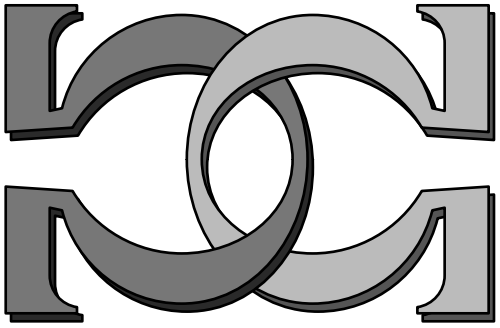

Centre for Discrete Mathematics and Theoretical Computer Science
Computer Science Department, The University of Auckland
Private Bag 92019, Auckland, New Zealand
Phone: +64-9-373-7599 ext 85751, Fax: +64-9-373-7453
http://www.cs.auckland.ac.nz/CDMTCS/

CDMTCS: 2003 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.

Director

Professor C.S. Calude

Management Committee

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

- Professor Douglas Bridges (External Researchers Representative, Canterbury University),
- Professor Cristian Calude (Director),
- Dr. Michael J. Dinneen (Deputy Director),
- Professor David Gauld (HOD Mathematics Department),
- Professor John Hosking (HOD, Computer Science).

Deputy Director

Dr. Michael J. Dinneen

Research Reports Coordinator

Dr. Michael J. Dinneen

Seminar Coordinator

Dr. Mark Wilson

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), G.J. Chaitin (IBM, New York, US), C.J. Colbourn (University of Vermont, US), E.W. Dijkstra (1995-2002), 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).

International Affiliations

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

Departments of Participating Members

Computer science, mathematics, philosophy.

Introduction

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.

Plans, Objectives, Areas

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 main objectives of the CDMTCS are:

- to stimulate and encourage the interest of undergraduate students in theoretical computer science and discrete mathematics (including participation to ACM and regional programming contests),
- to foster research, development and cooperation in theoretical computer science and discrete mathematics (participating members, graduate students),
- to fund short and long term visitors, post-doctoral researchers, and doctoral students,

- to organize conferences, summer schools, workshops and seminars,
- to publish, in co-operation with Springer-Verlag, the book Series Discrete Mathematics and Theoretical Computer Science and the Journal of Universal Computer Science.

Participating Members

The Centre includes the following faculty members:

C. P. Bonnington (Mathematics, Auckland), D. S. Bridges (Mathematics, Canterbury), 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), H. Guesgen (Computer Science, Auckland), P. R. Hafner (Mathematics, Auckland), F. Kroon (Philosophy, Auckland), B. Khoussainov (Computer Science, Auckland), R. Nicolescu (Computer Science, Tamaki), A. Nies (Computer Science, Auckland), E. O'Brien (Mathematics, Auckland), B. Pavlov (Mathematics, Auckland), I. Reilly (Mathematics, Auckland), J. Seligman (Philosophy, Auckland), U. Speidel (Computer Science, Tamaki), M. Titchener (Computer Science, Tamaki), C. Thomborson (Computer Science, Auckland), M.C. Wilson (Computer Science, Auckland).

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), L. Staiger (Martin-Luther-Universität Halle-Wittenberg, Germany), 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. Joshua Arulanandham, Natural Algorithms [PhD]
2. Gary Cleveland, Multi-Agent Systems [PhD]
3. Myra Cohen, A combinatorial Design Platform for Automating Software Test Coverage, [PhD]
4. Simona Dragomir, Algorithmic Information Theory, [PhD]
5. Cynthia Fok, Games Played on Finite Graphs [ME]
6. Matthew Goode, Computational Aspects of Phylogenetics, [PhD]
7. Cristian Grozea, Non-Binary Codings [PhD]
8. Robert Kieran, Optical switch [MSc]
9. Jeong Seon Koo, A Decision Support System for Air Pollution Health Risk Analysis [PhD]

10. Byung-Doo Lee, A Heuristic Life-and-Death Problem Solver for the Game of Go [PhD]
11. Yang Jia, Similarity Measures [PhD]
12. Ute Loerch, Intelligent Question Answering in an Internet-Based Remote Learning Environment [PhD]
13. Andrew Luxton, Cognitive Maps for Exploration [PhD]
14. Sasha Rubin, Finite Automata and Algebraic Structures [PhD]
15. Chi-Kou Shu, Computing Exact Approximations of a Chaitin Omega Number [PhD]
16. Jamie Sneddon, Structural Graph Theory [PhD]
17. Anna Torstensson, Maximal Symmetry Groups of Hyperbolic 3-manifolds [PhD]

Visitors

The Centre hosted the following visitors:

- Prof. R. Downey, Victoria University of Wellington, NZ
- Prof. H. Maurer, Technical University of Graz, Austria
- Dr. F. Stephan, National ICT, Sydney, Australia
- Prof. T. Takaoka, Chrsitchurch University, NZ
- Dr. B. Mills, Massey University at Albany, NZ
- Dr. S. Tewijen, Technical University of Vienna, Austria
- Prof. L. Staiger, Martin-Luther-Universität Halle-Wittenberg, Germany
- Prof. K. Svozil, Technical University of Vienna, Austria
- Prof. Sergey Goncharov, Institute of Mathematics, Novosibirsk, Russia
- Prof. Moshe Vardi, Rice University, Houston, USA
- Dr. Jan Reimann, Mathematisches Institut, Heidelberg University, Germany

Major Developments

The major activity of the Centre in 2003 was the organisation of the Fourth International Conference on "Discrete Mathematics and Theoretical Computer Science" organized by the Université de Bourgogne and the CDMTCS in Dijon, France on 7 – 12 July 2003, `https://www.cs.auckland.ac.nz/CDMTCS/conferences/dmtcs03/`. The conference had five invited lectures by Gregory J. Chaitin (IBM, New York), Cunsheng Ding (UST, Hong Kong), Sorin Istrail (Celera Genomics, Rockville), Maurice Margenstein (LITA, Metz), Timothy Walsh (UQAM, Montreal), 18 regular papers and 3 posters. The book containing the proceedings have appeared as

> C. Calude, M. Dinneen, V. Vajnovski (eds.). *Proc. 4th International Conf. DMTCS'03*, Lecture Notes Comput. Sci. 2731, Springer Verlag, Heidelberg, 2003, 307 pp.

Other contributions to DMTCS'03 have been published in

> C. S. Calude, M. J. Dinneen, V. Vajnoski (eds.). *Supplemental Papers for DMTCS'03*, *CDMTCS Research Report*, 215, 2003, 41 pp.

A report on DMTCS'03 has been published in the *Bulletin of the EATCS*, 81, October 2003.

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, Philosophia Mathematica, 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.

Research Papers

More than 170 research papers have been published by faculty members and graduate students.

CDMTCS Research Reports

206. S.S. Goncharov and B. Khoussainov. Computationally Complete Computably Enumerable Algebras. 01/2003

207. B. Khoussainov and T. Kowalski. Games on Graphs: Automata, Structure, and Complexity. 01/2003

208. B. Khoussainov, S. Rubin and F. Stephan. On Automatic Partial Orders. 01/2003

209. B. Khoussainov, S. Rubin and F. Stephan. Definability and Regularity in Automatic Presentations of Subsystems of Arithmetic. 01/2003

210. L. Staiger. Constructive Dimension equals Kolmogorov Complexity. 01/2003

211. M. Margenstern. The Tiling of the Hyperbolic 4D Space by the 120-Cell Is Combinatoric. 02/2003

212. S.A. Terwijn. Complexity and Randomness. 03/2003

213. C.S. Calude, L. Staiger and K. Svozil. Randomness Relative to Cantor Expansions. 04/2003

214. K. Svozil. Eutatic Quantum Codes. 04/2003

215. C.S. Calude, M.J. Dinneen and V. Vajnovszki (editors). Supplemental Papers for DMTCS03. 05/2003

216. K. Svozil. Computational Universes. 05/2003

217. C.S. Calude, E. Calude and M.J. Dinneen. What is the Value of Taxicab(6)?. 05/2003

218. C.S. Calude and L. Staiger. Generalisations of Disjunctive Sequences. 06/2003

219. C.S. Calude. Dialogues on Quantum Computing. 06/2003

220. J.J. Arulanandham, C.S. Calude and M.J. Dinneen. A Fast Natural Algorithm for Searching. 06/2003

221. E. Calude, B. Mills and L. Mills. A Uniform Method for Testing Computational Complementarity. 06/2003

222. V. Becher, S. Figueira, A. Nies, S. Picchi. Program Size Complexity for Possibly Infinite Computations. 08/2003

223. J.J. Arulanandham, C.S. Calude and M.J. Dinneen. Balance Machines: Computing = Balancing. 10/2003

224. A. Moreira. RNA Rings in the Origin of Life. 10/2003

225. S. Daniels. Uniform Candy Distribution. 10/2003

226. C.S. Calude and G. Păun. Bio-Steps Beyond Turing. 11/2003

227. H. Ishihara and L. Vîţă. A constructive Banach's inverse mapping theorem in F-spaces. 12/2003

Educational Activities

The CDMTCS supports the following activities:

- The group of courses "Logic and computation" leading to BA, BSc, MA, MSc degrees organized in cooperation with the departments of computer science, mathematics, philosophy and linguistics. See `http://www.cs.auckland.ac.nz/~bmk/lc/`.

- Coaching for both the NZ and ACM local programming contests. Dr. Radu Nicolescu is currently the head judge for the Australasian South-Pacific Region, while Dr. Michael Dinneen is in charge of the Judging Systems for the region. Dr. Nicolescu was offered the first "Mike Lennon Award".

- Awards the "J.C. Butcher Award in Theoretical Computer Science"; Harris (Tzu-Hao) Lin is the second recipient of this award.

- CDMTCS Seminars:

  1. 2003-11-13 12:00:00 Frank Stephan, Learning a Subclass of Regular Patterns in Polynomial Time
  2. 2003-10-21 14:00:00 Chi-Kou Shu, Computing Exact Approximations of a Chaitin Omega Number
  3. 2003-10-14 14:00:00 Michael Dinneen, An Introduction to Bounded-Degree Broadcast Networks
  4. 2003-09-30 14:00:00 Andre Nies, Randomness and lowness
  5. 2003-09-24 14:00:00 Rod Downey, Parameterized complexity for the skeptic
  6. 2003-09-05 14:00:00 Jan Reimann, Normal Numbers and Selection Rules
  7. 2003-08-26 14:00:00 Tadao Takaoka, Heaps and shortest paths
  8. 2003-08-19 14:00:00 Ming Li, A distributed framework for graph algorithms
  9. 2003-08-12 14:00:00 Cristian Calude, Passages of Proof
  10. 2003-08-05 14:00:00 Arkadii Slinko, On parametrized complexity of optimal lobbying
  11. 2003-07-29 14:00:00 Sasha Rubin, Proving non-automaticity
  12. 2003-07-22 14:00:00 Bakhadyr Khoussainov, Automatic Structures

Professor Cristian S. Calude

Centre for Discrete Mathematics and Theoretical Computer Science

Financial Statement for 2003

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