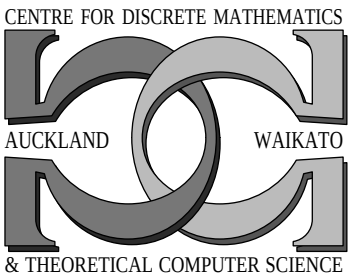

Centre for Discrete Mathematics and Theoretical Computer Science
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http://www.cs.auckland.ac.nz/CDMTCS/index.html

CDMTCS: 1997 ANNUAL REPORT

The Centre for Discrete Mathematics and Theoretical Computer Science 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
- Theoretical Foundations of Computer Vision

The major activity of the Centre in 1997 was the organisation of its second international conference, *UMC'98,* which took place in Auckland on 4-9 January 1998. This conference was an enormous success, with speakers from Europe, Asia, The USA, Canada, and Australasia. The volume containing 7 invited papers and 21 regular contributions was published by the DMTCS Series of Springer Verlag.

Director

Professor C.S. Calude (Auckland)

Deputy Director

Dr. Bakhadyr Khoussainov

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
- Professor Ian Collins (Auckland University Research Committee Representative)
- A/Professor Peter Gibbons, HOD, Computer Science,
- Dr. Bakhadyr Khoussainov
- Professor Ivan Reilly (Director, SMIS, University of Auckland)

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. Thomborson (Computer Science, Auckland), M. Utting (Computer Science, Waikato), I. H. Witten (Computer Science, Waikato).

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. Jrgensen (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).

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), 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), Gh. Păun (Institute of Mathematics, Romanian Academy), 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. Gordon Alford (Masters student, "DNA Computation: From Turing Machines to H Systems"),
2. Asat Arslanov (PhD student, "Theoretical Computer Science"),
3. Elena Calude (PhD student, "Theoretical Aspects of Artificial Intelligence"),
4. Robyn Curtis (Masters student, "Finitely-presented Groups ")
5. Peter Dobcsanyi (PhD student, "Applications & Adaptations of the Low Index Subgroups Process"),
6. Ulrich Guenther (PhD student, "Robust Image Compression Coding"),
7. John Pearson (PhD student, "Computational Aspects of Topological Graph Theory"),
8. Cameron Walker (PhD student, "Vertex-transitive Graphs with Large Vertex-Stabiliser").

Post-doctoral Fellows

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

Visitors

The Centre hosted the following visitors in 1997:

- M. Amos, University of Liverpool, UK,
- I. Antoniou, Solvay Institute, Belgium,
- V. E. Căzănescu, Bucharest University, Romania,

- K. Culik II, University of South Carolina, US,
- R. Downey, Victoria University in Wellington,
- A. Ekert, Oxford University, UK,
- A. Gibbons, University of Liverpool, UK,
- F. Harary, New Mexico State University, US,
- H. Ishihara, JAIST, Japan, H. J. Kimble, Caltech, US,
- R. Laue, University of Bayreuth, Germany,
- S. Lloyd, MIT, US,
- C. Moore, Santa Fe Institute, US,
- A. Nies, University of Chicago, US,
- Gh. Păun, Instituute of Mathematics, Romanian Academy,
- Prof. Cheryl Praeger, University of Western Australia,
- F. Richman, New Mexico State University, US,
- J. Reif, Duke University, US,
- A. Salomaa, Turku University, Finland,
- H. Thiele, Dortmund University, Germany,
- Prof. Anne Street, University of Queensland, Australia,
- K. Svozil, Technische Universität, Vienna,
- M. Vlach, JAIST, Japan,
- Prof. Herb Wilf, University of Pennsylvania, US.

Graduate Students Sponsored by the Centre

- G. Alford
- A. Arslanov
- G. Atkinson
- S. Rubin
- Jarno van der Linden

Research Grants

1. A. Arslanov and C. Calude: Auckland University Research Grant, A18/5/62090/F3414069, 1997, NZ$2,000, for the project *Topics in Algorithmic Information Theory*.
2. C. Calude: Auckland University Research Grant, A18/5/62090/F3414063, 1997, NZ$4,000, for the project *Physical versus Computational Complementarity*.
3. C. Calude: Auckland University Research Grant, A18/5/62090/F3414075, 1997, NZ$4,000, for the project *Physical versus Computational Complementarity*.
4. E. Calude and H. Guesgen: University Auckland Research Grant A18/5/62090/F3414070 1997, NZ$1,500, for the project *Theoretical Aspects of Artificial Intelligence: Automata-Theoretical Models of Complementarity*.
5. M. J. Dinneen: Auckland University Research Grant, A18/5/62090/F3414075, 1997, $ 3600, for the project *Classifying Graph Families by Minors*.
6. B. Khoussaionov: NSF Division of International Programs grant for cooperative research between USA and New Zealand, INT-9602579, 1997-2000, US$ 30.000, for the project *Computability, Logic and Complexity*.
7. B. Khoussaionov: A PFU Endowed Chair Grant of the Information Science School at Japan Advanced Institute of Science and Technology, December, 1996 – February, 1997 (485.000Yen).
8. B. Khoussaionov: Travel Grant of the Center For Foundations of Intelligent Systems (USA), US$2.000US, October 1997.
9. B. Khoussaionov: A18/5/62090/F3414057, October 1996, NZ$4.000, for the research project *Computability, Randomness, and Models of Computations*.
10. B. Khoussaionov: Auckland University New Staff Research Grant, A18/5/62090/F3414066, April 1997, NZ$9.600, for the research project *Computability, Complexity, and Randomness*.
11. B. Khoussaionov: Auckland University Research Grant for collaborative research with Dr. A.Slinko from Math Dept, April 1997, NZ$3.000, for the project on *Computable Algebras and Groups*.

Editorial Boards

- C. S. Calude has been elected to Editorial Board of *Grammars* and *Fundamenta Informaticae*.
- R. Nicolescu has been elected to Editorial Board of *Fundamentals and Applications of Modelling and Computer Graphics*.

Cooperation with Waikato University

Our partners from the University of Waikato have decided to put more emphasis on applied science, specifically in the area of computer science, and, consequently from January 1998 the Centre operates only at the University of Auckland.

Financial Statement

We have concluded a three years agreement of sponsorship with Pukekohe Travel and the contribution for 1997 ($ 15,000) has been transferred to us.

A financial statement is attached.

Workshops/Conferences organised by the Centre

Workshop: "Computability and Related Matters in Mathematics and Physics" (Hamilton, February, 1997); the proceedings will appear in 1998 as a special issue of the journal "Chaos, Fractals, Solitons".

The First Japan-New Zealand Workshop "Logic in Computer Science" (Auckland, August, 1997); the proceedings have appeared as November special issue of "J. UCS".

The First International Conference "Unconventional Models of Computation" (Auckland, January, 1998); the proceedings have appeared as a volume in the DMTCS Series of Springer Verlag; reports will appear in "Nature", "Complexity" and "EATCS Bull.", "NZ Herald", "Bits and Bytes" and "NZ Infotech Weekly".

Affiliations

The Logic Group at JAIST and Mindship International.

Publications and Technical Reports

DMTCS Book Series with Springer

1. L. Groves and S. Reeves (eds.) Formal Methods Pacific '97 , Proceedings of FMP'97, Springer-Verlag, Singapore, 1997.
2. G. J. Chaitin. The Limits of Mathematics. A course on information theory & the limits of formal reasoning Hardcover, Springer-Verlag, Singapore, 1997.
3. C.S. Calude, J. Casti, M. Dinneen (eds.). *Unconventional Models of Computation*, Springer-Verlag, Singapore, 1998.

Journal Special Issues

D. S. Bridges, C.S. Calude, M. Dinneen, B. Khoussainov (eds.). *Proceedings of the First Japan–New Zealand Workshop on "Logic in Computer Science". J. UCS* 11 (1997), 1134-1281.

Research Papers

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

Technical Reports

26. M.J. Dinneen, J.A. Ventura, M.C. Wilson, and G. Zakeri. Compound Constructions of Minimal Broadcast Networks
27. H. Ishihara, B. Khoussainov, and A. Nerode. Decidable Kripke Models of Intuitionistic Theories
28. N. Brand and M. Morton. Uniform Generalized Steinhaus Graphs
29. R.J. Coles, R. Downey and B. Khoussainov. On Initial Segments of Computable Linear Orders
30. S. Legg. Solomonoff Induction
31. B. Khoussainov and R.A. Shore. Computable Isomorphisms, Degree Spectra of Relations, and Scott Families

32. C.S. Calude, P.H. Hertling and B. Khoussainov. Do the Zeros of Riemann's Zeta-Function Form a Random Sequence?

33. Y. Wang. Randomness, Stochasticity and Approximations

34. A. Arslanov. On a Conjecture of M. Van Lambalgen

35. B. Khoussainov, A. Yakhnis and V. Yakhnis. Clusters of Two Player Games and Restricted Determinacy Theorem

36. C.S. Calude, P.H. Hertling and K. Svozil. Embedding Quantum Universes into Classical Ones

37. D. Bridges, F. Richman and P. Schuster. Linear Independence and Choice

38. F. Richman and D. Bridges. A Constructive Proof of Gleason's Theorem

39. C.S. Calude. A Genius' Story: Two Books on Gdel

40. E. Calude and M. Lipponen. Deterministic Incomplete Automata: Simulation, Universality and Complementarity

41. M. Conder. Explicit Definition of the Binary Reflected Gray Codes

42. M. Conder. Small Trivalent Graphs of Large Girth

43. G. Alford. An Explicit Construction of a Universal Extended H System

44. U. Gunther, P. Hertling, R. Nicolescu and M. Titchener. Representing Variable-Length Codes in Fixed-Length T-Depletion Format in Encoders and Decoders

45. B. Khoussainov, A. Yakhnis and V. Yakhnis. Games with Unknown Past

46. B. Khoussainov and A. Slinko. Nonassociative Computable Rings and Their Isomorphisms

47. R. Downey. On the Universal Splitting Property

48. R. Downey and A. Nies. Undecidability Results for Low Complexity Degree Structures

49. R.G. Downey, M.R. Fellows and K.W. Regan. Parameterized Circuit Complexity and the W Hierarchy

50. K. Cattell, M.J. Dinneen, R.G. Downey, M.R. Fellows and M.A. Langston. On Computing Graph Minors Obstructi on Sets

51. R.G. Downey and C.G. Jockusch Jr. Effective Presentability of Boolean Algebras of Cantor-Bendixson Rank 1

52. R.G. Downey, M.R. Fellows, A. Vardy and G. Whittle. The Parameterized Complexity of Some Fundamental Problems in Coding Theory

53. C.S. Calude and M. Lipponen. Computational Complementarity and Sofic Shifts

54. C.S. Calude, E. Calude and B. Khoussainov. Finite Nondeterministic Automata: Simulation and Minimality

55. M.J. Dinneen. Practical Enumeration Methods for Graphs of Bounded Pathwidth and Treewidth

56. D. Bridges and L. Dediu. Paradise Lost, or Paradise Regained?

57. P. Hertling. The Real Number Structure is Effectively Categorical

58. H.W. Guesgen. Imprecise Reasoning about Geographic Information

59. C.S. Calude, P.H. Hertling, B. Khoussainov and Y. Wang. Recursively Enumerable Reals and Chaitin Omega Numbers

60. E. Calude and M. Lipponen. Minimal Deterministic Incomplete Automata

61. P. Hertling and Y. Wang. Invariance Properties of Random Sequences
62. C.S. Calude and A. Nies. Chaitin Omega Numbers and Strong Reducibilities
63. C.S. Calude, L. Priese and L. Staiger. Disjunctive Sequences: An Overview
64. P. Hertling. Surjective Functions on Computably Growing Cantor Sets
65. P. Hertling. Embedding Cellular Automata into Reversible Ones
66. V.E. Căzănescu. Feedback for Relations
67. P. Hertling. The Effective Riemann Mapping Theorem
68. D. Bridges and S. Reeves. Constructive Mathematics, in Theory and Programming Practice
69. D. Bridges, F. Richman and P. Schuster. Adjoints, Absolute Values and Polar Decompositions
70. D. Bridges, C. Calude, B. Pavlov and D. ştefănescu. The Constructive Implicit Function Theorem and Applications in Mechanics
71. C. Martin-Vide and G. Păun. Cooperating Distributed Splicing Systems
72. G. Păun. DNA Computing Based on Splicing: Universality Results
73. G. Păun. Two-Level Distributed H Systems
74. C.S. Calude and P.H. Hertling. Computable Approximations of Reals: An Information-Theoretic Analysis
75. P. Hertling (editor). Unconventional Models of Computation'98: Posters
76. C. Martin-Vide, G. Păun, G. Rozenberg and A. Salomaa. X-Families: An Approach to the Study of Families of Syntactically Similar Languages
77. P. Hertling. A Lower Bound for Range Enclosure in Interval Arithmetic
78. R. Laue. Halvings on Small Point Sets
79. P. Hertling and K. Weihrauch. Randomness Spaces

Honours

1. Prof. M. Conder has been admitted to Fellowship of the NZ Mathematical Society (July 1997).

2. Dr. Marjo Lipponen, a Post-Doctoral Research Fellow with the Centre, has been awarded the Nevanlinna Dissertation Prize (1996) for her PhD Thesis "On Primitive Solutions of the Post Correspondence Problem" written under the supervision of Professor Arto Salomaa (member of the Centre's IAB).

Cooperation with Waikato University

Our partners from the University of Waikato have decided to put more emphasis on applied sciences, and, consequently, from January 1998 the Centre is operating only at the University of Auckland.

C. Calude

Professor Cristian S. Calude

Centre for Discrete Mathematics and Theoretical Computer Science

Financial Statement for 1997

Income		
	Carry on from 1996	$31,000
	Auckland, Computer Science Department	$18,000
	Auckland Mathematics Department	$3,000
	Pukekohe Travel	$15,000
	SMIS Grant	$2,500
	Total income:	$69,500
Expenditure		
	UMC;98	$27,739.80
	Communication	$983.96
	Travel and accommodation visitors	$10,897
	Graduate students support	$13,966.46
	Sundry expenses	$9,093.27
	Computer	$6,000
	Total expenditure	$64,210.38
Surplus of income over expenditure		**$5,289.62**