

# CURRICULUM VITAE

last update: 29/12/2022

<b>Name and Degree:</b>	doc. Mgr. Milan Krbálek, Ph.D.
<b>Birth:</b>	13 <sup>th</sup> April 1971, Hlinsko, Czech Republic
<b>Grade:</b>	Associate Professor
<b>ORCID iD:</b>	0000-0003-3218-6463
<b>Research iD:</b>	A-1661-2016
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<b>Affiliation:</b>	Department of Mathematics Faculty of Nuclear Sciences and Physical Engineering Czech Technical University, Prague, Czech Republic
<b>Affiliation II:</b>	Institute of Computer Aided Engineering and Computer Science Faculty of Civil Engineering Brno University of Technology
<b>Guarantor of Study Program:</b>	
2010 – present	AMSM — Applied Mathematical-Stochastic Methods Bachelor Degree Program & Master Degree Program
<b>Education:</b>	
1994 – 1999	University of Hradec Králové, Master Degree
1999 – 2003	Faculty of Nuclear Sciences and Physical Engineering, Doctoral Degree
2011	Faculty of Nuclear Sciences and Physical Engineering, Associated Professor
<b>Scientific Status:</b>	
2011 – present	Country Representative of World Conference of Transport Research (WCTR)

## Scientific Group:

2010 – present

GAMS — Group of Applied Mathematics and Stochastics

## Ph.D. Students:

ing. Pavel Hrabák, Ph.D. & RNDr. František Šeba, Ph.D. & ing. Marek Bukáček, Ph.D. & ing. Jana Vacková\*

## Scientific Fellowships:

2019 – present

Massey University of New Zealand, Auckland, New Zealand

2017 – present

Hochschule Munich, Munich, Germany

2015 – present

Julich Supercomputing Centre, Julich, Germany

1999 – present

Institute of Economy and Traffic, Technical University of Dresden, Germany

2013 – present

Nanyang Technological University, Singapore, Singapore

1999 – present

Max Planck Institute for Physics of Complex Systems, Dresden, Germany

2016 – present

Technical University, Munich, Germany

2001 – present

Joint Institute of Nuclear Research, Dubna, Russia

2008 – present

Université Paris-Sud 11, Paris, France

2014 – present

AGH University Krakow, Krakow, Poland

1999 – present

Institute of Physics, Czech Academy of Science, Czech Republic

1999 – present

University of Hradec Králové, Czech Republic

2005 – present

Brno University of Technology, Faculty of Civil Engineering, Czech Republic

2013 – present

Institute of Information Theory and Automation, Czech Republic

## Research Topics:

Mathematical Modeling of Socio-Physical Dynamics

Vehicular Headway Modeling

Analytical Computations for Physics of Traffic

Numerical Models of Traffic Flows

Asymmetric Simple Exclusion Model

Gap Acceptance Theory

Models for Pedestrian Flows

Models for Crowd Under the Panic Conditions

Theory of Balanced Distributions

Balanced Particle Systems

Random Matrix Theory

### Scientific Evaluation:

Web of Science	<b>348</b> (with self-citations, last update: 29/12/2022)
Web of Science	<b>220</b> (without self-citations, last update: 29/12/2022)
H-index (Web of Science)	<b>11</b> (with self-citations, last update: 29/12/2022)
Number of WOS Publications	<b>32</b> (last update: 29/12/2022)

### Top Projects:

2020 – 2024	AdMath4Traffic – Advanced mathematical-physical methods for modeling of traffic flow microstructure (supported by Technology Agency of the Czech Republic TA ČR)
2018 – 2020	Automated inspection system for a car engine space (in collaboration with Škoda Auto)
2015 – 2017	Detection of stochastic universalities in non-equilibrium states of socio-physical systems by means of Random Matrix Theory (supported by Czech Science Foundation GA ČR)

### Scientific Collaborators:

Prof. RNDr. Petr Šeba, DrSc.	Random Matrix Theory & Theory of Chaos & Parking Problems & New Aspects in Physics of Traffic
Prof. Dr. Dirk Helbing	Quantitative Sociodynamics & Physics of Traffic & Local Thermodynamical Gases
Prof. Vyaceslav Borisovic Priezhev	Generalizations of Asymmetric Simple Exclusion Model
Prof. Ingrid Rotter	Classical and Quantum Chaos
Dr. Peter Wagner	Physics of Traffic & Cellular Models
Prof. Cecile Appert-Rolland	Advanced Statistical Analysis of Traffic Data
Ing. Jiří Apeltauer, Ph.D.	Vehicular Headway Modeling & Gap Acceptance Theory
Ing. Pavel Hrabák, Ph.D.	TASEP & Models for Pedestrian Flows
Doc. Ing. Tomáš Hobza, Ph.D.	Vehicular Headway Modeling & Random Matrix Theory & Gap Acceptance Theory
Ing. Marek Bukáček, Ph.D.	Pedestrian dynamics

### Teaching Activities:

FNSPE, CTU Prague	Mathematical Analysis (Calculus), Equations of Mathematical Physics,
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University of Hradec Králové	Seminar on Calculus, Mathematical Modeling of Vehicular Traffic, Random Matrix Theory, Mathematics for Particle Systems Theory of Deterministic Chaos, Introduction to Probability Theoretical Physics, Theory of Electricity and Magnetism, Theory of Relativity, Mathematics for Physicists
Brno University of Technology	Machine Learning Methods

### Reviewed Articles in the Impacted Scientific Periodicals:

2022	M. Krbálek, T. Hobza, M. Patočka, M. Krbálková, J. Apeltauer, et.al. <i>Statistical aspects of gap-acceptance theory for intersection capacity</i> Physica A <b>585</b> (2022), in print
2022	M. Krbálek, F. Šeba, and M. Krbálková <i>Super-random states in vehicular traffic — Detection &amp; explanation</i> Physica A <b>585</b> (2022), 126418
2020	A. Novozámský, D. Vít, F. Šroubek, J. Franc, M. Krbálek, et.al. <i>Automated Object Labeling For Cnn-Based Image Segmentation</i> , ICIP-IEEE International Conference on Image Processing (2020), 2036–2040
2019	M. Krbálek, J. Apeltauer, and František Šeba <i>Traffic Flow Merging – Statistical and Numerical Modeling of Microstructure</i> Journal of Computational Science <b>32C</b> (2019), 99–105
2019	O. Kollert, M. Krbálek, T. Hobza, and M. Krbálková <i>Statistical rigidity of vehicular streams – theory versus reality</i> Journal of Physics Communications <b>3</b> (2019), 035020
2018	M. Bukáček, P. Hrabák, and M. Krbálek <i>Microscopic Travel Time Analysis of Bottleneck Experiment</i> Transportmetrica A: Transport Science <b>14/5-6</b> (2018), 375
2018	M. Krbálek, J. Apeltauer, T. Apeltauer, and Z. Szabová <i>Three methods for estimating a range of vehicular interactions</i> Physica A <b>491</b> (2018), 112
2018	M. Krbálek, P. Hrabák, and M. Bukáček, <i>Pedestrian headways — Reflection of territorial social forces</i> Physica A <b>490</b> (2018), 38
2017	M. Krbálek <i>Quantitative analysis of interaction range in vehicular flows</i>

- 2016 Transportation Research Procedia **25** (2017), 1268  
M. Krbálek and P. Hrabák  
*Time-headway distribution for periodic totally asymmetric exclusion process with various updates*  
Physics Letters A **380/9-10** (2016), 1003
- 2016 M. Bukáček, P. Hrabák, and M. Krbálek  
*Individual Microscopic Results Of Bottleneck Experiments*  
Traffic and Granular Flow '15 (2016), 105
- 2015 M. Krbálek and J. Šleis  
*Vehicular headways on signalized intersections: theory, models, and reality*  
J. Phys. A: Math. Theor. **48** (2015), 015101
- 2014 M. Bukáček, P. Hrabák, and M. Krbálek  
*Experimental Study of Phase Transition in Pedestrian Flows*  
Transportation Research Procedia **2** (2014), 105
- 2014 M. Bukáček, P. Hrabák, and M. Krbálek  
*Cellular Model of Pedestrian Dynamics with Adaptive Time Span*  
Lecture Notes in Computer Science **7385** (2014), 669
- 2013 P. Hrabák, M. Bukáček, and M. Krbálek  
*Cellular Model of Room Evacuation Based on Occupancy and Movement Prediction: Comparison with Experimental Study*  
Journal of Cellular Automata **8** (2013), 383
- 2013 Milan Krbálek  
*Theoretical predictions for vehicular headways and their clusters*  
J. Phys. A: Math. Theor. **46** (2013), 4451011
- 2012 P. Hrabák, M. Bukáček, and M. Krbálek  
*Cellular Model of Room Evacuation Based on Occupancy and Movement Prediction*  
Lecture Notes in Computer Science **7495** (2012), 709
- 2011 M. Krbálek and P. Hrabák  
*Inter-particle gap distribution and spectral rigidity of totally asymmetric simple exclusion process with open boundaries*  
J. Phys. A: Math. Theor. **44** (2011), 175203
- 2011 M. Krbálek and K. Kittanová  
*Lattice thermodynamic model for vehicular congestions*

- 2011 Procedia Social and Behavioral Sciences **20** (2011), 398  
M. Krbálek and P. Hrabák  
*Distance- and time-headway distribution for totally asymmetric simple exclusion process*  
Procedia Social and Behavioral Sciences **20** (2011), 406
- 2010 M. Krbálek  
*Analytical derivation of time spectral rigidity for thermodynamic traffic gas*  
Kybernetika **46-6** (2010), 1108
- 2009 M. Krbálek and P. Šeba  
*Spectral rigidity of vehicular streams (Random Matrix Theory approach)*  
J. Phys. A: Math. Theor. **42** (2009), 345001
- 2008 M. Krbálek  
*Inter-vehicle gap statistics on signal-controlled crossroads*  
J. Phys. A: Math. Theor. **41** (2008), 205004
- 2007 M. Krbálek  
*Equilibrium distributions in a thermodynamical traffic gas*  
J. Phys. A: Math. Theor. **40** (2008), 5813
- 2005 M. Krbálek  
*Dopravní systémy jako termodynamické plyny*  
Československý časopis pro fyziku **5** (2005), 432
- 2004 M. Krbálek and D. Helbing  
*Determination of interaction potentials in freeway traffic from steady-state statistics*  
Physica A **333** (2004), 370
- 2003 M. Krbálek and P. Šeba  
*Headway statistics of public transport in Mexican cities*  
J. Phys. A: Math. Gen. **36** (2003), L1
- 2001 M. Krbálek, P. Šeba, and P. Wagner  
*Headways in the traffic flow - remarks from a physical perspective*  
Phys. Rev. E **64** (2001), 066119
- 2000 M. Krbálek and P. Šeba  
*Statistical properties of the city transport in Cuernavaca (Mexico) and random matrix ensembles*  
J. Phys. A: Math. Gen. **33** (2000), L229

## Other Reviewed Articles, Thesis, and Papers:

- 2021 A. Lhotáková, M. Krbálek  
*Scaling of the Generalized Inverse Gaussian distribution*  
Proceedings of SPMS 2020-2021, Chlum u Třeboně, Malá Skála
- 2021 V. Pánek, M. Krbálek  
*Super-Poissonian states in balanced particle systems*  
Proceedings of SPMS 2020-2021, Chlum u Třeboně, Malá Skála
- 2020 M. Krbálek, F. Šeba, M. Krbálková  
*On Rivalry between Attractive and Repulsive Stimuli in Vehicular Traffic*  
Proceedings of SPMS 2020-2021, Chlum u Třeboně, Malá Skála
- 2019 F. Šeba, M. Krbálek  
*Super-Poissonian Statistics In Traffic Flow*  
APLIMAT 2020 - Proceedings (2020), 930–941
- 2019 M. Krbálek  
*Chůze v davu: impulzy bez doteku*  
Vesmír **9** (2019), 500–502
- 2018 M. Krbálek and M. Krbálková  
*3s-Unification for Vehicular Headway Modeling*  
Proceedings of SPMS 2018, Dobřichovice (2018)
- 2017 M. Krbálek, J. Apeltauer, and T. Apeltauer  
*Vliv třídy rozdělení časových odstupů na kapacitu neřízených křižovatek*  
Silnice Železnice **4** (2017), 90
- 2017 Milan Krbálek  
*Actively-Followed Vehicles*  
Proceedings of SPMS 2017, Dobřichovice 2017, ISBN 978-80-01-06338-5
- 2016 M. Krbálek, J. Apeltauer, and T. Apeltauer  
*Analýza mikrostruktury dopravního proudu s využitím standardních empirických dat*  
Silnice Železnice **5** (2016), 98
- 2015 M. Krbálek, J. Apeltauer, T. Apeltauer, and M. Všečka  
*Analýza mikrostruktury dopravního proudu metodami teorie náhodných matic*  
Silnice Železnice **3** (2015), 30

- 2015 Milan Krbálek  
*Matematický siloměr na detekci sociálních interakcí*  
Rozhledy matematicko-fyzikální  
Jednota českých matematiků a fyziků, 90/1-2 (2015), 30-38
- 2011 Milan Krbálek  
*Socio-physical modeling of traffic stream dynamics,*  
*Habilitation Thesis, FNSPE, Czech Technical University*
- 2010 Milan Krbálek  
*Discrete thermodynamical modelling of traffic streams*  
Proceedings of World Conference on Transport Research 2010  
Lisbon, Portugal
- 2010 Milan Krbálek  
*Time clearance distribution and associated spectral rigidity*  
*of thermodynamic traffic gas*  
Proceedings of Conference SPMS 2010, Děčín, Czech Republic
- 2007 Milan Krbálek  
*Dopravní systémy jako termodynamické plyny*  
Československý časopis pro fyziku **55** (2005), 432-435
- 2003 Milan Krbálek  
*Traffic systems - particle gases in thermal equilibrium*  
*(Random Matrix Theory approach), Doctoral Thesis*  
FNSPE, Czech Technical University
- 2000 Milan Krbálek and Petr Šeba  
*Description of the traffic systems by the random matrix theory*  
Proceedings of the Nostradamus 2000 Conference, Zlín, Czech Republic

#### **Textbooks:**

- 2022 Milan Krbálek a Jana Vacková  
*Matematické modelování dopravy*  
Česká technika - nakladatelství ČVUT, Praha 2022



- 2021 Milan Krbálek  
*Funkce více proměnných*  
Česká technika - nakladatelství ČVUT, Praha 2021
- 2019 Milan Krbálek  
*Matematická analýza III (čtvrté vydání)*  
Česká technika - nakladatelství ČVUT, Praha 2019
- 2014 Milan Krbálek  
*Teorie míry a Lebesgueova integrálu*  
Česká technika - nakladatelství ČVUT, Praha 2014
- 2012 Milan Krbálek  
*Úlohy matematické fyziky*  
Česká technika - nakladatelství ČVUT, Praha 2012
- 2010 Milan Krbálek  
*Matematická analýza IV – cvičení*  
Česká technika - nakladatelství ČVUT, Praha 2010
- 2009 Milan Krbálek  
*Matematická analýza IV (druhé rozšířené vydání)*  
Česká technika - nakladatelství ČVUT, Praha 2009
- 2008 Milan Krbálek  
*Úlohy matematické fyziky - cvičení*  
Česká technika - nakladatelství ČVUT, Praha 2008

**Commercial Interview:**

*DVTV (with Emma Smetana): Brain as the main cause of vehicular platoons  
& BBC: Buses on Quantum Schedules*

**Popular Articles:**

*The Times (London), Discovery (USA), Science News (Washington), MF Dnes (Czech Republic), Quanta Magazine (New York), Vesmír (Czech Republic)*

**Personal Interests:**

Running & Hiking & Cycling & Photographing & Music & Espresso & Caribbean Rums & Graphical Design & Takamine – Santa Fè