

Curriculum vitae

Krzysztof Burnecki

Affiliation:

Hugo Steinhaus Center, Faculty of Pure and Applied Mathematics, Wrocław University of Science and Technology (WUST), Wyspiańskiego 27, 50-370 Wrocław, Poland
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Academic degrees:

10/89 – 06/94 *Wrocław University of Technology (WUT), Faculty of Fundamental Problems of Technology, Applied Mathematics.*

01/99 *Master's degree in Mathematics.* MSc thesis: "Computer testing of self-similarity".
WUT, Institute of Mathematics.

09/13 *Doctor's degree in Mathematics.* Doctoral thesis: "Self-similar models in risk theory".
Wrocław University of Technology, Faculty of Electronics.

Habilitation in Control and Robotics. Monograph: "Identification, validation and prediction of fractional dynamical systems".

Professional experience:

10/98 – present *WUT; Institute of Mathematics, then Faculty of Pure and Applied Mathematics.*
Assistant till September, 1999, assistant professor till March, 2015, **associate professor** hereafter.

03/05-04/13 *TUW CUPRUM*
Actuary.

09/12 – 08/15 *WUT, Faculty of Fundamental Problems of Technology.*
Vice-dean.

10/15 – 09/16 *WUST, Faculty of Pure and Applied Mathematics.*
Vice-dean.

2014 – present *WUST, Hugo Steinhaus Center.*
Vice-director.

09/20 – present *WUST, Faculty of Pure and Applied Mathematics, Department of Applied Mathematics.*
Head.

Prizes, awards:

98, 13,14,15,18-22 Rector's prize in recognition of teaching and scientific activities.

2016 Rector's special scientific prize established in honour of Hugo Steinhaus.

Research and teaching experience:

- Research in stochastic modelling, computational statistics, insurance mathematics, and mathematical (bio)physics.
- **Author or co-author of more than 60 articles** published in international journals such as: **Nature**, Physical Review Letters, Chaos, Astrophysical Journal, Biophysical Journal, Scientific Reports, New Journal of Physics, Physical Chemistry Chemical Physics, Physical Review E, Physica A, Chaos, Solitons & Fractals, IEEE Transactions on Signal Processing, Computational Statistics, Probability and Mathematical Statistics, Insurance: Mathematics and Economics, Risks. **Co-author of more than 10 chapters** in Springer and Wiley books. **Author of one monograph:** Identification of stochastic dynamical systems.
- Reviewer of Computational Statistics, Insurance: Mathematics & Economics, Journal of Risk and Insurance, Physical Review E, Physica A, Acta Physica Polonica B, Stochastic Models, Probability and Mathematical Statistics, Operations Research and Decisions, Mathematica Applicanda.
- Supervisor of more than 60 MSc theses.
- **Supervisor of three PhD degrees:** Grzegorz Sikora (WUT, 2014), Michał Balcerek (WUST, 2018) and Aleksandra Wilkowska (WUST, 2023). **Co-supervisor** (together with Prof. Peter Ouweland and Prof. Eckhard Platen) **of one PhD degree:** Mario Giuricich (Cape Town University, 2018).
- **Invited speaker and participant** in over 30 international and national conferences on stochastic modelling, physics, biophysics, financial mathematics and risk management.
- **Main organizer of one international conference** and co-organizer of six international conferences and workshops.
- **Visiting professor** at School of Computational and Applied Mathematics (University of the Witwatersrand, South Africa), School of Business and Economics (Humboldt-Universität zu Berlin, Germany), Department of Physics (Bar-Ilan University, Israel), Institute for Physics and Astronomy (University of Potsdam, Germany), Faculty of Commerce (Cape Town University, South Africa), British Antarctic Survey (Great Britain).
- **Editor-in-Chief** of BioPhysMath, **associate editor** of Computational Statistics, Mathematica Applicanda, ICIAM Dianoia and EMS Magazine.
- **Member** of Polish Mathematical Society, Polish Society of Actuaries and ECMI Council.
- **(Web of Science) H-index: 19; sum of times cited** without self-citations: **>1000**.
- **(Google Scholar) H-index: 26; sum of times cited: >2700**.

Grants in the last 10 years:

2007-2012	ENVIROTEX: New generation barrier materials protecting against harmful environment, POIG.01.03.01-00-006/08, participant.
2008-2013	Detectors and sensors for measuring factors hazardous to environment – modeling and monitoring of threats, POIG.01.03.01-02-002/08, vice-coordinator .
2009-2011	Energy industry development strategy in Lower Silesia by means of foresight methods, POIG.01.01.01-02-005/08, participant.
2010-2013	Anomalous diffusion processes. Theory and applications, KBN, NN201 417639, participant.
2013-2018	Anomalous dynamics of complex physical and biological systems – stochastic modeling and statistical identification, Maestro NCN 2012/06/A/ST1/00258, participant.
2018-2023	Mathematical and physical modeling of single particle tracking – big data approach (sptBIGDATA), Beethoven DFG-NCN 2016/23/G/ST1/04083, vice-coordinator .
2023-2026	Multi-peril and multi-region natural catastrophe risk management: from building multidimensional loss models to novel CAT securities, NCN OPUS 24 2022/47/BHS4/2139, principal investigator .

Projects with the industry and Wroclaw municipality:

1995-2006	Co-author of the following reports: “Insurance strategy for PSE S.A.” (1995–1996), “Insurance analysis for ESP S.A.” (1999–2000), “Optimal insurance strategy based on breakdown and loss analysis of ESP S.A. property” (2000), “System of managing risk in the Power Plant Opole S.A.” (2002-2003), “Verification of algorithms in the risk management module” (Transition Technologies S.A.) (2004-2005) and “Analysis of risk factors and design of an optimal structure allowing for the effective risk management in BOT holding” (2005-2006).
2005-2012	Author of annual reports on insurance portfolio and Quantitative Impact Study II–VI surveys for TUW CUPRUM.
2006	Coordinator of the project “Analysis and forecasting the evolution of human potential and the job market in Lower Silesia” under a contract between Wroclaw University of Technology and the Wroclaw Agglomeration Development Agency (ARAW).

Selected publications

(For the full list of publications see <http://prac.im.pwr.edu.pl/~burnecki/publications.html>)

Mathematical physics and biophysics (number of citations if greater than 50)

- [1] J. Janczura, M. Balcerek, **K. Burnecki**, A. Sabri, M. Weiss, D. Krapf (2021), Identifying heterogeneous diffusion states in the cytoplasm by a hidden Markov model, **New Journal of Physics** 23, 053018.
- [2] M. Balcerek, H. Loch-Olszewska, J.A. Torreno-Pina, M.F. Garcia-Parajo, A. Weron, C. Manzo, **K. Burnecki** (2019), Inhomogeneous membrane receptor diffusion explained by a fractional heteroscedastic time series model, **Physical Chemistry Chemical Physics** 21, 3114 - 3121.
- [3] **K. Burnecki**, G. Sikora, A. Weron, M. M. Tamkun, and D. Krapf (2019), Identifying diffusive motions in single-particle trajectories on the plasma membrane via fractional time-series models, **Physical Review E** 99(1):1-10.
- [4] J. Ślęzak, **K. Burnecki**, R. Metzler (2019), Random coefficient autoregressive processes describe Brownian yet non-Gaussian diffusion in heterogeneous systems, **New Journal of Physics** 21, 073056.
- [5] A. Weron, **K. Burnecki**, E.J. Akin, L. Sole, M. Balcerek, M.M. Tamkun, D. Krapf (2017), Ergodicity breaking on the neuronal surface emerges from random switching between diffusive states, **Scientific Reports** 7, 5404 (**cited 60 times – Web of Science**).
- [6] T. Sungkaworn, M-L. Jobin, **K. Burnecki**, A. Weron, M.J. Lohse, D. Calebiro (2017), Single-molecule imaging reveals receptor-G protein interactions at cell surface hot spots, **Nature** 550, 543-547 (**cited 193 times – Web of Science**).
- [7] **K. Burnecki**, E. Kepten, Y. Garini, G. Sikora, A. Weron (2015), Estimating the anomalous diffusion exponent for single particle tracking data with measurement errors – An alternative approach, **Scientific Reports** 5:11306 (**cited 52 times – Web of Science**).
- [8] **K. Burnecki**, E. Kepten, J. Janczura, I. Bronshtein, Y. Garini, A. Weron (2012), Universal algorithm for identification of fractional Brownian motion. A case of telomere subdiffusion, **Biophysical Journal** 103, 1839-1847 (**cited 111 times – Web of Science**).
- [9] **K. Burnecki**, A. Weron (2010), Fractional Lévy stable motion can model subdiffusive dynamics, **Physical Review E** 82, 021130 (**cited 82 times – Web of Science**).
- [10] M. Magdziarz, A. Weron, **K. Burnecki**, J. Klafter (2009), Fractional Brownian motion versus the continuous-time random walk: A simple test for subdiffusive dynamics, **Physical Review Letters** 103, 180602 (**cited: 266 times – Web of Science**).

Statistical methods and time series modelling

- [1] F. Sabzikar, J. S. Kabala, and **K. Burnecki** (2022). Tempered fractionally integrated process with stable noise as a transient anomalous diffusion model. **Journal of Physics A: Mathematical and Theoretical** 55(17), 1-27.
- [2] J.S. Kabala, **K. Burnecki**, F. Sabzikar (2021), Tempered linear and non-linear time series models and their application to heavy-tailed solar flare data, **Chaos** 31, 113124.
- [3] M. Balcerek, **K. Burnecki**, G. Sikora, A. Wylomańska (2021), Discriminating Gaussian processes via quadratic form statistics, **Chaos** 31, 063101.
- [4] M. Balcerek, **K. Burnecki** (2020), Testing of multifractional Brownian motion, **Entropy** 22(12), 1403.
- [5] A. Wylomańska, D.R. Iskander, **K. Burnecki** (2020), Omnibus test for normality based on the Edgeworth expansion, **PLoS ONE** 15(6), e0233901.
- [6] A. A. Stanislavsky, **K. Burnecki**, J. Janczura, K. Niczyj, A. Weron (2019), Solar X-ray variability in terms of a fractional heteroskedastic time series model", **Monthly Notices of the Royal Astronomical Society** 485, 3970-3980.
- [7] G. Sikora, E. Kepten, A. Weron, M. Balcerek, **K. Burnecki** (2017), An efficient algorithm for extracting the magnitude of the measurement error for fractional dynamics, **Physical Chemistry Chemical Physics** 19, 26566-26581.
- [8] **K. Burnecki**, A. Wylomańska, A. Chechkin (2015), Discriminating between light- and heavy-tailed distributions with limit theorem, **PLoS ONE** 10, e0145604.
- [9] **K. Burnecki**, A. Weron (2014), Algorithms for testing of fractional dynamics: a practical guide to ARFIMA modelling", **Journal of Statistical Mechanics** P10036.
- [10] **K. Burnecki**, G. Sikora (2013), Estimation of FARIMA parameters in the case of negative memory and stable noise, **IEEE Transactions on Signal Processing** 61, 2825-2835.

Actuarial mathematics and risk management

- [1] **K. Burnecki**, M. A. Teuerle, and A. Wilkowska (2022), Diffusion approximations of the ruin probability for the insurer-reinsurer model driven by a renewal process, **Risks** 10(6):1-16.
- [2] **K. Burnecki**, M. Teuerle, A. Wilkowska (2021), Ruin Probability for the Insurer–Reinsurer Model for Exponential Claims: A Probabilistic Approach, **Risks** 9(5), 86.
- [3] **K. Burnecki**, M. Giuricich, Z. Palmowski (2019), Valuation of contingent convertible catastrophe bonds — The case for equity conversion, **Insurance: Mathematics and Economics** 88, 238-254.
- [4] M.N. Giuricich, **K. Burnecki** (2019), Modelling of left-truncated heavy-tailed data with application to catastrophe bond pricing, **Physica A: Statistical Mechanics and its Applications** 525, 498-513.
- [5] **K. Burnecki**, M.N. Giuricich (2017), Stable Weak Approximation at Work in Index-Linked Catastrophe Bond Pricing, **Risks** 5(4), 64.
- [6] **K. Burnecki**, J. Janczura, R. Weron (2011), Building loss models, in **Statistical Tools for Finance and Insurance**, 2nd Edition, Springer, Berlin, 293-328.
- [7] **K. Burnecki**, G. Kukla, D. Taylor (2011), Pricing of catastrophe bonds, in **Statistical Tools for Finance and Insurance**, 2nd Edition, Springer, Berlin, 371-392.
- [8] **K. Burnecki**, W. Haerdle, and R. Weron (2004), Simulation of risk processes. In J. L. Teugels and B. Sundt, editors, **Encyclopedia of actuarial science**. Vol. 3, 1564-1570. Wiley, Chichester.
- [9] **K. Burnecki**, A. Marciniuk, and A. Weron (2003). Annuities under random rates of interest – revisited, **Insurance: Mathematics and Economics** 32(3), 457-460.
- [10] **K. Burnecki** (2000), Self-similar processes as weak limits of a risk reserve process, **Probability and Mathematical Statistics** 20(2), 261-272.