

Peter Hines

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CURRENT POSITION

Research Associate **University of York Computing Department 2006-present**

Researcher in foundations of quantum computing, an ongoing project currently funded by the QICS network.

PREVIOUS EMPLOYMENT

Research Associate **University of York Computing Department 2005-2006**

Researcher in quantum algorithms & computation, a short project funded by the QIP-IRC network.

Research Associate **Oxford University Computing Laboratory 2002-2005**

Researcher in foundations of reversible and quantum computation, a 3 year project funded by an EPSRC - LMS collaboration.

Commercial Programmer **self-employed 2000-2002**

Self-employed programmer working on a variety of mathematical computing projects for commercial clients, including BTC Group management consultancy, Rio-Tinto Zinc, and thelearningbusiness.com

Research Associate **University of Wales, Bangor 1999**

Researcher and programmer on a short (6-month) project in information-theoretic models of psychological classification.

Casual Lecturer **1997-1999**

Lecturer employed on an hourly basis, teaching a number of courses, including mathematics, computer science, programming, and information technology.

EDUCATION

PhD - University of Wales, Bangor (1998)

Categorical logic, Inverse semigroups, the Geometry of Interaction

MSc - University of Wales, Bangor (1994)

Knot theory, self-distributive algebras, knot invariants & knot polynomials

BSc. - University of York (1992)

Pure mathematics

TEACHING EXPERIENCE

Lecturing and demonstrating in the following subjects

University of York: Quantum Computation, Discrete Mathematics, Introductory Logic, Propositional and Predicate Calculus, Categorical logic.

Oxford University: Game Semantics, Category theory, Formal Program Verification, Artificial Intelligence, Maple

University of Wales: Discrete mathematics, Combinatorics, Automata theory, Statistics, Programming (MatLab, Java, C, C++, 68000 assembler), parallel computation, mathematics for computer scientists, introductory computing.

PEER-REVIEWED PUBLICATIONS

Where copyright allows, these may be downloaded from <http://www.peterhines.net/downloads/papers/>

- *P. Hines (1998)* The theory of self-similarity, and its applications, **PhD Thesis, University of Wales**
- *P. Hines, M. Lawson (1998)* An application of polycyclic monoids to rings, **Semigroup Forum** 56 146-149
- *P. Hines (1999)* The categorical theory of self-similarity, **Theory and Applications of Categories** 6(3) 33-46
- *P. Hines (2002)* A short note on coherence & self-similarity, **Journal of Pure & Applied Algebra** (175) 135-139
- *P. Hines (2003)* A categorical framework for finite state machines, **Mathematical Structures in Computer Science** (13) 451-480
- *P. Hines (2006)* Physical Systems as Constructive Logics, in **Unconventional Computation**, C. Calude et. al (ed.s), Springer LNCS, 101-112
- *P. Hines, E. Pothos, N. Chater (2007)* A non-parametric approach to simplicity clustering, **Applied Artificial Intelligence** 21(8) 729-752
- *P. Hines (2008)* Machine Semantics : from causality to computational models, **International Journal of Unconventional Computation** 4(3) 249-272
- *P. Hines (2008)* Machine Semantics, **Theoretical Computer Science** 409(1) 1-23
- *E. Pothos, A. Perlman, D. Edwards, T. Gureckis, P. Hines, N. Chater (2008)* Modeling Category Intuitiveness, **Cognitive Science Journal** 415-420
- *P. Hines, S. Braunstein (2009 - in press)* The structure of partial isometries, in **Semantic Techniques in Quantum Computation**, Cambridge University Press 1-34
- *P. Hines (2009 - to appear)* Can a quantum computer run the von Neumann architecture ? in **New Structures for Physics**, Springer Lecture notes in Physics 1-43
- *P. Hines (invited submission)* Categorical analogues of monoid semirings, **proc. Physics, Computation & Information, MFPS 2007, Mathematical Structures in Computer Science** 1-36
- *P. Hines (under revision, following referee's comments)* Dynamical algebras as self-similar objects in unique decomposition categories, **Mathematical Structures in Computer Science** p. 1-45
- *P. Hines (submitted)* Quantum circuit oracles for Abstract Machines computations, **Theoretical Computer Science** 1-36

REFEREEING

Refereeing papers for the following journals or conferences :

Mathematical Structures in Computer Science, Theoretical Computer Science, International Journal of Quantum Information, LMS Journal of Computation and Mathematics, International Journal of Unconventional Computation, Logic in Computer Science, International Colloquium on Automata Languages and Programming, Mathematical Foundations of Programming Semantics, Non-Standard Computation.

INVITED TALKS

The following is a selection of invited talks:

- Logics Quantum and Classical: **Artificial Intelligence Seminars 2009** (York, U.K.)
- Category Theory and Quantum Logic: **Foundational Structures for Quantum Information and Computation (2008)** (Oberurgl, Austria)
- Towards a quantum machine semantics: **MFPS 2007, workshop on Physics, Computation, and Information**, (New Orleans, USA)
- The inverse and the trace - iteration in models of reversible computing: **LICS 2007, workshop on traced monoidal categories, network algebras and applications** (Wroklaw, Poland)
- The order theory of Iteration: **Schloss Dagstuhl (2006) workshop on Computational Structures for Modeling Time, Space, and Causality** (Dagstuhl, Germany)
- Planar two-way automata - from inverse semigroups to the quantum Jones polynomial: **FountainFest 2006, Semigroups, Categories & Automata, in honor of J. Fountain** (York, U.K.)
- Compact Closed Monoids - definitions and constructions: **GeoCal 2006 Semantics, workshop on Geometry of Interaction** (Marseille, France)
- Reversibility and coherence between computational paths: **Institut Henri-Poincare 2006** (Paris, France)
- Random Thoughts on Abstract Machines: **Categorical Quantum Information 2006, Bellairs Research Institute, McGill University** (Bellairs, Barbados)
- Quantum data and code in computer architectures, **QUOXIC Oxford-Imperial Meeting 2004, Imperial College** (London, U.K.)
- The zoology of quantum computers - classical and quantum control structures & data: **Fields Institute Summer School 2003, Logic & Foundations of Computation, workshop on QM programming languages** (Ottawa, Canada)
- Kleene's Theorem, star-free languages, and the Geometry of Interaction: **Oxford Informatic Seminars 2000** (Oxford, U.K.)

ACADEMIC COMPUTER PROGRAMS

The following computer programs are freely available for use within an academic environment:

- **Non-parametric data clustering:** A C++ implementation of the information-theoretic analysis of human classification given in Hines, Pothos, Chater 2007.
- **Non-metric information theory package:** A Matlab package for using information theory and Minimum Description Length principles in classification, clustering, and significance testing.

OTHER ACADEMIC RESPONSIBILITIES

Successful Grant Applications:

- **London Mathematical Society/EPSRC, MathFit program (2002-2005)** *Foundations of quantum and reversible computation*, with S. Abramsky (Oxford)
- **EU IST program (2006-2009)** *QICS: Foundational Structures for quantum information and computation*, a collaboration between a number of EU sites
- **EPSRC (2008-2011)** *Quantum Computation: Foundations, Security, Cryptography and Group Theory*, a joint project between the universities of York, Newcastle, and Herriot-Watt

Personnel responsibilities

- **Part of interview & selection panel for postdoctoral researchers**, on the *Quantum Computation: Foundations, Security, Cryptography and Group Theory* project
- **Evaluation of PhD proposals**, both for posts funded by the above projects, and general applications.

REFEREES

The following have kindly agreed to send references directly:

Prof. Sam Braunstein,
Dept. of Computer Science,
University of York,
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Telephone: 01904 434761
E-mail: schmuel@cs.york.ac.uk

Prof. Philip Scott,
Dept. of Mathematics & Statistics,
University of Ottawa,
Ottawa, Ontario
Canada

Telephone: (613) 562-5800 x3502
E-mail: phil@site.uottawa.ca

Dr. Keye Martin,
Naval Research Laboratory,
Washington DC 20375
U.S.A.

E-mail: keye.martin@nrl.navy.mil

ALTERNATIVE REFEREES

For further information, the following have kindly agreed to provide references, on request:

Dr. M. V. Lawson,
School of Mathematical Sciences,
Colin Maclaurin Building,
Herriot-Watt University,
Edinburgh EH14 4AS
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School of Mathematics and Statistics,
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Newcastle on Tyne NE1 7RU
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