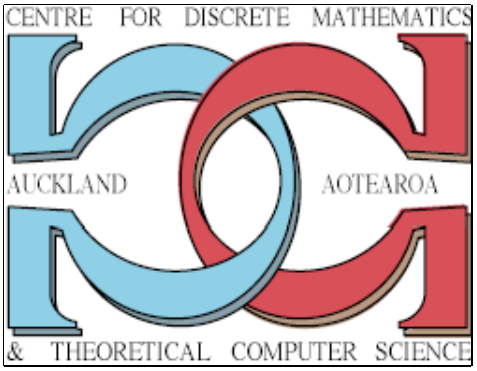

Centre for Discrete Mathematics and Theoretical Computer Science
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CDMTCS: 2000 ANNUAL REPORT

The Centre for Discrete Mathematics and Theoretical Computer Science was founded in 1995 in order to a) support basic research on the interface between mathematics and computing, b) increase local knowledge in these areas, and c) broaden research skills in New Zealand.
The aim of the Management Committee to build one of the world's best centres for research in Discrete Mathematics and Theoretical Computer Science is coming true. The Centre has become a major force in fostering research and development in those areas within the South Pacific Region and creating productive links between that region's researchers and their counterparts in the rest of the world.

Although the Centre encourages and supports a wide range of research activity, its primary research foci are the following

- Artificial Intelligence
- Combinatorial Optimisation
- Computability and Complexity
- Constructive Algorithmics
- Quantum and Molecular Computation

The Centre is supported financially by the Departments of Computer Science and Mathematics and sponsored by *Pukekohe Travel*.

The major activity of the Centre in 2000 was the organisation of the second international conference "Unconventional Moels of Computation" (UMC'2K) in co-operation with the International Solvay Institutes in Brussels, Belgium; the conference was held in Brussels, Belgium on 13-16 December 2000. By all standards, the conference was a remarkable success. The volume containing invited papers and regular contributions has appeared as I. Antoniou, C.S. Calude, M.J. Dinneen (eds.). *Unconventional Models of Computation (UMC'2K)*, Springer-Verlag, London, 2000, 310 pp.

Director

Professor C.S. Calude (Auckland)

Deputy Director

Dr. Michael J. Dinneen

Research Reports Coordinator

Dr. Michael J. Dinneen

Management Committee

The activities of the Centre are overseen by a Management Committee consisting of

- Professor Douglas Bridges (External Researchers Representative, Waikato University)
- Professor Cristian Calude (Director)
- Dr. Michael J. Dinneen (Deputy Director),
- A/Professor John Hosking (HOD, Computer Science),
- Professor Gaven Martin (HOD Mathematics Department),
- Professor Alan Williamson (UARC Representative).

Participating Members

The Centre includes the following faculty members:

> P. Bonnington (Mathematics, Tamaki), D. S. Bridges (Mathematics, Waikato), C. Calude (Computer Science, Auckland), M. D. E. Conder (Mathematics, Auckland), M. J. Dinneen (Computer Science, Auckland), R. W. Doran (Computer Science, Auckland), P. Gibbons (Computer Science, Auckland), U. Guether (Computer Science, Tamaki), H. Guesgen (Computer Science, Auckland), P. R. Hafner (Mathematics, Auckland), F. Kroon (Philosophy, Auckland) B. Khoussainov (Computer Science, Auckland), R. Nicolescu (Computer Science, Tamaki), E. O'Brien (Mathematics, Auckland), B. Pavlov (Mathematics, Auckland), I. Reilly (Mathematics, Auckland), M. Titchener (Computer Science, Tamaki), C. Thomborson (Computer Science, Auckland), M.C. Wilson (Computer Science and Mathematics, Auckland).

International Advisory Board

The Centre has a International Advisory Board consisting of the following members:

> M.A. Arslanov (Kazan State University, Russia), R.C. Backhouse (Eindhoven University of Technology, Netherlands), J. Casti (Santa Fé Institute, New Mexico, US, and Technische Universität, Vienna, Austria), G.J. Chaitin (IBM, New York, US), C.J. Colbourn (University of Vermont, US), E.W. Dijkstra (University of Texas, Austin, US), J.H. Dinitz (University of Vermont, US), J.A. Goguen (University of California at San Diego, US), R.L. Graham (University of California at San Diego, US), J. Hartmanis (Cornell University, US), H. Jürgensen (University of Western Ontario, Canada and Potsdam University, Germany), C.C. Lindner (Auburn University, Alabama, US), R. Mathon (University of Toronto, Canada), B.D. Mackay (Australian National University, Australia), A. Nerode (Cornell University, US), I. Prigogine (Solvay Institute, Belgium), G. Rozenberg (Leiden University, Netherlands), A. Salomaa (University of Turku, Finland), J. Seberry (University of Wollongong, Australia), D van Dalen (University of Utrecht, Netherlands).

External Researchers

The *External Researchers* had a great contribution to the Centre's activities by refereeing papers, assisting with conference and workshop organisation, and by other means. The current External Researchers are

> I. Antoniou (Solvay Institute, Belgium), E. Calude (Massey University at Albany, New Zealand), R. Downey (Victoria University of Wellington, New Zealand), B. Everitt (University of Aberdeen, Scotland), R. Goldblatt (Victoria University of Wellington, New Zealand), P. Hertling (FernUniversität Hagen, Germany), D. Holton (University of Otago, New Zealand), K.-W. Lih (Institute of Mathematics, Academia Sinica, Taiwan), C. Little (Massey University, New Zealand), M. Lipponen (Turku University, Finland), J. McKay (Concordia University, Canada), Gh. Păun (Institute of Mathematics, Romanian Academy, Romania), C.E. Praeger (University of Western Australia), K. Svozil (Technische Universität, Vienna), D. Ştefănescu (Bucharest University, Romania), S. Yu (University of Western Ontario, Canada), I Tomescu (Bucharest University, Ontario).

Graduate Students

The following graduate students are working in close connection with the research program of the Centre:

1. Paul Reedy, DNA Computing [Masters]
2. Jeong Seon Koo, A Decision Support System for Air Pollution Health Risk Analysis [PhD]
3. Ute Loerch, Intelligent Question Answering in an Internet-Based Remote Learning Environment [PhD]
4. Andrew Luxton, Cognitive Maps for Exploration [PhD]
5. Michael Prestidge, Difference sequences in graph crossings on surfaces [Masters]
6. Jamie Sneddon, Infinite Planar Graphs [PhD]
7. Liu Xiong, Vertex Cover Obstructions and A Minor Containment Algorithm [Masters completed 2000]
8. Zili Deng, Applied Tree Automata for Bounded Treewidth Graphs [Masters]
9. Fang Guo, Branch-and-Bound Algorithms for the Broadcast Problem [Masters]
10. Zhou (Joe) Peng, Graph Embeddings and Drawings of Graphs of Bounded Treewidth [Masters]
11. Fingee Wu, Distributed Memetic Algorithms [Masters]
12. Chi-Kou Shu, Computing Exact Approximations of a Chaitin Omega Number [Phd]
13. Sasha Rubin, Automata and Logic [Phd]
14. Qinghui Zeng. Randomness as an Invariant for Number Representations [Masters completed 2000]
15. Peiming Liang, Randomness and Cellular Automata [Masters completed 2000]
16. Margaret Ng, A Metric Lexical Analysis [Masters completed 2000]
17. Terry Chiu, Testing Computational Complementarity For Finite Automata Using Distributed Object Technology [Masters completed 2000]
18. Marian Baroni, Quantum Computation [Phd]
19. Mihaela Baroni, Quantum Computation [Phd]
20. Cristian Grozea, Non-Binary Codings [Phd]

Visitors

The Centre hosted the following visitors:

- Prof. Persi Diaconis, Stanford University, USA.
- Prof. Robert Jajcay, Indiana State University, USA.
- Prof. Dragan Marusic, University of Ljubljana, Slovenia.
- Prof. Tomaz Pisanski, University of Ljubljana, Slovenia.
- Prof. Thomas Tucker, Colgate University (NY), USA.
- Prof. Bruce Richter, University of Waterloo, Canada.
- Prof. Joan Hutchinson, Macalester College, St Paul, Minnesota, USA.
- Prof. Cheryl Praeger, University of Western Australia, Perth, Australia.
- Prof. Jozef Siran, Slovak Technical University, Bratislava, Slovakia.
- Prof. Robin Thomas, Georgia Institute of Technology, Atlanta, Georgia, USA.
- Prof. Tom Tucker, Colgate University, Hamilton, New York, USA.
- Prof. Mark Watkins, Syracuse University, New York,USA.
- Prof. Sergei Goncharov, Novosibirsk University, Russia.
- Dr. Denis Hirshcfeldt, The University of Chicago, USA.
- Dr. Walker White, Cornell University, USA.
- Dr. Paddy Krishnan, The University of Canterbury, NZ.
- Assoc. Prof. Hajime Ishihara, JAIST, Japan.
- Dr. Frank Stephan, The University of Heidelberg, Germany.
- Prof. Rick Thomas, University of Leicester UK.
- Prof. Ray Mines, New Mexico State University, USA.
- Prof. Dr. Dirk van Dalen, University of Utrecht, Holland.
- Assoc. Prof. Hajime Ishihara, JAIST, Japan.
- Dr. R. Gayler, Strategy Advantage, Australia.
- Dr. Sebastian Link, , Massey University, NZ.
- Prof. Klaus-Dieter Schewe, Massey University, NZ.
- Prof. V. Petkov, Victoria University of Wellington, NZ.
- Prof. Rod Downey , Victoria University of Wellington, NZ.
- Prof. Mike Fellows, Victoria University, Canada.
- Dr. Andre Nies, University of Chicago, USA¿
- Prof. Karl Svozil, Technical University of Vienna, Austria.
- Prof. Larry Carter, UCSD, USA.
- Prof. Jeanne Ferrante, UCSD, USA.

Research Grants

1. Paul Bonnington, Marsden Fund grant continued, $43,000 per annum (2000: 2nd year of grant)
2. Marston Conder, Jianbei An & Eamonn O'Brien Marsden Fund grant (year 2 of 3-year grant), $81875.
3. Hans Guesgen, Grant in aid for research and study leave in 1/2000 $6,000.
4. Michael Dinneen, Marsden Grant $ 260, 000 for three years, continued.
5. Bakh Koussainov: Birkhauser comp grant, NSF grant is continued till 2001, Marsden grant $150,000.
6. C. Calude: UARC Grant, 9343/3414111.
7. C. Calude, J. Hosking, F. Kroon, AU Foundation Grant for supporting the visit of Professor J. Casti.

Workshops/Conferences Organised by the Centre

- The Second International Conference *UMC'2K, Unconventional Models of Computation*, Solvay Institutes, Free University of Brussels, Belgium, December 2000.
- *Algebraic and Topological Methods In Graph Theory, ATMGT2000*, Auckland, December 11-15, 2000.
- *Workshop on Multiset Processing (WMC'2000)*, Curtea de Argeş, Romania, August 2000.
- *The 5th Anniversary Workshop on Discrete Mathematics and Theoretical Computer Science*, Auckland University, New Zealand, May 2000.

Workshops/Conferences Organised by Members of the CDMTCS

- Paul Bonnington and Marston Condor co-orginized the Conference *Algebraic & Topological Methods in Graph Theory.*
- Marston Conder: co-organiser of *NZMRI Meeting on Algorithms & Complexity*
- Hans Guesgen: co-organiser of the *ECAI-00 Workshop on Current Issues in Spatio-Temporal Reasoning*

Programme Committee

- Hans Guesgen: Special Track on *Spatio-Temporal Reasoning at FLAIRS-00*, Co-chair of the *ECAI-00 Workshop on Current Issues in Spatio-Temporal Reasoning*, *TIME-00* and *IEA/AIE-00.*
- Michael Dinneen: *UMC2K, CDMTCS 5th Aniversity, ATMGT2000.*
- C. Calude: The Second International Conference *UMC'2K, Unconventional Models of Computation*, *The Fourth Conference of the Systemics, Cybernetics and Informatics (SCI2000)*, *Workshop on Descriptional Complexity of Automata, Grammars and Related Structures (DCAGRS 2000)*, *First Conference on Theoretical Computer Science and Informatics Technologies*, *The 8-th International Conference on Algebraic Methodology And Software Technology (AMAST'2000)*, *Third International Colloquium on Words, Languages and Combinatorics.*

Affiliations

- Logic Group at JAIST,
- Mindship International,
- Turku Centre for Computer Science (TUCS).

Publications and Technical Reports

The CDMTCS is editing Springer-Verlag Books Series *Discrete Mathematics and Theoretical Computer Science* and cooperates with Graz University of Technology and Turku University in editing Springer-Verlag *Journal of Universal Computer Science*. Members of the CDMTCS are members of the editorial boards of the following journals: *N.Z. Journal of Mathematics, International Journal of Applied Intelligence, Pattern Analysis and Applications Journal, Australasian Journal of Combinatorics, Analele Universităţii Bucureşti, Matematică-Informatică, Journal of Computing and Information, Grammars, Fundamenta Informaticae, Romanian Journal of Information Science and Technology.* Special Issues of the *International Journal on Applied Intelligence, Journal of Universal Computer Science* have been edited.

DMTCS Book Series with Springer

1. Gheorghe Ştefănescu. *Network Algebra*, Springer-Verlag, London, 2000.
2. C. S. Calude, G. Păun (eds.). *Finite vs Infinite, Contributions to an Eternal Dilemma*, Springer-Verlag, London, 2000.
3. I. Antoniou, C.S. Calude, M.J. Dinneen (eds.). *Unconventional Models of Computation, UMC'2K,* Springer-Verlag, London.
4. G. J. Chaitin. *Exploring Randomness*, Springer-Verlag London.

Research Papers

More than 182 research papers have been published by faculty members and graduate students.

CDMTCS Research Reports

118 M.J. Dinneen and L. Xiong. The Minor-Order Obstructions for The Graphs of Vertex Cover Six

119 G. Păun. Computing with Membranes (P Systems): Twenty Six Research Topics

120 G. Krenn, J. Summhammer and K. Svozil. Interferometric Information Gain Versus Interaction-Free Measurement

121 H. Havlicek, G. Krenn, J. Summhammer and K. Svozil. On Coloring the Rational Quantum Sphere

122 K. Svozil. Solution of Problem No. 10769

123 J. Castellanos, G. Păun and A. Rodriguez-Paton. Computing with Membranes: P Systems with Worm-Objects

124 S. Goncharov and B. Khoussainov. Open Problems in the Theory of Constructive Algebraic Systems

125 B. Khoussainov. On Computable Theoretic Properties of Structures and Their Cartesian Products

126 B. Khoussainov. Algebraic Constraints, Automata, and Regular Languages

127 M.J. Dinneen and B. Khoussainov. Update Networks and Their Routing Strategies

128 B. Khoussainov and S. Rubin. Finite Automata and Isomorphism Types

129 B. Khoussainov and R.A. Shore. Solutions of the Goncharov-Millar and Degree Spectra Problems in The Theory of Computable Models

130 C.S. Calude, M.J. Dinneen and K. Svozil. Reflections on Quantum Computing

131 B. Khoussainov and R.A. Shore. Effective Model Theory: The Number of Models and Their Complexity

132 C.S. Calude and B. Pavlov. The Poincaré-Hardy Inequality on the Complement of a Cantor Set

133 M.D. Kearse and P.B. Gibbons. Computational Methods and New Results for Chessboard Problems

134. C.S. Calude and M.J. Dinneen (editors). The 5th Anniversary Workshop on Discrete Mathematics and Theoretical Computer Science

135. R.G. Downey and G.L. LaForte. Presentations of Computably Enumerable Reals

136. K. Svozil. Quantum Interfaces

137. K. Svozil. Science at the Crossroad Between Randomness and Determinism

138. C. Areces and V. Becher. Analytic AGM Revision

140. C.S. Calude, M.J. Dinneen and G. Păun (editors). Pre-Proceedings of the Workshop on Multiset Processing

141. C.S. Calude Real Numbers: From Computable to Random

142. R. Pemantle and M.C. Wilson Asymptotics of Multivariate Sequences II. Multiple Points of the Singular Variety

143. C.S. Calude. Who Is Afraid of Randomness?

144. R.G. Downey, D.R. Hirschfeldt and A. Nies. Randomness, Computability, and Density

145. K. Svozil. Quantum Information: The New Frontier

146. C.S. Calude, M.J. Dinneen and C.-K. Shu Computing 80 Initial Bits of A Chaitin Omega Number

147. I. Antoniou, C.S. Calude and M.J. Dinneen (editors). Supplemental Papers for the 2nd Unconventional Models of Computation Conference

Honours

1. Douglas Bridges: Awarded degree of D.Sc. from Oxford University, May 2000. Elected Fellow of the Royal Society of New Zealand, November 2000.

2. Marston Conder collected DSc from University of Oxford at ceremony in July 2000.

Professor Cristian S. Calude

Centre for Discrete Mathematics and Theoretical Computer Science

Financial Statement for 2000

Income		
	Carry on from 1999	$ 22,000
	Auckland, Computer Science Department	$ 20,000
	Auckland Mathematics Department	$ 3,000
	Total income:	$ 45,000
Expenditure		
	Communication	$ 531.77
	Travel and accommodation visitors	$ 3,525.44
	Travel	$ 10,501.93
	Hospitality	$ 482.50
	Books, equipemn, other	$ 13,898.95
	Total expenditure	$ 28,940.52
Carry on 2001		**$ 16,060**