

# CURRICULUM VITAE

*Martin Nilsson Jacobi*

- Date of birth: August 31, 1972      Address: Complex systems group  
Pre-marriage name: Martin Nilsson      Department energy and environment  
Place of birth: Växjö, Sweden      Chalmers University of Technology  
Citizenship: Swedish      412 96 Göteborg, Sweden
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Education:  
Undergraduate: Chalmers University of Technology, Göteborg, 1992–1994.  
Graduate: M.Sc. in Engineering Physics, Göteborg, 1995,  
thesis: *Supersymmetry*, supervisor: Prof. Bengt E.W. Nilsson.  
PhD student at the Institute of Theoretical Physics, Chalmers University of Technology,  
Göteborg, 1995–2000.  
Licentiate Thesis, Göteborg, 1998, thesis: *Computational Complexity of Physical Models*.  
PhD Thesis, Göteborg, 2000, thesis: *Mathematical Models of Molecular Evolution*.  
PhD in physics, Chalmers University of Technology and University of Gothenburg, 2001.
- Awards: John Ericsson medal for outstanding scholarship, Chalmers University of Technology,  
Göteborg, 1996.
- Grants:
  - 1) Partner in integrated EU project: Programmable Artificial Cell Evolution (PACE).
  - 2) Partner in integrated EU project: Emergent Organization in Biomolecular Systems (EMBIO).
  - 3) Four year research grant for a position as assistant professor from the Swedish science foundation.
  - 4) Partner in integrated EU project: Morphogenesis and gene regulatory networks in plants and animals: a complex systems modelling approach (MORPHEX)
  - 5) Ph.D. research grant for Kolbjørn Tunstrøm from the Norwegian science foundation.
- Work positions:
  - 1) PhD student, Chalmers University of Technology, Göteborg, 1995–2000
  - 2) Director funded Post Doctoral Fellow, Los Alamos National Laboratory, 2000–2002
  - 3) Post Doctoral Fellow in the Self-Organizing Systems group, Los Alamos National Laboratory, 2002
  - 4) Post Doctoral Fellow, Nordic Institute for Theoretical Physics (NORDITA), Copenhagen, 2003–2004.
  - 5) Assistant professor in the Complex systems group at Chalmers University of Technology, Gothenburg, 2004–.
- Committees: Member of the European Complex Systems Society council.  
Program Chair, "European Conference on Complex Systems (ECCS)," Oxford, 2006.  
Program Chair, "European Conference on Complex Systems (ECCS)," Dresden, 2007.
- Publications:
  - 1) *The Computational Complexity of Sandpiles*, Journal of Statistical Physics, 96, 205–224, 1999, (Authors: C. Moore and M. Nilsson).
  - 2) *Error Thresholds for Quasi-Species on Dynamic Fitness Landscapes*, Physical Review Letters, 84: 191–194, 2000, (Authors: M. Nilsson and N. Snoad).
  - 3) PhD Thesis: *Mathematical Models of Molecular Evolution*, Göteborg 2000.
  - 4) *Ansatz for dynamical hierarchies*, Artificial Life 7: 329-353 (2001), (Authors: S. Rasmussen, N. Baas, B. Mayer, M. Olsen, and M. Nilsson)
  - 5) *Defense of the Ansatz for dynamical hierarchies*, Artificial Life 7: 367-373 (2001) (Authors: S. Rasmussen, N. Baas, B. Mayer, M. Olsen, and M. Nilsson)

- 6) *Parallel Quantum Computation and Quantum Codes*, SIAM Journal on Computing, Vol. 31, 3, 799–815, 2001, (Authors: C. Moore and M. Nilsson).
- 7) *Quasi-Species on a Fitness Landscape with a Fluctuating Peak*, Physical Review E, 65, 031901, 2002, (Author: M. Nilsson and N. Snoad).
- 8) *Quasi-Species Evolution on Dynamic Fitness Landscapes* Evolutionary Dynamics: Exploring the Interplay of Selection, Accident, Neutrality and Function, edited by J. P. Crutchfield and P. Schuster, p. 275-290, Santa Fe Institute Studies in the Sciences of Complexity Series, New York: Oxford University Press, 2002, (Authors: M. Nilsson and N. Snoad).
- 9) *Hierarchical Clustering Using Non-Greedy Principal Direction Divisive Clustering*, Information Retrieval 5(4), 311–321, 2002, (Author: M. Nilsson).
- 10) *Optimal Mutation Rates in Dynamic Environments*, Bulletin of Mathematical Biology 64 (6) 1033–1043, 2002, (Authors: M. Nilsson and N. Snoad).
- 11) *Constructive Molecular Dynamics (MD) Lattice Gases: 3-D Molecular Self-Assembly*, New Constructions in Cellular Automata, Eds. David Griffeath and Christopher Moore, p. 183-210: Oxford University Press, 2003, (Authors: M. Nilsson, S. Rasmussen, B. Mayer, and D. Whitten).
- 12) *A Cellular Automata for Simulating Molecular Self-Assembly*, conference proceedings of Discrete Models for Complex Systems (DMCS'03), Lyon, France, June 16–19, 2003, (Authors: M. Nilsson and S. Rasmussen).
- 13) *Bridging Non-Living and Living Matter*, Artificial Life, 9 (3), p. 269–316, 2003 (Authors: S. Rasmussen, L. Chen, M. Nilsson, and S. Abe).
- 14) *Generalized Singular Spectrum Time Series Analysis and Continuous Transformation Groups*, Proceedings of the Royal Society of London A, 460(2043), p.929–938, 2004, (Author: M. Nilsson).
- 15) *Hierarchical Structures in Smooth Dynamical Systems*, Artificial Life, 11, 493–512, 2005 (Author: Martin Nilsson).
- 16) *Homochiral growth through enantiomeric cross-inhibition*, Origins of Life and Evolution in the Biosphere, 35, p. 225–241, 2005 (Authors: A. Brandenburg, A.C. Andersen, S. Höfner and M. Nilsson).
- 17) *Dissociation in a polymerization model of homochirality*, Origins of Life and Evolution in the Biosphere, 35, p. 507–521, 2005 (Authors: A. Brandenburg, A. Andersen and M. Nilsson).
- 18) *Modeling the dynamics of a minimal protocell container*, International Journal of Astrobiology 4, p. 79–89, 2005, (Authors: M. Nilsson Jacobi, S. Rasmussen and K. Tunstrøm).
- 19) *Unidirectional polymerization leading to homochirality in the RNA world*, International Journal of Astrobiology, 4, 233–239, 2005 (Authors: M. Nilsson, A. Brandenburg, A.C. Andersen and S. Höfner).
- 20) *Quasi-Species and Aggregate Dynamics*, proceedings of Alife X, 145–151, 2006 (Authors: A. Eriksson, O. Görnerup, M. Nilsson Jacobi and S. Rasmussen).
- 21) *Quasispecies and recombination*, Theoretical Population Biology, 70, 4, 479–485, 2006, (Authors: M. Nilsson Jacobi and M. Nordahl).
- 22) *Quotient Manifold Projections and Hierarchical Dynamics*, proceeding of ECCS, 2006, (Author: M. Nilsson Jacobi).
- 23) *Emergence of protocellular growth laws*, Philosophical Transactions of the Royal Society B, Volume 362, Number 1486, 1841–1845, 2007, (Authors: T. Rocheleau, S. Rasmussen, P.E. Nielsen, M. Nilsson Jacobi, and H. Ziock.)
- 24) *A Method for Inferring Hierarchical Dynamics in Stochastic Processes*, to appear in Advances in Complex Systems, (Authors: O. Görnerup and M. Nilsson Jacobi).
- 25) *Using force covariance to derive effective stochastic interactions in dissipative particle dynamics*, to appear in Physical Review E, (Authors: A. Eriksson, M. Nilsson Jacobi, J. Nyström, and K. Tunstrøm).
- 26) *Hierarchical Dynamics*, to appear in Spinger's encyclopedia on complex systems, (Author: M. Nilsson Jacobi).

Conferences:

Invited speaker at the “Future directions in complex systems” workshop in Lyon 2003.

Invited speaker at the “Discrete Models for Complex Systems (DMCS’03)” conference in Lyon 2003.  
Invited speaker at the “Astrobiological problems for physicists” conference at Nordita, Copenhagen 2004.  
Invited speaker at the “Future Directions in Complex Systems” conference in Santa Fe 2005.

- Teaching Experience: Assistant teacher at Chalmers University of Technology and Göteborg University, 1995–2000. Courses include: General physics (undergraduate level), Experimental physics (undergraduate level), Classical Mechanics (undergraduate level), Quantum mechanics and Quantum field theory (graduate level), Mathematical biology (graduate level), guest lecturer in astrobiology at the University of Lund (undergraduate level).
- Main lecturer in “Simulation of complex systems”, Chalmers University of Technology, 2004–2007 (masters level).  
Lecturer on nonlinear dynamical systems at “West African regional college on applied mathematics”, Cape Coast, Ghana, 2004.  
Lecturer on model reconstruction and parameter estimation at “West African regional college on applied mathematics”, Cape Coast, Ghana, 2005.  
Lecturer on functional analysis with applications at “West African regional college on applied mathematics”, Cape Coast, Ghana, 2006.
- Ph.D. students: Olof Görnerup, 2005–  
Kolbjørn Tunstrøm, 2005–  
Johan Nyström, 2005–
- Conference org. Co-organizer of the “Astrobiological problems for physicists” conference at Nordita Copenhagen 2004.  
Co-organizer and lecturer at “West African spring school in applied mathematics,” Cape Coast, Ghana, 2005.  
Co-organizer and lecturer at “West African spring school in applied mathematics,” Cape Coast, Ghana, 2006.  
Main organizer of “Workshop on mesoscopic simulation methods in biomolecular systems,” at the European Center for Living Technology in Venice, Italy, 2006.  
Program Chair, “European Conference on Complex Systems (ECCS),” Oxford, 2006.  
Program Chair, “European Conference on Complex Systems (ECCS),” Dresden, 2007.
- Miscellaneous: Official opponent on Claes Andersson’s Licentiate thesis defense, titled: *Complex Systems in Urban Growth*.  
Official opponent on Anders Erikson’s Licentiate thesis defense, titled: *Modeling evolutionary phenomena, Examples from genetics and game theory*.
- Business Experience: 1999 Co-founder of TiFiC AB (automated computer support systems).  
2000 Co-founder of Mindmetric AB (semi-automatic customer relations and knowledge management platforms).  
2000–2001 Research and development manager for Mindmetric AB.

**Brief professional background:**

**1995:** After studying to a M.Sc. in physics (1992-1995) at Chalmers University of Technology, Gothenburg, Sweden, I started Ph.D. studies at the elementary particle physics group at Chalmers working on string theory and super symmetric field theory.

**1996-2000:** After one year of Ph.D. studies I decided to change my area of research to complex systems. I remained in the theoretical physics group but worked on complex systems. My supervisor was Mats Nordahl. The work resulted in a number of publications on evolution and information transmission in pre-biotic replicator systems [2,7,8,10,21], and computational aspects of physical systems [1,6].

**2000-2003:** Directly after my Ph.D. I work as a director funded post doc at Los Alamos National Laboratory (LANL), New Mexico, USA. My sponsor was Steen Rasmussen. My collaboration with Steen is focused on physical realizations of artificial proto-cells [13], simulation of lipid self-assembly in water [11,12,18], and dynamical hierarchies [4,5]. I also worked on time series analysis [14] and cluster analysis of high dimensional data [9].

**2003-2004:** After my post doc at LANL I chose to move back to Sweden and accepted a post doc position at the Nordic Institute of Theoretical Physics and Astrophysics (NORDITA) in Copenhagen. At Nordita I continued to work on dynamical hierarchies [15]. During my stay at Nordita I also worked with Axel Brandenburg on the origin of homo chirality in polymerization processes [16,17,19]. We organized two Nordic meetings on "Origins of life and astrobiology," and I gave a talk at NASA's 2004 conference on Astrobiology in Reykjavik.

**2004-2007:** The Programmable Artificial Cell Evolution (PACE) project started in 2004. I had actively participated in writing the proposal and therefore this opened an opportunity for me to return to Chalmers on an assistant professor position. Shortly after starting at Chalmers I received additional funding from the Swedish science foundation (VR) to fully support my position as assistant professor for four years. My research during the last three years has followed three parallel threads, modeling of pre-biotic systems [20,21,23], developing mesoscopic simulation methods for self-assembling systems [25], and developing a unified theory of state space reduction [22,24,26]. Since 2004 the complex systems group at Chalmers has expanded from one senior and two Ph.D. students to two senior scientists, two post docs, and three Ph.D. students. We are participating in three different EU projects: Programmable Artificial Cell Evolution (PACE), Emergent Self-Organization in Biomolecular Systems (EMBIO) and Morphogenesis and gene regulatory networks in plants and animals: a complex systems modelling approach (MORPHEX).