Curriculum vitae

PERSONAL INFORMATION
Family name, First name: LOEBL MARTIN
Date of birth: March 19, 1963, Prague, Czech Republic
URL for web site: http://kam.mff.cuni.cz/~loebl

EMPLOYMENT

1989- present:	Department of Applied Mathematics KAM MFF UK, Faculty of Mathematics and Physics, Charles University Prague, Czech Republic
From 2007	Head of the Optimization group of KAM MFF UK
From 2008	Full Professor
From 2015	Head of the Department of Applied Mathematics KAM MFF UK.

FELLOWSHIPS AND AWARDS

1986	Prize of the Czechoslovak Academy of Sciences (for a joint paper with J. Matousek)
1990	International Meeting of Young Computer Scientists (IMYCS) award
1990 – 1991	Humboldt Research Fellow, Forschungsinstitut fur Diskrete Mathematik, Universitat Bonn, Germany (12 months)
1993	Postdoctoral Fellow, DIMACS, Rutgers University, U.S.A.
1994 – 1995	NSERC Canada International Fellow, University of Waterloo, Canada

STAYS ABROAD
Long: Georgia Institute of Technology, Atlanta, U.S.A. 2000 – 2001.
Short: Budapest, Technion Haifa, Paris 6, Paris 7, Poincare Institute Paris, Bordeau, Nancy, Rome, Pavia, Barcelona, Berlin, Bielefeld, Hamburg, Koeln, Oxford, Cambridge, Warwick, Royal Holloway, Sao Paulo, Buenos Aires, Santiago, Waterloo, Vancouver, Princeton, Berkeley, Stanford, Los Alamos National Laboratory, Rutgers University, Atlanta, Columbia University.

SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS
Supervisor of 9 Ph.D. Students (6 Czechs, 2 Chileans, 1 Iranian, 7 finished, 7 have academic jobs) in the Czech Republic:
Marek Janata (2005)
Ondrej Pankrac (2006) Assistant Professor Charles University Prague http://iuuk.mff.cuni.cz/~pangrac/
Jan Vondrak (2007) Associate Professor Stanford University U.S.A. http://theory.stanford.edu/~jvondrak/
Hossein Teimoori (2010) Kashani University Iran http://ghiasodin.academia.edu/HosseinTeimooriFaal
Jirka Fink (2011) Assistant Professor Charles University Prague https://kam.mff.cuni.cz/~fink/
Jose Zamora (2013) Assistant Professor Universidad Andres Bello Chile http://mat-unab.cl/~jzamora/
Pavel Rytir (2013)
Andrea Jimenez (expected to finish 2018; I was also co-supervisor of Andrea's doctoral thesis Universidad de Chile defended 2012) Universidad deValparaiso Chile http://ajimenez.cimfav.cl/
Jakub Cerny (started 2017)

Supervisor of 2 postdoctoral fellows (1 British, 1 Spanish) in the Czech Republic:
Anna DeMier (2006) Associate Professor UPC Barcelona https://mat-web.upc.edu/people/anna.de.mier/
Iain Moffatt (2006) Royal Holloway University of London http://www.personal.rhul.ac.uk/uxah/001/
For more information see my Ten years track-record.

RESPONSIBILITIES, COMMISSIONS OF TRUST
European Commission, REA scientific evaluator for FP7 and H2020.

2012- 2016 member of the panel of Informatics of the Grant agency of Czech Republic GACR.

Prize of Jirka Matousek http://kam.mff.cuni.cz/cenajm.html I introduced this prize in 2015 for excellent doctoral students in memory of our colleague Jirka Matousek.

Main organizer (with Petr Danecek) Prague's Bioinformatics seminar. The aim is to bring together academicians and students of mathematics and informatics at Charles University with researchers in bioinformatics. http://siret.ms.mff.cuni.cz/danecek/index.html

Member of the scientific committee of LEA-STRUCO, an associated international laboratory of CNRS (DIMATIA and LIAFA) https://www.irif.univ-paris-diderot.fr/~charbit/STRUCO/index.html

Main organizer (with Lenka Zdeborova and Jarik Nesetril) Czech workshop on complex systems, http://artax.karlin.mff.cuni.cz/~zdebl9am/cwssIII.htm

Member of hiring and reviewing committees in Argentina, Brazil, Chile, Czech Republic, Germany. Reviewer for grant agencies in Argentina, Brazil, Chile, Germany, Israel, Switzerland, U.S.A.

PUBLICATIONS
Coauthor of 35+ journal publications since 2000 (70+ total); in the last ten years 5 papers in Advances in Mathematics, 2 papers in Annales de'l Institut Henri Poincare; for details see my web page. A sample of older papers:
A. Galluccio, M. Loebl, J. Vondrak, A New Algorithm for the Ising Problem: Partition Function for Finite Lattice Graphs, Physical Review Letters **84**, 5924-5927 (2000).
M. Kiwi, M. Loebl, J. Matousek,Expected Length of the Longest Common Subsequence For Large Alphabets, Advances in Mathematics **197** 2005.

PATENTS
U.S.A. patent number 08856940 (2015) Information Concealing. For details see my Ten years track-record.

BOOKS
Martin Loebl, Discrete Mathematics in Statistical Physics, ISBN 978-3-834-89329-1(Print) 978-3-528-03219-7(Online), Vieweg+Teubner Verlag (2010).

M. Klazar, J. Kratochvil, M. Loebl, R.Thomas, P. Valtr (eds) Topics in Discrete Mathematics: Dedicated to Jarik Nešetril on the Occasion of his 60th birthday, ISBN 978-3-540-33700-3, Springer Verlag, Series Algorithms and Combinatorics (2006); received **Prize of Rector of Charles University**.

M. Loebl, J. Nesetril, R. Thomas (eds) A Journey Through Discrete Mathematics: A Tribute to Jiri Matousek ISBN 978-3-319-44479-6 Springer Verlag (2017).

MAJOR COLLABORATIONS not discussed in the Ten years track-record
I started my academic career with research in graph theory and algorithms. My master thesis was related to discrete optimization and my doctoral thesis focused on combinatorial functions growing extremely fast; this is related to unprovability in Finite Set Theory. With **Jirka Matousek** and **Jarik Nesetril** (my supervisor) we achieved several interesting results (see e.g. Proceeding of AMS 116,3 (1992)). My first paper with **Ron Aharoni** is from the field of infinite combinatorics.
I started working on matching theory with **Svatopluk Poljak**. In a series of papers we characterized complexity of subgraph packing, solving a problem posed by Lovasz (see e.g. Journal of Combinatorial Theory-B 59,1 (1993)).
In a joint paper with **Paul Erdos**, **Zoltan Furedi** and **Vera Sos** (Studia Sci. Math. Hungar. 30 (1995)) we studied the discrepancy of hypergraphs and introduced the extensively studied **Loebl-Komlos-Sos Conjecture** (see paragraph on Diana Piguet in my Ten years track-record).
My view of mathematics changed in the second half of the 1990's when I read a seminal paper of Kasteleyn which started the theory of Kasteleyn orientations. In spring 2016 in Berkeley I attended a lecture of Valiant, and he spoke equally enthusiastically about the same Kasteleyn's paper. With **Anna Galluccio** we proved the formula conjectured by Kasteleyn in the beginning of sixties, known nowadays as the Arf-invariant formula. Our method was implemented by **Jan Vondrak** (see paragraph on Jan Vondrak in my Ten years track-record).

On-going projects (for more information see the Ten years track-record)

The Stanley's conjecture. Collaborators of this project include Iain Moffatt (Royal Holloway University of London) and Jean-Sebastien Sereni (CNRS, France).
The conjectures of Stanley, Welsh and Loebl imply that non-isomorphic general graphs are distinguished, after a simple preprocessing, by their Potts partition function with a magnetic field contribution.

The complexity of the Ising partition function. Collaborators of this project include Lenka Zdeborova (Institute de Physique Theoretique, Saclay, France) and Misha Chertkov (Los Alamos National Lab, U.S.A.)
Developing the theory of geometric representations of binary linear codes and 4D discrete Ihara-Selberg function lead me to write the Ising partition function of a general graph, in particular of a 3D cubic lattice, as a single (formal) product. This is surprising; before, such formula was proved by Feynman in the beginning of sixties for the planar graphs only. This provides a completely new tool to study the Ising problem in the dimension at least three.
Another research direction is the study of complexity lower bounds, by establishing optimality of the method of Kasteleyn orientations.

Matchings of graphs and hypergraphs. Collaborators of this project include Maria Chudnovsky (Princeton University, U.S.A.) and Ron Aharoni (Technion, Israel). We use methods of structural graph theory to study the List-coloring conjecture and the Aharoni- Berger conjecture.

Selected publications of last ten years ordered thematically (the full list of my publications is in my web page)

M. Loebl, Chromatic Polynomial, q-Binomial Counting and Colored Jones Function, Advances in Mathematics 211-2, 2007. I recast our joint work with Garoufalidis in the language of graph polynomials. This work viewed graph polynomials in a completely new way. This is one of my most original works. It influenced Iain Moffatt and Andrew Goodall to start working in graph polynomials. Iain's supervisor was Garoufalidis, and Iain went to Prague for his postdoc. My on-going work on the Stanley's Conjecture is motivated by these results.

M. Loebl, I. Moffatt, The chromatic polynomial of fatgraphs and its categorification, Advances in Mathematics 217, 2008. This is the main result from Iain's stay in Prague. We discovered new algebraic connections of the graph polynomials of embedded graphs and the Jones polynomial of knots. This work's suggested explorations of graphs are still quite open.

M. Klazar, M. Loebl, I. Moffatt, The Potts model and chromatic functions of graphs, Annales de'l Institut Henri Poincare D (Combinatorics, Physics and their Interactions) 1(1) 47- 60 (2014).
This later work confirms one of important suggestions of the first paper above: that the Potts partition function with a magnetic field contribution is as strong as the strongest studied graph polynomials. It is plausible that with simple preprocessing such Potts partition function can distinguish non-isomorphic graphs.

M. Loebl, J.S. Sereni, Isomorphism of weighted trees and Stanley's conjecture for caterpillars, 2017, submitted.
Stanley's conjecture is a major conjecture of the enumerative combinatorics from 1996 independently formulated by Noble and Welsh, and studied also e.g. by statistical physisists. In my three papers mentioned above a surprising fact is established:
If Stanley's conjecture holds for the chordal graphs (chordal graphs are blown-up trees) then non-isomorphic general graphs are distinguished, after a simple preprocessing, by their Potts partition function with a magnetic field contribution. This would mean that the Potts partition function, one of the most basic functions of the statistical physics, already contains all the information about the underlying graph.

The Stanley's conjecture asserts that certain statistical information called U-polynomial suffices to distinguish non-isomorphic trees. Very little has been obtained before our work; we proved the conjecture for special trees called caterpillars (this case was extensively studied without success since the formulation of the Stanley conjecture) and also established a promising new method for the general conjecture.

M. Loebl, L. Zdeborova, The 3D Dimer and Ising Problems Revisited, European J. Combinatorics 29/3, 2008. The paper simplifies and generalizes my previous work on applications of the Kasteleyn method to the 3-dimensional Ising problem (one of the main objectives of this proposal). Lenka Zdeborova, now in Institute de Physique Theoretique, Saclay, France, was a bright physics student in Prague. We keep speaking with Lenka about mathematics, physics and informatics; we jointly organize the Czech Workshop on Complex Systems, see my CV.

M. Kang, M. Loebl, The enumeration of planar graphs via Wick's theorem, Advances in Mathematics 221 (5) 2009. This is another paper exploring connections with statistical physics.

M. Loebl, P. Somberg, Discrete Dirac Operators, Critical Embeddings and Ihara-Selberg Functions, The Electronic Journal of Combinatorics 22, 1 (2015). In 2007 I learned about the work of Cimasoni and Reshetikhin on the Arf-invariant formula, and of Mercat on discrete analytic functions. Kenyon defined discrete Dirac operators on critical planar graphs and observed that the dimer partition function is determined by the local geometric information of a critical planar embedding. I became fascinated by attempts of Cimasoni to extend the results of Kenyon to the graphs critically embedded on a surface of genus bigger than zero. I realized that one needs to use the theory of Kac-Ward-Feynman-Sherman based on products and rotations. At that time, these results were forgotten. I explained them in Prague to Somberg, Cimasoni and Masbaum and it resulted in several papers of Cimasoni and also our paper.

M. Loebl, Binary linear codes via 4D discrete Ihara-Selberg Functions, to appear in Annales de'l Institut Henri Poincare D (Combinatorics, Physics and their Interactions) (2017).
This work extends the method Kac-Ward-Feynman-Sherman mentioned in the above paper to study general binary linear codes. In particular this generalizes a formula of Feynman (1961) on the Ising partition function from planar graphs to general graphs. As an important consequence, the Ising partition function of the cubic lattice is written as a single (formal product and this opens a way to study its logarithm.

M. Loebl, G. Masbaum, On the optimality of the Arf invariant formula for graph polynomials, Advances in Mathematics 226 (2011). We continued to discuss mathematics with Gregor Masbaum and we managed to prove the Norine's conjecture for the Ising partition function. This result provides an exponential complexity lower bound in a very restricted but commonly used model of computation. I was invited to speak about the result by communities across fields. The paper is involved but the arguments are well understood. I believe this may be one of my most important results.

E. Berger, K. Choromanski, M. Chudnovsky, J. Fox, M. Loebl, A. Scott, P. Seymour, S. Thomasse, Tournaments and colouring, J.Comb.Theory, Ser.B 103(1) 1- 20 (2013). This is my recent work on colorings in the structural graph theory.

R. Aharoni, M. Loebl, The Odd Case of Rota's Bases Conjecture, Advances in Mathematics 282 (2015) 427-442. I heard from Aharoni about the Rota's bases conjecture, that it is implied (for each even size) by the Alon-Tarsi conjecture, and a beautiful enumeration proof of this fact by Onn. I found a non-commutative generalization of Onn's proof, and it was the beginning of our joint work. This paper contains proof of 'half of Alon-Tarsi conjecture'. One objective in this research area has been to understand the List coloring conjecture. In the course of our work with Ron a group formed including Berger, Chudnovsky, Kotlar and Ziv, which extensively collaborates.

R. Aharoni, N. Alon, E. Berger, M. Chudnovsky, D. Kotlar, M. Loebl, R. Ziv Fair representation by independent sets, in: A Journey Through Discrete Mathematics: A Tribute to Jiri Matousek, Springer (2017). This is my recent work on colorings and matchings using the topological methods.

PATENTS
J. Blamey, L. Kencl, M. Loebl: Information concealing, **Czech** patent number 301799 (2010).
J. Blamey, L. Kencl, M. Loebl: Information concealing, **U.S.A**. patent number 08856940 (2015).

Protection of sensitive content is crucial for extensive information sharing. The patents concern information concealing to enable information sharing, by introduction and maintenance of repeats. The patented claims are from Informatics and Structure of DNA.

RECENT INVITED PRESENTATIONS

2011 Counting, Inference and Optimization on Graphs, Princeton University
http://intractability.princeton.edu/
2014 Spin glasses: an old tool for new problems, Institute d'Etudes Scientifiques de Cargese
http://www.lps.ens.fr/~krzakala/WEBSITE_Cargese/overview.htm
2015 Chromatic and Colored Structures in geometry and statistical physics, Instituto Nacionale di Alta Mathematica, Cortona (series of 3 lectures)
https://www.altamatematica.it/sites/default/files/chrocos_giornaliero.pdf
2016 The Classification Program of Counting Complexity, Simons Institute Berkeley
https://simons.berkeley.edu/talks/martin-loebl-2016-03-30
2016 The Mathematics of Jiri Matousek, Prague
http://kam.mff.cuni.cz/conferences/mathjm/program.html#martin_loebl

MAJOR CONTRIBUTION TO EARLY CAREERS OF EXCELLENT RESEARCHERS

Jan Vondrak, Associate Professor, Stanford University http://theory.stanford.edu/~jvondrak/
Jan wrote his master thesis (1999) resulting in influential papers (jointly also with Anna Galluccio) under my supervision. After obtaining his master degree Jan completed doctoral studies at MIT (2005, supervisor M.X. Goemans). After the doctorate at MIT Jan completed his doctoral studies at Charles University in 2007 under my supervision. Jan is interested in optimization of submodular functions, approximation algorithms, algorithmic game theory and probabilistic combinatorics. We have 3 joint papers related to algorithmic and computational aspects of the theory of Kasteleyn orientations. We regularly discuss mathematics.

Jirka Fink, Assistant Professor, Charles University https://kam.mff.cuni.cz/~fink/
Jirka wrote his master thesis and doctoral thesis (2011) in applied discrete mathematics under my supervision. After obtaining the doctorate Jirka continued to do applications and scientific computation in his postdocs and he is becoming a leader in this field. We regularly speak.

Diana Piquet, Researcher, Czech Academy of Sciences http://uivty.cs.cas.cz/~piguet/
Diana wrote her doctoral thesis in 2008. Her supervisor was Jarik Nesetril and I contributed in a major way to Diana's supervision. Her thesis was on the **Loebl- Komlos- Sos Conjecture** mentioned in my CV. This has been a leading topic of Diana's research. A group of researchers including Jan Hladky, Maya Stein, Julia Bottcher and Peter Allen established around her. Diana won prestigious fellowships, and she is clearly established at the frontiers of research in graph theory worldwide.

Iain Moffatt, Royal Holloway University of London http://www.personal.rhul.ac.uk/uxah/001/
Iain did his postdoc with me in 2006 and since then we have completed 3 publications. It is clear from Iain's achievements that he established himself as a leader in the community of graph polynomials.