

Resume

Thomas J. Peters

EDUCATION

Ph.D., Mathematics

Wesleyan University, Middletown, Connecticut, 1982

M.S., Mathematics

University of Rhode Island, North Kingston, Rhode Island, 1978

B.A., Mathematics

New College, University of South Florida, Sarasota, Florida, 1973

EXPERIENCE

Associate Professor

Department of Computer Science and Engineering

Joint Appointment with Department of Mathematics

University of Connecticut, Storrs, Connecticut (9/95 - present)

Interdisciplinary investigations into semantic consistency between topological information, represented exactly by symbolic data and geometric instantiations which are approximated with floating point data. Fundamental contributions are to the sub-fields of computational topology, computer graphics, computational geometry, and software engineering. Active industrial collaborations are maintained with The Boeing Corporation and United Technologies Corporation (Pratt and Whitney).

Instructional emphasis upon graduate courses in computational topology, splines, computer graphics, computational geometry and algorithms and upon undergraduate courses in algorithms, computer graphics, discrete mathematics, numerical analysis, software engineering, and computer architecture.

Visiting Faculty Member

Département d'Informatique et de Recherche Opérationnelle,

Université de Montréal, Montréal, Québec (8/96 - 12/96)

Sabbatical leave focusing upon integration of numerical analysis and topology for semantic consistency between modeling and simulations.

Assistant Professor

Department of Computer Science and Engineering

University of Connecticut, Storrs, Connecticut (9/90 - 9/95)

Visiting Associate Professor

Department of Computer Science and Engineering

University of Connecticut, Storrs, Connecticut (9/89 - 6/90)

Research Scientist

Draper Laboratory, Cambridge, MA (8/88 - 8/89)

Software architect for the integration of expert systems with engineering design and analysis systems. Specialist in applications of artificial intelligence and CAD/CAM to robotics and concurrent design.

Senior Scientist

Prime/Computervision, Bedford, MA (6/84 - 7/88)

Senior technical leader for a high performance graphics product for shading spline surfaces. Responsible for all mathematical aspects of a software/hardware hybrid tessellator for high performance display with demonstrable error bounds.

Designer of a geometry subsystem for non-uniform rational B-splines (NURBS). Senior software architect, theorist and designer for solid modeling.

Senior software architect for a design system exceeding six million lines of source code. Principal theorist and architect for a new initiative in Mechanical Computer Aided Engineering (MCAE).

Visiting Research Mathematician

University of Manitoba, Winnipeg, Manitoba, Canada summer 1983

Mathematical research.

Assistant Professor of Mathematics

University of Hartford, West Hartford, CT (9/82 - 6/83)

Mathematical research and teaching.

Environmental Analyst

Department of Environmental Protection Hartford, CT (11/73 - 11/75)

Mathematical modeling of the dispersion of atmospheric pollutants. Resultant publication on ozone transport.

CONSULTING

United Technologies Corporation, CT, 1997 - 1998.

PDES, Inc., Charleston, SC, 1996.

ENSR Consulting and Engineering Corporation, Acton, MA, 1991 - 1992.

Prime/Computervision Corporation, Bedford, MA, 1990.

CNC Software, Tolland, CT, 1990.

Northern Research and Engineering Corporation, Woburn, MA, 1989.

REFEREED PUBLICATIONS, 43 Total, plus 1 Invited Editorial

These publications are divided into the subcategories of Computer Science and Computational Mathematics, Software Engineering, and Engineering Applications to reflect the interdisciplinary nature of my research. Arguably, some that are listed in one subcategory could easily be placed in another, where my choices have tried to emphasize the intended audience.

Computer Science and Computational Topology

1. *Computational topology: ambient isotopic approximation of 2-manifolds*, Amenta, N., Peters, T. J., and Russell, A., accepted for publication, Theoretical Computer Science, to appear.
2. *Computational topology for CFD: theorems, criteria and issues*, Peters, T. J. and Stewart, N. F., Proceedings of the First MIT Conference on Computational Fluid and Solid Mechanics, Cambridge, MA, Elsevier, 2001, 951 – 953.
3. *Equivalence of topological form for curvilinear geometric objects*, L.-E. Andersson, T. J. Peters, N. F. Stewart, International Journal Computational Geometry and Applications, (10), No. 6, 2000, 609 - 622.
4. *Geometric models – one size no longer fits all!*, Proceedings of Implementation Road Map 1999, D. H. Brown, Dearborn, MI, October 26, 1999, DCV-27-A-3: 3-14.
5. *Self-intersection of composite curves and surfaces*, Andersson, L.-E., Peters, T. J. and Stewart, N. F., Computer Aided Geometric Design, (15), No. 5, 1998, 507 - 527.
6. *Is robust geometry possible?*, Duff, T., Fortune, S., Hoffmann, C. M., Peters, T. J., Weiler, K., ACM SIGGRAPH, July 22, 1998, Orlando, FL, Conference Abstracts and Applications, 217 – 219.
7. *Implementing a culling and self-intersection algorithm for stereolithography files in Ada 95*, Proceeding for the ACM SIGAda International Conference (SIGAda 98) November 8-12, 1998, Washington DC, 104 – 113.
8. *Geometry and graphics accuracy*, Peters, T. J., ACM SIGGRAPH, July 22, 1998, Orlando, FL, Conference Abstracts and Applications, p. 218
9. *Algorithmic tolerances and semantics in data exchange*, Peters, T. J., Stewart, N. S., Ferguson, D. R., and Fussell, P. S., Proceedings of the 1997 ACM Symposium on Computational Geometry, Nice, France, June 4 - 6, 1997, 403 – 405.
10. *Polyhedral perturbations that preserve topological form*, L.-E. Andersson, S. M. Dorney, T. J. Peters, N. F. Stewart, Computer Aided Geometric Design, 12, 1995, 785 – 799.
11. *The diversity of topological applications within computer aided geometric design*, Peters, T. J., Rosen, D. W., and Dorney, S. M., Annals of the New York Academy of Sciences, (728), 1994, 198 – 209.

12. *Integrating bounding boxes, lines of support and shadowing for intersection detection in the plane*, Peters, T. J. and V. Toscano, IFIP Transactions, Geometric Modeling for Product Realization, eds., P.R. Wilson, M.J. Wozny, and M.J. Pratt, August 1993, 29 – 44.
13. *Intelligent decision support for assembly system design*, Hernandez, J. A., Peters, T. J., et al, Innovative Applications of Artificial Intelligence, eds., R. Smith and C. Scott, AAAI Press, July 14, 1991, 135 – 156.
14. *An integrated system for concurrent design engineering*, Hernandez, J. A., Luby, S. C., Hutchins, P. M., Leung, H. W., Gustavson, R. E., De Fazio, T. L., Whitney, D. E., Nevins, J. L., Edsall, A. C., Metzinger, R. W., Tung, K. K., Peters, T. J., Proceedings of the Seventh Annual IEEE Conference on Artificial Intelligence Applications, Miami Beach, FL, February 1991, 205 – 211.
15. *Products and remote points: examples and counterexamples*, Peters, T. J. and Dow A., Proceedings of the American Mathematical Society, (104), 1988, 1296 – 1304.
16. *Locally finite families, completely separated sets and remote points*, Peters, T. J. and Henriksen, M., Proceedings of the American Mathematical Society, (103), 1988, 988 – 995.
17. *Game strategies yield remote points*, Dow, A. and Peters, T. J., Topology and Its Applications, (27), 1987, 245 – 256.
18. *For any X , the product $X \times Y$ has remote points for some Y* , Proceedings of the American Mathematical Society, (95), 1985, 641 – 648.
19. *Dense homeomorphic subspaces of X^* and of $(EX)^*$* , Topology Proceedings, (8), 1983, 285 – 301.
20. *G -spaces: products, absolutes and remote points*, Topology Proceedings, (7), 1982, 119 – 146.

Software Engineering

1. *An IDL to Ada95 mapping to support propagation modeling*, D. Needham, S. Demurjian, T. Peters, Ada Letters, March 2000.
2. *Towards a distributed object-oriented propagation model using Ada95*, D. Needham, S. Demurjian, K. El Guemhioui, T. Peters, Proceedings of SIGAda99, Redondo Beach, CA. Oct 17-21, 1999, 203 – 210.
3. *Object modeling to localize knowledge for feature interrelationships*, Peters, T. J., Demurjian, S. A., McCartney, R., and Needham, D. M., *Knowledge Intensive CAD*, Volume 2, Proceedings of the IFIP TC5 WG5.2 International Conference on Knowledge Intensive CAD, (Ed. Mäntylä, M., Finger, S., and Tomiyama, T.), 16 - 18 Sept. 1996, Pittsburgh, PA, USA, Chapman and Hall, London, 1998, 198 – 207.

4. *An Ada95 basis for propagation modeling*, Needham, D., Demurjian, S., and Peters, T. J., Proceedings of 1997 TriAda Conference, St. Louis, MO, November, 1997.
5. *ADAM: a language-independent, object-oriented, design environment for modeling inheritance and relationship variants in Ada95, C++, and Eiffel*, Needham, D., Demurjian, S., El Guemhioui, K., Peters, T. J., Zamani, P., McMahon, M., and Ellis, H., Proceedings of 1996 TriAda Conference, Philadelphia, PA, Dec. 1996.
6. *Modeling topological interdependencies in Ada95*, Needham, D. M., Peters, T. J., and Demurjian, S. A., Proceedings of the Tenth Annual Ada Software Engineering Education and Training Symposium, Prescott, Arizona, June 25 - 28, 1996, 101 - 114.
7. *Integrating Ada 95 within a language independent approach to undergraduate software engineering education*, D. M. Needham, S. A. Demurjian, T. J. Peters, & K. El Guemhioui, Proceedings 9th Annual Ada Software Engineering Education and Training Symposium, Morgantown, WV, June 6 - 9, 1995, 42 - 51.
8. *Profiling in an object-oriented design environment that supports Ada9X and Ada83 code generation*, El Guemhioui, K., Demurjian, S., Peters, T. J., and Ellis, H., Proceedings of 1994 TriAda Conference, Baltimore, MD, November 1994.
9. *Object-oriented design and automatic Ada code generation in the education of software engineers*, El Guemhioui, K., Demurjian, S., and Peters, T. J., Proceedings of 1993 TriAda Conference, Seattle, WA, September 1993.
10. *The (non) importance of a programming language in a software engineering course*, Demurjian, S. A., Peters, T. J., Beshers, G. McA., Ellis, H. J.C., and Nichols, G., Computer Science Education Journal, (3), No. 1, 1992, 35 - 52.

Engineering Applications

1. *Object-oriented design abstractions and code generation front ends to CAD systems*, Needham, D. M., Peters, T. J. and Demurjian, S. A., IFIP Transactions of the Fifth IFIP WG5.2 Workshop on Geometric Modeling in Computer-Aided Design, Airlie, Virginia, Chapman-Hall, 1997, 43 - 53.
2. *The role of topology in engineering design research*, Rosen, D. W. and Peters, T. J., Research in Engineering Design, (8), No. 2, 1996, 81 - 98.
3. *Propagating topological tolerances for rapid prototyping*, Peters, T. J., Demurjian, S. A., Needham, D. M., Peters, R. J., and Dorney, S. M., 1996 ASME IMECE Conference Proceedings, American Society of Mechanical Engineers, MED-Vol. 4, Manufacturing Science and Engineering, Atlanta, GA, Nov. 17 - 21, 1996, 487 - 498.
4. *Relations between features-prototyping object-oriented language extensions on an industrial example*, Brett, B. D., Peters, T. J., Demurjian, S. A., Needham, D. M., 1996 ASME Computers in Engineering Conference, American Society of Mechanical Engineers, Conference Proceedings, Irvine, CA, Aug. 19 - 22, 1996, CD-ROM release.

5. *A topological model of limitations in design for manufacturing*, T. J. Peters, D. W. Rosen, V. Shapiro, *Research in Engineering Design*, (6) No. 4, 1994, 223 – 233.
6. *Feature-based modeling by object-oriented design with propagation*, Peters, T. J., Demurjian, S. A., Ting, T.C., and Glovin, S., *Proceedings of 1994 International Conference on Data and Knowledge Systems for Manufacturing and Engineering*, Hong Kong, May 1994, 101 – 110.
7. *Mechanical design heuristics to reduce the combinatorial complexity for feature recognition*, *Research in Engineering Design*, 4:(4), 1993, 195 – 201.
8. *Topological properties that model feature-based representation conversions within concurrent engineering*, Rosen, D. W., Peters, T. J., *Research in Engineering Design*, 1992, 4:147 – 158.
9. *Encoding mechanical design features for recognition via neural nets*, *Research in Engineering Design*, (4), No. 1, 1992, 67 – 74.
10. *Combinatorial analysis for feature recognition*, *Proceedings of the Fourth International Conference on Design Theory and Methodology*, American Society of Mechanical Engineers, DE-Vol. 42, September 14, 1992, 91 – 97.
11. *A software architecture for graphical recognition of arbitrary mechanical design features*, Bardasz, T. and Peters, T. J., *Proceedings of the American Society of Mechanical Engineers, International Computers in Engineering Conference*, Boston, MA, August 1990.
12. *Integrating expert systems with a turnkey CAD/CAM system*, Peters, T. J., Morris, P. and Glovin, S., *Proceedings of the Conference on Computers in Engineering*, American Society of Mechanical Engineers, August 1988, 287 – 292.
13. *Features as a basis for intelligent CAD/CAM*, Peters, T. J., and Glovin, S., *Proceedings for the Conference on Simulation and Artificial Intelligence in Manufacturing*, Society of Manufacturing Engineers, October, 1987, 2-1 to 2-5.

Invited Journal Editorial

- Editorial, *Special Issue: Advances in Representation and Reasoning for Mechanical CAD*, Rosen, D. W. and Peters, T. J., *Research in Engineering Design*, Vol. 5, Nos. 3 & 4, 1993, 123 - 124.

MAJOR PRESENTATIONS

Only a representative sampling is included, covering major conferences and key industrial and governmental presentations.

Invited Conference and Workshop Presentations

International Invited Talk, Approximated Intersections Versus Exact Topology, Dagstuhl Seminar “Mathematical Structures for Computable Topology and Geometry”, May 26 - 31, 2002.

Invited Talk, Digital Topology to Simulation Topology?, Workshop on Digital Topology, City College and the Graduate Center, City University of New York, March 22-23, 2002.

Invited Colloquium, How Does One Connect the Dots? (Topology for Surface Reconstruction), Computer Science Colloquium, City University of New York Graduate Center, March 21, 2002.

Numerical accuracy and consistent topology in geometric computations, The Summer Conference Series in Topology and Applications, Special Session ‘Asymmetry/Computer Science’, July 18 - 21, 2001, City College of New York, New York, NY.

Geometric and topological modeling, Workshop on Mathematical Challenges in Product Development and Manufacture, Fields Institute, Toronto, Ontario, Canada, June 25-26, 2001.

Topological foundations for geometric modeling, Peters, T. J. and Russell, A. C., Dagstuhl Seminar on Topology in Computer Science, June 5 - 9, 2000, Dagstuhl, Germany

Consistent Topology and Geometry for CAD, Sixth SIAM Conference on Geometric Design, Albuquerque, Nov. 2, 1999,

Geometric Accuracy: Graphics Is Not the Only Show in Town!, Year Opening Lecture at the NSF Science and Technology Center for Graphics and Visualization, Sept. 30, 1999, simultaneously broadcast nationally to Brown University, Cornell University, University of North Carolina at Chapel Hill, University of Utah and California Institute of Technology.

Well-Defined Topology for Robust Geometric Modeling & Simulation, (with D. R. Ferguson and N. F. Stewart), Conference on Mathematical Foundations of CAD, Mathematical Sciences Research Institute, Berkeley, June 4-5, 1999.

Features and Anti-Features, Society of Industrial and Applied Mathematicians, Workshop on Mathematical Foundations for Features in Computer-Aided Design, Engineering and Manufacturing, October 22-23, 1998, Somerset Inn, Troy, MI,

Is Robust Geometry Possible?, panel consisting of T. Duff, S. Fortune, C. M. Hoffmann, T. J. Peters, K. J. Weiler, Association of Computing Machinery (ACM), SIGGRAPH ‘98, July 19 - 24, 1998, Orlando, FL

Topology and Semantics Relative to Geometric Accuracy, SIAM Geometric Design Conference ‘97, Geometric Accuracy Mini-Symposium, Nashville, TN, Nov. 3 - 6, 1997.

Topology, Semantics and Features for SIF, NIST SIF Workshop, NIST, Gaithersburg, MD, Nov. 25, 1996.

Object Modeling to Localize Knowledge for Feature Interrelationships, IFIP WG5.2 Knowledge Intensive CAD-II Workshop, Pittsburgh, Pennsylvania., Sept. 16-18, 1996.

Pattern Matching as a Basis of Programmatic Feature Recognition
Special Session on Geometry Related to Computer Vision, American Mathematical Society Meeting No. 851, Hoboken, NJ, October 20, 1989.

Invited Presentations in Industry and Government

CAD-2K, Prescient Technologies, Boston, MA, June 22, 1999.

Geometric Accuracy Through Simulation, Aerospace Special Interest Group, United Technologies Corporation, East Hartford, CT, June 21, 1998.

Geometry, Topology, and Analyses, Boeing, Seattle, WA, Mar. 27, 1998.

Topology, Semantics and SFF Versus the Geometric Accuracy Problem, Boeing, Seattle, WA, Jan. 10, 1997.

Creating and Maintaining Object-Oriented Relations Between Features, National Institute of Standards and Technology, Gaithersburg, MD October 6, 1995.

Topological Spaces for Modeling Feature Conversions within Concurrent Engineering, Department of Mathematics, General Motors Research and Development Center, Warren, MI, November 13, 1992.

Sculptured Surfaces and Solid Modeling, Northern Research and Engineering Corporation Conference on Current and Future Technology in Computer-Aided Engineering, Bedford, MA, August 9, 1989.

PENDING EVENTS of NOTE

Program Co-Chair for the recently approved SIAM 2003 Conference entitled “Mathematics for Industry: Challenges and Frontiers”, to be hosted with the Fields Institute, Toronto, Ontario, June 23 - 25, 2003.

International Invited Talk, Symbolic and Approximated Topology, 8th International Conference on Applications of Computer Algebra, Volos, Greece, June 25-28, 2002.

MAJOR GRANTS

I-TANGO: Intersections — Topology, Accuracy and Numerics for Geometric Objects (in Computer-Aided Design), Division of Mathematical Sciences, National Science Foundation, May 1, 2002 - April 30, 2005, PI T. J. Peters; co-PI C. M. Hoffmann, Computer Science Department, Purdue; co-PI N. M. Patrikalakis, Ocean Engineering and Mechanical Engineering Departments, Massachusetts Institute of Technology; co-PI, D. R. Ferguson, The Boeing Company. **\$700,000.**

REU Supplement to I-TANGO: Intersections — Topology, Accuracy and Numerics for Geometric Objects (in Computer-Aided Design), Division of Mathematical Sciences, National Science Foundation, May 1, 2002 – April 30, 2004, PI T. J. Peters; co-PI C. M. Hoffmann, Computer Science Department, Purdue; co-PI N. M. Patrikalakis, Ocean Engineering and Mechanical Engineering Departments, Massachusetts Institute of Technology; **\$15,000.**

Integrating Topology and Numerics at CAD Interfaces, T. J. Peters, Division of Mathematical Sciences, National Science Foundation, Jan. 15, 2000 - Dec. 31, 2001, Small Grant for Exploratory Research funded by four separate programs: (1) Computational Mathematics, (2) Geometric Analysis, (3) Numeric, Symbolic and Geometric Computation, and (4) Design and Integration Engineering, **\$30,000.**

SIAM Conference Support, Mathematics in Industry, Toronto, Ontario, June, 2003, PI D. Field, with co-PIs D. R. Ferguson, E. Moylan, J. Nachman, M. LaChance, T. J. Peters, P. Tuchinsky, P. Tannenbaum, awarded December 2001, for partial conference expenses, **not to exceed \$10,000.**

Graduate Student Internship, The Boeing Company, Summer 2001, **\$10,000.**

Topology for Design Models & Engineering Simulations, T. J. Peters and A. C. Russell, School of Engineering Deanery Initiative, Jan. 30, 2000 - Dec. 30, 2000, **\$18,000.**

Express Body Checker, United Technologies Corporation, PDES, Inc, and STEP Tools, Inc. 1997 - 1998, **\$71,158.**

Space Filling Curve Instructional Animation, Project to Increase Mastery of Mathematics and Science, Spring 98, **\$2,000.**

Simultaneous Modeling of Features and Design Interdependencies to Support Computer-Integrated Engineering Via Object-Oriented Software, Division of Manufacturing and Industrial Innovation, National Science Foundation, Grant Number MII-9308346, and Concentra Corporation, 1993 - 1997, **\$209, 963.**

Ada9X and Object-Oriented Design in an Enhanced Software Engineering Sequence, co-PIs: S. A. Demurjian and T. J. Peters, DARPA, June 1994 - Sep. 1995, Grant Number F29601-94-K-0043, **\$49,000.**

Adding Breadth and Laboratories to the Introductory Courses, PI: K. Barker, National Science Foundation, Grant Number CDA-9121314, July 1991 - Feb. 1995, T. J. Peters led the development of a laboratory based course in algorithms, **\$140,494.**

Integrating Ada and Object-Oriented Design within a Software Engineering Course, co-PIs: S. A. Demurjian and T. J. Peters, DARPA, Grant Number F29601-93-K-

0126, May 1993 - Feb., 1995, **\$57,309.**

Mathematical Foundations for Tolerance and Equivalent Topological Form in CAD/CAE/CAM, June 1993 - Oct. 1993, NASA Grant Number NGT 40037, **\$10,000.**

Air Quality Model Code Verification Analyses, co-PIs: R. Londregan and T. J. Peters, Lake Michigan Air Director Consortium, jointly to UConn and ENSR Consulting and Engineering Corporation, Jan. 1992 - July 1992, **\$200,000.**

GRADUATE STUDENTS

Doctoral Students Completed: D. M. Needham, August, 1997, S. M. Dorney, June 1994.

Masters Students Completed: C. Mow, June, 2002; K. Makles, January 2002; Z. Dong, June, 2000; Z. Lainwala, June, 1998; B. Brett, January 1996; T. Ye, June 1995; V. Toscano, June 1993.

PROFESSIONAL MEMBERSHIPS:

Member of American Mathematical Society, Society for Industrial and Applied Mathematics (SIAM), SIAM Activity Group on Geometric Design (SIAG/GD).