

Curriculum Vitae for Oliver Goodman

Personal Details

Dr. Oliver A. Goodman	Department of Mathematics and Statistics
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Nationality: British (permanent resident of Australia)	AUSTRALIA

Education

1989 PhD. in mathematics from Warwick University, Coventry, England, supervised by Professor Epstein. Thesis title: “*Metrized Laminations and Quasisymmetric Maps.*”

1987 MSc. in mathematics (with distinction) from Warwick University, Coventry, England.

1986 BA. in mathematics (1st class) from St Catherine’s College, Oxford, England.

Professional Experience

Jan 1996-present: Research Fellow, University of Melbourne. The chief task for which I have been employed at Melbourne University has been the development of software for studying hyperbolic 3-manifolds. **Snap** adds mathematical rigour to the findings of Jeff Weeks’ program **SnapPea** and is used by mathematicians around the world for computing arithmetic and transcendental invariants and studying character varieties and deformation spaces in 3-dimensional hyperbolic geometry.

Jan-Dec 1995: European Union fellowship at the University of Bielefeld. Working with D.Huson, author of the RepTiles computer program, on hyperbolic and automatic groups. Studying potentially computable problems in the homology of groups.

Oct-Dec 1994: Visiting position at the University of Melbourne. Worked with Hodgson and Neumann implementing exact arithmetic in the 3-manifold program SnapPea for the study of arithmetic Kleinian groups.

Mar 1992-Oct 1994: Postdoc at the Geometry Center, University of Minnesota. Worked mainly on mathematical software; in particular, computation and geometric visualization in hyperbolic geometry. Studied related theoretical issues from a mathematical point of view. Taught one quarter of pre-calculus. Co-supervised the project of one of the 1993 summer program students.

Jan-Mar 1992: Worked for the Geometry Center at Warwick University writing mathematical software.

Jan 1990-Dec 1992: Programmer/Analyst at IBM UK. I undertook three projects: two were VM/REXX client-server fulfilment software, and the third involved C and scripting tools to format IBM’s business data for customer distribution via CD ROM.

Software

Snap, multiple releases 1996-2005: Unix/C++. Computes arithmetic invariants of hyperbolic 3-manifolds, verifies complete hyperbolic structures algebraically, and computes other transcendental invariants to arbitrary precision. See snap’s home page, <http://www.ms.unimelb.edu.au/~snap>.

Tube: Unix/C++. Constructs tube domains for incomplete as well as complete hyperbolic structures in the Dehn surgery space of a 3-manifold. See <http://www.ms.unimelb.edu.au/~snap>.

Hyperbolic.m: Mathematica package for carrying out computations in n -dimensional hyperbolic geometry and displaying 2- and 3-dimensional results visually in a variety of models. Distributed by Wolfram Research Inc.

CirclePack.m: Mathematica package to compute circle packings. Distributed by Wolfram Research Inc.

Geomview conformal model: Designed and carried out the initial implementation of Geomview’s Poincaré ball model view of hyperbolic 3-space. Geomview is available from the Geometry Center www.geom.umn.edu.

Mathpad: An SGI Iris based interactive graphics tool for Mathematica, designed to overcome the noninteractive nature of Mathematica graphics. Distributed by the Geometry Center.

Dragons (1986): Amstrad CPC-464 home computer video game, written during my undergraduate holidays and sold by Tansoft.

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Research

“*Tube domains for hyperbolic 3-manifolds with Dehn surgery singularity*” with Hodgson. Theoretical background to the program `tube`, an implementation of the approach of Hodgson and Dowty to determining the hyperbolic Dehn surgery space of a hyperbolic 3-manifold. Work in progress.

“*Commensurators of cusped hyperbolic manifolds*” with Heard and Hodgson. An algorithm for computing the commensurator of any non-arithmetic hyperbolic 3-manifold. Preprint.

“*Computing Arithmetic Invariants of 3-Manifolds*” with Coulson, Hodgson and Neumann. Describes the theoretical basis of the program `snap`. *Experimental Mathematics* **9**:1 (2000) 127-152.

“*Dehn’s algorithm for non-hyperbolic groups*” with M. Shapiro. A modification of Dehn’s algorithm solves the word problem in nilpotent and geometrically finite groups. Submitted to the LMS.

“*On the tight span of a 2-dimensional spherical graph*” with V. Moulton. A study of the tight span construction which provides a route to the computation of the homology of a group. *Discrete Mathematics* **218** (2000) 73-96.

“*An algorithm for computing Andre’ev polyhedra*”: A proof of Andre’ev’s theorem and details of an algorithm for carrying out the construction. Preprint (1995).

All of the above are available at <http://www.ms.unimelb.edu.au/~oag/>.

Teaching

122 Mathematics B (Advanced): Semester 2, 2004 (QoT rating 3.7/5).

423 Algebraic number theory: Honours course, semester 1, 2001, semester 2 2002-2004

Hyperbolic Geometry: Short course, Feb 11-15, 2002.

222 Linear and abstract algebra (year 2): Practice class tutor, semester 2, 2000.

425 Hyperbolic geometry and hyperbolic manifolds: with Craig Hodgson, Honours course, semester 1, 2000.

Student projects

Damian Heard, summer 2000-2001: Developed and implemented an algorithm for computing commensurators of cusped hyperbolic 3-manifolds.

Marta E. Salek, summer 2000-2001: Identified commensurators of punctured torus bundles using Jørgensen’s description of the canonical cell decomposition.

Owain Emslie, summer 2000-2001: Arithmetic eigenvalue-based method for finding irregular covers of closed hyperbolic 3-manifolds.

Tim Riley, summer 1997-1998: identifying Seifert fibre spaces.

Philip Walford, summer 1996-1997: hyperbolic knot complements

Sivathasan Saravanabavanathan, summer 1996-1997: Seifert fibre spaces.

Chaitanya Rao, summer 1996-1997: arithmetic of traces for hyperbolic 3-manifolds.

Seminars

Hyperbolic geometry, weekly seminars, semester 1, 2003: talked on Lackenby’s paper “The canonical decomposition of once-punctured torus bundles.”

Hyperbolic geometry, weekly seminars, summer 2003: Talked on Abigail Thompson’s paper “Thin position and the recognition problem for S^3 .”

Hyperbolic geometry, weekly seminars, winter 2000: organized, occasionally talked on Margulis Lemma and Mostow rigidity.

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Conference presentations

Jun 2005: "Commensurators of cusped hyperbolic manifolds," workshop on Geometry: Interactions with Algebra and Analysis, Massey University, Auckland, NZ.

Jan 2001: "Commensurability of cusped hyperbolic 3-manifolds," at mini-workshop in geometry and topology, Melbourne University.

Jul 1999: "Verified computation of hyperbolic 3-manifolds," at Workshop on Computation in Group Theory and Geometry, Warwick University, UK. Also given at conferences in Melbourne and Oxford.

Jun 1997: "Computing Arithmetic Invariants of Hyperbolic 3-Manifolds," at ANU, Canberra, Australia.

Oct 1995: "Computation of Arithmetic Hyperbolic 3-Manifolds in SnapPea," at AMS meeting at Northeastern University, Boston.

Sep 1993: "Andre'ev's theorem and circle packings," at North Illinois University, Evanston.

Oct 1992: "Hyperbolic.m," at conference on Geometric visualization, MSRI, Berkeley.