

# Wasiur Rahman Khuda Bukhsh

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## Summary

Interested in applied probability theory, mathematical biology. Provided service to the Governor's Office and the Ohio Department of Health as part of the OSU/IDI COVID-19 response modelling team.

## Professional Experience

- Oct 2021 – **Assistant Professor**, *School of Mathematical Sciences*, The University of Nottingham, University Park, Nottingham, NG7 2RD, UK
- Jan 2020 – **President's Postdoctoral Scholar**, *Mathematical Biosciences Institute and the College of Public Health*, The Ohio State University, Columbus, Ohio, USA
- Oct 2018 – **Postdoctoral Researcher**, *Mathematical Biosciences Institute and the College of Public Health*, The Ohio State University, Columbus, Ohio, USA
- Jan 2014 – **Research Associate**, *Technische Universität Darmstadt*, Darmstadt, Germany
- Sep 2018 – Department of Electrical Engineering and Information Technology
- Jun 2011 – **Manager**, *ICICI Bank*, Mumbai, India
- Dec 2013 – Advanced Analytics, Business Intelligence Unit (BIU)

## Education

- 2014 – 2018 **Ph.D. (Dr. rer. nat.)**, *summa cum laude*, *Department of Electrical Engineering and Information Technology*, Technische Universität Darmstadt, Germany
- 2009 – 2011 **Master of Statistics (M.Stat.)**, *Indian Statistical Institute*, Kolkata, India
- 2006 – 2009 **Bachelor of Science (B. Sc.) with Honours in Statistics**, *University of Calcutta*, Kolkata, India

## Publications

### Peer-reviewed journal publications

- [1] **Wasiur R. KhudaBukhsh**, Casper Woroszylo, Grzegorz Rempała, and Heinz Koepl. A Functional Central Limit Theorem for Susceptible-Infected (SI) Process on Configuration Model Graphs. *Advances in Applied Probability*, 2022. To appear in the 09/2022 issue. ArXiv preprint: <https://arxiv.org/abs/1703.06328>.
- [2] Ido Somekh, **Wasiur R. KhudaBukhsh**, Elisabeth Dowling Root, Greg Rempala, Eric Simoes, and Eli Somekh. Quantifying the Population-level Effect of COVID-19 Mass Vaccination

Campaign in Israel: A Modeling Study. *Open Forum Infectious Diseases*, 2022. Accepted for publication.

- [3] **Wasiur R. KhudaBukhsh\***, Hye-Won Kang, Eben Kenah, and Grzegorz Rempała. Incorporating age and delay into models for biophysical systems. *Physical Biology*, 18(1), 2021. (\*Invited paper).
- [4] **Wasiur R. KhudaBukhsh**, Boseung Choi, Eben Kenah, and Grzegorz Rempała. Survival Dynamical Systems for the Population-level Analysis of Epidemics. *Interface Focus*, 10(1), 2020.
- [5] **Wasiur R. KhudaBukhsh**, Arnab Auddy, Yann Disser, and Heinz Koepl. Approximate lumpability for markovian agent-based models using local symmetries. *Journal of Applied Probability*, 56, 9 2019.
- [6] Hye-Won Kang\*, **Wasiur R. KhudaBukhsh\***, Heinz Koepl, and Grzegorz Rempała. Quasi-steady-state approximations derived from a stochastic enzyme kinetics. *Bulletin of Mathematical Biology*, 81(5):1303–1336, 2019. \*joint first authors.
- [7] Saumya Yashmohini Sahai, Saket Gurukar, **Wasiur R. KhudaBukhsh**, Srinivasan Parthasarathy, and Grzegorz A. Rempała. A Machine Learning Model for Nowcasting Epidemic Incidence. *Mathematical Biosciences*, 2021.
- [8] **Wasiur R. KhudaBukhsh**, Sounak Kar, Bastian Alt, Amr Rizk, and Heinz Koepl. Generalized cost-based job scheduling in very large cluster systems. *IEEE Transactions on Parallel and Distributed Systems*, 31(11):2594–2604, 2020.
- [9] Boseung Choi, Sydney Busch, Dieudonné Kazadi, Benoit Ilunga, Emile Okitolonda, Yi Dai, Robert Lumpkin, Omar Saucedo, **Wasiur R. KhudaBukhsh**, Joseph Tien, Marcel Yotebieng, Eben Kenah, and Grzegorz A. Rempała. Modeling Outbreak Data: Analysis of a 2012 Ebola Virus Disease Epidemic in DRC. *BIOMATH*, 8(2), 2019.
- [10] **Wasiur R. KhudaBukhsh**, Amr Rizk, Sounak Kar, and Heinz Koepl. Provisioning and performance evaluation of parallel systems with output synchronization. *ACM Transactions on Modeling and Performance Evaluation of Computing Systems (TOMPECS)*, 4(1), 3 2019.
- [11] Bastian Alt, Markus Weckesser, Christian Becker, Matthias Hollick, Sounak Kar, Anja Klein, Robin Klose, Roland Kluge, Heinz Koepl, Boris Koldehofe, **Wasiur R. KhudaBukhsh**, Mahdi Mousavi, Martin Pfannemueller, Amr Rizk, Andy Schuerr, and Ralf Steinmetz. Transitions: A protocol-independent view of the future internet. *Proceedings of the IEEE*, 107(4):835–846, 4 2019.
- [12] **Wasiur R. KhudaBukhsh**, Julius Rückert, Julian Wulfheide, David Hausheer, and Heinz Koepl. SCHEDMIX: Heterogeneous strategy assignment in swarming-based live streaming. *Open Transactions on Communication Systems (OTCS)*, 2019. Accepted for publication.

#### Peer-reviewed conference proceedings

- [13] **Wasiur R. KhudaBukhsh**, Bastian Alt, Sounak Kar, Amr Rizk, and Heinz Koepl. Collaborative uploading in heterogeneous networks: Optimal and adaptive strategies. In *IEEE International Conference on Computer Communications (INFOCOM)*, 4 2018. < 20% acceptance rate. Best-in-Session Presentation Award.

- [14] **Wasiur R. KhudaBukhsh**, Amr Rizk, Alexander Frömmgen, and Heinz Koepl. Optimizing Stochastic Scheduling in Fork-Join Queueing Models: Bounds and Applications. In *IEEE International Conference on Computer Communications (INFOCOM)*, 5 2017. ~ 20% acceptance rate.
- [15] Adrian Šošić, **Wasiur R. KhudaBukhsh**, A. M. Zourbir, and Heinz Koepl. Inverse reinforcement learning in swarm systems. In *AAMAS Workshop on Transfer in Reinforcement Learning*, May 2017. Available: <http://www.tirl.info/proceedings/2017/SosicEtal-Inverse.pdf>.
- [16] Adrian Šošić, **Wasiur R. KhudaBukhsh**, A. M. Zourbir, and Heinz Koepl. Inverse reinforcement learning in swarm systems. In *International Conference on Autonomous Agents & Multiagent Systems (AAMAS)*, 5 2017. ~ 26% acceptance rate, Best Paper Award Finalist.
- [17] **Wasiur R. KhudaBukhsh**, Julius Rückert, Julian Wulfheide, David Hausheer, and Heinz Koepl. Analysing and Leveraging Client Heterogeneity in Swarming-based Live Streaming. In *IFIP Networking Conference (IFIP Networking) and Workshops*, 5 2016. ~ 26% acceptance rate.
- [18] Mahdi Mousavi, Hussein Al Shatri, **Wasiur R. KhudaBukhsh**, Heinz Koepl, and Anja Klein. Cross-Layer QoE-based Incentive Mechanism for Video Streaming in Multi-Hop Wireless Networks. In *IEEE 86th Vehicular Technology Conference (VTC)*, 9 2017.

#### Preprints/Submitted

- [19] **Wasiur R. KhudaBukhsh**, Caleb Deen Bastian, Matthew Wascher, Colin Klaus, Mark Weir, Eben Kenah, Elisabeth Root, Joseph H. Tien, and Grzegorz Rempała. Projecting COVID-19 Cases and Subsequent Hospital Burden in Ohio. *Epidemics*, 2022. Submitted.
- [20] **Wasiur R. KhudaBukhsh**, Sat Kartar Khalsa, Eben Kenah, Grzegorz Rempała, and Joseph Tien. COVID-19 dynamics in an Ohio prison. *Epidemics*, 2021. Preprint: <https://www.medrxiv.org/content/10.1101/2021.01.14.21249782v1>.
- [21] Kai Cui, **Wasiur R. KhudaBukhsh**, and Heinz Koepl. Motif-based mean-field approximation of interacting particles on clustered networks. *Physical Review E*, 2022. Preprint: <https://arxiv.org/abs/2201.04999>.
- [22] Matthew Wascher, Patrick Schnell, **Wasiur R. KhudaBukhsh**, Joseph Tien, and Grzegorz Rempała. Monitoring SARS-CoV-2 Transmission and Prevalence in Populations under Repeated Testing. 2021. Submitted.
- [23] Colin Klaus, Matthew Wascher, **Wasiur R. KhudaBukhsh**, Joseph H. Tien, Grzegorz A. Rempała, and Eben Kenah. Assortative mixing among vaccination groups and biased estimation of  $R_0$ . *The Lancet Infectious Diseases*, 2022. Revision requested.
- [24] Harley Vossler, Pierre Akilimali, Yuhan Pan, **Wasiur R. KhudaBukhsh**, Eben Kenah, and Grzegorz A. Rempała. Analysis of individual-level epidemic data: Study of 2018-2020 ebola outbreak in democratic republic of the congo. *Scientific Reports*, 2022. Revision requested.

#### Manuscripts in progress

- [25] Francesco Di Lauro\*, **Wasiur R. KhudaBukhsh**\*, István Z. Kiss, Eben Kenah, Max Jensen, and Grzegorz Rempała. Dynamic survival analysis of non-makrovian models for infectious disease epidemiology, 2021. \*Both authors contributed equally and are joint first authors.

- [26] Kai Cui, **Wasiur R. KhudaBukhsh**, and Heinz Koepl. Hypergraphon mean-field games. 2022.
- [27] **Wasiur R. KhudaBukhsh** and Eben Kenah. Semiparametric pairwise regression for infectious disease transmission with external sources of infection.
- [28] Hye-Won Kang, **Wasiur R. KhudaBukhsh**, and Grzegorz A. Rempała. Multiscale approximations of the togashi–kaneko reaction system. 2022.
- [29] Yushuf Sharker\*, Zaynab Diallo\*, **Wasiur R. KhudaBukhsh**, and Eben Kenah. Pairwise accelerated failure time models with external sources of infection and epidemiological studies of infectious disease transmission. \*Joint first authors.

### Thesis and technical notes

- [30] **Wasiur R. KhudaBukhsh**. *Model reductions for queueing and agent-based systems with applications in communication networks*. PhD thesis, Technische Universität, Darmstadt, 2018. Available at: <http://tuprints.ulb.tu-darmstadt.de/7588/>.
- [31] **Wasiur R. KhudaBukhsh**, Mark Sinzger, and Heinz Koepl. Bounds on the spectral radius of real-valued non-negative kernels on measurable spaces. Technical report, 2018. arXiv preprint: <https://arxiv.org/abs/1808.00258>.

## Awards and Funding

### Awards

1. 2019 President’s Postdoctoral Scholars Program (PPSP) of the Ohio State University
2. Best-in-Session Presentation Award at the IEEE International Conference on Computer Communications (IEEE INFOCOM), Honolulu, Hawaii, USA, 2018.

### Funding

1. NIH K99/R00 Pathway to Independence Award (not granted)
2. The German Academic Exchange Service (DAAD) travel grant (Kongressreise) to participate in the Annual Meeting of the SMB in Sydney, Australia (~ 2000 EUR)

## Presentations

Summary: 26 invited and 22 contributed/local talks. 5 poster presentations.

### Invited talks

1. Mini-symposium speaker at SIAM Conference on Uncertainty Quantification, April 15, 2022.
2. Statistics and Probability Seminar, University of Nottingham. February 3, 2022.
3. Mathematics of Reaction Networks (MoRN) seminar, January 27, 2022.
4. Math Bio seminar, The Ohio State University, virtual, November 4, 2021
5. Stochastic Systems seminar talk, Department of Mathematics, University of California San Diego, virtual, October 21, 2021
6. Guest lecture on infectious disease epidemiology, The Ohio State University, virtual, September 16, 2021
7. American Institute of Mathematics (AIM) Workshop on "Limits and control of stochastic reaction networks", July 28, 2021
8. Colloquium at the Department of Mathematics, Simon Fraser University, virtual, April 23, 2021
9. Special session at the Joint Mathematics Meetings (JMM), virtual, January 6-9, 2021
10. IDI Virtual COVID-19 Symposium, December 3, 2020

11. Seminar, Institute of Applied Mathematics and Mechanics, University of Warsaw, November 30, 2020
12. Seminar, Institute of Applied Mathematics and Mechanics, University of Warsaw, November 23, 2020
13. Biostatistics seminar, the Ohio State University, Columbus, OH, USA, October 30, 2020
14. Math-Bio seminar, Virginia Tech, virtual, September 23, 2020
15. International Webinar Series on Artificial Intelligence and Machine Learning, virtual, September 18, 2020
16. Workshop on "Life on Planet Earth: Above and Below", MBI, OSU, August 11, 2020
17. International Webinar, Departments of Mathematics and Physics, Bidhan Chandra College, virtual, July 18, 2020
18. Special session of Data Science, Business Intelligence Unit, ICICI Bank, Mumbai, India, July 24, 2020
19. Special session at the Erdős Institute Python Bootcamp, May 2020 (jointly with Marissa Renardy)
20. Biostatistics Seminar, the Ohio State University, Columbus, OH, USA, February 28, 2020
21. Mathematical Modeling and Statistical Analysis of Infectious Disease Outbreaks, CIRM, Marseille, France, February 21, 2020
22. Mini-symposium speaker at the Annual Meeting of the SMB, Montreal, Canada, 2019
23. Mini-symposium speaker at the International Conference on Mathematical Methods and Models in Biosciences (BioMath), June 2019, Poland
24. BIRS-CMO workshop on "Scaling Limits of Dynamical Processes on Random Graphs", May 2019, Oaxaca, Mexico
25. Mini-symposium speaker at the Annual Meeting of the SMB and the JSMB, Sydney, Australia, 2018
26. Cloud Computing, Machine Learning And Networking Research (CLAN) Lab, Purdue University (May, 2017), Host : Vaneet Aggarwal

#### Contributed talks

1. Annual Meeting of the Society for Mathematical Biology, June 13-17, 2021
2. Workshop on Mathematical and Computational Biology, June 10-11, 2021
3. The SIAM Conference on Applications of Dynamical Systems (DS21), May 23-27, 2021
4. ENAR Spring Meeting, March 14-17, 2021
5. Mathematical Biosciences Institute (MBI) Seminar, Columbus, Ohio, USA, March 04, 2021
6. Joint Mathematical Epidemiology and Math Education SMB Subgroup Meeting, Feb 7-8, 2021
7. Applied Mathematics Seminar, Department of Mathematics, The Ohio State University, November 19, 2020
8. Bernoulli-IMS One World Symposium 2020, virtual, August 25, 2020
9. Mini-symposium speaker at the Annual Meeting of the SMB, virtual, August 19, 2020
10. Joint Statistical Meetings 2020, virtual, August 2-6, 2020
11. Mini-symposium speaker at SIAM Conference on Mathematics of Data Science 2020 (virtual), June 2020
12. MBI Workshop on Mathematical and Computational Methods in Biology, May 6, 2020
13. International Indian Statistical Association Conference (IISA 2019), Mumbai, India, December 28, 2019
14. Latin American Congress of Probability and Mathematical Statistics (CLAPEM) XV, Merida-Yucatán, México, December, 2019
15. Mathematical Biosciences Institute (MBI) Seminar, Columbus, Ohio, USA, October, 2019

16. Joint Statistical Meetings (JSM) - American Statistical Association, Colorado, USA, 2019
17. Stochastic Processes and their Applications, Bernoulli Society, Northwestern University, July 2019, USA
18. International Conference on Mathematical Methods and Models in Biosciences (BioMath), June 2019, Poland
19. Mathematical Biosciences Institute (MBI) Seminar, Columbus, Ohio, USA, 2019
20. IEEE International Conference on Computer Communications (IEEE INFOCOM), Honolulu, Hawaii, USA, 2018
21. IEEE International Conference on Computer Communications (IEEE INFOCOM), Atlanta, GA, USA, 2017
22. IFIP Networking Conference and Workshops, Vienna, Austria, 2016

#### Poster presentations

1. Mathematical Models in Evolutionary Biology conference, CIRM, Marseilles, France, February 10-14 2020
2. Annual Meeting of the Infectious Disease Institute, The Ohio State University, September 2019, Columbus, OH, USA
3. Joint Statistical Meetings (JSM) - American Statistical Association, Colorado, USA, 2019
4. CMCF Algorithms and Methods for Single Cell Genomics, University of California, Irvine, June 2019, USA
5. BIRS-CMO workshop on "Scaling Limits of Dynamical Processes on Random Graphs", May 2019, Oaxaca, Mexico

## Teaching Experience

### University of Nottingham, UK

1. MATH2010: Probability Models and Methods  
School of Mathematical Sciences, The University of Nottingham  
Role: Instructor  
Terms: Spring 2022 (~270 students)

### The Ohio State University, USA

1. STAT 4201: Introduction to Mathematical Statistics  
Department of Statistics, The Ohio State University, USA  
Role: Instructor  
Terms: Fall semester 2019 (> 120 students)
2. PUBHBIO7193: Individual studies in Biostatistics (Advanced stochastic epidemiology)  
Division of Biostatistics, The Ohio State University, USA  
Role: Instructor (jointly with Eben Kenah)  
Terms: Summer semester 2019

### Technische Universität Darmstadt, Germany

1. Computational Methods for Systems and Synthetic Biology (CMSSB)  
Department of Electrical Engineering and Information Technology, Technische Universität Darmstadt, Germany  
Role: Teaching Assistant  
Terms: Summer semester 2016, Summer semester 2017

## Student Supervision and Mentoring

Summary: (Co-) Supervised a total of 12 undergrad (B.Sc.) and 6 M.Sc. students.

#### M.Sc. Students

1. Robert Lumpkin, 2019, Master degree project (jointly with Prof. Greg Rempala), Department of Mathematics, The Ohio State University, USA (*resulted in the publication [9]*)
2. Arnab Auddy, 2017, Summer internship, Technische Universität Darmstadt, Germany (*resulted in the publication [5]*)
3. Markus Schanz, 2017, Master thesis (jointly with Christian Koch), Technische Universität Darmstadt, Germany
4. Hameer Abbasi, 2017, Master thesis (jointly with Bastian Alt), Technische Universität Darmstadt, Germany
5. Ranjani Krishnan, 2018, Master thesis (jointly with Denny Stohr), Technische Universität Darmstadt, Germany
6. Sayantan Kumar, 2018, Summer internship, Technische Universität Darmstadt, Germany (*manuscript to be submitted for publication*)

### ■ Outreach and Service

#### Editing

1. Co-editor, special issue of Mathematical Biosciences and Engineering

#### COVID-19 Modelling Response

1. Provided service to the Ohio Department of Health and Ohio Hospital Association as part of the OSU/IDI COVID-19 response modelling team. Provided daily predictions of COVID-19 cases and resultant hospital burden in the state of Ohio, USA.

#### Organizing conferences

1. Invited session at the IMS Asia Pacific Rim Meeting, Melbourne, Australia, 2022 (pending acceptance. Jointly with Gursharn Kaur)
2. BIRS Workshop on "Preparing for the next pandemic", June 12-17, 2022 (jointly with Sara Del Valle, Joel C. Miller and Rick Durrett)
3. Mini-symposium at the SIAM Conference on Applications of Dynamical Systems, 2021
4. Mini-symposium at the Annual Meeting of the Society for Mathematical Biology, 2021 (Jointly with Hye-Won Kang)
5. Invited session at the Annual Meeting of the ENAR, 2021 (jointly with Marissa Renardy)
6. Mini-symposium at the Annual Meeting of the Society for Mathematical Biology, 2020 (jointly with Hye-Won Kang)
7. Mini-symposium at the SIAM Conference on Mathematics of Data Science (MDS20), Cincinnati, OH, USA, June 11, 2020 (jointly with Veronica Ciaconel)
8. Contributed Session at the Latin American Congress of Probability and Mathematical Statistics (CLAPEM) XV, Merida-Yucatán, México, December, 2019 (jointly with Hye-Won Kang)
9. Session at the 2019 International Indian Statistical Association Conference (IISA 2019), Mumbai, India, December 2019 (jointly with Arindam Fadikar)

#### Tutorials

1. "How to write scientific papers" for MBI REU students, 2019
2. "Introduction to epidemic modelling" for SAMMS REU students, 2019
3. "Modeling the COVID-19 pandemic" for the Erdős Institute bootcamp, May 2020

#### Mentoring REUs

1. MBI REUs, Summer 2019
2. Ohio 5 SURE students at the College of Public Health, OSU, 2019

#### Referee Service

1. Journal of Applied Probability/Advances in Applied Probability (Applied Probability Trust)
2. Stochastic Processes and their Applications
3. Stochastics (Taylor & Francis)
4. SIAM Multiscale Modeling & Simulation
5. Mathematical Biosciences
6. Bulletin of Mathematical Biology
7. Journal of Chemical Physics
8. Journal of Mathematical Biology
9. PLOS One
10. Journal of Mathematical Physics
11. Mathematical Biosciences and Engineering
12. European Journal of Control
13. Mathematics (MDPI)
14. IEEE Transactions on Automatic Control
15. Journal of Mathematics in Industry
16. Journal of Mathematical Analysis and Applications
17. Journal of Scientific Research
18. IEEE Control System Letters
19. IEEE Transactions on Networking
20. IEEE Transactions on Control of Network Systems
21. IEEE Multi-Conference on Systems and Control, Sydney, Australia, 2015
22. American Control Conference (ACC)

#### Other Services

1. Reviewer for the President's Research Excellence at OSU
2. Judge for abstract submissions at the Annual Meeting of the MIDAS Network, 2021
3. Judge for poster sessions at the Annual Meeting of the SMB 2021
4. Judge for the OSU Mathematical Contest for Modeling, 2018, 2019
5. Judge for OPA travel awards, the Ohio State University, 2019

#### Professional Memberships

1. Society for Industrial and Applied Mathematics (SIAM)
2. Bernoulli Society for Mathematical Statistics and Probability
3. The Society for Mathematical Biology (SMB)
4. American Statistical Association (ASA)
5. American Association for the Advancement of Science (AAAS)

#### Computer Skills

Programming Languages C, R, Python, SQL, Julia

Software Matlab, SAS, Microsoft Office,  $\text{\LaTeX}$

#### Languages



English Professional Proficiency

Bengali Mother Tongue

Hindi Working Knowledge

German Intermediate (B1 level)

## Media highlights

1. The Dynamical Systems Web (DSWeb): Student Feature in the Jan 2021 edition of the journal. (URL: <https://tinyurl.com/dsweb>)
2. OSC Research Report: COVID-19 projection models equip Ohioans. (URL: <https://tinyurl.com/resrchrprt>)
3. OSC News: Pandemic Modeling: COVID-19 Projection Models Equip Ohioans (URL: <https://tinyurl.com/oscwasiur>)
4. HPC Wire: Pandemic Modeling: COVID-19 Projection Models Equip Ohioans (URL: <https://tinyurl.com/hpcnews>)
5. IDI News: Far from trivial: A postdoctoral researcher's path to a key position in the OSU/IDI COVID-19 modeling team (URL: <https://tinyurl.com/IDInews>)
6. STEAM Member Spotlight - Dr. Wasiur Rahman KhudaBukhsh (URL: [https://www.youtube.com/watch?v=j\\_DEgauzw7w](https://www.youtube.com/watch?v=j_DEgauzw7w))

## References

Available upon request.