

# Michael Jerie

Curriculum Vitae  
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## Work Address

Centre of Policy Studies and Impact Project,  
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## Education

BSc. (Hons) H1 Mathematics, 1995, La Trobe University.  
Majors: Applied mathematics, Pure mathematics.

PhD (Mathematics), 2005, La Trobe University, Victoria.  
Thesis: *Raychaudhuri's equation and second-order differential equations.*  
Supervisor: Dr. Geoff Prince, La Trobe University.

## Computing/Programming Experience

Languages: MATLAB, REDUCE (LISP) and FORTRAN.  
Platforms: Windows and Linux on Intel and DEC Alpha architectures.

## History

### Current Position:

Research Fellow  
(June 2006 to present)  
GEMPACK Developer  
Centre of Policy Studies  
Monash University.

### Past Positions:

Lecturer  
(February 2005 to June 2006)  
Department of Mathematics, La Trobe University.

Mathematical Programmer  
(June 2003 to February 2005)  
Department of Statistical Science, La Trobe University.  
ARC funded research project, programming in MATLAB, for Dr. Paul Kabaila, department of Statistical Science, La Trobe University. Project Title: *New and computationally feasible methods of constructing efficient and exact confidence limits from count data.*

Computer Systems Officer  
(March 2001 to June 2003)

Department of Biochemistry, La Trobe University.  
Providing first level support for the department's network servers (Windows and Linux), desktop computers, and network. Supporting users and equipment in the research labs.

Mathematics Tutor  
(2000 to 2001)

Department of Mathematics, La Trobe University.  
Extensive work as a casual tutor and demonstrator, in varied class environments of 15 to 100 students. Subjects taught included 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> year under graduate courses.

Research Assistant/Mathematical Programmer  
(1999)

Department of Mathematics, La Trobe University.  
REDUCE programming; Programming in the computer algebra system REDUCE. The project task was to modify the differential equation symmetry finding package DIMSYM, a native REDUCE program. REDUCE is based on PSL (Portable Standard Lisp). DIMSYM is written in both the higher level REDUCE and the underlying PSL.

## Research Interests

My research interests fall into two distinct areas. The first is finding feasible methods of constructing efficient and exact confidence limits from count data. This is an algorithmic and computational problem. Computing Buehler upper confidence limits involves finding the solution to a global optimisation problem. These problems have the feature that typically the object function is very simple and computationally trivial, while the feasible region over which the object function is optimised is difficult to determine, and computationally expensive. In collaboration with P. Kabaila I am working on the design and implementation of an algorithm which solves the global optimisation problem to a realistic tolerance using local Lipschitz constants to compute bounds on partitions of subsets of the feasible region. This follows on from previous work where we describe an algorithm using much cruder bounds.

The second area of interest is in the application of Differential Geometry to ordinary differential equations and follows directly from my PhD thesis. In my PhD thesis I exhibited a generalised Raychaudhuri's equation for systems of second order differential equations. The generalised Raychaudhuri's equation can be used as an analytical tool for the long term behaviour of congruences of solution curves. I am interested in the various applications the generalised Raychaudhuri's equation, including the application to the focusing of congruences. For example, given a system of second order ordinary differential equations can one find a local congruence that focuses at a given point. Other applications include the classification of congruences under geometric invariance conditions, and the relationship between group actions corresponding to symmetries and the characteristics of caustics exhibited by singularities in the congruence of solutions.

## Publications

P. Kabaila and M. Jerie. *Global optimization and Buehler confidence limits*. Submitted to Journal of Global Optimization (2004), currently under revision.

M. Jerie and G.E. Prince. *Jacobi fields and linear connections for arbitrary second-order ODEs*. J. Geom. Phys. **43** (2002), 351–370.

M. Jerie and G.E. Prince. *A general Raychaudhuri's equation for second-order differential equations*. J. Geom. Phys. **34** (2000), 226–241.

M. Jerie, J.E.R O'Connor and G.E. Prince. *Spacetime symmetries for the Kerr metric*. Classical Quantum Gravity **16** (1999), no. 9, 2885–2887.

M. Jerie, J.E.R O'Connor and G.E. Prince. *Computer algebra determination of symmetries in general relativity*. Comput. Phys. Comm. **115** (1998), no. 2-3, 363–380.