

Centre for Discrete Mathematics and Theoretical Computer Science
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1 CDMTCS: 1996 ANNUAL REPORT

The Centre for Discrete Mathematics and Theoretical Computer Science, a joint venture of the Universities of Auckland and Waikato, was founded in 1995 in order to

- support basic research on the interface between mathematics and computing,
- increase local knowledge in these areas, and
- broaden research skills in New Zealand.

The aim of the Management Committee is to build one of the world's best centres for research in Discrete Mathematics and Theoretical Computer Science, and thereby to foster research and development in those areas within the South Pacific Region and to create 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.

The major activity of the Centre in 1996 was the organisation of its first international conference, *DMTCS '96*, which took place in Auckland on 9-13 December. This conference was an enormous success, with speakers from Europe, Asia, The USA, Canada, and Australasia. It is hoped that the conference will be the first in a series, with the next one in 1998.

The conference programme and other relevant information are attached to this report. Details of the talks can be found in the conference proceedings, *Combinatorics, Complexity, & Logic* (D.S. Bridges, C.S. Calude, J. Gibbons, S. Reeves, and I.H. Witten, eds), published by Springer-Verlag, Singapore.

VIC' 96, a satellite conference of DMTCS'96, was organised by the Victoria University of Wellington on 5-6 December 1996.

1.1 Directors

Professor D.S. Bridges (Waikato) and Professor C.S. Calude (Auckland)

1.2 Management Committee

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

- Professor Douglas. Bridges
- Professor Cristian Calude
- Professor Ian Collins (Auckland University Research Committee Representative)
- Professor Bob Doran (Deputy Dean of Science, University of Auckland)
- Professor Ivan Reilly (Director, SMIS, University of Auckland)

The University of Waikato Research Committee was invited to nominate a representative on the Management Committee, but felt that its interests were served already by Professor Bridges.

1.3 Participating Members

The Centre includes the following faculty members:

P. Bonnington (Mathematics, Tamaki), D. S. Bridges (Mathematics, Waikato), C. Calude (Computer Science, Auckland), J. Cleary, (Computer Science, Waikato), M. D. E. Conder (Mathematics, Auckland), M. J. Dinneen (Computer Science, Auckland), R. W. Doran (Computer Science, Auckland), A. G. French (Mathematics, Waikato), J. Gibbons (Computer Science, Auckland), P. Gibbons (Computer Science, Auckland), H. Guesgen (Computer Science, Auckland), P. R. Hafner (Mathematics, Auckland), R. Klette (Computer Science, Tamaki), F. Kroon (Philosophy, Auckland) B. Khoussainov (Computer Science, Auckland), M. Lennon (Computer Science, Tamaki), I. Melchert (Mathematics, Waikato), M. Morton (Mathematics, Auckland), R. Nicolescu (Computer Science, Tamaki), E. O'Brien (Mathematics, Auckland), B. Pavlov (Mathematics, Auckland), S. Reeves (Computer Science, Waikato), I. Reilly (Mathematics, Auckland), M. Titchener (Computer Science, Tamaki), C. Thornborson (Computer Science, Auckland), M. Utting (Computer Science, Waikato), I. H. Witten (Computer Science, Waikato).

1.4 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, and Technische Universität, Vienna), G.J. Chaitin (IBM, New York), C.J. Colbourn (University of Waterloo, Canada), E.W. Dijkstra (University of Texas, Austin), J.H. Dinitz (University of Vermont), J.A. Goguen (University of Oxford), R.L. Graham (AT&T Bell Labs, New Jersey), J. Hartmanis (Cornell University), H. Jurgensen (University of Western Ontario), C.C. Lindner (Auburn University, Alabama), R. Mathon (University of Toronto), B.D. Mackay (Australian National University), A. Nerode (Cornell University), I. Prigogine (Solvay Institute, Belgium), G. Rozenberg (Leiden University, Netherlands), A. Salomaa (University of Turku), J. Seberry (University of Wollongong, Australia), D van Dalen (University of Utrecht, Netherlands).

1.5 External Researchers

In 1996 the Center invited a number of mathematicians and computer scientists to become *External Researchers* who will contribute 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), R. Downey (Victoria University of Wellington, New Zealand), B. Everitt (University of Aberdeen, Scotland), R. Goldblatt (Victoria University of Wellington, New Zealand), D. Holton (University of Otago, New Zealand), C. Little (Massey University, New Zealand), J. McKay (Concordia University, Canada), C.E. Praeger (University of Western Australia), K. Svozil (Technische Universität, Vienna), D. Stefanescu (Bucharest University, Romania). S. Yu (University of Western Ontario, Canada), I Tomescu (Bucharest University, Ontario).

1.6 Research Grants

D.S. Bridges: Marsden Fund Doctoral Award of \$30000 per annum (1997-1999).

C. Calude: Auckland University Research Grant of \$3200 for *Randomness on Shift Spaces*.

C. Calude: Auckland University Research Post-Doctoral Fellowship (\$44,250 per annum plus \$4000 travel) for *Complexity and Randomness in Non-linear Spaces*.

C. Calude: Auckland University Research Grant of \$3200 for *Physical versus Computational Complementarity*.

M.D.E. Conder: Marsden Fund Award of \$31500 (second of three years) for *Combinatorial Methods in Mathematics and Applications*.

H. Guesgen: Auckland University Research Grant of \$3500 for *Advanced Constraint Satisfaction*.

R. Klette: German Research Foundation grant of DM10000 to support visitors for 8th International Workshop on *Theoretical Foundations of Computer Vision* (Dagstuhl, Germany).

M. Lennon, S. Manoharan, R. Nicolescu, M. Titchener: Infrastructure research grant \$55000

M. Lennon, S. Manoharan, R. Nicolescu, M. Titchener: division top-up grant \$5000 for m3r.tcs.auckland.ac.nz.

1.7 Graduate Students

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

1. Asat Arslanov (PhD student, "Theoretical Computer Science"),
2. Elena Calude (PhD student, "Theoretical Aspects of Artificial Intelligence"),
3. Peter Dobcsanyi (PhD student, "Combinatorial Computation using Distributed Processing"),
4. Stuart Inglis (PhD student, "Textual Image Processing"),
5. James Webb: (PhD student, "Computational Techniques for Solving Chessboard Problems"),
6. S. Irvine (PhD student, "Compression and Cryptology"),
7. John Pearson (PhD student, "Studies in Combinatorics and Group Theory"),
8. Cameron Walker (PhD student, "Compact Presentations for the Symmetric Groups"),
9. Craig Nevill-Manning (PhD student, "Programming by Example"),

10. Tony Smith (PhD student, “Probability-based Grammar Induction”),
11. Ulrich Guenther (PhD student, “Robust Image Compression Coding”),
12. Wang Yuchuan (PhD student, “Constructive Analysis of Partial Differential Equations”),
13. Robyn Curtis (Masters student, “The Cycle Double Cover Problem”)
14. Samantha Stephenson (Masters student, “Sharply Transitive Sets and Finite Projective Planes”),
Brent Martin (Masters student, “Instance-based Learning: Nearest Neighbour with Generalisation”),
15. James Littin (Masters student, “Learning Rules with Inter-attribute Dependencies”).

1.8 Post-doctoral Fellows

- P. Hertling (Computer Science, Auckland)
- P. McKenna (Mathematics, Auckland)
- Y. Wang (Computer Science, Auckland)

1.9 Visitors

In addition to the speakers and other participants at the DMTCS '96 conference, the Centre hosted the following visitors in 1996:

- Professor C. J. Colbourn (University of Vermont, USA)
- Professor D. Archdeacon (University of Vermont, USA)
- Professor R. Freivalds (University of Latvia)
- Professor J. Gruska (University of Bratislava, Slovakia)
- Professor Ray Mines (New Mexico State University)
- Dr Karl Svozil (Institut für Theoretische Physik, Technische Universität, Vienna)
- Professor Klaus Weihrauch (FernUniversität, Hagen, Germany)

1.10 Financial Statement

To be attached.

1.11 Publications and Technical Reports

The Co-Directors have negotiated an agreement with Springer-Verlag, Singapore, who will publish a series of books on Discrete Mathematics and Theoretical Computer Science for the Centre. These books, the first of which is the proceedings of the DMTCS '96 conference, will bear the Centre's logo on the front cover.

1.11.1 Books

Combinatorics, Complexity, & Logic (Proceedings of the International Conference DMTCS '96, held in Auckland, 9-13 December 1996; D.S. Bridges, C.S. Calude, J. Gibbons, S. Reeves, and I.H. Witten, eds), Springer-Verlag, Singapore.

1.11.2 Journal Special Issues

The Finite, the Unbounded and the Infinite (proceedings of the Summer School “Chaitin Complexity and Applications”, Mangalia, Romania, 27 June-6 July 1995), edited by C. Calude. J. UCS **5** (1996), 242-441.

1.11.3 Research Papers

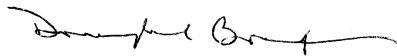
More than 200 research papers have been published by faculty members, graduate students and post-doctoral fellows.¹

1.11.4 Technical Reports

1. A. Arslanov. *Difference Splittings of Recursively Enumerable Sets*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-011.
2. I. Antoniou, B. Pavlov and A. Yafyasov. *Quantum Electronic Devices Based on Metal-Dielectric Transition in Low-Dimensional Quantum Structures*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-012.
3. C. Calude and C. Grozea. *Kraft-Chaitin Inequality Revisited*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-013.
4. C. Calude. *Algorithmic Information Theory: Open Problems*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-014.
5. C. Calude, E. Calude, K. Svozil and S. Yu. *Physical versus Computational Complementarity I*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-015.
6. C. J. Colbourn and P. B. Gibbons. *Uniform Orthogonal Group Divisible Designs with Block Size Three. (Designs listed in the Appendices and constructed directly by computer are available.)* Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-016.
7. B. Khossainov. *Randomness, Computability, and Algebraic Specifications*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-017.
8. B. Khossainov and R. A. Shore. *Scott Families and Computably Categorical Structures*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-018.
9. M.J. Dinneen, K. Cattell and M.R. Fellows. *Forbidden Minors to Graphs with Small Feedback Sets*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-019.
10. D. Bridges and R. Mines. *Sequentially Continuous Linear Mappings in Constructive Analysis*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-020.
11. C. Calude and F. W. Meyerstein. *Is the Universe Lawful?*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-021.
12. I. Tomescu. *On a problem of L. Priese*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-022.

¹Please contact Professor D.S. Bridges for more details.

13. P. Cholak, S. Goncharov, B. Khoushainov and R. A. Shore. *Computably Categorical Structures and Expansions by Constants*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-023.
14. B. Khoushainov, A. Nies and R. A. Shore. *Computably Presentable Models of Theories with Few Models*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-024.
15. C. Calude, E. Calude, and B. Khoushainov. *Deterministic Automata: Simulation, Universality and Minimality*. Centre for Discrete Mathematics and Theoretical Computer Science Report CDMTCS-025.



Professor Douglas S. Bridges
Co-Director



Professor Cristian S. Calude
Co-Director