

## Curriculum Vitae – Ole Møller Nielsen

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### Education

- Doctor of Philosophy (May 1998)  
**Technical University of Denmark**  
Department of Mathematical Modelling  
Thesis: “Wavelets in Scientific Computing”  
Grade Point Average: 11.0/13  
URL: <http://datamining.anu.edu.au/~ole/work/publications/thesis.pdf>
- Master of Science (November 1993)  
**Roskilde University, Denmark**  
Department of Computer Science  
Thesis: “DISCO – DIScrete and COntinuous simulation”  
Grade Point Average: 11.4/13
- Bachelor of Science (June 1990)  
**Roskilde University, Denmark**  
Department of Mathematics  
Grade Point Average: 11.5/13

## Professional history

- *Mar 2003 – Present*: Senior Computational Scientist, Geoscience Australia. Research and development of natural disaster models.
- *Sep 2003 – Dec 2003*: Visiting Professor, Department of Mathematics, Suranaree University of Technology, Nakhorn Ratchasima, Thailand. Teaching PhD course in High Performance Computing.
- *Sep 2001 – Feb 2003*: Research Fellow, School of Mathematical Sciences, Australian National University. Funded by Australian Partnership for Advanced Computing. Reserach in parallel methods for large scale data mining.
- *Nov 2000 – August 2001*: Independent consultant  
Main developer of 'Pathology Explorer' WEB datamining application at CSIRO Mathematics and Information Science. Tutored assembly programming at Department of Computer Science, ANU. Performed UNIX system administration tasks at Mathematical Sciences Institute, ANU
- *Nov 1999 – Aug 2000*: Research Fellow  
Computer Sciences Laboratory, RSISE, Australian National University. Research in Data Mining, software development and consultancies in health services with the Commonwealth Science and Industrial Research Organisation (CSIRO).
- *Nov 1998 – Oct 1998*: Postdoctoral Fellow (Post Doc)  
Computer Sciences Laboratory, RSISE, Australian National University. Research in Wavelets and Data Mining.
- *Mar 1998 – Oct 1998*: Scientific Computing Consultant  
UNI•C, Danish Computing Centre for Research and Education. Design and development of parallel image analysis algorithm.
- *Mar 1994 - Feb 1998*: PhD student at the Technical University of Denmark
  - *20 July – 31 July 1997*: Visiting Fellow  
Computer Sciences Laboratory, Australian National University.
  - *1 June – 20 July 1997*: Honorary Research Fellow  
Department of Physics, Auckland University, New Zealand.
  - *Jan 1996 – July 1996*: Visiting Graduate Student  
Courant Institute of Mathematical Sciences, New York University.

- *June 1995 – Dec 1995*: Visiting Graduate Student  
Computer Sciences Laboratory, Australian National University.
- *Spring 1995*: Teaching assistant, graduate level, master's course  
Technical University of Denmark.  
Finite element methods for solving PDE's.
- *Fall 1997*: Teaching assistant, graduate level, master's course  
Technical University of Denmark.  
Image restauration, multigrid methods, and parallel programming.

## **My mission**

To involve myself in research and development of technical or scientific technologies aimed at concrete applications or consultancies that have a high degree of practical impact to society in an area outside the immediate realms of science.

## **General expertise**

- Automation of complex processes.
- Experience in balancing time, quality, scope and resources to achieve tangible outcomes.
- Expertise in managing development of scientific software.
- Strategic thinking, team play, clear communication and leadership.
- Able to overcome problems to get 'the job done'.

## **Selected Math skills**

- Numerical Linear Algebra
- Computational Fluid Mechanics (Finite-{volumes, elements, differences} discretisations, Non-linear differential equations such as the Shallow Water Wave Equations and the Nonlinear Schrödinger equation).
- Data Mining and predictive modelling (Classification and Regression Trees, High dimensional surface fitting, Machine learning, Penalised Least-squares techniques).
- Wavelets, Fourier transforms and filter banks.
- Linear Programming.

## Selected IT skills

- Programming languages: Python, C/C++, Matlab, Fortran 77/90, Delphi
- Distributed computing tools: MPI, DCOM, Fujitsu VP-Fortran
- WEB programming: HTML, Javascript, CGI, PHP, WebWare, MapServer
- Data management: XML, MySQL, Excel
- Software developing tools: CVS, Subversion, TRAC, unit testing, make
- Operating systems: Debian Linux, Windows NT, Solaris
- Text processing: Emacs, L<sup>A</sup>T<sub>E</sub>X, Xfig, MS-Word, Open Office

## Some achievements

- A new modelling capability that has enabled Geoscience Australia to simulate impacts of tsunami or storm surge disasters on the built environment and to present the results in forms that are easily interpreted. The software developed is a state-of-the-art hydrodynamic modelling tool that has raised the bar for what is technically and conceptually possible and has created significant interest from both academia and industry. In particular, we are able to predict what *consequences* a hydrological disaster may have on a particular community rather than a simple statement about waveheights off-shore. The work of me and my team was awarded the "EMA Safer Communities Award 2005" and is the main reason Emergency Management Australia is now recognising the benefits of entering a formal collaboration with science to achieve their outcomes.
- A corporate high performance computing capability in my organisation. This involved building a prototype parallel Linux cluster, developing and selling the business case to the senior management team, setting up a corporate wide special interest group, putting in the capital bid, procuring the hardware through a formal tender process, leading the acceptance testing and finally developing and deploying parallel software as well as coaching colleagues in using the cluster.
- Influencing my workplace to take up modern software development methodologies and practices that have improved the quality, speed and audit trail of corporate software.

- A binding for the Message Passing Interface (MPI) for the Python programming language. This binding was published as open source and is currently used widely in the scientific community (bio-informatics, health and data mining and modelling). PyPar is available at <http://datamining.anu.edu.au/pypar>
- The development of a WEB-enabled data exploration tool online analysis of large Health care databases at the Health Insurance Commission. This involved data mining and record linkage of about 80 million MBS claims and 50 million PBS claims and required the development of special purpose software to handle these volumes.
- Designed and developed an open software library for data mining of large relational databases using the scripting language Python. This library is successfully used for fast, interactive access to large databases at the Australian National University (ANU) and Commonwealth Science and Industrial Research Organisation (CSIRO).
- Developed database of currently 0.5 million GPS coordinates searchable by proximity to a given location and by optional keywords. The search engine is fast due to database tables dynamically organised in a tree structure. Wrote WEB front end for searching, retrieving and uploading GPS waypoints using the GPS search engine.
- Successfully implemented and applied a wavelet based algorithm for surface fitting of high-dimensional data for use in predictive modelling.
- Developed vector-parallel fast wavelet transforms for the Fujitsu scientific software library. The implementation was accompanied by a performance model that predicted both sequential and parallel actual performance. About 80 % of peak performance on one processor was achieved, and the parallel efficiency was *independent* of the problem size as well as the number of processors.
- Developed an efficient algorithm for wavelet transforms of circulant matrices and various operations on them. Exploiting the particular structure of this problem reduced the storage requirements as well as the algorithmic complexity from *quadratic* to *linear* in the number of non-zeros.
- Did the initial analysis, design, and architecture evaluations towards the parallelisation of a medical image analysis algorithm.
- Published an easy-to-understand wavelet tutorial in IEEE Computer Applications in Power, Volume 12, Number 1, January 1999.

- Have given technical and scientific presentations at various institutions and conferences including International Disaster Reduction Conference (Switzerland 2006); UNESCAP High Level Technical meeting on Tsunami Disasters (Thailand 2005); Australian Earth Quake Engineers annual meeting (GA 2006), Dynamic Earth Conference (ANU 2006), Computational Techniques and Applications Conferences (CTAC 1999, 2006); Modelling and Simulations (MODSIM 2005), Ninth Internal Python Conference (California 2001), Australian Epidemiological Association (Sydney); NSW Health; IBM Yorktown heights (USA); St Catherine's College, Oxford (UK); Umeaa University (Sweden); UNI•C (Denmark); and many more.

## Selected publications

- *Modelling answers tsunami questions.* Ole Nielsen, Jane Sexton, Duncan Gray and Nick Bartzis. AusGeo News September 2006 Issue No. 83.  
<http://www.ga.gov.au/ausgeonews/ausgeonews200609/modelling.jsp>
- *Parallelisation of a finite volume method for hydrodynamic inundation modelling.* S. G. Roberts, L. Stals and O. M. Nielsen. Proceedings of CTAC'06 - The 13th Biennial Computational Techniques and Applications Conference, 2-5 July 2006, ANZIAM Journal, Vol 48.  
<http://anziamj.austms.org.au/ojs/index.php/ANZIAMJ/article/view/153>
- *Hydrodynamic modelling of coastal inundation.* Nielsen, O., S. Roberts, D. Gray, A. McPherson and A. Hitchman In Zerger, A. and Argent, R.M. (eds) MODSIM 2005 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2005, pp. 518-523. ISBN: 0-9758400-2-9.  
<http://www.mssanz.org.au/modsim05/papers/nielsen.pdf>
- *Computer Architecture and Organization.* Chapter in Encyclopedia of Biostatistics, second edition. Ole M. Nielsen, Wiley InterScience, 2005
- *Quantifying Vulnerability: A methodology for those at risk to natural hazards.* A. Dwyer, C. Zoppou, O. Nielsen, S. Day, S. Roberts. International Journal of Mass Emergencies and Disasters (In review)
- *An Iterative Approach to Determining the Length of the Longest Common Subsequence of Two Strings.* Hilary S Booth, Ole M Nielsen, Susan R Wilson. Methodology And Computing In Applied Probability 6 (4): 401-421, Kluwer Press December 2004

- *Multidimensional Smoothing Using Hyperbolic Interpolatory Wavelets*. Markus Hegland, Ole M. Nielsen and Zuowei Shen, Electronic Transactions on Numerical Analysis 17:168-180, 2004.
- *Parallelisation of Sparse Grids for Large Scale Data Analysis*. Jochen Garcke, Markus Hegland and Ole Nielsen. In P.M.A. Sloot, D. Abrahamson, A. Bogdanov, J. Dongarra, and J Gorbachev, editors, Computational Science - ICCS 2003, volume 2659 of Springer Lecture Notes in Computer Science, pages 683-692, 2003.
- *Parallel Computing Techniques for High Performance Probabilistic Record Linkage*. Peter Christen, Markus Hegland, Stephen Roberts, Ole M Nielsen, T. Churches, and K Lim. Proceedings of the symposium on Health Data Linkage, 2002.
- *Data Mining with Python*. Ole M. Nielsen, Peter Christen, Markus Hegland and Tatiana Semenova, Proceedings of the 9th International Python Conference, Long Beach, California, March 2001. Foretec Seminars, Inc
- *Scalable Parallel Algorithms for Surface Fitting and Data Mining*. Peter Christen, Markus Hegland, Ole M. Nielsen, Stephen Roberts, Peter E. Strazdins and Irfan Altas, Elsevier Journal of Parallel Computing, special issue on *Aspects of Parallel Computing for Linear Systems and Associated Problems*, September 2000.
- *Data Mining of Administrative Claims Data of Pathology Services*. Simon Hawkins, Graham Williams, Rohan Baxter, Peter Christen, Michael Fett, Markus Hegland, Fuchun Huang, Ole Nielsen, Tatiana Semenova and Andrew Smith, Thirty-Fourth Hawaii International Conference on System Sciences (HICSS-34), January 2001.
- *Parallel Performance of Fast Wavelet Transforms*. Ole Møller Nielsen and Markus Hegland, International Journal of High Speed Computing, Vol. 11, No. 1 (2000) 55-74. World Scientific Publishing Company
- *High Dimensional Wavelet Smoothing, CTAC99 proceedings*. Ole Nielsen, Journal of the Australian Mathematical Society Series B - Applied Mathematics, June 2000
- *Wavelet Analysis for Power System Transients*. Anthony Wayne Galli and Ole Møller Nielsen, IEEE Computer Applications in Power, Volume 12, Number 1, January 1999.

## References

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