

## Curriculum Vitae

- Robert H. Lewis**     Department of Mathematics  
Fordham University  
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<http://fordham.academia.edu/RobertLewis>
- Education**             Cornell University, PhD, mathematics  
University of North Carolina, Chapel Hill  
M.S. (computer science)
- PhD Thesis**             Homology Decompositions and Cofibrations of Nonsimply  
Connected Spaces, directed by Peter Kahn (algebraic topology).
- Professional  
Experience**             - Visiting Professor, Department of Mathematics and Statistics,  
University of New Mexico, fall 2005.  
- Consultant in Computer Algebra, Institute for Defense Analysis (Center  
for Computing Sciences), Bowie MD; spring semester 2005.  
- Consultant in Computer Algebra, Institute for Defense Analysis (Center  
for Computing Sciences), Bowie MD; summer 2004.  
- Consultant in Computer Algebra, Institute for Defense Analysis (Center  
for Computing Sciences), Bowie MD; summer 2003.  
- Consultant in Computer Algebra, Institute for Defense Analysis (Center  
for Computing Sciences), Bowie MD; summer 2002.  
- Consultant in Computer Algebra, Aerospace Mass Properties  
Analysis, Inc. (“AMPAC”); 1997-1998.  
- Consultant in Computer Algebra, Naval Air Warfare Center, Aircraft  
Division (“NAWCAD”), Warminster PA; 1996.  
- Professor, Fordham University, since 2009.  
- Associate professor, Fordham University, 1986 - 2009.  
- Assistant professor, Fordham, 1980 – 1986.
- Refereed  
Publications**             Computational Study of 3D Affine Coordinate Transformations, with  
P. Zaletnyik, B. Palancz, J. Awange, in *Computational Geometry*.  
Nova Science Publishers, New York. 30 pages. to appear.  
Comparing Acceleration Techniques for the Dixon and Macaulay Resultants,  
Proceedings of the ACA 2007 Conference, to appear in *Mathematics  
and Computers in Simulation*. doi:10.1016/j.matcom.2008.04.020  
Heuristics to Accelerate the Dixon Resultant, *Mathematics and  
Computers in Simulation* **77**, Issue 4, p. 400 – 407, April 2008.  
Algorithmic Search for Flexibility Using Resultants of Polynomial Systems  
(with E. Coutsias), in *Automated Deduction in Geometry*. Lecture Notes  
in Computer Science, Vol. 4869, p. 68 – 79. Botana, F., Recio, T. (Eds.)  
Springer, Berlin, 2007.

Solving the Least Squares Method Problem in the AHP for  $3 \times 3$  and  $4 \times 4$  Matrices (with Sandor Bozoki), Central European Journal for Operations Research **13** p. 255 – 270, September 2005.

Top Secret Mathematical Topic, Internal publication, Institute for Defense Analysis, 18 pages, April 2005.

Conic Tangency Equations and Apollonius Problems in Biochemistry and Pharmacology (with Stephen Bridgett), Mathematics and Computers in Simulation **61(2)** p. 101 – 114, January 2003.

Computer Algebra System *Fermat*, software and documentation, in: *Computer Algebra Handbook*, J. Grabmeier, E. Kaltofen, V. Weispfenning (editors), Springer-Verlag, 2002.

Comparison of Polynomial-Oriented Computer Algebra Systems (with Michael Wester), SIGSAM Bulletin **33(4)**, p. 5 – 13, Dec. 1999.

Solving the Recognition Problem for Six Lines Using the Dixon Resultant (with Peter Stiller), Mathematics and Computers in Simulation **49** (1999) p. 203 – 219.

Computer Search for Nilpotent Complexes (with Guy Moore), Experimental Mathematics **6** (1997) p. 239 – 246.

Isomorphism Classes and Derived Series of Almost-Free Groups (with Sal Liriano), Experimental Mathematics **3** (1994) p. 255 – 258.

Homology and Cell Structure of Nilpotent Spaces, Trans. Am. Math. Soc. **290** (1985) p. 747 – 760.

Equivariant Cofibrations and Nilpotency, Trans. Am. Math. Soc. **267** (1981) p. 139 – 155.

Two Results Relating Nilpotency and Cofibrations, Proceedings Am. Math. Soc. **72** (1978) p. 403 – 408.

**Publication  
Submitted**

Partitioning Multivariate Polynomial Equations via Vertex Cuts (with Gregory Bard and Kenneth Koon-Ho Wong); Mathematics in Computer Science, special issue on Symbolic Computation and Cryptography. 32 pages. Birkhauser. submitted October 6, 2008.

**Publication  
In Preparation**

Determining Flexibility of Molecules Using Polynomial Systems: Cyclo-Hexane and Cyclo-Octane, with E. Coutsias. Proceedings of the Odyssey Conference of Computational Chemistry, June 2008.

**Software**

Author of computer algebra system *Fermat* for infinite precision rational arithmetic; modular and finite field arithmetic; polynomial, rational function, and matrix manipulations; and mathematical computer graphics. <http://home.bway.net/lewis/>

**Formal Refereed  
Software Published**

Computer Algebra System *Fermat*, software and documentation; in the CD accompanying *Computer Algebra Handbook*, J. Grabmeier, E. Kaltofen, V. Weispfenning (editors), Springer-Verlag, 2002.

Computer Algebra System *Fermat*, software and documentation; in CD

accompanying “Computer Programming”, July 2002, published by Gruppo Editoriale Infomedia (Italy), R. Boni, editor;  
Computer Algebra System *Fermat*, software and documentation;  
for “Math CD,” Laurent Siebenmann (editor); see  
<http://www.math.washington.edu/~burdzy/MathCD.html>

**Web**

“Mathematics, the Most Misunderstood Subject”

**Publication**

<http://www.fordham.edu/mathematics/whatmath.html>.

**Other**

**Publications**

Polynomials Everywhere, *Sapientia et Doctrina*, Inside Fordham.  
[www.fordham.edu/campus\\_resources/public\\_affairs/inside\\_fordham/march\\_2\\_2007/in\\_focus\\_faculty\\_and/sapientia\\_et\\_doctrin.25318.asp](http://www.fordham.edu/campus_resources/public_affairs/inside_fordham/march_2_2007/in_focus_faculty_and/sapientia_et_doctrin.25318.asp)  
Silhouette-based 2D-3D Pose Estimation Using Algebraic Surfaces (with Nazar Khan), submitted to the ICCV 2007 Conference.  
Fast Detection of the Nilpotent Part of a Matrix, technical report, NAWCAD. 1996.  
A Primer on p-adic Rings and Computations, technical report, NAWCAD, 1996.  
Computer Search for Nilpotent Complexes (with Guy Moore), Notices of the Am. Math. Soc. January 1993.  
Idemfind, a Program to Detect Similarities in Programming Assignments, technical report, UNC Chapel Hill Computer Science Department, 1980.

**Grants**

Fordham University Faculty Research Grant, 2006.  
Fordham University Faculty Fellowship 2005.  
Fordham University Faculty Fellowship 1996.  
National Science Foundation R.E.U. Grant, 1991.  
- principal investigator.  
National Science Foundation R.E.U. Grant, 1989.  
- principal investigator.  
National Science Foundation R.E.U. Grant, 1988.  
- principal investigator.  
Fordham University Faculty Research Grant, 1987.  
Fordham University Faculty Fellowship 1987.  
Cornell University Six-Year PhD Fellowship.

**Theses Directed**

Jiazhao Xu, “On the Construction of Finite Three Dimensional Nilpotent Spaces,” Masters Thesis, May 1992.  
Christopher Snyder, “The Search for Three Dimensional Nilpotent Complexes: An Algorithm”. B.A. Honors Thesis, December 1988.

**Undergraduate  
Research Directed**

Three teams of undergraduates during three summers, 1988, 1989, and 1991, sponsored by the National Science Foundation R.E.U. Program (Research Experiences for Undergraduates). A total of sixteen students. All pursued the topic “Search for Three Dimensional Nilpotent Complexes.” The paper listed above with coauthor Guy Moore describes this project.

**Sponsored or  
Invited Addresses**

- “Resultant Techniques for Polynomial Systems and Applications to Molecular Flexibility”, Workshop on Algebraic Methods in Systems Biology and Statistics, SAMSI Institute, Research Triangle Park, North Carolina, September 14 – 17, 2008.
- “Determining Molecular Flexibility Using Resultants of Polynomial Systems,” Odyssey Conference on Computational Chemistry, Edmonton, Alberta. June 2, 2008.
- “CAS and the Instruction of Mathematics: Where Are We Today?,” Invited member of panel, ACA Conference, Oakland University, Michigan, July 21, 2007.
- “Algorithmic Search for Flexibility Using Resultants,” Department of Mathematics and Computer Science, Seton Hall University, April 10, 2006.
- “Algorithmic Search for Flexibility Using the Dixon Resultant,” Department of Computer Science, University of New Mexico, December 1, 2005.
- Top Secret Mathematical Topic, Internal conference, Institute for Defense Analysis, April 2005.
- “Exploiting Symmetry with the Dixon Resultant”, Applications of Computer Algebra, Lamar University, July 21 – 23, 2004.
- “Using the Dixon Resultant on Big Problems”, International Symposium on Symbolic and Algebra Computation, Drexel University, August 4 – 6, 2003.
- Lecture-demonstration “Solving Large Polynomial Systems with the Dixon Resultant”, Applications of Computer Algebra, North Carolina State University, July 28 – 31, 2003.
- One hour lecture and demonstration, “Computer Algebra System *Fermat*,” at the conference Computer Algebra for the Working Mathematician, City College of New York, May 15 – 16, 2003.
- “Computational Geometry via the Dixon Resultant,” AMS Special Session on Computational Algebraic and Analytic Geometry for Low-dimensional Varieties, AMS/MAA meeting, Baltimore, January 18, 2003.
- “Solving Large Polynomial Systems with the Dixon Resultant,” Center for Computing Sciences, Bowie, MD, July 1, 2002.
- “*Fermat* Computer Algebra System,” (demo), Center for Computing Sciences, Bowie, MD, July 1, 2002.
- “Solving Large Polynomial Systems with the Dixon Resultant,” CBMS Conference, Texas A&M University, May 21, 2002.
- “Apollonius Meets Computer Algebra,” University of Western Ontario, October 19, 2001.
- “Comparison of Polynomial-Oriented Computer Algebra Systems,” Solving Equations: Symbolic Computation in Algebra & Geometry, Mt. Holyoke College, June 2000.
- “The Six-Line Problem and Resultants,” IMACS/ACA Conference, Prague, August 1998.
- “Solving the Six-Line Problem with Resultants,” IMACS/ACA Conference, Maui, July 1997.

IMACS/ACA Conference, Maui, July 1997, member of Computer Algebra Panel.

“*Fermat*, Computer Algebra System,” (demo), University of Delaware, Newark, DE, March 1996.

“Hensel’s Lemma,” City College, New York, Spring 1995.

“Finite Dimensional Nilpotent Complexes,” Cornell University, Fall 1987.

“Wall Obstructions to Finiteness of Nilpotent Complexes,” Vassar College, Fall 1986.

C.U.N.Y. Graduate Center, series of six lectures on Nilpotent Complexes, 1985.

“Three Dimensional Nilpotent Complexes,” Cornell University, Spring 1983.

“Sorting Algorithms,” University of North Carolina, Charlotte, Spring 1980.

“Cofibrations of Nilpotent Complexes,” Davidson College, Spring 1980.

“Cofibrations of Nilpotent Complexes,” George Mason University, Virginia, March 1980.

“Cofibrations of Nilpotent Complexes,” Youngstown State University, Ohio, February 1980.

“Cofibrations and Nilpotency,” Oakland University, Rochester, Michigan, Spring 1978.

#### **Other Talks Delivered**

“Determining Flexibility of Molecules Using Resultants of Polynomial Systems.” Algebraic Biology Conference, RISC Institute, Austria. July 31, 2008.

“Polynomial Equations Arising in Global Positioning Systems and in Nash Equilibria.” ACA 2008 Conference, RISC Institute, Austria. July 29, 2008.

“Comparing Acceleration Techniques for Dixon and Macaulay Resultants.” ECCAD Conference, Shepherd University, West Virginia, May 10, 2008.

“Comparing Acceleration Techniques for Dixon and Macaulay Resultants.” ACA Conference, Oakland University, Michigan, July 2007.

“Algorithmic Search for Flexibility with Resultants of Polynomial Systems.” AMS/MAA Meeting, New Orleans, January 2007.

“Algorithmic Search for Flexibility with Resultants.” ADG 2006 Conference, Pontevedra, Spain, August 31, 2006.

“*Fermat*, Computer Algebra System.” International Congress of Mathematicians 2006, Madrid, Spain, August 24, 2006.

“Algorithmic Search for Flexibility with Resultants.” ECCAD Conference, Philadelphia, May 5, 2006.

“Solving Polynomial Systems with Resultants.” Mathematics Department, University of New Mexico, September 22, 29, 2005.

“Groebner Basis Theory.” Mathematics Department, University of New Mexico, December 7, 14, 2005.

“Solving The Least Squares Method Problem In The AHP For  $3 \times 3$  and  $4 \times 4$  Matrices (with S. Bozoki),” The 7th International Symposium on the Analytic Hierarchy Process, August 7 - 9, 2003. Bali, Indonesia.

- “Solving Large Polynomial Systems with the Dixon Resultant,” SCA 2002 Conference, University of Western Ontario, July 15, 2002.
- “Solving the Polynomial Signal Processing Equations of Selesnick-Burrus and Little,” ECCAD Conference, LaGuardia Community College, New York, May 18, 2002.
- “*Fermat* Computer Algebra System,” (demo), ECCAD Conference, LaGuardia Community College, New York, May 18, 2002.
- “Apollonius Meets Computer Algebra,” IMACS/ACA Conference, Albuquerque NM, May 29-June 1, 2001.
- “Comparison of Polynomial-Oriented Computer Algebra Systems,” ISSAC Conference, Vancouver BC, July 28-31, 1999.
- “Image Analysis and Resultants,” M.A.A. Meeting, Hofstra University, New York, May 5, 1999.
- “The Six-Line Problem and Resultants,” ECCAD Conference, N. C. State University, April 24, 1999.
- “*Fermat* Computer Algebra System,” (demo), ECCAD Conference, Naval Academy, Annapolis, April 1998.
- “Solving Polynomial Equations with Resultants,” University of Delaware, Newark, DE, October 1996.
- “*Fermat* Computer Algebra System,” (demo), ECCAD Conference, I.B.M. Watson Lab, April 1996.
- “Computer Search for Nilpotent Complexes,” ISSAC Conference, Montreal, July 1995.
- “*Fermat*, a Computer Algebra System,” ISSAC Conference, Montreal, July 1995.
- “*Fermat*, a Computer Algebra System,” (demo), ECCAD Conference, Newark, DE, April 1995.
- “Computer Search for Nilpotent Complexes,” ECCAD Conference, Newark, DE, April 1995.
- “Computer Search for Nilpotent Complexes,” M.A.A. Meeting, New York City, May 1993.
- “Computer Search for Nilpotent Complexes,” A.M.S. Meeting, San Antonio, January 1993.
- “Nilpotency and Cofibrations,” A.M.S. Meeting, Atlanta, January 1977.

**Ongoing Research  
Projects**

- Polynomial resultants, especially the Dixon method.
- Apollonius-type sphere, line, and ellipsoid problems in 3D.
- Computational chemistry, such as flexibility of chemical molecules.
- Computational Geometry problems, such as the Fermat-Steiner point in 3D.
- Polynomial G.C.D. algorithms.
- Matrix normal form algorithms.
- Computational Algebraic Topology.
- Implementation of computer algebra systems.

**Professional Activity** Chair, Department of Mathematics, Fordham University, 1999 - 2005.  
Frequent referee for *Mathematics and Computers in Simulation*.  
Frequent referee for *Journal of Symbolic Computation*.  
Frequent referee for talks at conferences (ISSAC and ACA).  
Frequent reviewer for various text book publishers.

**Courses Taught** College Mathematics  
Applied Calculus I  
Applied Calculus II  
Linear Mathematics  
Finite Mathematics  
Computer Literacy  
Mathematical Methods in Business I  
Mathematical Methods in Business II  
Calculus and Analytic Geometry I  
Calculus and Analytic Geometry II  
Calculus and Analytic Geometry III  
Mathematical Modeling  
Introduction to Discrete Mathematics  
Algorithmic Mathematics  
Introduction to Computer Science (Undergraduate)  
Computer Programming in PL/I  
Applied Computer Science  
Data Structures  
Linear Algebra  
Ordinary Differential Equations  
Computer Architecture  
Compiler and Assembler Design  
Theory and Design of Programming Languages  
Mathematical Structures  
Real Analysis (Undergraduate)  
Complex Analysis (Undergraduate)  
Topology (Undergraduate)  
Abstract Algebra (Undergraduate)  
Topics in Applied Mathematics (Undergraduate)  
Independent Study in Chaos and Fractals (Undergraduate)  
Introduction to Computer Science (Graduate)  
Analysis of Algorithms (Graduate)  
Abstract Algebra I (Graduate)  
Abstract Algebra II (Graduate)  
Numerical Analysis (Graduate)  
Topology (Graduate)

**Mathematical Outreach Activity** Judge, senior high level, Tri-County Science and Technology Fair, April 12, 2008, held at Kennedy Catholic High School, Katonah, New York.  
One fifty minute lecture to Stuyvesant High School advanced math students

(30 students) on the R.S.A. cryptosystem, February 2002.  
One fifty minute lecture to Regis High School advanced math students  
(30 students) on the R.S.A. cryptosystem, December 2001.  
Two fifty minute lectures to Bronx High School of Science advanced math clubs  
(120 students) on the R.S.A. cryptosystem, March 2001.

## References

Professor Evangelos Coutsias, University of New Mexico.  
Professor Michael Barnett, CUNY and Princeton University (chemistry).  
Professor Peter Stiller, Texas A. and M. University.  
Professor Erich Kaltofen, North Carolina State University.  
Doctor Anthony Hearn, Rand Corporation.  
Professor John Little, College of the Holy Cross.  
Professor David Saunders, University of Delaware.  
Professor Gilbert Baumslag, City College of New York.  
Doctor Michael Wester, University of New Mexico.  
Professor William Singer, Fordham University.