# Curriculum Vitae

Prof. Dr. rer. nat. habil. Markus Lohrey
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## 1. Academic Employments

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|---|---|
| Jan. 1997 – Nov. 1997 | Ph.D. scholarship in the postgraduate program *Specification of Discrete Processes and Systems of Processes by Operational Models and Logics* at Dresden University of Technology, Germany |
| Dec. 1997 – Apr. 2000 | Research associate (German BAT IIa) at the Computer Science Department (Theoretical Computer Science) at the University of Stuttgart, Germany |
| May 2000 – March 2004 | Assistant lecturer (German C 1) at the Computer Science Department (Theoretical Computer Science) at the University of Stuttgart, Germany |
| Apr. 2004 – Sep. 2004 | Temporary professorship at the chair for *Algorithms and Complexity* at the RWTH Aachen, Germany |
| Oct. 2004 – Sep. 2005 Oct. 2006 – Mar. 2007 | University lecturer (German C 2) at the Computer Science Department (Theoretical Computer Science) at the University of Stuttgart, Germany |
| Oct. 2005 – Sep. 2006 | Temporary professorship at the chair for *Data Structures and Efficient Algorithms* at the Martin-Luther-University of Halle-Wittenberg, Germany |
| since April 2007 | Full professor at the the Computer Science Department (Algebraic and Logical Foundations of Computer Science) at the University of Leipzig, Germany |

## 2. Long term visits

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|---|---|
| July 2001 – Apr. 2002 | Post-doc researcher at Laboratoire d'Informatique Algorithmique: Fondements et Applications (LIAFA, University Paris 7, France) and Institut de Recherche en Informatique et Systèmes Aléatoires (IRISA, University Rennes 1, France) |
| March 2005 | Invited professor at Laboratoire d'Informatique Algorithmique: Fondements et Applications (LIAFA, University Paris 7, France) |

## 3. Education

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|---|---|
| 1989 – 1990 | Study of Computer Science at Georg-Simon-Ohm University for applied sciences, Nürnberg, Germany<br>Degree: Prediploma |
| 1991 – 1996 | Study of Computer Science at Friedrich-Alexander University of Erlangen-Nürnberg, Germany<br>Degree: Diploma in Computer Science |
| July 1999 | Ph.D. (Dr. rer. nat.) in Computer Science from the University of Stuttgart, Germany<br>Title of the thesis: On the confluence problem for trace rewriting systems<br>Thesis advisor: Prof. Dr. Volker Diekert<br>Magna Cum Laude |
| June 2003 | Habilitation in Computer Science from the University of Stuttgart, Germany<br>Title of the thesis: Computational aspects of infinite monoids |

## 4. Research Interests

Logic in Computer Science (decidable theories, complexity of theories, model-checking hierarchical structures)

Finitely generated infinite graphs (context-free graphs, automatic graphs etc.)

Data compression (algorithms on compressed strings and trees, compression of XML data)

Computational complexity of problems in automata theory and algebra (word problems in monoids and groups, word equations, tree automata, rewriting systems, etc.)

Verification of message sequence charts

Process algebras (stochastic calculi, axiomatization)

## 5. Publications

The following publications can be found at
http://www.informatik.uni-stuttgart.de/fmi/ti/personen/Lohrey/veroeff_eng.html

**Fully refereed papers in international journals**

1. Algorithmic problems on inverse monoids over virtually-free groups (with Volker Diekert und Nicole Ondrusch), to appear in *International Journal of Algebra and Computation*

2. Rational subsets of HNN-extensions and amalgamated free products (with Géraud Sénizergues), to appear in *International Journal of Algebra and Computation*

3. First-order and counting theories of $\omega$-automatic structures (with Dietrich Kuske), to appear in *Journal of Symbolic Logic*

4. Model-checking hierarchical structures, to appear in *Journal of Computer and System Sciences*

5. Efficient memory representation of XML document trees (with Giorgio Busatto and Sebastian Maneth), to appear in *Information Systems*

6. Inverse monoids: decidability and complexity of algebraic questions (with Nicole Ondrusch), *Information and Computation* 205(8), pp. 1212–1234, 2007

7. When is a graph product of groups virtually-free? (with Géraud Sénizergues), *Communications in Algebra* 35(2), pp. 617–621, 2007

8. The complexity of tree automata and XPath on grammar-compressed trees (with Sebastian Maneth), *Theoretical Computer Science* 363(2), pp. 196–210, 2006

9. Logical aspects of Cayley-graphs: the monoid case (with Dietrich Kuske), *International Journal of Algebra and Computation* 16(2), pp. 307–340, 2006

10. Word problems and membership problems on compressed words, *SIAM Journal on Computing* 35(5), pp. 1210–1240, 2006

11. Axiomatising divergence (with Pedro D'Argenio and Holger Hermanns), *Information and Computation* 203(2), pp. 115-144, 2005

12. Decidability and complexity in automatic monoids, *International Journal of Foundations of Computer Science* 16(4), pp. 707–722, 2005

13. Complexity results for prefix grammars (with Holger Petersen), *R.A.I.R.O. — Informatique Théorique et Applications* 39, pp. 391–401, 2005

14. On the theory of one-step rewriting in trace monoids (with Dietrich Kuske), *Theory of Computing Systems* 38(1), pp. 39–81, 200

15. Logical aspects of Cayley-graphs: the group case (with Dietrich Kuske), *Annals of Pure and Applied Logic* 131(1–3), pp. 263–286, 2005

16. Bounded MSC communication (with Anca Muscholl), *Information and Computation* 189(2), pp. 160–181, 2004

17. Existential and positive theories of equations in graph products (with Volker Diekert), *Theory of Computing Systems* 37(1), pp. 133–156, 2003

18. Realizability of high-level message sequence charts: closing the gaps, *Theoretical Computer Science* 309(1–3), pp. 529–554, 2003

19. A note on the existential theory of equations in plain groups (with Volker Diekert), *International Journal of Algebra and Computation* 12, pp. 1–7, 2002

20. Confluence problems for trace rewriting, *Information and Computation* 170, pp. 1–25, 2001

21. NP-completeness results concerning the transformation of logic programs into attribute grammars, *Acta Cybernetica* 13, pp. 209–224, 1998

## Papers submitted to international journals

1. The submonoid and rational subset membership problems for graph groups (with Benjamin Steinberg)

2. Fixpoint logics on hierarchical structures (with Stefan Göller)

3. Partially commutative inverse monoids (with Volker Diekert and Alexander Miller)

4. Word equations over graph products (with Volker Diekert)

## Conference publications

1. Efficient computation in groups via compression (with Saul Schleimer), to appear in *Proceedings of CSR 2007*

2. The submonoid and rational subset membership problems for graph groups (with Benjamin Steinberg), to appear in *Proceedings of LATA 2007*

3. PDL with intersection and converse is 2EXP-complete (with Stefan Göller and Carsten Lutz), *Proceedings of FOSSACS 2007*, Lecture Notes in Computer Science 4423, pp. 198–212, 2007

4. Infinite state model-checking of propositional dynamic logics (with Stefan Göller), *Proceedings of CSL 2006*, Lecture Notes in Computer Science 4207, pp. 349–364, 2006

5. Partially commutative inverse monoids (with Volker Diekert and Alexander Miller), *Proceedings of MFCS 2006*, Lecture Notes in Computer Science 4162, pp. 292–304, 2006

6. Querying and Embedding Compressed Texts (with Yury Lifshits), *Proceedings of MFCS 2006*, Lecture Notes in Computer Science 4162, pp. 681–692, 2006

7. Monadic chain logic over iterations and applications to pushdown systems (with Dietrich Kuske), *Proceedings of LICS 2006*, pp. 91–100, 2006

8. Theories of HNN-extensions and amalgamated products (with Géraud Sénizergues), *Proceedings of ICALP 2006*, Lecture Notes in Computer Science 4052, pp. 504–515, 2006

9. First-order and counting theories of $\omega$-automatic structures (with Dietrich Kuske), *Proceedings of FOSSACS 2006*, Lecture Notes in Computer Science 3921, pp. 322–336, 2006

10. Tree automata and XPath on compressed trees (with Sebastian Maneth), *Proceedings of CIAA 2005*, Lecture Notes in Computer Science 3845, pp. 225–237, 2006

11. Fixpoint logics over hierarchical structures (with Stefan Göller), *Proceedings of FST& TCS 2005*, Lecture Notes in Computer Science 3821, pp. 483-494, 2005

12. Efficient memory representation of XML documents (with Giorgio Busatto and Sebastian Maneth), *Proceedings of DBPL 2005*, Lecture Notes in Computer Science 3774, pp. 199–216, 2005

13. Inverse monoids: decidability and complexity of algebraic questions (with Nicole Ondrusch), *Proceedings of MFCS 2005*, Lecture Notes in Computer Science 3618, pp. 664–675, 2005

14. Model-checking hierarchical structures, *Proceedings of LICS 2005*, pp. 168–177, 2005

15. Decidability and complexity in automatic monoids, *Proceedings of DLT 2004*, Lecture Notes in Computer Science 3340, pp. 308–320, 2004

16. Word problems on compressed words, *Proceedings of ICALP 2004*, Lecture Notes in Computer Science 3142, pp. 906–918, 2004

17. Word equations over graph products (with Volker Diekert), *Proceedings of FST&TCS 2003*, Lecture Notes in Computer Science 2914, pp. 156–167, 2003

18. Automatic structures of bounded degree, *Proceedings of LPAR 2003*, Lecture Notes in Artificial Intelligence 2850, pp. 344–358, 2003

19. Decidable theories of Cayley-graphs (with Dietrich Kuske), *Proceedings of STACS 2003*, Lecture Notes in Computer Science 2607, pp. 463–474, 2003

20. Safe realizability of high-level message sequence charts, *Proceedings of CONCUR 2002*, Lecture Notes in Computer Science 2421, pp. 177–192, 2002

21. On the theory of one-step rewriting in trace monoids (with Dietrich Kuske), *Proceedings of ICALP 2002*, Lecture Notes in Computer Science 2380, pp. 752–763, 2002

22. Axiomatising divergence (with Pedro D'Argenio und Holger Hermanns), *Proceedings of ICALP 2002*, Lecture Notes in Computer Science 2380, pp. 585–596, 2002

23. Bounded MSC communication (with Anca Muscholl), *Proceedings of FOSSACS 2002*, Lecture Notes in Computer Science 2303, pp. 295–309, 2002

24. Existential and positive theories of equations in graph products (with Volker Diekert), *Proceedings of STACS 2001*, Lecture Notes in Computer Science 2285, pp. 501–512, 2002

25. Word problems for 2-homogeneous monoids and symmetric logspace, *Proceedings of MFCS 2001*, Lecture Notes in Computer Science 2136, pp. 500–511, 2001

26. On the parallel complexity of tree automata, *Proceedings of RTA 2001*, Lecture Notes in Computer Science 2051, pp. 201–216, 2001

27. Implementing Luby's algorithm on the Cray T3E (with Jürgen Gross) *High Performance Computing in Science and Engineering*, pp. 467–477, Springer 2000

28. Word problems and confluence problems for restricted semi-Thue systems, *Proceedings of RTA 2000*, Lecture Notes in Computer Science 1833, pp. 172–186, 2000

29. Complexity results for confluence problems, *Proceedings of MFCS 99*, Lecture Notes in Computer Science 1672, pp. 114–124, 1999

30. On the confluence of trace rewriting systems, *Proceedings of FST&TCS 98*, Lecture Notes in Computer Science 1530, pp. 319–330, 1998

31. Priority and maximal progress are completely axiomatisable (extended abstract) (with Holger Hermanns), *Proceedings of CONCUR 98*, Lecture Notes in Computer Science 1466, pp. 237–252, 1998

**Other publications**

1. Computational aspects of infinite monoids, Habilitation thesis, University of Stuttgart, 2003

2. Das Konfluenzproblem für Spurersetzungssysteme, PhD thesis, University of Stuttgart, 1999

## 9. Third-party funds

GELO (Graphen mit entscheidbaren Logiken), granted by the German Research Foundation
project volume: 1 research associates (German BAT IIa) for five years

## 10. Organisational activities

Member of the program committee of the conference *Symposium on Theoretical Aspects of Computer Science* (STACS 2006), Marseille, Frankreich 2006

Member of the program committee of the conference *Automata: from Mathematics to Applications* (AutoMathA 2007), Palermo, Italy 2007

Organisation of the workshop *Computational Complexity and Decidability in Algebra* (colocated with CSR 2007), Ekaterinburg, Russia, 2007

Organisation of the Dagstuhl seminar *Algorithmic-logical theory of infinite structures* (with R. Downey, B. Khoussainov, D. Kuske, and M. Vardi), October 2007

Organisation of the Dagstuhl seminars *Structure-based compression of complex massive data* (with S. Böttcher, S. Maneth and W. Rytter), June 2008

Organisation of the workshops *Computational Complexity and Decidability in Algebra*, Ekatarinburg, Russia, September 2007

Organisation of the *17. Theorietag Automaten und Formale Sprachen* (with Manfred Droste), Leipzig, Germany, September 2007

Member of the program committee of the conference *Current Trends in Theory and Practice of Computer Science* (SOFSEM 2008), Novy Smokovec, Slovakia, 2008

## 11. Teaching experience

see http://inf.informatik.uni-stuttgart.de/fmi/ti/personen/Lohrey/lehre.html for more details

### Courses for which I was fully responsible

| | | |
|---|---|---|
| Parameterized algorithms | summer term 2006 | Martin-Luther-University Halle-Wittenberg |
| Algorithmic topics for compressed data | summer term 2006 | Martin-Luther-University Halle-Wittenberg |
| Randomized algorithms | winter term 2005/2006 | Martin-Luther-University Halle-Wittenberg |
| DNA-computing | winter term 2005/2006 | Martin-Luther-University Halle-Wittenberg |
| Theoretical Computer Science I | summer term 2005 | University of Stuttgart |
| Formal semantics | winter term 2004/2005 | University of Stuttgart |
| Selected topics from the theory of algorithms | summer term 2004 | RWTH Aachen |
| Cryptographical methods | winter term 2003/2004 | University of Stuttgart |
| Graph theory | winter term 2002/2003 | University of Stuttgart |
| Parallel algorithms | summer term 2000 summer term 2001 | University of Stuttgart University of Stuttgart |

### Seminars for which I was fully responsible

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|---|---|---|
| Selected topics from theoretical computer science | summer term 2005 | University of Stuttgart |
| Algorithms from biocomputing | summer term 2004 | RWTH Aachen |
| Circuit complexity | summer term 2004 | RWTH Aachen |
| Data compression | summer term 2001 summer term 2002 winter term 2003/2004 | University of Stuttgart University of Stuttgart University of Stuttgart |

| Quantum computing | summer term 2000 | University of Stuttgart |
| Distributed algorithms | winter term 1999/2000 | University of Stuttgart |

## Student research projects and diploma theses that I have supervised

Reachability in undirected graphs in logspace, by Thomas Baumann
student research project, University of Stuttgart, 2007

Subword problems on compressed strings, by T. Nonner
diploma thesis, University of Stuttgart, 2005

Parity games on hierarchical graphs, by S. Göller
diploma thesis, University of Stuttgart, 2005

Definability and data compression, by R. Wittmann
student research project, University of Stuttgart, 2002

Word equations in hyperbolic groups, by M. Kufleitner
diploma thesis, University of Stuttgart, 2001

Parallel complexity and space complexity of some problems for Mazurkiewicz traces, by A. Miller
diploma thesis, University of Stuttgart, 2001

An implementation of Luby's algorithm on the Cray T3E, by J. Gross
diploma thesis, University of Stuttgart, 1999

## Student tutorials

For a wide range of lectures in theoretical computer science I was responsible for the organization and supervision of accompanying student tutorials, which covered topics like formal language theory, basic recursion and complexity theory, discrete mathematics, formal semantics, and efficient algorithms.

## 12. Invited talks

### At international workshops

Word Problems for Mazurkiewicz traces
Dagstuhl Seminar Logic, Algebra, and Formal Verification of Concurrent Systems,
Dagstuhl, Germany, November 2000

Complexity of automatic structures
International Workshop on Automata, Structures and Logic 2004 (satellite workshop of
Developments in Language Theory 2004), Auckland, New Zealand, December 2004

The submonoid and rational subset membership problems for graph groups
*North British Geometric Group Theory Seminar 2007*, York, UK, 2007

### At institutes

Das Konfluenzproblem für Spurersetzungssysteme
Technical University of Munich, Germany, January 2000

Word problems for restricted semi-Thue systems
University Paris 7, LIAFA, France, April 2000 Rewriting with traces

University Rennes 1, IRISA, France, March 2001

Word problems for 2-homogeneous Thue systems and symmetric logspace
University of Leicester, Great-Britain, October 2001

Bounded communication in message sequence charts
University Paris-Sud, France, November 2001

Monadic second-order and first-order logic on Cayley-graphs
University Paris 7, LIAFA, France, December 2002

Graphen mit entscheidbarer monadischer Theorie 2. Stufe und Anwendungen für Cayley-
Graphen
RWTH Aachen University, Germany, February 2003

FO and MSO over hierarchically defined graphs
University Paris 7, LIAFA, France, June 2004

Applications of verification techniques in inverse monoid theory
University Paris 7, LIAFA, France, September 2005

Automatic structures and generalized quantifiers
University Rennes 1, IRISA, France, October 2005

Prof. Dr. rer. nat.habil. Markus Lohrey   Institut für Informatik   University of Leipzig

Entscheidbarkeit und Komplexität algebraischer Fragestellungen in inversen Monoiden
University of Leipzig, November 2005

Monadic chain logic over iterations and applications to pushdown systems
RWTH Aachen University, May 2006