

# Alexey Frolov

## Curriculum Vitae

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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

- 2017–present **Assistant Professor**, Skoltech, Center for Computational and Data-Intensive Science Engineering (CDISE), Moscow, Russia
- 2013–present **Senior Research Scientist**, IITP RAS, 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

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## Projects

- 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

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## 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

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## Skills & Abilities

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

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## Teaching & Mentoring Experience

- Spring 2018 **Instructor**, Information and Coding Theory, Skoltech, 6 credits
- Fall 2017 **Instructor**, Modern Coding Theory, MIPT
- Fall 2017 **Instructor**, Introduction to Blockchain, Skoltech, 3 credits
- Spring 2017 **Instructor**, Information and Coding Theory, Skoltech, 6 credits
- Ph.D. students:* S. Kruglik
- MS students:* M. Malakhova and A. Glebov
- BS students:* G. Balitsky, A. Dzis, K Nazirkhanova

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## 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. 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, Séminaire 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 (ITA), 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)

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**Languages**

English **Fluent**

Russian **Native Speaker**