

## PAUL S. BOURDON

---

---

Department of Mathematics  
Washington and Lee University  
Lexington, Virginia 24450

Office Phone: (540) 458-8808  
E-mail: [bourdonp@wlu.edu](mailto:bourdonp@wlu.edu)  
Website: <http://home.wlu.edu/~bourdonp>

### Education:

Washington and Lee University; Lexington, Virginia  
B.S. in mathematics and physics, summa cum laude, 1981  
University of North Carolina at Chapel Hill  
Mathematics Department: M.S. 1983; Ph.D. 1985  
Thesis: *Invariant subspaces for the shift operator on some Hilbert spaces of analytic functions* (under the direction of J. A. Cima)

### Fields of Specialization:

Complex Analysis, Function Theory, Operator Theory, Quantum-Information Theory

### Professional History:

Michigan State University	
-Research Associate	1985-1987
-Visiting Assistant Professor	1987-1988
Washington and Lee University	
-Assistant Professor	1987-1992
-Associate Professor	1992-1997
-Professor	1997-2003
-Cincinnati Professor of Mathematics	2003-
-Mathematics Department Head	2009-2011

### Fellowships and Awards:

George Washington Scholarship (W&L)	1977-1981
Pogue Fellowship (UNC)	1981-1983
Teaching Fellowship (UNC)	1984-1985
Dana Fellowship (W&L)	1987-1990
National Science Foundation research opportunity award	Summer of 1987
National Science Foundation research opportunity award	Summer of 1988
Glenn Grant (W & L)	Summer of 1989
National Science Foundation Grant (RUI program)	1991-1993
National Science Foundation Grant (RUI program)	1994-1997
National Science Foundation Grant (RUI program)	1997-2000
John Smith Award for Distinguished Teaching of Mathematics, conferred by MD-VA-DC Section of MAA	April 2000
National Science Foundation Grant (RUI program)	2001-2004

### **Honors Students:**

David Bennett '92; Thesis "Chaotic linear operators on infinite dimensional Hilbert space"; Mr. Bennett received the Ali Amir-Moez Best Paper Award for 1992 from the *Journal of Undergraduate Mathematics* for an article he wrote for that journal based on the contents of his honors thesis.

Matthew Appel '94; Thesis "Norms of composition operators on the Hardy space"

Angela Matney '97; Thesis "The Nevanlinna counting function"

Emilie Weisner '00; Thesis "Backward minimal points for bounded linear operators on Hilbert spaces"; an article that Ms. Wiesner wrote based on her honors thesis was published by *Linear Algebra and Its Applications* (Volume 338 (2001), pp. 251-259)

Erin Fry '03; Thesis "Compressing operators to obtain single-point numerical ranges"

Christina Spofford '03; Thesis "Norms of composition operators on the Hardy space"

Jonathan Browder '04; Thesis "Compressions of Linear Operators Yielding a Single Point Numerical Range"

Lu Li '11; Thesis "Superdense Coding with Partially Entangled Quantum Particles"

Wenling Shang '11; Thesis "Hermitian Weighted Composition Operators on the Weighted Hardy Spaces"

### **Summer Research Assistants\* (year(s) in parentheses):**

David Bennett ('91)

Jennifer Carr ('91 and '92)

Matthew Appel ('92 and '93)

Colin Wynne ('94)

John Thrall ('95 and '96)

Angela Matney ('96)

Jill Herman ('97)

Ed Clarkson ('98)

Emilie Weisner ('99)

Tina Harbilas('01)

Erin Fry ('02)

Christina Spofford ('02)

Jonathan Browder ('03)

Alexander Miltenberger ('05)

Joseph McDonald ('07)

Wendy Shang ('09 and '10)

Kelsey Wright ('09)

Lu Li ('10)

---

\* Students supported by the NSF's REU program and by W&L's Lee Scholars program

## **Publications:**

1. *Cyclic Nevanlinna class functions in Bergman spaces*, Proc. Amer. Math. Soc. 93 (1985), 503-506.
2. Cellular-indecomposable operators and Beurling's theorem, Michigan Math. J. 33 (1986), 187-193.
3. *Similarity of parts to the whole for certain multiplication operators*, Proc. Amer. Math. Soc. 99 (1987), 563-567.
4. *Density of the polynomials in Bergman spaces*, Pacific J. Math. 130 (1987), 215-221.
5. *Finite codimensional invariant subspaces of Bergman spaces* (with S. Axler), Trans. Amer. Math. Soc. 306 (1988), 805-817.
6. *On integrals of Cauchy-Stieltjes type* (with J. A. Cima), Houston J. Math. 14 (1988), 465-474.
7. *Fourier series, mean Lipschitz spaces, and BMO* (with J. Shapiro and W. Sledd), Analysis at Urbana I: Proceedings of the special year in modern analysis at the University of Illinois 1986-1987, London Math. Soc. Lecture Notes Series 137, Cambridge University Press (1989), pp. 81-110.
8. *Spectral synthesis and common cyclic vectors* (with J. Shapiro), Mich. Math. J. 37 (1990), 71-90.
9. *Cyclic composition operators on  $H^2$*  (with J. Shapiro), Proc. of Symposia in Pure Mathematics, American Mathematical Society, 51 (1990), 43-53.
10. *Fredholm composition and multiplication operators on the Hardy space*, Integral Equations and Operator Theory 13 (1990), 607-610.
11. *Bôcher's Theorem* (with S. Axler and W. Ramey), American Mathematical Monthly 99 (1992), 51-55.
12. *Harmonic Function Theory* (with S. Axler and W. Ramey), Graduate Texts in Mathematics Series, Springer-Verlag, New York, 1992.
13. *Invariant manifolds of hypercyclic vectors*, Proc. Amer. Math. Soc. 118 (1993), 845-847.
14. *The second iterate of a map with dense orbit*, Proc. Amer. Math. Soc. 124 (1996), 1577-1581.
15. *Norms of composition operators on the Hardy space* (with students M. Appel and J. Thrall), Experimental Mathematics 5 (1996), 111-117.
16. *Cyclic Phenomena for Composition Operators* (with J. Shapiro), Memoirs of the American Mathematical Society, American Mathematical Society, Providence 1997.
17. *Rudin's orthogonality problem and the Nevanlinna counting function*, Proc. Amer. Math. Soc. 125 (1997), 1187-1192.
18. *Mean growth of Koenigs eigenfunctions* (with J. Shapiro), Journal of the Amer. Math. Soc. 10 (1997), 299-325.

19. *Riesz composition operators* (with J. Shapiro), Pacific J. of Math. 181 (1997), 231-246.
20. *Orbits of hyponormal operators*, Mich. Math. J. 44 (1997), 345-353.
21. *Some properties of cyclic operators* (with S. Ansari), Acta Sci. Math. (Szeged) 63 (1997), 195-207.
22. *Convergence of the Koenigs sequence*, Contemp. Math. 213 (1998), 1-10.
23. *Essential angular derivatives and maximum growth of Koenigs eigenfunctions*, Journal of Functional Analysis 160 (1998), 561-580.
24. *Compact composition operators on BMOA* (with J.A. Cima and A.L. Matheson), Trans. Amer. Math. Soc. 351 (1999), 2183-2196.
25. *Hypercyclic operators that commute with the backward Bergman shift* (with J.H. Shapiro), Trans. Amer. Math. Soc. 352 (2000), 5293-5316.
26. *The numerical ranges of automorphic composition operators* (with Joel H. Shapiro), J. Math. Anal. Appl. 251 (2000), 839-854.
27. *Harmonic Function Theory* (with S. Axler and W. Ramey), 2nd edition, Graduate Texts in Mathematics Series, Springer-Verlag, New York, 2001.
28. *Reproducing kernels and norms of composition operators* (with Dylan Q. Retsek), Acta Sci. Math. (Szeged) 67 (2001), 387-394.
29. *When is zero in the numerical range of a composition operator?* (with Joel H. Shapiro), Integral Equations and Operator Theory 44 (2002), 410-441.
30. *Components of linear-fractional composition operators*, J. Math. Anal. Appl. 279 (2003), 228-245.
31. *Which linear-fractional composition operators are essentially normal?* (with D. Levi, S. Narayan, and J. Shapiro), J. Math. Anal. Appl. 280 (2003), 30-53.
32. *Somewhere dense orbits are everywhere dense* (with Nathan Feldman), Indiana University Mathematics Journal 52 (2003), 811-819.
33. *Norms of linear-fractional composition operators* (with E. Fry, C. Hammond, and C. Spofford), Trans. Amer. Math. Soc. 356 (2004), 2459-2480.
34. *Unital quantum operations on the Bloch Ball and Bloch region* (with T. Williams), Physical Review A 69 (2004), 022314: 1-7.
35. *Some properties of  $N$ -supercyclic operators* (with N. Feldman, and J. Shapiro), Studia Math. 165 (2004), 135-157.
36. *On convergence to the Denjoy-Wolff point* (with V. Matache and J. Shapiro), Illinois J. Math. 49 (2005), 405-430.
37. *Selfcommutators of Automorphic Composition Operators* (with B. MacCluer), Complex Var. Elliptic Equ. 52 (2007), 85-104.
38. *Sharp probability estimates for Shor's order-finding algorithm* (with H. T. Williams), Quantum Information and Computation 7 (2007), 522-550.
39. *Deterministic dense coding and entanglement entropy* (with E. Gerjuoy, J. McDonald, and H. T. Williams), Phys. Rev. A 77, 022305 (2008).

40. *Adjoint of rationally induced composition operators* (with J. H. Shapiro), J. Funct. Anal. 255 (2008), 1995-2012.
41. *The augmented message-matrix approach to deterministic dense coding theory* (with E. Gerjuoy and H. T. Williams), Physical Review A 79, 042315 (2009).
42. *Bellwethers for boundedness of composition operators on weighted Banach spaces of analytic functions*, Journal of the Australian Mathematical Society 86 (2009), 305-314.
43. *Intertwining relations and extended eigenvalues for analytic Toeplitz operators* (with J.H. Shapiro), Illinois Journal of Mathematics 52 (2008), 1007-1030.
44. *Images of minimal-vector sequences under weighted composition operators on  $L^2(D)$*  (with Antoine Flattot), Operator Theory Advances and Applications 202 (2010), 39-51.
45. *Overcoming a limitation of deterministic dense coding with a non-maximally entangled initial state* (with E. Gerjuoy), Physical Review A 81, 022314 (2010).
46. *Normal weighted composition operators on the Hardy space  $H^2(U)$* " (with Sivaram Narayan), J. Math. Anal. Appl. 367 (2010), 278-286.
47. *Spectra of some composition operators and associated weighted composition operators*, J. Operator Theory, to appear.
48. *Reproducing kernel Hilbert spaces supporting nontrivial Hermitian weighted composition operators* (with W. Shang), submitted.
49. *Entanglement enhancement of a noisy classical communication channel* (with H.T. Williams), submitted.
50. *Invertible weighted composition operators*, submitted.

**Talks given:**

Virginia Tech 3/85 (Function and operator theory conference) and 5/90  
 Indiana University 9/85  
 University of Michigan 9/85  
 Michigan State University 2/86, 10/86, 4/87, 6/97  
 Washington and Lee University 12/86, 10/88, 10/91, 3/01, 1/03, 3/10  
 University of Richmond 10/88, 9/92, 9/00, 10/03, 2/04  
 University of Virginia 1/89, 1/92, 4/92, 2/98, 10/02, 4/04  
 University of North Carolina at Chapel Hill 2/85 and 2/89  
 University of Georgia 3/89 (Southeastern analysis meeting V)  
 University of Tennessee at Knoxville 11/89  
 University of North Carolina at Charlotte 4/91 (Southeastern analysis meeting VII)  
 National meeting of the AMS (San Francisco 1/95): Holomorphic Spaces special-session.  
 William and Mary 10/95

Kent State University 11/95

Central-section meeting of the AMS (Kent, Ohio 11/95): Function and Operator Theory special session

Mississippi State University 4/97

University of Toronto 6/97

Furman University (YAMS conference) 7/99, 7/01

Washington University 2/00

Eastern Section Meeting of the AMS (Pittsburgh, PA, 11/04): Trends in operator theory and Banach spaces special session

International Workshop on Operator Theory and its Applications (Williamsburg, 7/08)

Virginia Military Institute 11/09

### **Professional Service:**

Served as a referee for the following journals: American Mathematical Monthly, Integral Equations and Operator Theory, Proceedings of the American Mathematical Society, Michigan Mathematical Journal, Illinois Journal of Mathematics, Indiana University Mathematics Journal, Israel Journal of Mathematics, Journal of Functional Analysis, Houston Journal of Mathematics, Bulletin of the Iranian Mathematical Society, Monatshefte für Mathematik, Journal of Operator Theory, Contemporary Mathematics, Arkiv för Matematik, Forum D'Analyses, Acta Scientiarum Mathematicarum, Transactions of the American Mathematical Society, Journal of Mathematical Analysis and Applications, Abstract and Applied Analysis, Proceedings of the Edinburgh Mathematical Society, Bulletin of the Canadian Mathematical Society, Bulletin of the Korean Mathematical Society, London Mathematical Society Journals, Arkiv der Mathematik, Rendiconti del Circolo Matematico di Palermo, Taiwanese Journal of Mathematics, Linear Algebra and Its Applications, Mathematische Zeitschrift, Complex Variables, Proceedings of the Royal Irish Academy, Physics Letters A

Served as a reviewer for Mathematical Reviews

Served as a reviewer for the National Science Foundation of the USA

Served as President of Washington and Lee University's chapter of Phi Beta Kappa, 2000-2002.