Michael J. Evans
Emeritus Lillian and Rupert Radford Professor of Mathematics
Washington and Lee University

Educational Record

1966	B.S. in Ed., Mathematics, Eastern Illinois University
1967	M.S., Mathematics, Michigan State University
1970	Ph.D., Mathematics, Michigan State University, Thesis: *Properties of L_p Derivatives*, Advisor: Clifford E. Weil

Employment Record

1969-70	Michigan State University, East Lansing, Graduate Teaching Assistant
1970	Ohio University, Athens, Assistant Professor
1971-72	U.S. Army Biological Defense Research Laboratory, Dugway, UT, Mathematician/Statistician (Specialist 5)
1972	Brigham Young University, Provo, UT, Visiting Instructor
1973-74	Ohio University, Athens, Assistant Professor
1974-78	Western Illinois University, Macomb, Assistant Professor
1978-82	Western Illinois University, Macomb, Associate Professor (and Associate Chairman, 1980-82)
1982-85	N.C. State University, Raleigh, NC, Associate Professor (and Director of Undergraduate Programs in Mathematics)
1985-93	N.C. State University, Raleigh, NC, Professor (and Director of Undergraduate Programs in Mathematics, through 1989)
Spring 1988	University of Wisconsin–Milwaukee, Visiting Professor
1993-2012	Washington and Lee University, Lexington, VA, Radford Professor (and Head of the Department of Mathematics, 1993-2001)
Fall 2002	University of St. Andrews, Scotland, Visiting Professor
Fall 2007	University of St. Andrews, Scotland, Visiting Professor
Winter 2011	University of South Carolina Beaufort, Visiting Professor
Winter 2012	University of South Carolina Beaufort, Visiting Professor
2012-13	Washington and Lee University, Visiting Professor

Professional Organization

- American Mathematical Society

Awards

- NASA Graduate Fellowship, Michigan State University: 1966-69
- Michigan State University Graduate Fellowship: 1969-70
- Phi Kappa Phi Membership: 1969
- U.S. Army Commendation Medal (for mathematical modeling): 1972
- Western Illinois University Research Council Grants: 1978, 1981
- Phi Eta Sigma Teaching Award, Western Illinois University: 1978
- Western Illinois University Presidential Merit Awards: 1979, 1981
- Outstanding Extension Service Award, N.C. State University: 1986
- Instructional Enhancement Grant, College of Physical and Mathematical Sciences, N.C. State University: 1991

- Outstanding Teacher Award and Membership in the Academy of Outstanding Teachers, N.C. State University: 1992
- Glenn Summer Research Grants, 1994, 1995, 1996, Washington and Lee University
- One of seven W&L faculty members to write a successful half-million dollar grant proposal to the W. M. Keck Foundation to initiate a multidisciplinary program in Nonlinear Dynamics: 2000
- National Science Foundation Grant to host the 26th Summer Symposium on Real Analysis on the Washington and Lee Campus, June 2002.

Mathematical Research Interests

The majority of my research efforts have taken place in the broad field of real analysis, though I have completed a few projects in complex analysis, dynamical systems, topology, and mathematical modeling of certain biological systems. When describing real analysis to undergraduate students, I like to say that it is basically *4-wheel drive calculus.* In other words, the techniques and theorems that one learns in college calculus courses are on the well-manicured superhighway. Many hypotheses must be satisfied before those techniques can be applied. Real analysts study what can be done when those hypotheses are not satisfied.

Represesentative talks

- "Comments on Approximate High Order Smoothness," 14^{th} Summer Symposium on Real Analysis, San Bernardino, CA, June 1990.
- "Monotonicity, Porosity, and Dimension," Auburn University NSF MiniConference on Real Analysis, October 1990.
- "Fractal Geometry as a Capstone Course for Mathematics Majors," Southeastern Sectional Meeting of the MAA, Mobile, April 1991
- "Symmetric Porosity and Symmetric Cantor Sets," 15^{th} Summer Symposium on Real Analysis, Smolenice, Czechoslovakia, August 1991
- "Mean Value Theorems for Symmetrically Differentiable Functions," AMS Annual Meeting, Baltimore, January 1992.
- "Symmetric and Ordinary Differentiation," Auburn University NSF MiniConference on Real Analysis, March 1992.
- "First Return Limits," Slippery Rock University Colloquium, March 1993.
- "First Return Differentiation," Auburn University NSF MiniConference on Real Analysis, March 1993.
- "When Communicating a Function, Speak Rarely and Carry a Simple Algorithm," Colloquium, Washington and Lee University, January 1994.
- "Path Derivatives," Colloquium, University of Louisville, April 1994.
- "Mathematical Life After Fermat's Last Theorem," Endowed Professorship Lecture to Washington and Lee Community, May 1994.

- " First Return Representations of Baire One Functions," (one-hour invited address) 19^{th} Summer Symposium on Real Analysis, Erice, Sicily.
- "Why is Symmetric Porosity So Different," 20^{th} Summer Symposium on Real Analysis, Windsor Ontario, June 1996.
- "Tampering with the Definition of the Derivative," Colloquium, Washington and Lee University, Novmeber 1996.
- "Universally Polygonally Approximable Functions," American Mathematical Society, Louisville, KY, March 1998.
- "Enuf's Enuf: A Minimalist's Appreciation of Baire One Functions," (one-hour invited address), NSF/Auburn University MiniConference on Real Analysis, March 1999.
- "First-Return Limiting Processes in Real analysis," Colloquium Series, University of St. Andrews, Scotland, November 2001.
- "The Ubiquitous Baire Class One, Darboux Functions," Colloquium Series, University of St. Andrews, Scotland, November 2002.
- "Some Fun with First-Return Adjectives and Adverbs," Colloquium, Washington and Lee University, March 2003.
- "More or Less First-Return Recoverable Functions," NSF/Auburn University MiniConference on Real Analysis, March 2003.
- "In Search of a Definition for First-Return Continuity," 28th Summer Symposium on Real Analysis, Slippery Rock University, June, 2004.
- "The Role of Consistency in First-Return Analysis," 11th International Conference on Real Analysis and Measure Theory, Ischia, Italy, July 2004.
- "Recent Advances and Open Problems in First-Return Analysis," 29th Summer Symposium on Real Analysis, Whitman College, June, 2005.
- "A Characterization of Baire one Functions of Two Variables," 12th International Conference on Real Analysis and Measure Theory, Ischia, Italy, July 2006.
- "Graphing by Connecting the Dots," Colloquium Series, University of St. Andrews, Scotland, October 2007.
- "Relations among the Following Types of Integration: Lebesgue, Improper Riemann, Henstock-Kurzeil, First-Return," Analysis Seminar Series, University of St. Andrews, Scotland, November 2007.
- "Baire One, Darboux-like Functions of Two Variables," 32nd Summer Symposium on Real Analysis, Chicago, June 2008.

- "Analogs of Young's Characterization of Baire one, Darboux Functions," 33rd Summer Symposium on Real Analysis, Durant, Oklahoma, June 2009.
- "Baire one, Gibson and Weakly Gibson Functions of Several Variables," 34th Summer Symposium on Real Analysis, Wooster, Ohio.

Professional Service

- Co-Managing Editor, *Real Analysis Exchange*: 1976-82
- Associate Editor, *Real Analysis Exchange*: 1982-present
- Reviewer for *Mathematical Reviews*: 1980-present
- Referee for various journals, including *Proceedings of the American Mathematical Society, Transactions of the American Mathematical Society, American Mathematical Monthly, Aequationes Mathematicae, Demonstratio Mathematica*, and *Real Analysis Exchange*
- Co-Organizer of Special Session on Classical Real Analysis, American Mathematical Society Annual Meeting, San Antonio, TX: January 1987
- Co-Organizer of Summer Symposium in Real Analysis XXVI, Washington and Lee University, June 2002.

Ph. D. Students at N. C. State University

- Robert W. Vallin, Dean M. Oppegaard, Dave L. Renfro

Refereed Mathematical Publications

1. *L_p derivatives and approximate Peano derivatives,* Trans. Amer. Math. Soc. **165** (1972), 381–388.
2. *On continuous functions and the approximate symmetric derivative*, Colloq. Math. **31** (1974), 129–136.
3. *Monotonicity and the L_p symmetric derivative,* Tamkang Journal Math. **7** (1976), 1–5.
4. *A directional cluster set example*, Enseignment Math. **22** (1976), 219–225
(with C. L. Belna and P. D. Humke).
5. *On qualitive cluster sets,* Colloq. Math. **37** (1977), 255–261
(with P. D. Humke).
6. *A symmetric condition for monotonicity,* Bull. Inst. Math. Academia Sinica **6** (1978), 85–91.
7. *Directional cluster sets and essential directional cluster sets of real valued functions defined in the upper half plane,* Rev. Roum. Pures et Appl. **24** (1979), 1165–1173
(with P. D. Humke).
8. *Most directional cluster sets have common values,* Fund. Math. **101** (1978), 1–10
(with C. L. Belna and P. D. Humke).
9. *Symmetric and ordinary differentiation,* Proc. Amer. Math. Soc. **72** (1978), 261–267
(with C. L. Belna and P. D. Humke).
10. *Symmetric monotonicity,* Acta Math. Acad. Sci. Hungar. **34** (1979), 17–22
(with C. L. Belna and P. D. Humke).
11. *Symmetric and strong differentiation,* Amer. Math. Monthly **86** (1979), 121–123
(with C. L. Belna and P. D. Humke).
12. *Planar continua with restricted limit directions,* Pacific J. Math. **90** (1980), 259–260
(with C. L. Belna and P. D. Humke).

13. *On the equality of unilateral derivates*, Proc. Amer. Math. Soc. **79** (1980), 609–613
(with P. D. Humke).

14. *On the approximate derivates of continuous functions,* Bull. Inst. Math. Acad. Sinica **8** (1980), 609–614
(with P. D. Humke).

15. *Peano derivatives: A survey,* Real Anal. Exch. **7** (1981), 5–23
(with C. E. Weil).

16. *Parametric differentiation,* Colloq. Math. **45** (1981), 125–131
(with P. D. Humke).

17. *On iterated L_p derivatives,* Bull. Inst. Math. Acad. Sinica **10** (1982), 89–94
(with C. E. Weil).

18. *Analogues of the Denjoy–Young–Saks Theorem,* Trans. Amer. Math. Soc. **271** (1982), 253–260
(with C. L. Belna, G. T. Cargo, and P. D. Humke).

19. *Qualitative differentiation,* Trans. Amer. Math. Soc. **280** (1983), 303–320
(with L. Larson).

20. *Qualitative maxima of a function,* Rev. Roum. Math. Pures et Appl. **30** (1985), 745–748.

21. *The continuity of symmetric and smooth functions,* Acta Math. Hungar. **43** (1984), 251–257
(with L. Larson).

22. *Qualitative derivates and derivatives,* Rev. Roum. Math. Pures et Appl. **33** (1988), 575–581.

23. *Monotonicity, symmetry, and smoothness,* Classical Real Analysis, Contemporary Mathematics Series, Amer. Math. Soc. **42** (1985), 49–54
(with L. Larson).

24. *A pathological approximately smooth function,* Acta Math. Hungar. **46** (1985), 211–215
(with P. D. Humke).

25. *Qualitative directional cluster sets,* Bull. Polish Acad. Sci. Math. **34** (1986), 11–14
(with P. D. Humke).

26. *L_p smoothness and approximate continuity,* Proc. Amer. Math. Soc. **92** (1984), 258–262
(with P. D. Humke).

27. *Peano differentiation and high order smoothness in L_p,* Bull. Inst. Math. Acad. Sinica **13** (1985), 197–209.

28. *Approximate Peano derivatives and the Baire* one property,* Real Anal. Exch. **11** (1985), 283–289.

29. *A typical property of Baire one Darboux functions,* Proc. Amer. Math. Soc. **98** (1986), 441–447
(with P. D. Humke).

30. *Approximate continuity and L–points of integrable functions,* Real Anal. Exch. **11** (1986) 390–410
(with P. D. Humke).

31. *L–points of typical functions in the Zahorski classes,* Real Anal. Exch. **12** (1986), 337–348
(with P. D. Humke).

32. *Approximate smoothness of continuous functions,* Colloq. Math. **54** (1987), 307–313.

33. *High order smoothness*, Acta Math. Hungar. **50** (1987), 17–20.

34. *Approximate symmetric behavior of real functions,* Real Anal. Exch. **14** (1989), 375–392.
(with P. D. Humke).

35. *Characterizations of turbulent one dimensional mappings via ω–limit sets,* Trans. Amer. Math. Soc. **326** (1991), 261–280.
(with P. D. Humke, Ch.-M. Lee, and R. J. O'Malley).

    - *Corrigendum to Characterizations of turbulent one dimensional mappings via ω–limit sets,* Trans. Amer. Math. Soc. **333** (1992), 939-940.
    (with P. D. Humke, Ch.-M. Lee, and R. J. O'Malley)

36. *Approximate high order smoothness,* Acta Math. Hungar. **61** (1993), 369–388.
(with Z. Buczolich and P. D. Humke).

37. *A symmetric porosity conjecture of Zajíček,* Real Anal. Exch. **17** (1991–92), 258–271.
(with P. D. Humke and K. Saxe).

38. *Mean value theorems for symmetrically differentiable functions,* Real Anal. Exch. **17** (1991–92), 657–667.
(with S. Fu).

39. *Some theorems whose σ–porous exceptional sets are not σ–symmetrically porous,* Real Anal. Exch. **17** (1991–92), 809–814.

40. *A note on symmetric and ordinary differentiation,* Real Anal. Exch. **17** (1991–92), 820–826.

41. *Symmetric porosity of symmetric Cantor sets,* Czech. Math. J. **44** (1994), 251–264
(with P. D. Humke and K. Saxe).

42. *A characterization of σ–symmetrically porous symmetric Cantor sets,* Proc. Amer. Math. Soc. **122** (1994), 805–810.
(with P. D. Humke and K. Saxe).

43. *Qualitative symmetric differentiation,* Real Anal. Exch. **18** (1992-93), 575–584.
(with R. W. Vallin).

44. *First return path systems: Differentiability, continuity, and orderings,* Acta Math. Hungar. **66** (1995), 83–103.
(with U. B. Darji and R. J. O'Malley)

45. *Universally first return continuous functions*, Proc. Amer. Math. Soc. **123** (1995), 2677–2685
(with U. B. Darji and R. J. O'Malley)

46. *Some interesting small subclasses of the Baire 1 functions*, Real Anal. Exch. **19** (1993-94), 328–331.
(with U. B. Darji and R. J. O'Malley)

47. *Recovering Baire 1 functions*, Mathematika **42** (1995), 43–48
(with U. B. Darji)

48. *A first return characterization of Baire 1 functions*, Real Anal. Exch. **19** (1993-94), 510–515
(with U. B. Darji and R. J. O'Malley)

49. *Condition $\mathcal{B}$ and Baire 1 generalized derivatives*, Proc. Amer. Math. Soc. **123** (1995), 1727–1736
(with U. B. Darji and R. J. O'Malley)

50. *Path differentiation: further unification*, Fund. Math. **146** (1995), 267–282.
(with U. B. Darji)

51. *First return approachability*, J. Math. Anal. Appl. **199** (1996), 545–557.
(with U. B. Darji and P. D. Humke)

52. *Fine tuning the recoverability of Baire one functions*, Real Anal. Exch. **21** (1995-96), 165–174.
(with R. J. O'Malley)

53. *Contrasting symmetric porosity and porosity*, J. Applied Analysis **4** (1998), 19–41.
(with P. D. Humke)

54. *Fine properties of Baire one functions*, Fund. Math. **155** (1998) 177–188.
(with U. B. Darji, C. Freiling, and R. J. O'Malley)

55. *Universally polygonally approximable functions*, J. Appl. Analysis **6** (2000), 25–45.
(with P. D. Humke and R. J. O'Malley)

56. *A perplexing class of Baire one functions*, Real Anal. Exch. **25** (1999-2000), 727-742.
(with P. D. Humke and R. J. O'Malley)

57. *Exceptional sets for universally polygonally approximable functions*, J. Appl. Analysis **7** (2001), 175–190.
(with P. D. Humke)

58. *The quasicontinuity of delta fine functions*, Real Anal. Exch. **28** (2002-2003), 543-548.
(with P. D. Humke)

59. *A first-return examination of the Lebesgue integral*, Real Anal. Exch. **27** (2001-2002), 578–581.
(with U. B. Darji)

60. *Almost everywhere first-return recovery*, Bull. Polish Acad. Sci. - Math. **52** (2004), 185–195.
(with P. D. Humke)

61. *Consistent first-return Riemann sums for Lebesgue integrals*, Acta Math. Hungar. **103** (2004), 303–312.
(with P. D. Humke)

62. *Consistent recovery and polygonal approximation of functions* Real Anal. Exch. **28** (2002-2003), 641–648.
(with P. D. Humke and R. J. O'Malley)

63. *"More or less" first-return recoverable functions*, Acta Mathematica Universitatis Comenianae **LXXII** (2003), 261–278.
(with P. D. Humke)

64. *First-return limiting notions in real analysis*, Real Anal. Exch. **29** (2003-04), 503–529.
(with R. J. O'Malley)

65. *First-return integrals*, J. Math. Anal. Appl. **305** (2005), 546–559.
(with M. Csornyei, U. B. Darji, and P. D. Humke)

66. *Two-dimensional analogs of first-return continuity*, Tatra Mountains Mathematical Publications **35** (2007), 71–89.
(with P. D. Humke)

67. *Almost every sequence integrates*, Acta Math. Hungar. **117** (2007), 35–39.
(with P. D. Humke)

68. *A characterization of Baire class one functions of two variables*, J. Math. Anal. Appl. **335** (2007), 1–6.
(with P. D. Humke)

69. *Functions not first-return integrable*, J. Math. Anal. Appl. **347** (2008), 381–390.
(with U. B. Darji)

70. *Revisiting a century-old characterization of Baire one Darboux functions*, Amer. Math. Monthly **116** (2009), 451–455.
(with P. D. Humke)

71. *Generalizations of Young's Theorem to real functions of several variables*, Rend. Circ. Mat. Palermo, Ser.II, **58** (2009), 287–296.
(with P. D. Humke)

72. *Two classes of Darboux-like, Baire one functions of two variables*, Czech. J. Math. **60 (135)** (2010), 549–569.
(with P. D. Humke)

73. *Baire one, Gibson and weakly Gibson real functions of several variables*, Rend. Circ. Mat. Palermo, Ser.II **59** (2010), 47–51.
(with P. D. Humke)

74. *Collections of Darboux-like, Baire one functions of two variables*, J. Appl. Anal. **16** (2010), 135–149.
(with P. D. Humke)

75. *Some subclasses of the real-valued honorary Baire two functions on* $\mathbb{R}^n$, Rend. Circ. Mat. Palermo, Ser.II **62** (2012), 79-90.
(with Manuel J. Sanders III)

Mathematical Publications for a General Audience

- *A third of a century of friendship and mathematics*, Washington and Lee University Journal of Science **8** (2007), 22–25.
(with P. D. Humke)