Alexey Frolov

Curriculum Vitae

Skolkovo Institute of Science and Technology
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DOB: February 19, 1987

Education

2010–2012 **Institute for Information Transmission Problems (IITP)**, Russian Academy of Sciences, Moscow, Russia

Ph.D. in *Mathematics*

Thesis: Error-Correcting Capabilities of Non-Binary LDPC Codes
Supervisor: Prof. Victor Zyablov
Thesis Committee: Prof. Leonid Bassalygo, Prof. Eugene Krouk, Dr. Peter Trifonov

2004–2010 **Bauman Moscow State Technical University (BMSTU)**, Moscow, Russia

M.Sc. in *Computer Science*

GPA = 5.0/5.0

Research Interests

Information Theory, Communications, LDPC Codes, Polar Codes, Multiple-Access Techniques, Coding for Distributed Storage, Machine Learning

Awards and Achievements

2016 **Russian Government Award in Science and Technology for Young Scientists**

Topic: Research and development of protocols for prospective wireless networks

2013 **Moscow Government Award for Young Scientists**

Topic: Development of multiple access techniques, which increase reliability of multimedia data delivery in real time

2013 **Russian President Scholarship**

Topic: Coded modulation based on low-complexity decoded codes for next generation wireless systems

Professional Experience

2019–present **Associate Professor**, Skoltech, Center for Computational and Data-Intensive Science Engineering (CDISE), Moscow, Russia

2013–present **Senior Research Scientist**, IITP RAS, Moscow, Russia

2017–2019 **Assistant Professor**, Skoltech, Center for Computational and Data-Intensive Science Engineering (CDISE), Moscow, Russia

2016–2017 **Senior Research Scientist**, Skoltech, Center for Computational and Data-Intensive Science Engineering (CDISE), Moscow, Russia

2013–2014 **Scientific Consultant**, Huawei Technologies, R&D center, Moscow, Russia

2012–2013 **Research Scientist**, IITP RAS, Moscow, Russia

2008–2012 **Junior Research Scientist**, IITP RAS, Moscow, Russia

Projects

2018–2020	**Russian Science Foundation**, "18-19-00673 – Development of random multiple access methods for massive machine type communications", Project Leader
2018–2019	**Russian Foundation for Basic Research**, "18-37-00459 – Investigation of Coding Techniques for High-Loaded Distributed and Cloud Storage Systems", Project Leader
2018–2019	**Huawei Technologies Co. Ltd.**, "Deep Neural Network Based Decoder Design for 5G Codes", Project Leader
2017–2019	**Skoltech-MIT Next Generation Program**, "Theoretical fundamentals of random multiple-access channels with applications to massive machine-type communications and digital fingerprinting", co-PI
2017–2018	**Huawei Technologies Co. Ltd.**, "Unified FEC for optical lines", Project Leader
2017	**Strizh**, "Development of short low-complexity hard-decision decoded error-correcting codes for IoT", Project Leader
2017	**nWave (UK)**, "Development and comparison of short low-complexity soft-decision decoded error-correcting codes for IoT", Project Leader
2016–2017	**Huawei Technologies Co. Ltd.**, "Development of error-correcting codes for eMBB and URLLC scenarios of future 5G physical layer", Project Leader
2014–2015	**Huawei Technologies Co. Ltd.**, "Development of new error-correcting codes for of future 5G physical layer", Deputy Project Leader, *Huawei RRC Best Cooperation Project*
2014–2018	**Russian Science Foundation**, "14-50-00150 – Digital technologies and their applications", Lead Researcher

Visiting Researcher

2018	MIT, USA
2016	Israel Institute of Technology (Technion), Israel
2015	University of Maryland, USA
2014	Swiss Federal Institute of Technology (EPFL), Switzerland
2012	Ulm University, Germany

Skills & Abilities

Programming Languages	C/C++, MATLAB, Python
Parallel Computing	CUDA, OpenMP, MPI

Teaching & Mentoring Experience

Fall 2018	**Co-instructor** (joint with Y. Yanovich), Introduction to Blockchain, Skoltech, 3 credits
Spring 2018	**Instructor**, Information and Coding Theory, Skoltech, 6 credits
Fall 2017	**Instructor**, Modern Coding Theory, MIPT
Fall 2017	**Co-instructor** (joint with Y. Yanovich), Introduction to Blockchain, Skoltech, 3 credits
Spring 2017	**Instructor**, Information and Coding Theory, Skoltech, 6 credits
	Ph.D. students: S. Kruglik, A. Glebov, E. Marshakov
	MS students: G. Balitsky, A. Dzis, K Nazirkhanova, R. Shaniiazov, E. Chukavina

Selected Journal Publications

1. Tamo I., Barg A. and **Frolov A.**, Bounds on the Parameters of Locally Recoverable Codes // IEEE Transactions on Information Theory, 2016, 62:6, 3070–3083. ISI Web of Knowledge: 000380070600010. DOI: 10.1109/TIT.2016.2518663. Impact Factor 2.650

2. **Frolov A.**, Zyablov V., On the multiple threshold decoding of LDPC codes over GF(q) // Advances in Mathematics of Communications, 2017, 11:1, 123–137. ISI Web of Knowledge: 000397057000007. DOI: 10.3934/amc.2017007. Impact Factor 0.8

3. **Frolov A.**, Upper bound on the minimum distance of LDPC codes over GF(q) based on counting the number of syndromes. // Problems of Information Transmission, 2016, 52:1, 6–13. ISI Web of Knowledge: 000376106900002. DOI: 10.1134/S0032946016010026. Impact Factor 0.371

4. **Frolov A.**, Zyablov V., On the capacity of a multiple-access vector adder channel // Problems of Information Transmission, 2014, vol. 50 no. 2, pp. 133–143. ISI Web of Knowledge: 000339384800002. DOI: 10.1134/S0032946014020021. Impact Factor 0.371

5. Osipov D., **Frolov A.**, Zyablov V. On the User Capacity for a Multiple-Access System in a Vector Disjunctive Channel with Errors. // Problems of Information Transmission. 2013. vol. 49. no. 4. pp. 308–321, ISI Web of Knowledge: 000330766500002. DOI: 10.1134/S0032946013040029. Impact Factor 0.371

6. Osipov D., **Frolov A.**, Zyablov V. Multiple access system for a vector disjunctive channel // Probl. Inf. Transm. 2012. vol. 48. no. 3 pp. 243–249. ISI Web of Knowledge: 000310208200004. DOI: 10.1134/S0032946012030040. Impact Factor 0.371

7. **Frolov A.** and Zyablov V., Bounds on the minimum code distance for nonbinary codes based on bipartite graphs. // Problems of Information Transmission, 2011, 47:4, 327–341. ISI Web of Knowledge: 000299373700002. DOI: 10.1134/S0032946011040028. Impact Factor 0.371

8. **Frolov A.** and Zyablov V., Asymptotic estimation of the fraction of errors correctable by q-ary LDPC codes. // Problems of Information Transmission, 2010, 46:2, 142–159. ISI Web of Knowledge: 000280241600004. DOI: 10.1134/S0032946010020043. Impact Factor 0.371

9. **Frolov A.**, Zyablov V. A coding technique for Q-frequency S-user gaussian channel // Journal of Communications Technology and Electronics December 2014, Volume 59, Issue 12, pp 1483–1488, ISI Web of Knowledge:000346248200019. DOI: 10.1134/S1064226914120055. Impact Factor 0.359

10. Zyablov V., **Frolov A.** A signal-code construction for a multiple-access system using a vector channel with an additive white Gaussian noise // Journal of Communications Technology and Electronics August 2012, Volume 57, Issue 8, pp 953–957, ISI Web of Knowledge:000308549500022. DOI: 10.1134/S1064226912080104. Impact Factor 0.359

Selected Conference Publications

1. Kruglik S., **Frolov A.**, Bounds and Constructions of Codes with All-Symbol Locality and Availability // In Proc. IEEE Int. Symp. Inf. Theory, Aachen, Germany, June 25–30, 2017, pp. 1023–1027. DOI: 10.1109/ISIT.2017.8006683

2. Kruglik S., Dudina M., Potapova V., **Frolov A.** On One Generalization of LRC Codes with Availability // In Proc. IEEE Information Theory Workshop (ITW), Kaohsiung, Taiwan. pp.1–5, November 6-10, 2017

3. **Frolov A.**, An Upper Bound on the Minimum Distance of LDPC Codes over GF(q) // In Proc. IEEE Int. Symp. Inf. Theory, Hong Kong, China, June 14–19 2015, pp. 2885–2888. ISI Web of Knowledge:000380904702189. DOI: 10.1109/ISIT.2015.7282984

4. **Frolov A.** and Zyablov V., On the Multiple Threshold Decoding of LDPC codes over GF(q) // In Proc. IEEE Int. Symp. Inf. Theory, Hong Kong, China, June 14–19 2015, pp. 2673–2677. ISI Web of Knowledge:000380904702146. DOI: 10.1109/ISIT.2015.7282941

5. **Frolov A.** and Zyablov V., A new coding method for a multiple-access system with a large number of active users // In Proc. IEEE Information Theory Workshop (ITW), Jerusalem, Israel. pp.1–5, April 26-May 1 2015, ISI Web of Knowledge: 000381501800039. DOI: 10.1109/ITW.2015.7133114

6. **Frolov A.**, Zyablov V., Sidorenko V., Fischer R., On a multiple-access in a vector disjunctive channel. // In Proc. IEEE International Symposium on Information Theory, Istanbul, Turkey, July 7–12, 2013. P. 211–215. ISI Web of Knowledge:000348913400043. DOI: 10.1109/ISIT.2013.6620218

7. **Frolov A.**, Coding for S-User Vector Adder Channel // In Proc. XIV International Symposium on Problems of Redundancy in Information and Control Systems (REDUNDANCY), St Petersburg, Russia, pp. 43–46, June 01-05, 2014, ISI Web of Knowledge: 000380509700011. DOI: 10.1109/RED.2014.7016702

8. **Frolov A.**, Rybin P., Ivanov F. On Iterative LDPC-Based Joint Decoding Scheme for Binary Input Gaussian Multiple Access Channel // 2016 XV International Symposium "Problems of Redundancy in Information and Control Systems" (REDUNDANCY), Saint-Petersburg, Russia. September 26-29, 2016. P. 48–52

9. Osipov D., **Frolov A.**, Zyablov V. On the Capacity of a PPM UWB Multiple-Access System with a Single User Noncoherent Reception. // In Proc. Wireless Access Flexibility First International Workshop. Kaliningrad, 2013. P. 49–57. DOI: 10.1007/978-3-642-39805-6_5

10. **Frolov A.**, Zyablov V. Upper and Lower Bounds on the Minimum Distance of Expander Codes // Proc. of IEEE International Symposium on Information Theory (ISIT 2011), Saint-Petersburg, Russia. 2011.–Jul./Aug. P. 1302–1306

Invited Talks

Feb. 2019	Deep Neural Network Based Decoding of Short 5G LDPC Codes, German Aerospace Center (Deutschen Zentrums fur Luft- und Raumfahrt, DLR), Germany
Feb. 2019	Energy-efficient coded random access with applications to massive machine-type communications, Institute for Communications Engineering, Technical University of Munich (TUM), Germany
Dec. 2018	New Bounds and Generalizations of Locally Recoverable Codes with Availability, Dagstuhl Seminar "Algebraic Coding Theory for Networks, Storage, and Security", Germany
Oct. 2018	Energy-efficient coded random access with applications to massive machine-type communications, Laboratory for Information and Decision Systems Seminar, MIT, USA
Feb. 2018	Deep Neural Network Based Decoding of Error-Correcting Codes, Laboratory for Information and Decision Systems Seminar, MIT, USA
Dec. 2017	Deep Learning-Based Channel Decoding, The 4th International Professors Day on ICT Algorithm Design (ICTAD-2017), Huawei Russian Research Center
Dec. 2016	Coding for High-Loaded Distributed and Cloud Storage Systems, The 3rd Professor Day Academic Conference, Huawei Russian Research Center
Sep. 2016	The Analysis of Error-Correcting Capabilities of Non-Binary LDPC Codes, Séminare de Cryptographie Université de Rennes 1, Rennes, France
March 2016	The Analysis of Hard-Decision Multi-Threshold Decoding of Non-Binary LDPC Codes, Coding Theory Seminar, Israel Institute of Technology (Technion), Israel
Dec. 2015	Iterative Coding Schemes for Random and Deterministic Multiple Access, Huawei Technologies 2nd Professors Day, Huawei Russian Research Center
Feb. 2015	On the Multiple Threshold Decoding of q-ary LDPC codes, Communication, Control and Signal Processing Seminar, University of Maryland, USA
Nov. 2012	Multiple access system for a vector disjunctive channel, Ulm University, Germany

Professional Service

Session Chair:
- IEEE Information Theory Workshop (ITW), 2015.

Reviewer:
- IEEE Transactions on Information Theory.
- IEEE Transactions on Communications.
- IEEE Communications Letters.
- Problems of Information Transmission
- Designs, Codes and Cryptography
- Advances in Mathematics of Communications
- Discrete Mathematics
- EURASIP Journal on Advances in Signal Processing
- EURASIP Journal on Wireless Communications and Networking
- IEEE Wireless Communications Letters
- IEEE International Symposium on Information Theory (ISIT)
- IEEE Information Theory Workshop (ITW)

Languages

English **Fluent**
Russian **Native Speaker**