

BRUCE N. LUNDBERG

Professor of Mathematics and Chair

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Department of Mathematics and Physics
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Pueblo, Colorado 81001-4901

EDUCATION

PhD	Mathematics	Colorado State University	1989	Advisor: A. B. Poore.
Thesis Title: <i>Multistep Predictors in Continuation Methods and Equality Constrained Optimization.</i>				
Specialties: Numerical & Applied Analysis & Optimization, Optimal Control, Scientific Computing.				
MA	Cross-Cultural Studies	Fuller Theological Seminary	1984	
MA	Mathematics	Arizona State University	1980	
BS	Mathematics, Religion	Grand Canyon University	1978	
AA		Glendale Community College	1976	

PROFESSIONAL EXPERIENCE

August 1993 - Present	Professor, Department of Mathematics and Physics, Colo. St. Univ.-Pueblo. Department Chair (5/15-18); Assoc. Prof. (6/96-4/03); Assist. Prof. (8/93-5/96)
June 1993 - Present	Member of the Technical Staff, Flight Mechanics Department, The Aerospace Corporation.
July-August 2004	Consultant, Transportation Technology Center Inc., Colorado.
August 1984 - May 1993	Associate Professor, Department of Mathematics, Grand Canyon University Department Chair (8/1989-5/92); Assistant Prof. (8/1984- 5/92)
Summers 1989-1992	Visiting Research Scholar, Colorado State University (June - August)
January 1988 -May 1989	NASA Fellow, Supercomputing Trainee, Colorado State University
August 1985 - Dec. 1987	Teaching Assistant, Department of Mathematics, Colorado State University
August 1981 - May 1982	Lecturer, Department of Mathematics, Arizona State University
August 1978-Aug. 80	ASU Teaching Assistant. Associate Director, Math Learning Center, 8/79 - 8/80.
Summer 1978- Spring 84	Part Time Mathematics Instructor: Grand Canyon University (78-80) Arizona State University (Fall 1980), Pasadena City College (Spring 1984)

TEACHING: Undergraduate scientific computation, partial differential equations, numerical and advanced analysis and linear algebra, probability and mathematical statistics, history of mathematics, and other mathematics, orbital mechanics, applied mathematics. Seminars in optimal control, supercomputing, communicating mathematics, and Christian perspectives on mathematics and the sciences. Graduate and undergraduate advising in mathematics, optimization and optimal control, scientific computing, engineering and physics. Graduate courses in scientific computation, math modeling, and real analysis.

RESEARCH AND SCHOLARSHIP (Selected)

Refereed Academic Publications: Technical

- Numerical Continuation and Singularity Detection Techniques in Parametric Nonlinear Programming, SIAM J. Optim. (3), February 1993, pp. 134-154.
- Variable Order Adams-Bashforth Predictors with Error-Stepsize Control for Continuation Methods, SIAM J. Sci. and Statist. Computing, (12), May 1991, pp. 695-723.
- Smooth Penalty Functions and Continuation Methods for Constrained Optimization, in *Computational Solution of Systems of Nonlinear Equations*, ed. by E.L. Allgower and K. Georg, AMS, Providence, RI, 1990, pp. 389-412.
- Numerical Optimal Control Via Smooth Penalty Functions, *Computation and Control*, K. Bowers and J. Lund, eds., Birkhauser, Boston, 1989, pp. 105-115.
- Multiplier-Continuation Algorithms for Constrained Optimization, Recent Advances in Multidisciplinary Analysis and Optimization, J.-F. M. Barthelemy, ed., NASA Conference Publication 3031 Part 3, NASA Langley Research Center, Hampton, Virginia, September 28-30, 1988.

Technical Reports (internally refereed/edited/published): Twenty seven papers published from 1993-2015 on topics in trajectory optimization and identification, sensitivity analysis and singularities in optimization and optimal control, astrodynamics, mathematical modeling, automatic differentiation, uncertainty quantification, and filtering.

Invited Presentations: • “Numerical Continuation Methods for Nonlinear Programming Problems,” & • “Numerical Continuation in Nonlinear Parametric Programming,” Minisemester on Parametric and Shape Optimization, Banach International Mathematical Center, Warsaw, Poland, 3/8-16/93. • “Conflicts and Confederacies between Mathematics and Christianity,” *Canyon Institute for Advanced Studies/Arizona Forum for Science and Religion Invited Lecture Series*, 3/25/04. • “Habits of Happiness for Leading Learners,” NeXT Fellow Joint Meeting Seminar, Joint Mathematics Meeting, San Diego, 1/5-8/08. • Adventures in Applying Mathematics: People, Problems, and Profit. Keynote Address, 11th Annual TORUS (Texas/Oklahoma Regional Undergraduate Symposium), 2/25/17 at Cameron University.

Refereed Academic Publications: Other:

• Probability, Fine-Tuning, and the Mind’s Road to Providence. *Journal of Interdisciplinary Studies*. XXVII(1/2): 155-184. 11/2015. (won the JIS ‘Oleg Zinan Award’ for best paper). • On Modes of Learning and J. H. Newman’s *Oxford University Sermons. Liberal Arts and Core texts in Our Students’ World, Selected ACTC Proceedings.*, accepted 10/2016, to appear. • Hans Jonas on Mathematics, Technology, and Human Nature. *Journal of Interdisciplinary Studies*. XXV(1/2): 67-88. 11/2013. • In Search of a Theology of Mathematics. *Journal of Interdisciplinary Studies*. XXIII(1/2): 165-186. 9/2011. • Social Sources for Renewal in Academic Mathematics, *The UMAP Journal* 19.3: 337-346, Fall 1998.

Published Proceedings Papers: • An Adjoint Jump Shooting Method for Parametric Low Thrust Orbit Transfer Problems with Eclipsing, Proceedings of the Fourth International Conference on Astrodynamics Tools and Techniques (WPP-308), May 3-6, 2010, ESAC, Madrid, Spain. • Modeling Collaboration, Proceedings of the 3rd Biennial Symposium on Mathematical Modeling in the Undergraduate Curriculum, La Crosse, Wisconsin, June 12-14, 1998. • Numerical Continuation and Bifurcation Techniques for Parametric Nonlinear Programming, in the proceedings of the Fourth AIAA/USAF/NASA/OAI Symposium on Multidisciplinary Analysis and Optimization, Cleveland, September 21-23, 1992. • Bifurcations and Sensitivity in Parametric Nonlinear Programming, in the proceedings of the Third Air Force/NASA Symposium on Multidisciplinary Analysis and Optimization, October 1, 1990. • Conflicts and Confederacies between Mathematics and Christianity, *CIAS Newsletter*, Vol. V, Issue 1, Fall 2005. pp. 6-7.

Algorithm and Software Development: Thirteen major algorithm and software development works, including: *ABCON*, a FORTRAN program for numerical continuation using variable order and stepsize Adams-Bashforth predictors, included by invitation in the international software library, *netlib*, Spring 1993.

Numerous Consulting Presentations to various Aerospace and Railroad Industry Groups

External Grants, Proposals, and Participation: more than 20 grant projects involving writing, research and administration including several NSF submissions. Two highlights: • Funded CCHE funded grant “Designing a Science Course for Collaborative Teaching,” with PI Prof. Fran Bagenal, UC Boulder. This proposal was submitted July 1996. This was funded for two years and provided CSU-P over \$52,000 for 6 workstations, other equipment, travel and 2.5 months of summer salary (1997 and 1998) for developing numerical projects using current solar and planetary data. • Funded NSF-HPC grant with PI Dr. Patrick Burns at CSU-Fort Collins (DCNS-6923386, High Performance Computing Infrastructure for Science and Engineering Research Projects, \$627, 326).

Referee Reports, Reviews & Editing: • Many referee reports for *SIAM J. Optim.*, *J. Optim. & Eng.*, *ACTC proceedings*, *J. Interdisciplinary Studies*. • Review of Misa, Thomas J. 2011. *Leonardo to the Internet: Technology and Culture from the Renaissance to the Present*. 2nd ed. in *Journal of Interdisciplinary Studies*. XXIV(1/2): 200-2. • Reviews and editorial work for several other technical books.

Numerous Workshops, Conferences, Post-Doctoral Study in mathematics, computation, engineering, ethics and theology.

Contributed Presentations: More than 70 presentations including: • “A Very Short Intro to Optimal Control,” RMSMAA Meeting, Univ. N. Colorado, 4/14/18. • “Why i ? PreCalc Paths to $\text{CIS}(t) = \text{Exp}(i t)$,” and “Chairs Luncheon Remarks,” Rocky Mountain MAA Sections Meeting, CSU-Pueblo, 4/21-22/17. • “Sample of One,” Joint Intermountain and Rocky Mountain MAA Sections Meeting, Colorado Mountain University, 4/ 8-9/16. • “Estimating Orbital Element Probabilities from a State Vector,” RMSMAA Meeting, Colorado College, 4/17-18/15. • “Numerical Adjoint-Jump Shooting Methods for Nonlinear Parametric Optimal Control Problems with Discontinuous Dynamics,” Colorado Nonlinear Day, 11/1/14, hosted by and at UCCS. • “Learning from the Late Antique Academy in Alexandria,” RMSMAA 2014 Meeting at University of Wyoming, 3/28-29/14. • “Newman’s Idea of University Mathematics,” 17th Annual ACTC (Assoc. for Core Texts and Courses) Conference at Yale University, 4/14-17/11. • “Mathematics and Human Nature: Some Reflections Based on the Work of Hans Jonas,” Second Annual *Institute for the Study of Nature* Summer Conference, MIT, Boston, Mass., 6/14-15/08. • “The Virtues of Euler: Ethical Foundations for Mathematics,” ISN Summer Conference, University of Illinois, 6/15-16/07. • “Numerical Continuation and Bifurcation Methods in Parametric Nonlinear Programming,” Third International Conference on Parametric Optimization and Numerical Optimization, Gustrow, Germany, 8/26-31/91.

SERVICE (Selected)

Undergraduate Research Supervision: 40+ students from 1990-2017, with many conference presentation by students, and a student proceedings paper. Advised 11 International Math Modeling Competition teams.

Graduate Advising and Committees: M.S. in Mathematics Advisor. Committee Member for five mathematics or systems engineering M.S. students.

Numerous Committees and Boards at Colorado State University-Pueblo, Grand Canyon University, Colorado State University. Member of the International Editorial Board, *Journal of Interdisciplinary Studies*, 2015-. UCE (Universal Chastity Education) Board member, 2017-.

HONORS, AWARDS, MEMBERSHIPS, TRAVEL

Honors and Awards:

- 2015 Oleg Zinan Award for Best Essay, *Journal of Interdisciplinary Studies*, 11/15.
One of 12 in a field of over 300 JIS papers published since 1989.
- 2004 Outstanding Faculty Award, College of Science and Mathematics,
Colorado State University-Pueblo, April 2004.
- 1998 Provost’s and State Board of Agriculture Award, “Excellence in Undergraduate Teaching”
(with \$1000), University of Southern Colorado, May 1998.
- 1987 NASA Supercomputing Fellowship, Colorado State University, 87-89.
- 1987 Outstanding Graduate Assistant Award (with \$1000), Colorado State University.

Membership: Mathematical Association of America. American Mathematical Society. Association for Core Texts and Courses. Institute for Interdisciplinary Studies Senior Fellow.

Travel: Spain and Portugal, CSU-Pueblo Choir Tour singer, 5/9-19/16. Madrid, Spain, 4/29 - 5/ 6/10 (ICATT 4 Conference and Talk at ESAC Astronomy Center); Paris, London, Copenhagen 5/7-14/10. Warsaw and Krakow, Poland, 3/6-16/93 (Math Lectures at Mini-Semester, Banach Institute). Denmark, Sweden and Germany, 5/19-31/91 (Math Lecture). Japan, Philippines, Singapore, Indonesia and Taiwan, February-August 1981 (Teaching and Music). Across United States by bicycle (2700 miles), June 1973; Backpacked Colorado Trail segments 9-13, August 9-13, 2010, John Muir Trail, July 24-August 4, 2011, 7 day Wind River Range loop 2014 & 17. Double-Century ride, Colorado, May 30, 2012; *LOTOJA Classic* 206 mile Logan to Jackson Bike Ride, Sept 7, 2013; *Golden Grand Fondo*, June 2015. Stonewall Century & San Isabel Loop Century bicycle rides, Summer 16. Pueblo to Denver & Pikes Peak Hill Climb Grand Fondo bicycle rides, Summer 17. Pueblo, CO - Syracuse, KS (180 mi, May 29) & San Isabel Century bicycle rides, Summer 2018.