

Karol Filip Bołbotowski

Curriculum Vitae

Personal Information

Full name: Karol Filip Bołbotowski
Date of birth: 3 March 1989
City of residence: Warsaw, Poland
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Academic Education

Degree studies

Institution: Warsaw University of Technology, Faculty of Civil Engineering
Year of graduation: 2014
Programme: Civil Engineering, specialization: Theory of Structures
Master's thesis: Problems of statics and optimal designing of plane frames with deformational constraints. Symbolic computation program within the Mathematica environment.
Supervisor: Tomasz Lewiński

Doctorate

Institutions: Doctoral studies at the College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences (MISMaP), University of Warsaw; doctoral proceedings conducted by the Faculty of Civil Engineering, Warsaw University of Technology, in cooperation with the Faculty of Mathematics, Informatics and Mechanics, University of Warsaw, under an agreement between Warsaw University of Technology and the University of Warsaw.
Year PhD awarded: 2022
Field: Engineering and Technical Sciences
Discipline: Civil Engineering and Transport
Dissertation title: *Elastic bodies and structures of the optimum form, material distribution and anisotropy*, [link to dissertation](#)
Supervisors: Tomasz Lewiński, Piotr Rybka
Reviewers: Robert V. Kohn, Jan Sokołowski

Employment

Assistant Professor

Institution: University of Warsaw, Faculty of Mathematics, Informatics and Mechanics
Employment period: October 2026 – May 2029
Position: Samuel Eilenberg Assistant Professor at the Institute of Applied Mathematics and Mechanics.

Postdoctoral researcher

Institution: University of Warsaw, Faculty of Mathematics, Informatics and Mechanics
Employment period: January 2026 – September 2026
Position: Postdoctoral researcher in an OPUS project *Calculus of variation for Machine Learning Problem* funded by the National Science Centre, Poland, led by Błażej Miasojedow.

Postdoctoral researcher

Institution: University of Warsaw, Faculty of Mathematics, Informatics and Mechanics
Employment period: October 2025 – December 2025
Position: Postdoctoral researcher in the IDUB TPB project *Evolutionary PDEs 2025* led by Iwona Chlebicka

Postdoctoral researcher

Institution: Institut Louis Bachelier, office at the Lagrange Mathematics and Computing Research Center in Paris
Employment period: September 2023 – August 2025
Position: Postdoctoral researcher in the *Optimal Transport* group led by Guillaume Carlier, Alessio Figalli, Quentin Mérigot, and Filippo Santambrogio.

Assistant professor

Institution: Warsaw University of Technology, Faculty of Civil Engineering
Employment period: September 2022 – September 2025; sabbatical from Sep. 2023 to Aug. 2025
Position: Assistant professor at the Department of Structural Mechanics and Computer Aided Engineering.

Research and teaching assistant

Institution: Warsaw University of Technology, Faculty of Civil Engineering
Employment period: April 2014 – August 2022
Position: Research and teaching assistant at the Department of Structural Mechanics and Computer Aided Engineering.

Research visits and fellowships

University of Münster, Mathematics Münster Cluster of Excellence

Visit period: Autumn 2025, 4 weeks
Host: Benedikt Wirth
Role/purpose: Conducting research as a [Young Research Fellow](#) on the optimal design of trusses with a subadditive cost function using methods of branched optimal transport.

University of Jyväskylä, Department of Mathematics and Statistics

Visit period: Winter 2025, 1 week
Host: Danko Lučić
Role/purpose: Conducting research on optimal mass distribution and Sobolev and BV spaces with respect to a measure.

Université de Toulon, Institut de Mathématiques de Toulon

Visit periods: Autumn 2019, 9 weeks; winter 2020, 3 weeks; summer 2022, 2 weeks; summer 2025, 1 week
Host: Guy Bouchitté
Role/purpose: Conducting research on applications of optimal transport in structural design.

University of California, Los Angeles, Department of Mathematics

Visit period: Autumn 2017, 4 weeks
Host: Wilfrid Gangbo
Role/purpose: Conducting research on applications of optimal transport in grillage design.

University of Sheffield, Department of Civil Engineering

Visit period: Autumn 2016, 4 weeks
Host: Matthew Gilbert
Role/purpose: Conducting research on numerical methods in optimal grillage design.

Participation in Research Projects

Participation in international projects

Project at the Lagrange Mathematics and Computing Research Center, Paris

Project title: *Optimal Transport*
Funding institution: Huawei, France
Project leaders: Guillaume Carlier, Alessio Figalli, Quentin Mérigot, and Filippo Santambrogio
Duration: 2021 – 2026
Role: Postdoctoral researcher

Leadership of national projects

PRELUDIUM NCN Project

Project title: *Topology optimization of thin elastic shells – a method synthesizing shape and free material design*
Project number: 2015/19/N/ST8/00474
Funding institution: National Science Center, Poland
Duration: July 2016 – July 2020
Role: Project leader and principal investigator

Participation in national projects

OPUS NCN Project

Project title: *Calculus of variation for Machine Learning Problem*
Project number: 2024/55/B/ST6/01694
Funding institution: National Science Center, Poland
Project leader: Błażej Miasojedow
Duration: June 2025 – June 2029
Role: Postdoctoral researcher

IDUB project, Thematic Research Programme

Project title: *Evolutionary PDEs*
Funding institution: University of Warsaw
Project leader: Iwona Chlebicka
Duration: January 2025 – December 2025
Role: Postdoctoral researcher

OPUS NCN Project

Project title: *Merging the optimum design problems of structural topology and the optimal choice of material characteristics. The theoretical foundations and numerical methods.*
Project number: 2019/33/B/ST8/00325
Funding institution: National Science Center, Poland
Project leader: Tomasz Lewiński
Duration: March 2020 – March 2023
Role: Investigator

OPUS NCN Project

Project title:	<i>Topology optimization of engineering structures. An approach synthesizing the methods of: free material design, composite design and Michell-like trusses.</i>
Project number:	2013/11/B/ST8/04436
Funding institution:	National Science Center, Poland
Project leader:	Tomasz Lewiński
Duration:	July 2014 – December 2017
Role:	Investigator

Publications and Preprints

1. Bołbotowski, K.: Bi-martingale optimal transport and its applications. Preprint arXiv:2510.27451, 2025. [\[link\]](#)
2. Bołbotowski, K., Bouchitté, G.: Sharp inequalities between Zolotarev and Wasserstein distances in $\mathcal{P}_2(\mathbb{R}^d)$. Preprint arXiv:2511.00232, 2025. [\[link\]](#)
3. Fairclough, H., Bołbotowski, K., He, L., Liew, A., Gilbert, M.: Topology and geometry optimization of grid-shells incorporating design-dependent self-weight loading. *Comput. Struct.*, 320 Article no. 107997, 2026. [\[link\]](#)
4. He, L., Fairclough, H., Gilbert, M., Liew, A., Bołbotowski, K.: Minimum material vault designs generated via adaptive layout optimization. *Eng. Struct.*, 334 Article no. 120213, 2025. [\[link\]](#)
5. Bołbotowski, K., Czarnecki, S., Lewiński, T.: The Isotropic Material Design methods with the cost expressed by the L^p -norm. Preprint arXiv:2502.03161, 2025. [\[link\]](#)
6. Bołbotowski, K., Bouchitté, G.: Kantorovich-Rubinstein duality theory for the Hessian. Preprint arXiv:2412.00516, 2024. (to appear in *Duke Math. J.*) [\[link\]](#)
7. Bołbotowski, K.: Optimal design of plane elastic membranes using the convexified Föppl's model. *Appl. Math. Optim.*, 90 Article no. 23, 2024. [\[link\]](#)
8. Bołbotowski, K., Lewiński, T.: Setting the Free Material Design problem through the methods of optimal mass distribution. *Calc. Var. Partial Differ. Equ.*, 61 Article no. 76, 2022. [\[link\]](#)
9. Bołbotowski, K.: Optimal vault problem – form finding through 2D convex program. *Comput. Math. Appl.*, 109:280–324, 2022. [\[link\]](#)
10. Bołbotowski, K., Bouchitté, G.: Optimal design versus maximal Monge-Kantorovich metrics. *Arch. Ration. Mech. Anal.*, 243:1449–1524, 2022. [\[link\]](#)
11. Bołbotowski, K.: Higher order weighted Sobolev spaces on the real line for strongly degenerate weights. Application to variational problems in elasticity of beams. *J. Math. Anal. Appl.*, 488 Article no. 124038, 2020. [\[link\]](#)
12. Bołbotowski, K., Lewiński, T., Sokół T.: Michell Structures within L-shaped domains. *Computer Assisted Methods in Engineering and Science*, 27:185–204, 2020. [\[link\]](#)
13. Bołbotowski, K., He, L., Gilbert, M.: Design of optimum grillages using layout optimization. *Struct. Multidisc. Optim.*, 58:851–868, 2018. [\[link\]](#)
14. Lewiński, T., Rozvany, G.I.N., Sokół, T., Bołbotowski, K.: Exact analytical solutions for some popular benchmark problems in topology optimization III: L-shaped domains revisited. *Struct. Multidisc. Optim.*, 47:937–942, 2018. [\[link\]](#)

Conference and Workshop Talks

- Bołbotowski, K.; Bouchitté, G. *Design of grillages via optimal transport*. Minisymposium: "Recent Advances on Methods and Algorithms for Structural Optimization" at the SIAM Conference on Optimization (OP26), Edinburgh, June 2-5, 2026. Invited by the minisymposium organizers.
- Bołbotowski, K.; Bouchitté, G. *Zolotarev metric as an alternative for Wasserstein*. Conference: Warsaw Analysis Days Event WADE25, University of Warsaw, 22–26 September 2025. Organizers: K. Mazowiecka, A. Zatorska-Goldstein. Invited by the organizers.
- Bołbotowski, K.; Bouchitté, G. *Zolotarev distance, optimal elastic systems, and a pair of diffusions*. Workshop: Diffusion in Warsaw, University of Warsaw, Faculty of Mathematics, Informatics and Mechanics, 9–12 September 2025. Organizers: I. Chlebicka, B. Miasojedow, J. Schino, Z. Szymańska, N. David, J. Endal, A. Wróblewska-Kamińska.
- Bołbotowski, K.; Bouchitté, G. *Minimum compliance design of grillages via optimal transportation method*. Con-

- ference: 95th Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM), Poznań University of Technology, Poznań, 7–11 April 2025. Organizers: M. Kuczma, T. Łodygowski, W. Sumelka. Keynote; invited by the organizers.
- Bołbotowski, K.; Bouchitté, G. *Optimal stochastic dominance through the lens of optimal transport*. Workshop: “Optimal Transportation and Applications”, Centro di Ricerca Matematica Ennio De Giorgi, Scuola Normale Superiore, Pisa, 2–6 December 2024. Organizers: L. Ambrosio, G. Buttazzo, N. Gigli, F. Santambrogio, G. Savaré. Invited by the organizers. [YouTube recording](#).
 - Bołbotowski, K.; Bouchitté, G.; Carlier, G.; Mérigot, Q.; Santambrogio, F. *Optimal convex dominance – relations to mechanics and optimal transport*. Workshop: “X Partial Differential Equations, Optimal Design and Numerics”, Centro de Ciencias de Benasque Pedro Pascual, Benasque, Spain, 18–30 August 2024. Organizers: G. Buttazzo, O. Glass, G. Leugering, E. Zuazua. Invited by the organizers.
 - Bołbotowski, K.; Bouchitté, G. *Optimal design of grillages via optimal transport*. Banach Center – Oberwolfach Graduate Seminar: “Optimal Transport Theory and Hydrodynamics (from Euler to Monge and vice versa)”, Będlewo, 12–17 November 2023. Organizers: Y. Brenier, M. Iacobelli, F. Santambrogio.
 - Bołbotowski, K. *A convex formulation for optimal design of planar elastic membranes using the Föppl’s model*. Conference: 15th World Congress of Structural and Multidisciplinary Optimisation (WCSMO15), Cork, Ireland, 5–9 June 2023. Organizer: ISSMO.
 - Bołbotowski, K. *Optimal design of plane elastic membranes and application to 3D form-finding*. Keynote. Joint event: 24th International Conference on Computer Methods in Mechanics and 42nd Solid Mechanics Conference, Świnoujście, Poland, 5–8 September 2022. Organizers: Polish Association for Computational Mechanics, Institute of Fundamental Technological Research, Polish Academy of Sciences.
 - Bołbotowski, K. *On optimality of surface structures*. Workshop: “IX Partial Differential Equations, Optimal Design and Numerics”, Centro de Ciencias de Benasque Pedro Pascual, Benasque, Spain, 21 August–2 September 2022. Organizers: G. Buttazzo, O. Glass, G. Leugering, E. Zuazua. Invited by the organizers.
 - Bołbotowski, K. *Vaults of minimum weight and compliance – form finding via 2D convex problem*. Conference: 14th World Congress of Structural and Multidisciplinary Optimisation (WCSMO14), Boulder, Colorado, USA, 13–18 June 2021; online conference. Organizers: ISSMO, ASSMO.
 - Bołbotowski, K. *Elasticity theory of optimal structures with singularities in the material distribution*. Conference: 13th World Congress of Structural and Multidisciplinary Optimisation (WCSMO13), Beijing, 20–24 May 2019. Organizers: ISSMO, ASSMO.
 - Bołbotowski, K. *Theory of grillage optimization – a discrete setting*. Conference: 6th International Conference on Engineering Optimization (EngOpt2018), Lisbon, 17–19 September 2018. Organizer: Instituto Superior Técnico, Lisbon.
 - Bołbotowski, K. *Are Michell Structures and Optimum Grillages Equivalent to Frameworks Composed of Infinite Number of Straight Members?* Conference: 41st Solid Mechanics Conference (SolMech 2018), Warsaw, 27–31 August 2018. Organizer: Institute of Fundamental Technological Research, Polish Academy of Sciences.
 - Bołbotowski, K. *Optimal framework structures and links to optimal transport problem*. Conference: “Variational Problems in Optical Engineering and Free Material Design”, Banach Center, Warsaw, 7–9 June 2018. Organizers: Ahmad Sabra, Piotr Rybka.
 - Bołbotowski, K.; He, L.; Gilbert, M. *Grillage layout optimization – theory and numerical methods*. Conference: 12th World Congress of Structural and Multidisciplinary Optimisation (WCSMO12), Braunschweig, 5–9 June 2017. Organizers: ISSMO, ASSMO.
 - Bołbotowski, K.; Sokół, T. *New method of generating Strut-and-Tie models using truss topology optimization*. Conference: 21st International Conference on Computer Methods in Mechanics (CMM-2015), Gdańsk, 8–11 September 2015. Organizer: Polish Association for Computational Mechanics.
 - Bołbotowski, K.; Sokół, T.; Knauff, M. *Application of topology optimization in the design of reinforced-concrete structures using Strut-and-Tie models*. Conference: 59th Scientific Conference of KILIW PAN and the Science Committee of PZITB, Krynica, 15–20 September 2013. Organizers: KILIW PAN, Science Committee of PZITB, WBIA PL.

Seminar Talks

- Bołbotowski, K. *What can a probabilist learn from building a ceiling?* Colloquium Nonlinear Science, Universität Münster, 16 December 2025.
- Bołbotowski, K.; Bouchitté, G. *Computing the Zolotarev-2 metric via the second-order Kantorovich-Rubinstein duality*. Oberseminar Numerik, Department of Mathematics and Computer Science, Universität Münster, 10 December 2025.

- Bołbotowski, K.; Bouchitté, G. *Second-order Kantorovich-Rubinstein duality*. Seminar of the Department of Equations of Mathematical Physics, Faculty of Mathematics, Informatics and Mechanics, University of Warsaw, 16 October 2025.
- Bołbotowski, K.; Bouchitté, G. *Optimal grillage structures via minimal stochastic dominance and optimal transport*. Séminaire Équations aux Dérivées Partielles et Applications, Institut Élie Cartan, Université de Lorraine, Nancy, 10 June 2025.
- Bołbotowski, K.; Bouchitté, G. *Optimal grillage structures via minimal stochastic dominance and optimal transport*. Analysis Seminar, Department of Mathematics and Statistics, University of Jyväskylä, 12 Feb. 2025.
- Bołbotowski, K.; Bouchitté, G.; Carlier, G.; Mérigot, Q.; Santambrogio, F. *Optimal stochastic dominance through the lens of optimal transport*. Groupe de Travail de Calcul des Variations (GdT CalVa), Université Paris-Cité, Sophie Germain Building, 4 November 2024.
- Bołbotowski, K.; Bouchitté, G. *Optimal design of grillages via optimal transport*. Groupe de Travail de Transport Optimal, EDP et Machine Learning (GdT OT-PDE-ML), Laboratoire de Mathématiques d'Orsay, Université Paris-Saclay, 16 October 2023.
- Bołbotowski, K. *Optimal vaults*. Meeting of the Optimization Section of the Committee on Mechanics, Polish Academy of Sciences, 23 February 2024, online.
- Bołbotowski, K. *Optimal vaults*. Seminar of Chair L-10 on computer modelling and simulation, Faculty of Civil Engineering, Cracow University of Technology, 21 March 2024, online.
- Bołbotowski, K. *Optimal design of plane elastic membranes and application to the form-finding of optimal roof structures*. Scientific seminar of the Institute of Structural Analysis, Poznań University of Technology, and the Committee for Mechanical and Civil Engineering Sciences at the Poznań Branch of the Polish Academy of Sciences, Faculty of Civil Engineering and Transport, Poznań University of Technology, 6 March 2023.
- Bołbotowski, K. *From optimal plane membranes to optimal 3D vaults*. Laboratoire IMATH, Université de Toulon, 7 July 2022.
- Bołbotowski, K. *On topics in optimal design of elastic structures and links to the Monge-Kantorovich problem*. Seminar of the Department of Equations of Mathematical Physics, Faculty of Mathematics, Informatics and Mechanics, University of Warsaw, 18 November 2021.
- Bołbotowski, K. *Optimization of engineering structures: Michell trusses and grillages*. Department of Mathematics, University of California, Los Angeles (UCLA), 28 September 2017.

Awards and Distinctions

- Young Research Fellow at the Mathematics Münster Cluster of Excellence, University of Münster for 4 weeks in the autumn 2025; host: Benedikt Wirth. [\[link\]](#)
- First Prize of the Lodz University of Technology named after Professor Urszula Ledzewicz for a doctoral dissertation in applications of mathematics, 5th edition, 2023. [\[link\]](#)
- First-Degree Scientific Award of the Committee on Mechanics of the Polish Academy of Sciences named after Professor Michał Życzkowski for 2021. [\[link\]](#).
- Finalist of the international Cor Baayen Early Career Researcher Award, 2023 edition, awarded to young researchers in computer science and applied mathematics. [\[link\]](#).
- “Golden Chalk” Award in the category of best teacher of remote classes in the academic year 2019/2020, awarded by the Student Government of the Faculty of Civil Engineering, Warsaw University of Technology.

Organizational Activity

- Organization of the thematic session *Shape optimization problems in analysis and in mechanics* jointly with Prof. María del Mar González during the workshop “X Partial Differential Equations, Optimal Design and Numerics”, Centro de Ciencias de Benasque Pedro Pascual, Benasque, 18–30 August 2024.
- Organization of the thematic session *Mass optimization problems and homogenization* jointly with Prof. Juan Casado-Díaz during the workshop “IX Partial Differential Equations, Optimal Design and Numerics”, Centro de Ciencias de Benasque Pedro Pascual, Benasque, 21 August–2 September 2022.
- Co-organization of scientific and teaching seminars at the Department of Structural Mechanics and Computer-Aided Engineering, Faculty of Civil Engineering, Warsaw University of Technology, in 2014–2023.