

Curriculum Vitae of Gregory Budzban

I. Professional Affiliation and Contact Information

- A. Present University Department: Mathematics
- B. Office Address: Neckers 387 gbudzban@math.siu.edu

II. Education

- B.A. Mathematics, University of South Florida, 1980
- M.A. Theoretical Computer Science, University of South Florida, 1985
- Ph.D. Mathematics, University of South Florida, 1991
 - Advisor: Arunava Mukherjea
 - Dissertation Title: Weak convergence of convolution iterates of probability measures on topological semigroups

III. Professional Experience

- 1985-1991 Martin Marietta, Image and Signal Processing Department, Parallel algorithm development with applications to video transmission and image compression, Principal Investigator - Model based computer vision research, Technical Director - DARPA Neural Net Automatic Target Recognition Contract
- 1991-1997 Assistant Professor, Department of Mathematics, Southern Illinois University at Carbondale
- 1997-2006 Associate Professor, Department of Mathematics, Southern Illinois University at Carbondale
- 2006-present Professor, Department of Mathematics, Southern Illinois University at Carbondale

IV. Research and Creative Activity

- A. Interests and Specialties:
Probability on Groups and Semigroups; Markov Random Fields; Stochastic Methods in Image Processing, Non-homogeneous Markov Chains.
- B. Current Projects
Characterize weak convergence of probability measures on compact semigroups and groups, Determine convergence theorems for non-stationary Markov chains, Semigroup techniques and the Road Coloring Problem, Curriculum Development using mathematically rich activities

- C. Grants Applied for:
1. Parallel Algorithms for Markov Random Fields for Region Labelling, SIU Summer Research Fellowship Program, submitted October 1991
 2. Convergence of Convolution Products of Probability Measures with Applications to Signal and Image Processing, NSA Mathematical Sciences Young Investigator Program, submitted October 1992
 3. A Stochastic Hierarchical Vision System, SIUC Special Research Project, submitted October 1993
 4. Stochastic Feature Extraction for Fingerprint Identification, Martin Marietta Information Systems, submitted January 1994.
 5. A Stochastic Hierarchical Vision System, Oak Ridge Associated Universities Program, submitted February 1994.
 6. Convolution Products of Probability Measures with Applications to Nonhomogeneous Markov Chains, National Science Foundation, submitted November 1995.
 7. Summer Research Fellowship, U.S. Navy, Naval Research Labs, Naval Training Systems Center, Orlando, FL, submitted January 1998.
 8. Semigroups, Probability, and the Road Coloring Problem, NSA Mathematical Sciences Program, submitted October 1999.
 9. Semigroups and the Generalized Road Coloring Problem, NSA Mathematical Sciences Program, submitted October 2000.
 10. Raising the Floor: The Development of Selected Experientially Based Mathematics Instruction Modules for Previously Underserved Target Populations, National Science Foundation, submitted August 2001.
 11. Synergy: Mathematics and Pre-engineering Curriculum Integration in Secondary Schools, GE Math Excellence Fund, submitted June 2004.
 12. Contributions to Solving an Educational Problem, U.S. Department of Education, submitted October 2004.
 13. Training Math Literacy Workers, Young People's Project, submitted October 2005.
 14. Constructing the Foundation for Mathematical Literacy: High School Algebra and Geometry Mterials Based on Mathematically-Rich Experiences, National Science Foundation, submitted March 2006.
 15. Developing Student Cohorts for the Enhancement of Mathematical Literacy in Underserved Populations, National Science Foundation, submitted January 2008.
- D. Grants Received
1. Martin Marietta Doctoral Fellowship, September 1987 - May 1988, \$16,500.00

2. Martin Marietta Image Processing Software Grant, May 1992. Software worth in excess of \$1,000,000.00
3. SIUC Summer Research Fellowship, June 1992
4. SIUC Special Research Project, Funded January 1994 - June 1996.
5. Summer Research Fellowship, U.S. Navy, Naval Research Labs, Naval Training Systems Center, Orlando, FL, June - August 1998, \$12,000.00. "Neural Net Applications to Training Systems."
6. Raising the Floor: The Development of Selected Experientially Based Mathematics Instruction Modules for Previously Underserved Target Populations, National Science Foundation, December 2002 - December 2005, total award \$549,079, SIUC portion \$79,958.
7. Synergy: Mathematics and Pre-engineering Curriculum Integration in Secondary Schools, GE Math Excellence Fund, January 1, 2005-December 31, 2005, total award \$100,000, SIUC portion \$27,002.
8. Training Math Literacy Workers, Young People's Project, 1/1/2006 - 12/31/2006, \$13,591.
9. Constructing the Foundation for Mathematical Literacy: High School Algebra and Geometry Materials Based on Mathematically-Rich Experiences, National Science Foundation. September 2006-September 2009, total award \$2,750,000, SIUC portion \$140,000.
10. Developing Student Cohorts for the Enhancement of Mathematical Literacy in Underserved Populations, National Science Foundation. September 2008-September 2013, total award \$4,000,000, SIUC portion \$641,000.

V. Publications and Creative Works

A. Books

1. Probability on Algebraic Structures, Volume 261 of Contemporary Mathematics, Budzban, Feinsilver, and Mukherjea (eds.), AMS Publications, 2000.
2. "The Road Coloring Problem" curriculum module, developed under NSF funding for "Raising the Floor."
3. "The Relay Race: curriculum module, developed under NSF funding for "Raising the Floor."
4. "Geometry" curriculum module being developed under GE Math Excellence grant.
5. "Random Walks," curriculum module being developed under NSF funding for "Constructing the Foundation of Mathematical Literacy."

B. Articles in Professional Journals

1. Budzban, G. and DeCatrel, J., "Markov Random Fields on a SIMD Machine for Global Region Labelling," Proceedings of the SPIE, Vol. 1470, pp. 175-182, (1991)

2. Budzban, G., Forman, A. and Skoblick, R., "A Locally Connected Parallel Network for Real-Time Target Detection," 20th AIPR Workshop: Computer Vision Applications, Joan B. Lurie, Editor, Proc. SPIE 1623, pp. 209-214 (1992)
3. Budzban, G. and Mukherjea, A., "Convolution Products of Non-identical Distributions on A Topological Semigroup," Journal of Theoretical Probability, Vol. 5, No. 2, pp. 283-307 (1992)
4. Budzban, G., "Necessary and Sufficient Conditions for the Convergence of Convolution Products of Non-identical Distributions on a Finite Abelian Semigroup," Journal of Theoretical Probability, Vol. 7, No. 3, pp. 635-646 (1994)
5. Budzban, G. and Stirewalt, T., "Hierarchical Markov Random Fields with Stable Points," Proc. SPIE, Vol. 2304, pp. 105-110 (1994)
6. Budzban, G. and Stirewalt, T., "Markov Random Fields with Stable Points for Region Labelling," Proceedings of Neural, Parallel, and Scientific Computations, Vol. 1, pp. 69-72 (1995).
7. Beintema, M. and Budzban, G., "The Structure of Limit Measures and their Supports on Topological Semigroups," Semigroup Forum, Vol. 52, pp. 25-35 (1996).
8. Budzban, G. and Ruzsa, I., "Some Results Concerning Convergence of Convolution Products of Probability Measures on Discrete Semigroups," Journal of Theoretical Probability, Vol. 10, No. 1, pp. 185-200 (1997).
9. Beintema, M. and Budzban, G., "Semigroups of Binary Stochastic Matrices and the Convergence of Non-homogeneous Markov Chains," Semigroup Forum, Vol. 57, pp. 348-358 (1998).
10. Budzban, G. and Casey, W., "The Effect of Stable Points on Phase Transitions in Markov Random Fields," Proceedings of IEEE International Conference on Image Processing, pp. 77-79 (1998).
11. Budzban, G., and Mukherjea, A., "A Semigroup Approach to the Road Coloring Problem," Contemporary Mathematics, Vol. 261, pp. 195-207 (2000).
12. Budzban, G., and Mukherjea, A., "Subsemigroups of Completely Simple Semigroups and Weak Convergence of Convolution Products of Probability Measures," Semigroup Forum, Vol. 68, pp. 400-410 (2004).
13. Budzban, G., "Semigroups and the Generalized Road Coloring Problem," Semigroup Forum, Vol. 69, pp. 201-208 (2004).
14. Budzban, G., and Mukherjea, A., "Product Subsemigroups of Completely Simple Semigroups," in "Lectures on Stochastic Difference Equations," Abo Akademi Reports in Computer Science and Mathematics, Vol. 35, pp. 36-45 (2004).

15. Budzban, G., and Feinsilver, P., "Quarternionic Algebras with Applications to the Road Coloring Problem," Proceedings of the Workshop on Semigroups and Automata, ICALP, Lisbon, pp. 23-42 (2005).
 16. Budzban, G., "Convergence of Convolution Products of Non-Identical Distributions on Completely Simple Semigroups," Journal of Mathematical Analysis and Applications, Vol. 317, pp. 698-706 (2006).
 17. Budzban, G., and Feinsilver, P., "A Vector Space Approach to the Road Coloring Problem, Invited paper, Proceedings of the Workshop on Words and Automata, Steklov Institute, St. Petersburg, Russia, June 2006.
 18. Budzban, G., and Feinsilver, P., "Completely Simple Semigroups, Lie Algebras, and the Road Coloring Problem," Semigroup Forum, Vol. 74, pp. 206-226 (2007).
 19. Budzban, G., "The Road Coloring, the Algebra Project, and the Writing of K-12 Curriculum Based on 'Mathematically Rich Experiences,'" Invited paper, submitted to Notices of the AMS.
 20. Budzban, G., and Högnas, G., "The Kernel of the Semigroup of Probability Measures on a Compact Semigroup with Application to Random Measures," submitted to Semigroup Forum.
 21. Budzban, G., and Feinsilver, P., "Periodic Digraphs and the Generalized Road Coloring Problem," to be submitted to Israel Journal of Mathematics.
 22. Budzban, G., "Convolution Products of Probability Measures on Finite Completely Simple Semigroups," in preparation.
- C. Chapters in Professional Books
1. In the research monograph "Probability Measures on Topological Semigroups" by Hognas and Mukherjea, Plenum Press, 1995, Chapter 2, Section 4, entitled "Weak Convergence of Convolution Products of Nonidentical Probability Measures" contains the following results from my doctoral dissertation: Lemmas 2.41, 2.42, 2.43 and Theorems 2.44, 2.45, 2.46. In addition Theorem 2.51 is reprinted from Budzban and Mukherjea (1992).

VI. Teaching Experience

- A. Teaching Interests and Specialties: Probability, Probability on Algebraic Structures, Theoretical Computer Science, Semigroup Theory
- B. Teaching Awards and Honors: Outstanding Teacher College of Science (2007)
- C. Current Graduate Faculty Status: Direct Dissertation
- D. Number of Master's and Ph.D. Committees on which you have served: 12 Master's, 1 Ph.D.

- E. Names of Students who have completed Master's Theses and Doctoral Dissertations under my direction:
1. Toney Stirewalt, Master's Thesis, 1995
Thesis title: "Markov Random Fields with Stable Points for Region Labelling"
 2. Young Rock Cha, Master's Thesis, 1996
Thesis title: "Non-homogeneous Markov Chains"
 3. William Casey, Master's Thesis, 1996
Thesis title: "Convergence of Markov Random Fields with Stable Points"
 4. Paula Thonney, Master's Thesis, 2001
Thesis title: "Semigroups and the Road Coloring Problem"
 5. James Gill, Master's Thesis, 2004
Thesis title: "A Lie Algebra Approach to the Road Coloring Problem"
 6. Angela Schneider, Master's Thesis, 2004
Thesis title: "Random Walks on Finite Groups Using the Theory of Markov Chains"
 7. Maisha Moses, Master's Thesis 2006
Thesis title: "Network Models of Social Interaction"
 8. Gayan Wilathgamuwa, Master's Thesis 2006
Thesis title: "Homogeneous and Non-homogeneous Markov Random Fields"

VII. University Service

- A. Department Committees:
1. Math Field Day, 1991, 1992, 1993, 1994, 1995, 1996
 2. Undergraduate Advisor, 1997, 1998
 3. Undergraduate Programs Committee, 1997-1998, 2003-2005, 2006-2008
 4. Math Club Faculty Advisor, 1997-1998
 5. Pi Mu Epsilon Advisor, 1999-2000
 6. Graduate Programs Committee, 1999-2002
 7. Colloquium Chair, 1999-2005
 8. Analysis Hiring Committee, 2000
 9. 108 Course Chair, 2000-2001, 2002-2003
 10. Chair, Financial Mathematics Hiring Committee, 2001
 11. Math Education Hiring Committee, 2007, 2008
 12. 109 Course Chair, 2008
- B. College and University Committees and Councils:
1. Illinois Junior Science and Humanities Symposium, 1997-2005
 2. Office of Research Development and Administration Review Committee, 2000-2002

VIII. Professional Service

- A. Membership in Professional Associations:
 - 1. American Mathematical Society
 - 2. IEEE
- B. Evaluation of Manuscripts for Journals and Book Publishers and of Grant Proposals for Agencies:
 - 1. IEEE, Proceedings of International Conference on Neural Nets and their Applications, 1994
 - 2. Journal of Theoretical Probability, 1996
 - 3. Mathematical Reviews, 1997, 1998, 1999, 2002, 2003
 - 4. National Science Foundation, 2002, 2003, 2005, 2006
 - 5. Acta Mathematica Sinica, 2005
 - 6. Applied Artificial Intelligence, 2006
 - 7. International Journal of Mathematics and Computer Science, 2007
 - 8. Discrete Mathematics, 2007
 - 9. Proceedings of Implementation and Application of Automata, 2007
 - 10. Theoretical Computer Science, 2008
- C. Papers and Presentations at Professional Meetings:
 - 1. "Mathematical Foundations of Computer Vision," Florida Mathematical Association annual meeting, Rollins College, 1988.
 - 2. "A Hybrid Structural/Analytic Approach to Target Recognition," Navy Research Lab., Passive Imaging Seminar, Monterey, California, 1989.
 - 3. "Real-Time Convergence of Markov Random Fields Using Parallel Annealing on a SIMD Machine," Martin Marietta 2nd Image Processing Conference, Baltimore, Maryland, 1989.
 - 4. "Toward a Unifying Framework for Fractals, Neural Networks, and Dynamical Systems," Martin Marietta 3rd Image Processing Conference, Orlando, Florida, 1990.
 - 5. "Weak Convergence of Probability Measures on Compact Semigroup with Applications to Iterated Function Systems," AMS Annual Meeting, San Francisco, California, 1991.
 - 6. "Weak Convergence of Convolution Iterates of Probability Measures on Semigroups," Invited Paper, Special Session on Probability on Algebraic and Topological Structures," AMS Meeting Southeast Section, Tampa, Florida, 1991.
 - 7. "A Locally Connected Parallel Network for Real-Time Target Detection," SPIE Workshop on Applied Imagery Pattern Recognition, Washington, D.C., 1991.
 - 8. "The Structure of Limit Measures and Their Supports on Topological Semigroups," Clifford Memorial Conference, New Orleans, 1994.

9. "Convolution Products of Probability Measures on Finite Semigroups with Applications to Non-homogeneous Markov Chains," Invited Paper, Probability on Groups and Related Structures, Oberwolfach, Germany, 1994.
10. "Markov Random Fields with Stable Points for Region Labelling," International Conference on Neural, Parallel, and Scientific Computation, Atlanta, Georgia, May 1995.
11. "Semigroups of Binary Stochastic Matrices with Applications to Non-homogeneous Markov Chains," Conference on Modern Algebra and Applications, Nashville, May 1996.
12. "Convergence of Markov Random Fields," Invited Paper, Special Session on Mathematical Methods in Computer Vision, AMS Meeting #919, Memphis, March 1997.
13. "The Effect of Stable Points on the Convergence of Markov Random Fields," IEEE International Conference on Image Processing, Chicago, IL, October 5-9, 1998.
14. "Convex Combinations of Semigroup Elements with Applications," Invited Paper, "Probability on Geometric Structures," Centre International de Rencontres Mathematiques, Luminy, France, July 16-20, 2001.
15. "Semigroups and the Road Coloring Problem," Invited Colloquium Presentation, University of Louisville Department of Mathematics, April 11, 2003.
16. "The Generalized Road Coloring Problem," Invited Colloquium Presentation, University of South Florida, June 13, 2003.
17. "The Road Coloring Problem as a Basis for 9th Grade Curriculum Development," as a part of the invited Algebra Project presentation at the Mathematical Sciences Research Institute, March 2004.
18. "Semigroups and the Generalized Road Coloring Problem," Invited Presentation, International Conference on Automata, Languages, and Programming (ICALP), Turku, July 2004.
19. "Convergence of Convolution Products on Completely Simple Semigroups," Invited Presentation, Probability on Groups and Related Structures, Budapest, August 2004.
20. "Using the Road Coloring Problem to Introduce the Concept of Function, Parts 1 and 2," two invited 1-hour presentations during the MAA special session on "Using Mathematically Rich Activities to Develop K-12 Curricula," Joint AMS/MAA meeting, Atlanta, January 7-8, 2005.
21. "The Trip Line as a Basis for Introducing Vector Arithmetic at the 9th Grade Level," Mathematical Knowledge for Teachers, Mathematical Sciences Research Institute, May 25-28, 2005 (Facilitator for workshop session).
22. "Completely Simple Semigroups, Lie Algebras, and the Road Coloring Problem," (joint with P. Feinsilver) Invited Presentation, ICALP, Lisbon, 2005 (presented by P. Feinsilver).

23. "Mathematics Curriculum from Mathematically-Rich Activities," ICTM annual meeting, Carbondale, February 2006.
 24. "Random Walks on Semigroups and the Road Coloring Problem," invited colloquium presentation, University of Turku, Department of Mathematics, May 2006.
 25. "An Investigation of the Road Coloring Problem," invited colloquium presentation, Abo Akademi Department of Mathematics, May 2006.
 26. "A Vector Space Approach to the Road Coloring Problem," invited colloquium, Workshop on Words and Automata, Steklov Institute, St. Petersburg, Russia, June 2006.
 27. "The Algebra Project High School Curriculum: The Road Coloring Problem and the Relay Race," Workshop at the NCTM Kansas City Meeting, October 2007.
 28. "The Mathematics of the Road Coloring Problem," week course at Canada/USA Math Camp, Reed College, Portland, July 2008.
 29. "Matrix Multiplication via the Road Coloring Problem," invited presentation ICTM annual meeting, Peoria, October 2008.
- D. Professional Meetings Organized
1. AMS Special Session, Probability on Algebraic Structures, Gainesville, Florida, March 1999 (co-organized with Philip Feinsilver and Arun Mukherjea).
 2. Carbondale Probability Day, Carbondale, Illinois, November 2002. Invited speakers included Rene Schott, University Henri Poincare; Salah Mohammed, SIUC; Arun Mukherjea, University of South Florida; Gyula Pap, University of Debrecen.