

Professor of Mathematics and  
Electrical and Computer Engineering,  
University of Illinois at Urbana-Champaign

ymb@illinois.edu  
(646) 770-2330, (217) 244-3392  
<http://ymb.web.illinois.edu>

## appointments

- 2011 - **Professor of Mathematics and Electrical Engineering, Research Professor at Coordinated Sciences Lab**, University of Illinois at Urbana-Champaign, IL.
- 2019-2020 **Professor at Institute of Mathematics for Industry**, Kyushu University, Japan
- 2003 - 2011 **Adjunct Professor in Electrical Engineering**, Columbia University, New York, NY.
- 2001 - 2011 **Department Head** (before 2006, **Member of Technical Staff**) Industrial Mathematics and Operations Research, Bell Laboratories, Murray Hill, NJ.
- 2000 - 2001 **Professor** at the Department of Mathematics, University of Versailles, France.
- 1998 - 2000 **Researcher** at EURANDOM, Technical University of Eindhoven.
- 1993 - 1997 **Habilitation Fellow** of Deutsche Forschungsgemeinschaft. **Habilitation** in June 1998.
- 1995 - 1997 **Lecturer**, School of Mathematics, University of Hull, Kingston-upon-Hull, England.
- 1992 - 1993 **Wissenschaftlicher Mitarbeiter**, Department of Mathematics, Osnabrück University.
- 1991 - 1992 **Alexander-von-Humboldt Research Fellow** at the Department of Mathematics, Osnabrück University.
- 1986 - 1991 **Research Fellow**, Institute for Control Sciences, Moscow.

## education

- 1983 - 1987 **PhD study**, Institute for Control Sciences, Moscow. PhD in Applied Mathematics in 1987.
- 1977 - 1982 **MSc**, Applied Mathematics, Moscow Institute of Railroad Engineering, Moscow.

## awards

- 2006 Lady Davis Professorship at Technion
- 1993-1996 Habilitation Fellowship of the DFG (German Science Foundation)
- 1990-1991 Alexander von Humboldt Research Fellowship

## select service

2019-	Associate Editor, Stochastic Models.
2017-	Associate Editor, International Journal of Mathematics for Industry.
2017-	Associate Editor, Journal of Applied and Computational Topology.
2017-2019	AMS Committee on Mathematical Research Communities, Chair.
2016	Organizer: ICERM topical semester on <i>Topology in Motion</i> .
2014-2019	Director: Program on Illinois Industrial and Interdisciplinary Internship.
2009 - 2012	AMS Short Courses Committee.

## recent grants

2018 - 23	MURI: Science of Embodied Innovation, Learning and Control, ARO, \$750K, PI.
2016 - 21	Collaborative Research: Topological Invariants for Enhanced Data Analysis, NSF-DMS, \$190K, PI.
2015 - 18	Identifying Subgroups of Tinnitus using Novel Resting State fMRI Biomarkers and Cluster Analysis, DoD, \$745K, Co-PI.
2014 - 20	Program for Interdisciplinary and Industrial Internships at Illinois, NSF-DMS, \$1,200K, PI.

## extended research visits

3-7. 2018	University of Bremen, Bremen, Germany.
8-12. 2017	University of Pennsylvania, PA, USA.
5-6. 2008	Hebrew University, Jerusalem, Israel.
1-2, 5. 2006	Technion, Haifa, Israel.
6. 2003	Hebrew University, Jerusalem, Israel.
1-2. 2000	DIMACS, Rutgers University, NJ, USA.
8-9. 1998	IHES, Bures-sur-Yvette, France.

## research interests (with pointers to the publications):

applied topology, dynamical systems and singularities

applied topology: A-[2, 3, 4, 12, 16, 14, 11, 22, 23, 24, 30, 54, 64, 60, 80, 79, 81, 82], B-[1];  
dynamics: A-[18, 20, 26, 42, 50, 62, 63, 71]; singularities: A-[6, 10, 13, 57, 54, 64, 80];  
random walks on manifolds: A-[1, 5, 28, 62, 63].

probability theory and applications, analytic combinatorics

Stochastic geometry, random convex hulls and multidimensional extrema: A-[25, 34, 39, 36, 55, 58, 59, 65, 67, 68, 70, 72, 83, 86, 87, 51, 44] B-[2]. characterization of probability distributions: A-[53, 69, 73, 74, 75, 76], analytic methods: A-[9, 8, 11, 27, 31].

networks, control, data analysis, mathematical economics, applications in physics and biology

sensor networks A-[33, 37, 38, 40]. control: A-[17], stochastic networks and queueing systems: A-[29, 55, 47, 48], optimal control: A-[56, 84, 88], topological theory of social choice: A-[57, 61, 66, 77, 85]

## A: papers

- [1] Yu. Baryshnikov, M. Kvalheim, Flux in tilted potential systems: negative resistance and persistence, 2021
- [2] Yu. Baryshnikov, Topological Perplexity of Feedback Stabilization, 2021.
- [3] Yu. Baryshnikov, Linear Obstacles in Linear Systems and Ways to Avoid Them, 2021.
- [4] M. Assif PK, Yu. Baryshnikov, Biparametric persistence for smooth filtrations, 2021.
- [5] Yu. Baryshnikov, On Random Quantum Random Walks, preprint, 2020.
- [6] Yu. Baryshnikov, Euler Characteristics of Exotic Configuration Spaces, preprint, 2020.
- [7] Yu. Baryshnikov, Time Series, Persistent Homology and Chirality, preprint, 2019.
- [8] Yu. Baryshnikov, S. Melczer, R. Pemantle, Asymptotics of multivariate sequences in the presence of a lacuna, preprint, 2019.
- [9] Yu. Baryshnikov, S. Melczer, R. Pemantle, Stationary points at infinity for analytic combinatorics, *Found. of Comp. Math.*, 21, 3, 2021.
- [10] Yu. Baryshnikov, B. Shapiro, Quadratic Differentials and Signed Measures, *J. d'Analyse Math.*, 2021.
- [11] M. Arnold, Yu. Baryshnikov, Yu. Mileyko, Typical representatives of free homotopy classes in multi-punctured plane, *Journal of Topology and Analysis*, 11, n. 3, pp. 623-659, 2019.
- [12] Yu. Baryshnikov, R. Ghrist, Minimal Unimodal Decomposition On Trees *J. Appl. Comp. Topology*, 4, pp. 199–209 (2020)
- [13] Yu. Baryshnikov, S. Melczer, R. Pemantle, A. Straub, Diagonal asymptotics for symmetric rational functions via ACSV, *29th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms*, Art. No. 12, 15 pp., LIPIcs. 110, 2018.
- [14] Yu. Baryshnikov, R. Ghrist, Stokes's Theorem, Data, & the Polar Ice Caps, *The American Mathematical Monthly*, 125, n. 9, pp. 830–834, 2018.
- [15] B. J. Zimmerman, I. Abraham, S. A. Schmidt, Yu. Baryshnikov, F. T. Husain, Dissociating tinnitus patients from healthy controls using resting state cyclicity analysis and clustering, *Netw. NeuroSci.*, n. 1, pp. 67–89, 2018
- [16] Yu. Baryshnikov, C. Klivans, N. Kosar, On the Topology of No- $k$ -equal Spaces, *arXiv:1708.00032*, 2017.
- [17] A. Agrachev, Yu. Baryshnikov, A. Sarychev, Ensemble controllability by Lie algebraic methods, *ESAIM: Cont., Opt. and Calc. Var.*, 2016.

- [18] Yu. Baryshnikov, J. Duda, W. Szpankowski, Types of Markov Fields and Tilings, *IEEE Trans. on Information Theory*, 2016.
- [19] H. Wang, C. Chen, Yu. Baryshnikov, A design of hybrid feedback stabilization on 1D coverage, *2016 American Control Conference (ACC)*, 5154–5160, 2016.
- [20] Yu. Baryshnikov, V. Blumen, K. Kim, V. Zharnitsky, Billiard dynamics of bouncing dumbbell, *Physica D: Nonlinear Phenomena*, **269**, 21–27, 2015.
- [21] H. Wang, C. Chen, Yu. Baryshnikov, Topological Perspective on Cycling Robots for Full Tree Coverage, *Algorithmic Foundations of Robotics XI*, 659–675, Springer, 2015.
- [22] Yu. Baryshnikov, B. Shapiro, How to Run a Centipede: a Topological Perspective, In: *Geometric Control Theory and sub-Riemannian Geometry*, Springer INdAM Series 5, 37–51, 2014.
- [23] Yu. Baryshnikov, R. Ghrist, M. Wright, Hadwiger’s Theorem for Definable Functions, *Adv. Math.*, 245, 573–586, 2013.
- [24] Yu. Baryshnikov, P. Bubenik, M. Kahle Min-Type Morse Theory for Configuration Spaces of Hard Spheres, *Int. Math. Res. Notices*, doi:10.1093/imrn/rnt012, 2013.
- [25] M. Arnold, Yu. Baryshnikov, S. M. LaValle, Convex Hull Asymptotic Shape Evolution, In: *Algorithmic Foundations of Robotics X*, 349–364, Springer, 2012.
- [26] Yu. Baryshnikov, V. Zharnitsky, Search on the brink of chaos, *Nonlinearity* **25**, 3023–3047, 2012.
- [27] Yu. Baryshnikov and R. Pemantle, Asymptotics of multivariate sequences: quadratic points, *Adv. Math.*, **228**, no. 6, 3127–3206, 2011
- [28] Yu. Baryshnikov, W. Brady, A. Bressler and R Pemantle, Two-dimensional quantum random walk, *J. Stat. Phys.*, **142**, pp. 78–107, 2011.
- [29] Yu. Baryshnikov, F. Bonahon, E. Jonckheere and M. Lou Euclidean versus hyperbolic congestion in idealized versus experimental networks. *Internet mathematics*, 7, no. 1, 1–27, 2011.
- [30] Y. Baryshnikov and R. Ghrist, Unimodal Category and Topological Statistics, *Proc. NOLTA*, 2011.
- [31] Yu. Baryshnikov, D. Romik, Enumeration formulas for Young tableaux in a diagonal strip, *Israel J. Math.*, **178**, pp.157–186, 2010.
- [32] Yu. Baryshnikov, R. Ghrist, Euler integration over definable functions, *Proc. Natl. Acad. Sci. USA*, **107**, pp.9525–9530, 2010.
- [33] Yu. Baryshnikov, R. Ghrist, Target enumeration via Euler characteristic integrals, *SIAM J. Appl. Math.*, **70**, pp. 825–844, 2009.
- [34] Yu. Baryshnikov, M. Penrose, J. Yukich, Gaussian limits for generalized spacings, *Ann. Appl. Probab.*, **19**, pp. 158–185, 2009.
- [35] Yu. Baryshnikov, P. Eichelsbacher, T. Schreiber, J. Yukich, Moderate deviations for some point measures in geometric probability, *Ann. Inst. Henri Poincaré Probab. Stat.*, **44**, pp. 422–446, 2008.

- [36] Yu. Baryshnikov, On expected number of maximal points in polytopes, *DMTCS*, 2007 Conference on Analysis of Algorithms, AofA 07, pp. 227–236, 2008.
- [37] Yu. Baryshnikov, E. G. Coffman, K. J. Kwak, W. Moran Target Count Recovery from Sensing Error, or: Noise is Good , *LNCS (DCOSS'08 Proceedings)*, 2008.
- [38] Yu. Baryshnikov, E. G. Coffman, K. J. Kwak High Performance Sleep-Wake Sensor Systems based on Cyclic Cellular Automata , *LNCS (IPSN'08 Proceedings)*, 2008.
- [39] Yu. Baryshnikov, P. Eichelsbacher, T. Schreiber and J. Yukich Moderate deviations for some point measures in geometric probability, *Ann. Inst. Henri Poincaré Probab. Stat.* **44**, 422–446, 2008.
- [40] Yu. Baryshnikov and J. Tan On localization problem in anchoritic sensor networks, *Springer LNCS*, **4549**, 82-96, 2007.
- [41] Yu. Baryshnikov, Ed Coffman and B. Yimwadsana, On Times to Compute Shapes in 2D Tile Self-assembly, *Springer LNCS*, **4287**, 215-222, 2006.
- [42] Yu. Baryshnikov and V. Zharnitsky. Sub-Riemannian geometry and periodic orbits in classical billiards, *Mathematical Research Letters*, **4**, 587-598, 2006.
- [43] Yu. Baryshnikov, E. Coffman, J. Feng and P Momčilović. Asymptotic analysis of a nonlinear AIMD algorithm, *2005 International Conference on Analysis of Algorithms, Discrete Math. Theor. Comput. Sci. Proc., DMTCS*, 27-37, 2006.
- [44] Yu. Baryshnikov and J. Yukich. Gaussian limits for random measures in geometric probability, *Ann. Appl. Prob.*, **15**, 213-253, 2005.
- [45] Yu. Baryshnikov, E. G. Coffman, and P. Momcilovic. DNA-Based Computation Times, *Springer Lect. Notes Comp. Sci.*, **3384**, 14 - 23, 2005.
- [46] Yu. Baryshnikov, P. Heider, W. Parz and V. Zharnitsky. Whispering gallery modes inside the asymmetric resonant cavities, *Phys. Rev. Letters*, **93**, 4839-4842, 2004.
- [47] Yu. Baryshnikov, E. G. Coffman, and P. Jelenkovic. Space filling and depletion, *J. App. Prob.*, **41**, 1-12, 2004.
- [48] Yu. Baryshnikov, E. G. Coffman, and P. Jelenkovic, P. Momcilovoc and D. Rubenstein Flood search under the California Split rule, *Operations Research Letters* **32(3)**,199-206, 2003.
- [49] Andrew, L. L. H., Baryshnikov, Y., Coffman, E. G., Jr., Hanly, S. V., and White, J., An Asymptotically Optimal Greedy Algorithm for Large Optical Burst Switching Systems, *Perf. Eval. Rev.* , **31**, 2003.
- [50] Yu. Baryshnikov and V. Zharnitsky. Billiards and Non-holonomic systems. *Zapiski Nauchnyh Seminarov POMI*, **300** (*Representation Theory, Dynamical Systems. Special Issue. Part 8; editors A. M. Vershik and N. V. Svanidze*, 56-64, 20
- [51] Yu. Baryshnikov and J. Yukich. Gaussian limits and random parking, 2002, *J. Stat. Physics*, **111**, no. 1-2:443–463, 2003.

- [52] Yu. Baryshnikov, E.G. Coffman, and P. Jelenkovic. Kelly's LAN Model Revisited. *Performance Evaluation Review*, 29:28–29, 2001.
- [53] Yu. Baryshnikov. GUEs and queues. *Probab. Theory Related Fields*, 119(2):256–274, 2001.
- [54] Yu. Baryshnikov. On Stokes sets. In *New developments in singularity theory (Cambridge, 2000)*, pages 65–86. Kluwer Acad. Publ., Dordrecht, 2001.
- [55] Yu. Baryshnikov and A. Gnedin. Counting intervals in the packing process. *Ann. Appl. Probab.*, 11(3):863–877, 2001.
- [56] D. Assaf, Yu. Baryshnikov, and W. Stadje. Optimal strategies in a risk selection investment model. *Adv. in Appl. Probab.*, 32(2):518–539, 2000.
- [57] Yu. Baryshnikov. On isotopic dictators and homological manipulators. *J. Math. Econom.*, 33(1):123–134, 2000.
- [58] Yu. Baryshnikov. Supporting-points processes and some of their applications. *Probab. Theory Related Fields*, 117(2):163–182, 2000.
- [59] Yu. Baryshnikov and A. V. Gnedin. Sequential selection of an increasing sequence from a multidimensional random sample. *Ann. Appl. Probab.*, 10(1):258–267, 2000.
- [60] Yu. Baryshnikov. On small Carnot-Carathéodory spheres. *Geom. Funct. Anal.*, 10(2):259–265, 2000.
- [61] Yu. Baryshnikov and G. Chichilnisky. Intergenerational choice: a paradox and a solution. In *Topology and markets (Waterloo, ON, 1994)*, pages 99–110. Amer. Math. Soc., Providence, RI, 1999.
- [62] Yu. Baryshnikov. Wiener soccer and its generalization. *Electron. Comm. Probab.*, 3:1–11 (electronic), 1998.
- [63] Yu. Baryshnikov and W. Stadje. Asymptotics of damped periodic motions with random initial speed. *Math. Nachr.*, 189:5–21, 1998.
- [64] Yu. Baryshnikov. Bifurcation diagrams of quadratic differentials. *C. R. Acad. Sci. Paris Sér. I Math.*, 325(1):71–76, 1997.
- [65] Yu. Baryshnikov. Gaussian samples, regular simplices, and exchangeability. *Discrete Comput. Geom.*, 17(3):257–261, 1997.
- [66] Yu. Baryshnikov. Topological and discrete social choice: in a search of a theory. *Soc. Choice Welf.*, 14(2):199–209, 1997. Topological social choice.
- [67] Yu. Baryshnikov. How many variants can be optimal? *Mat. Model.*, 8(4):79–88, 1996.
- [68] Yu. Baryshnikov and E. S. Orlova. Determination of maxima for arbitrary orders. *Avtomat. i Telemekh.*, (1):139–148, 1996.
- [69] Yu. Baryshnikov. Counting the shape of a drum. *Adv. in Appl. Math.*, 17(1):101–116, 1996.

- [70] Yu. Baryshnikov, B. Eisenberg, and G. Stengle. A necessary and sufficient condition for the existence of the limiting probability of a tie for first place. *Statist. Probab. Lett.*, 23(3):203–209, 1995.
- [71] Yu. Baryshnikov. Complexity of trajectories in rectangular billiards. *Comm. Math. Phys.*, 174(1):43–56, 1995.
- [72] Yu. Baryshnikov and R. Vitale. Regular simplices and Gaussian samples. *Discrete Comput. Geom.*, 11(2):141–147, 1994.
- [73] Yu. Baryshnikov and Wolfgang Stadge. An inverse problem for trigonometric polynomials: does the distribution of a homogeneous polynomial in a Gaussian random point define the polynomial? *Adv. in Appl. Math.*, 15(3):336–359, 1994.
- [74] Yu. Baryshnikov and W. Stadge. On sets of integers with prescribed gaps. *Monatsh. Math.*, 116(2):83–98, 1993.
- [75] Y. Baryshnikov and B. Eisenberg. Independent events and independent experiments. *Proc. Amer. Math. Soc.*, 118(2):615–617, (1993).
- [76] Yu. Baryshnikov, B. Eisenberg, and W. Stadge. Independent variables with independent sum and difference:  $S^1$ -case. *J. Multivariate Anal.*, 45(2):161–170, 1993.
- [77] Yu. Baryshnikov. Unifying impossibility theorems: a topological approach. *Adv. in Appl. Math.*, 14(4):404–415, 1993.
- [78] Yu. Baryshnikov, V. V. Podinovskii, and M. V. Polyashuk. Efficiency of decision rules in multicriterial problems of the choice of some best variants. *Avtomat. i Telemekh.*, (12):136–142, 1990.
- [79] Yu. Baryshnikov. Topology of surgeries of nonsmoothness sets of minimum functions of variational problems. *Funktsional. Anal. i Prilozhen.*, 24(3):62–63, 1990.
- [80] Yu. Baryshnikov. Real vanishing inflections and boundary singularities. In *Theory of singularities and its applications*, pages 129–135. Amer. Math. Soc., Providence, RI, 1990.
- [81] Yu. Baryshnikov. Indices for extremal embeddings of 1-complexes. In *Theory of singularities and its applications*, pages 137–144. Amer. Math. Soc., Providence, RI, 1990.
- [82] Yu. Baryshnikov. A Hamiltonian form of nonholonomic variational problems. *Uspekhi Mat. Nauk*, 45(1(271)):167–168, 1990.
- [83] Yu. Baryshnikov. The average number of variants that cannot be dominated in V. V. Podinovskii comparisons. *Avtomat. i Telemekh.*, (6):161–165, 1990.
- [84] Yu. Baryshnikov, B. A. Berezovskiy, and A. V. Gnedin. On a class of best-choice problems. *Inform. Sci.*, 39(1):111–127, 1986.
- [85] Yu. Baryshnikov and B. A. Berezovskii. Asymptotic equivalence of choice functions. *Avtomat. i Telemekh.*, (10):101–105, 1986.

- [86] Yu. Baryshnikov. The distribution of the number of nondominating variants. *Izv. Akad. Nauk SSSR Tekhn. Kibernet.*, (3):47–50, 217, 1986.
- [87] Yu. Baryshnikov. Mathematical expectation of the number of variants that are nondominated with respect to a binary relation. *Avtomat. i Telemekh.*, (6):111–116, 1985.
- [88] Yu. Baryshnikov, B. A. Berezovskiĭ, and A. V. Gnedin. The probability of stopping on a non-dominated variant. *Avtomat. i Telemekh.*, (10):131–137, 1984.

## patents

- [1] US Patent **10,959,670** Automated, Objective Method of Assessing Tinnitus Condition
- [2] US Patent **8,355,324** Method and apparatus for filtering data packets
- [3] US Patent **8,140,261** Locating sensor nodes through correlations

## books, chapters in books

- [1] V. I. Arnol'd, Yu. Baryshnikov and I. A. Bogayevsky In: S. N. Gurbatov, A. N. Malakhov, and A. I. Saichev. *Nonlinear random waves and turbulence in nondispersive media: waves, rays, particles*. Manchester University Press, Manchester, 1991.
- [2] B. A. Berezovskiĭ, Yu. Baryshnikov, V. I. Borzenko, and L. M. Kempner. *Mnogokriterialnaya optimizatsiya*. “Nauka”, Moscow, 1989.