July 2, 1997, Warsaw, Poland.

[60] (with Mitsuhiro Okada and Andre Scedrov) Phase semantics for light linear logic. In: "13-th Annual Conference on the Mathematical Foundations of Programming Semantics", Pittsburgh, Pennsylvania, March, 1997, Electronic Notes in Theoretical Computer Science, Volume 6 (1997)

[61] Effective Calculi as a Technique for Search Reduction, *American Mathematical Society Translations,* (2) Vol. 178, 1996, pp.133-148

[62] Linear Logic Automata, *Annals of Pure and Applied Logic*, 78 (1996) pp.147-188

[63] Simulating Computations in Second Order Non-Commutative Linear Logic. In J.-Y. Girard, M. Okada, and A. Scedrov, editors, *ENTCS (Electronic Notes in Theoretical Computer Science) Vol.3: A Special Issue on Linear Logic 96, Tokyo Meeting*. Elsevier, 1996.

[64] (with Z.M.Shalyapina) Russian inflexion and elementary word-building in a model of Russian morphological generation. - In *Dialogue 96. Proceedings of the International Workshop on Computational Linguistics and its Applications.* May 4-9, 1996. Puschino, Russia, pp.97-102.

[65] Chapter "Horn Linear Logic," pages 83-207 in the book by Gaisi Takeuti, Senkei Ronri Nyuumon (Introduction to Linear Logic). 1995, 234p. (in Japanese)

[66] Undecidability of Non-Commutative 2nd Order Multiplicative Linear Logic, *AMAST Links,* Vol. 2, Issue 05, June 1995.

[67] The Complexity of Neutrals in Linear Logic, In *Proc. 10-th Annual IEEE Symposium on Logic in Computer Science, San Diego, California,* June 1995.

[68] Petri Nets, Horn Programs, Linear Logic, and Vector Games, *Annals of Pure and Applied Logic*, 75 (1995) pp.107-135. A preliminary version In: Proceedings of the International Symposium Theoretical Aspects of Computer Software, TACS'94, Sendai, Japan, April 1994. In *Lecture Notes in Computer Science, (ed. M.Hagiya and J.Mitchell),* 1994, 789, p.642–666

[69] The Direct Simulation of Minsky machines in Linear logic, In J.-Y. Girard, Y. Lafont, and L. Regnier, editors, *Advances in Linear Logic*, London Mathematical Society Lecture Notes, Vol. 222, pp.123-145. Cambridge University Press, 1995.

[70] Simulating Guarded Programs in Linear Logic, In: Proceedings of the International Workshop on Theory and Practice of Parallel Programming, TPPP'94, Sendai, Japan, November 1994. In *Lecture Notes in Computer Science, (ed. T.Ito and A.Yonezawa),* 1995, 907, pp.45-69

[71] Horn Fragments of Non-Commutative Logics with Additives are PSPACE-complete. In *Proc. 1994 Annual Conference of the European Association for Computer Science Logic, Kazimierz, Poland,* September 1994.

[72] Computational and Concurrency Aspects of Linear Logic. In: Proceedings of the IFIP 13th World Computer Congress, Hamburg, Germany, 28 August - 2 September, 1994. *Technology and Foundations, Information Processing '94,* Volume 1, (ed. B.Pehrson and I.Simon) 1994, p.336–341.

[73] (with Z.M.Shalyapina) The RUMORS system of Russian synthesis. - In: *COLING 94. Proceedings of the 15th International Conference on Computational Linguistics.* Vol.I. August 5-9, 1994. Kyoto, Japan. pp.177-179.

[74] Simulating Linear Logic in $\mathbf{1}$-Only Linear Logic. CNRS, Laboratoire de Mathématiques Discrètes, Prétirage n° 94-02, January 1994, 81 p.

[75] The complexity of Horn Fragments of Linear Logic, *Annals Pure Appl. Logic,* 69 (1994) p.195–241. (Special issue of selected papers of LICS'92)

[76] Linear logic as a logic of computations, *Annals Pure Appl. Logic,* 67 (1994) p.183–212

[77] The Relational Knowledge-Base Interpretation and Feasible Theorem Proving for Intuitionistic Propositional Logic. University of Amsterdam, Institute for Logic, Language and Computation, ILLC Prepublication Series ML-93-21, December 1993.

[78] Horn Programming in Linear Logic is NP-complete. In: Proceedings of the 7th Annual IEEE Symposium on Logic in Computer Science, June 22-25, 1992, Santa Cruz, California, p.200–210

[79] (with Mati Pentus) Strong Normalization for the Equivalencies in Lambek Calculus and Linear Logic. Steklov Institute of Mathematics of Russian Academy of Science, Prepublication Series, Logic and Computer Science, LCS-92-04, May 1992

[80] Efficient Program Synthesis: Semantics, Logic, Complexity. In: Proceedings of the International Conference Theoretical Aspects of Computer Software, TACS'91, Sendai, Japan, September 1991. In *Lecture Notes in Computer Science, (ed. A.Meyer and T.Ito),* 1991, 526, p.615–632

[81] Efficient program synthesis in computational models. Journal of Logic Programming, 1990, v.9, No 2-3, p.159-177.

[82] The monadic Horn knowledge bases in expert systems. Proceedings of Academy of Sciences of the USSR, Technical Cybernetics, 1989, No 5, p.14-19.

[83] Semantics and logic of computational problems. Doklady Akademii Nauk SSSR, 1989, 305, No 4. English translation in Soviet Mathematics, Doklady 39 (1989), no. 2, (American Mathematical Society).

[84] Logical foundations of the program synthesis for solving computational tasks. Proceedings of Academy of Sciences of the USSR, Technical Cybernetics, 1988, No 2, p.81–93.

[85] Constructibility of the logic of computational problems. Doklady Akademii Nauk SSSR, 1988, 302, No 3. English translation in Soviet Mathematics, Doklady 38 (1989), no. 2 (American Mathematical Society).

[86] Complexity of hierarchical networks of finite automata. In: Fourteen papers translated from the Russian, American Mathematical Society Translations, series 2, v.137, 1987, p.112–118.

This paper has been selected for translation by Vladimir Arnold, one of the world-class scientists.

[87] A general method for constructing concrete strongly independent propositions. Doklady Akademii Nauk SSSR, 1987, 296, No 5. English translation in Soviet Mathematics, Doklady 36 (1988), no. 2 (American Mathematical Society).

[88] Quasi-polynomial algorithms for the recognition of the satisfiability and derivability of propositional formulas. Doklady Akademii Nauk SSSR, 1986, 290, No 2. English translation in Soviet Mathematics, Doklady (AMS).

[89] Efficient logical algorithms for the analysis and synthesis of programs. Doklady Akademii Nauk SSSR, 1985, 285, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[90] (with Dikovskii A.) Computational models with separable subtasks. Proceedings of Academy of Sciences of the USSR, Technical Cybernetics, 1985, No 5, p.36–60.

[91] Solving the problem of H. Rogers of relation between strong and weak recursion theorems. Doklady Akademii Nauk SSSR, 1984, 279, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[92] A uniform independence of invariant sentences. In: Lect. Notes in Computer Sci., 176, 1984, International Conference on Mathematical Foundations of Computer Science MFCS'84.

[93] On independence of invariant sentences. Doklady Akademii Nauk SSSR, 1984, 276, No 1. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[94] On the reducibility by general recursive operators. Doklady Akademii Nauk SSSR, 1983, 273, No 4. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[95] On the complexity and reducibility for algorithmic mass problems. Doklady Akademii Nauk SSSR, 1983, 272, No 2. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[96] On implicativeness for the lattice of truth-table degrees of algorithmic problems. Doklady Akademii Nauk SSSR, 1983, 270, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[97] On the register complexity of random access machines. Doklady Akademii Nauk SSSR, 1983, 268, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[98] On the complexity of the separation problem for recursively enumerable sets. Doklady Akademii Nauk SSSR, 1982, 267, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[99] On truth-table reducibilities for the problem of extending partial recursive functions. Doklady Akademii Nauk SSSR, 1982, 264, No 2. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[100] A complexity version of Godel's incompleteness theorem. In: Fundamentals of Computation Theory: Proceedings of the Conference on Algebraic, Arithmetic, and Categorical Methods in Computation Theory (FCT79), Berlin. September 1979, (ed. L.Budach), p.542.

[101] The estimate of the complexity of incompleteness of arithmetic. Doklady Akademii Nauk SSSR, 1978, 238, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[102] On the complexity of equivalent transformations in programming languages. In: Lect. Notes in Computer Sci., 53, 1977, International Conference on Mathematical Foundations of Computer Science MFCS'77.

[103] On computability of Kolmogorov complexity. In: Lect. Notes in Computer Sci., 56, 1977, International Conference on Fundamentals of Computing Theory FCT'77.

[104] Complex properties of context-sensitive languages. Doklady Akademii Nauk SSSR, 1977, 233, No 3. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[105] On precision of the complexity criterion for non-recursiveness and universality. Doklady Akademii Nauk SSSR, 1977, 232, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[106] The complexity of complete systems of equivalent transformations in programming languages. Doklady Akademii Nauk SSSR, 1977, 232, No 2. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[107] (with Kushner B.) The complexity of algorithms and Specker sequences. In: Investigations on mathematical logic and the theory of algorithms, 2 (ed. A.A.Markov). Computing Center of Academy of Sci. of USSR. 1976, p.73–83.

[108] On a relation between upper and lower bounds of the decision complexity of recursively enumerable sets. In: Investigations on mathematical logic and the theory of algorithms, 2 (ed. A.A.Markov). Computing Center of Academy of Sci. of USSR. 1976, p.62–72.

[109] The Dekker construction and effective non-recursiveness. Doklady Akademii Nauk SSSR, 1975, 222, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[110] A step-by-step semantic system with set variables. Doklady Akademii Nauk SSSR, 1975, 221, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[111] On sets of complex-programmed numbers. In: Lect.Notes in Computer Sci., 32, 1975, International Conference on Mathematical Foundations of Computer Science MFCS'75.

[112] "Complex" and "simple" integers. Doklady Akademii Nauk SSSR, 1974, 218, No 2. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[113] The complexity of limits of Specker sequences. Doklady Akademii Nauk SSSR, 1974, 214, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[114] On an extension of Markov's step-by-step semantic system. In: Theory of algorithms and mathematical logic (ed. A.A.Markov). Computing Center of Academy of Sci. of USSR. 1974, p.32–47.

[115] Non-reducibility of languages of the step-by-step semantic system. Doklady Akademii Nauk SSSR, 1973, 212, No 4. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[116] On the approximation complexity of arithmetical sets. Doklady Akademii Nauk SSSR, 1973, 211, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[117] The bounded decision complexity of algorithms. In: Investigations on mathematical logic and the theory of algorithms, 1 (ed. A.A.Markov). Computing Center of Academy of Sci. of USSR. 1973, p.3–47.

[118] On universality of strongly non-recursive sets. Doklady Akademii Nauk SSSR, 1972, 204, No 3. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[119] The bounded decision complexity of semi-recursively enumerable sets. Doklady Akademii Nauk SSSR, 1972, 203, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[120] On domains of optimal algorithms. Doklady Akademii Nauk SSSR, 1971, 198, No 1. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[121] On the complexity of minimization of boolean functions. Doklady Akademii Nauk SSSR, 1971, 198, No 1. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[122] The decision complexity of a recursively enumerable set as a criterion of its universality. Doklady Akademii Nauk SSSR, 1971, 194, No 3. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[123] On the decision complexity of recursively enumerable sets. Doklady Akademii Nauk SSSR, 1970, 192, No 4. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[124] On the decision and enumeration complexity of predicates. Doklady Akademii Nauk SSSR, 1970, 190, No 1. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[125] On estimates of the decision complexity of algorithms. Proceedings of Steklov Math. Institute of Academy of Sci. of USSR, 1969, v.16.

[126] On the decision complexity of algorithms. Doklady Akademii Nauk SSSR, 1969, 186, No 5. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

[127] (with N. Petri) Some theorems on the complexity of normal algorithms and computations. Doklady Akademii Nauk SSSR, 1969, 184, No 6. English translation in Soviet Mathematics, Doklady (American Mathematical Society).

Dissertations by Max Kanovich

[1] The problems of the efficient program synthesis within computational models. Doctor of Science Dissertation, Moscow State (Lomonosov) University, Dept. of Computational Mathematics and Cybernetics, 1989, 180 p. (in Russian)

[2] The complexity of bounded algorithmical problems and universality. Ph.D. Dissertation, Moscow State (Lomonosov) University, Dept. of Mechanics and Mathematics, 1971, 130 p. (in Russian)

Research Funding.

I have been involved in a number of national and international projects either as a PI, or as a team member, when I did not hold a permanent position in the related institution. Highlights from last years:

- EPSRC Grant "Modularity and Resource Separation", 2006-2009 (co-investigator);
- EPSRC Grant EP/K040049/1, "Boosting Automated Verification using Cyclic Proof" 2013-2017 (research associate);
- Russian Science Foundation grant 17-11-01294, "Knowledge representation, discovery, and processing: a logic-based approach" 2017-2019 (co-principal investigator);
- EPSRC Programme Grant EP/R006865/1, "Interface Reasoning for Interacting Systems (IRIS)" 2018-2023 (research associate)

My main interests are:

Computational and descriptive complexity, program verification and analysis, program synthesis, security and information assurance, cryptographic protocols, hybrid and real-time distributed systems, computational linguistics, natural language processing, logical foundations of computer science and artificial intelligence.

The general aim of my research is to introduce comprehensive formal systems that automatically exploit peculiarities of the problems under consideration, and to show that such formal systems can achieve a significant speedup over the traditional ones. Specifically,

- Efficient formalisms for the analysis of programs that manipulate memory.

  The aim is to research into formal systems based on separation logic, bunched implications and the like. The theoretical results on the complexity of the formal systems could have been of use in practical applications of logic to program analysis, verification, and logical interfaces between concurrent programs and environments.

- Efficient formalisms for assured information sharing.

  In the context of distributed systems security, the aim is to develop novel efficient methods, on one hand, to enable multiple participants to share information across and within security levels, and at the same time, on the other hand, to enforce confidentiality, privacy, trust, release, dissemination, data quality and provenance policies.

- Efficient formalisms to specify and investigate security problems in multi-agent systems interacting with environment, under quantitative time and resource constraints.

  The aim is to develop efficient formal systems capable of handling security protocols and policies that manage inter-communications in software, distributed systems, and concurrent systems. In particular, we aim at the cyber-physical protocols under explicit time constraints. We have to investigate the foundational differences and the impacts on the analysis when using models with discrete time and models with dense time.

- Efficient formalisms for planning within AI systems.

  We are looking for the comprehensive semantics and planning algorithms for transition systems under probabilistic and non-deterministic conditions and temporal uncertainty, for which the planning problem becomes the winning strategies problem.

- Efficient formalisms for Computational Linguistics.

  The aim is to develop comprehensive and efficient formal systems capable of handling syntactical and semantical properties of natural and formal languages, in order to extract the meaning from texts in natural/formal language and to represent this meaning as a formalized semantic interpretation readable by both computers and humans.

I have a PhD and a Dr.Hab in mathematics, physics, mathematical logic and computer science. I have a great experience of working in a research environment. I have a reknown expertise in CS and Math, including inductive theorem proving, separation logic and program analysis techniques. I have a strong background in verification, automated reasoning, program logics, etc., as evidenced by my work history and publication record (over 100 published refereed papers).

Membership of professional organizations

Member of Editorial Boards and Associations

- The European Association of Theoretical Computer Science, EATCS (membership)

- American Mathematical Society, AMS (membership)
- American Society for Engineering Education, ASEE (membership)
- Mathematical Structures in Computer Science, Cambridge University Press (editorial board)
- Workshop on Verification and Theorem Proving for Continuous Systems, (NetCA Workshop 2005) August 26, 2005, Oxford UK (editorial board)

Member of Program Committees

- Twenty-Seventh Annual IEEE Symposium on Logic in Computer Science (LICS 2012) June 25-28, 2012, Dubrovnik, Croatia
- Special Session Honoring M.Kanovich on the Occasion of His 65th Birthday, 18th Workshop on Logic, Language, Information and Computation (WoLLIC 2011), May 18-20, 2011, Philadelphia, USA
- Logic and Interaction Weeks, CIRM, Luminy, Marseilles, January 28 - March 1, 2002
- Organizer of Special Session on Linear Logic, 2001 Annual Meeting of the Association for Symbolic Logic, Philadelphia, March 10-13, 2001
- International Symposium on Principles of Software Evolution, Kanazawa, Japan, November 1-2, 2000
- Workshop on Distributed Systems, Satellite Workshop to 12th International Symposium on Fundamentals of Computation Theory, Iasi, Romania, September 2-3, 1999
- 1998 Annual Conference of the European Association for Computer Science Logic, Brno, Chech, August, 1998
- 1996 Annual Conference of the European Association for Computer Science Logic, Utrecht, The Netherlands, September 21-27, 1996
- Logics and models of computation, CIRM, Luminy, Marseilles, September 16-20, 1996
- Heyting'88 Meeting, Chaika near Varna; Bulgaria, 1988

Invited Speaker

I have been an invited speaker at over 35 international symposia and workshops in Europe, America, Japan and Australia. Highlights from last years:

- International workshop "Logical Models of Reasoning and Computation" Steklov Mathematical Institute, Moscow, February 1-3, 2012
- Invited lecture, 18th Workshop on Logic, Language, Information and Computation (WoLLIC 2011), May 18-20, 2011, Philadelphia, USA

  Special Session Honoring M.Kanovich on the Occasion of His 65th Birthday
- Plenary talk, Symposium on Logical Foundations of Computer Science (LFCS 2009) Jan 3-6, 2009, Florida, U.S.A.
- Int'l Symmetry Conference, Edinburgh, UK, January 14-17, 2007
- Geometry of computation: Linguistics and logic (GEOCAL'06) Marseilles-Luminy, France, February 12-19, 2006 ■

Personal Qualities

My work has been done in collaboration with the leading teams in the U.S., Europe, and Japan, such as

- University of Pennsylvania (Andre Scedrov, Peter Freyd);
- Stanford University (John Mitchell, Pat Lincoln);
- Queen Mary, University of London, and University College London (Peter O'Hearn, James Brotherston);
- Institut de Mathématiques de Luminy (Jean-Yves Girard, Yves Lafont);
- Institut Galilée, Universite Paris-13 (Jacqueline Vauzeilles);
- Keio University (Mitsu Okada).

As evidenced by my work history, publication record, and international collaboration, my work can be done only with the personal qualities such as:

- Commitment to high quality research.
- Ability to work collaboratively and as part of a team in a research community.
- Ability to work unsupervised.
- Ability to be self-motivated and able to use your initiative.
- Commitment to the policy of equal opportunity and the ability to work harmoniously with colleagues and students of all cultures and backgrounds.

Teaching

The great tradition of the Moscow University was that the basic undergraduate courses were taught by the most prominent researchers. As a student, I was taught by Kolmogorov, Markov, Aleksandrov, Dynkin, Kurosh. Such a constellation of great mathematicians in one department was exceptional. But, apart of being outstanding scientists, each of them had his own and efficient style of teaching. A legacy of my professors is that one of the most challenging aspects of being a part of a university is the opportunity to teach.

My own teaching experience stretches over more than 30 years. I have extensive expertise in all levels of undergraduate and graduate courses in Math and Computer Science, in improving program enrollments, and in supporting multidisciplinary research activities, including the long-term teaching engagements at the University of Pennsylvania (1999-2004), and Queen Mary, University of London (2004-2012).

I have a strong interest in teaching with theoretical and practical applications, an understanding and appreciation of building consensus and working collaboratively with diverse faculty, peers and administrators, and an understanding and appreciation of curricular development including assessment, educational objectives, and the impacts of the maturation of the field.

I have always been involved in an environment emphasizing applications of Mathematics in Software Engineering, Computer Science, Artificial Intelligence, and Computer and Information Technology.

I learn a lot from my students, especially undergraduates.

The main lesson is that our students are very sensitive to the lecture's attitude to teaching, so that each time you have to perform on the stage as if it is your first and last time, in order to 'grasp' your audience and attract their attention by whatever means you have. Needless to say that the importance of being well-prepared, creative and enthusiastic can never be underestimated.

I have lectured at many universities in Russia, France, Australia, Japan, the United Kingdom, and the U.S., and supervised numerous M.Sc. and PhD students' theses.

Here is the list of main undergraduate and graduate level courses I taught at different universities.

- National Research University Higher School of Economics, Faculty of Computer Science:

  "Fundamentals of Knowledge Representation" (for PhD students)

  "Automated Methods for Program Verification" (for Master students)

- Queen Mary, University of London: ("Logic and Proof", "Programming 2: Software Engineering", "Languages, Automata, Computation", "Introduction to Logic", "Computer Science Project 2", "Algorithms and Complexity", "Computer Science Project", "MSci Computer Science Project", Departmental Adviser in "Science and Engineering Foundation Programme (SEFP)", "Computability", "Language and Communication" (2011-2012, co-teaching, O'Hearn), "Program Specifications" (2012-2013, 2013-2014, co-teaching, Malacaria))
- University of Pennsylvania ("Mathematical Theory of Computation", "Introduction to Logic and Computability", "Calculus", "Advanced Calculus", "Programming Languages and Techniques", "Analysis of Algorithms", "Computer and Network Security", "Mathematical Foundations of Computer Science", "Theory of Computation");
- Keio University, Japan ("Logic for Computer Science and Artificial Intelligence", "Complexity of Algorithms");
- Tohoku University, Japan ("Logical and Mathematical Foundations of Computer Software");
- Russian University for the Humanities ("Computational Mathematics", "Numerical Analysis", "Numerical Methods in Mathematics", "Logic", "Discrete Mathematics", "Theory of Algorithms", "Complexity of Algorithms and Computations", "Formal Methods in Linguistics", "Formal Methods in Artificial Intelligence");

- Moscow (Lomonosov) University ("Logics of Computation", "Linear Logic and its Applications");
- Tver' University ("Algebra", "Advanced Algebra", "Advanced Mathematical Analysis", "Mathematical Logic and Discrete Mathematics", "Relational Knowledge Bases and Databases", "Prolog");
- Tula Polytechnic Institute ("Linear Algebra and Geometry", "Probability Theory", "Differential Equations", "Programming Languages", "Statistical Foundations of Radio-engineering");

Teaching Assessment. I briefly discuss the experience I gained while teaching "Fundamentals of Knowledge Representation" and "Automated Methods for Program Verification" at HSE.

Based on many years of the author's teaching experience in related subjects at the University of Pennsylvania, Queen Mary, University of London and University College London, the aim of the courses at HSE is to introduce the students to some of the most successful logic based *concepts, tools and techniques* used today in CS and IT, which are behind **a major breakthrough in the practical applications** in knowledge representation systems and, in particular, in verification of systems and software.

These methods are proven to be of great theoretical and practical potential in CS and IT.
The challenge has been twofold:

- to select the material and design the course so that to make it meet the actual needs of the CS and AI applications, and
- to do that so that to allow the students *to learn and digest* all necessary ideas to efficiently accommodate modern trends in knowledge representation, and to efficiently prove that the program system behave in the correct way.

Many of the students in the course had no very strong mathematical background. At the same time, these are theoretical courses, which are concerned with reasoning about algorithms and their complexity, focusing on basic concepts applicable in all areas of computer science, such as *knowledge representation and reasoning in a static context*, and *knowledge representation and reasoning in a dynamic context*, and *tractable solutions to generally intractable problems.*

On top of that, extra help was provided for those students who were in need of it. Individual help of this sort, although time-consuming, is one of the most satisfying and enjoyable aspects of teaching, if the students are really interested in learning the material. I was excited to observe the significant improvement in their performance by the end of the courses.

Integration of research and teaching. Since my research interests are in the most innovative areas of math and computer science, it helps in planning my courses and ensuring their orientation to the actual needs of computer science and information technology.

As an example of integration of my research with my teaching and its positive feedback, I have been lucky to resolve a long-standing open problem of finding a straightforward bijection between any two equinumerous partition ideals of order 1 (The problem has been stated in the classical book "The Theory of Partitions" by G.Andrews 1976). These results have been published in: M.Kanovich, "Finding Direct Partition Bijections by Two-Directional Rewriting Techniques." *Discrete Mathematics*, 285, 2004, pp. 151-166. and M.Kanovich "The two-way rewriting in action: Removing the mystery of Euler-Glaisher's map." *Discrete Mathematics*, 307, 2007, pp. 1909-1935.

In fact, the whole topic has been inspired by my "Mathematical Foundations of Computer Science" and "Programming Languages and Techniques" courses at the University of Pennsylvania and "Algorithms and Complexity" course at Queen Mary in connection with the corresponding exercise sessions on combinatorics and recurrence relations. ■