

Curriculum Vitae

Stephen William Semmes

Education

Armstrong State College,* Associate of Arts, 1979

Armstrong State College, Bachelor of Science, 1980

Washington University in St. Louis, Ph.D., 1983

Professional Appointments

Research Fellow, Institut Mittag-Leffler, 1982–1983

various postdoctoral capacities, Yale University, 1983–1987

Professor of Mathematics, Rice University, 1987–present

Noah Harding Professor of Mathematics, Rice University, 1997–present

Miscellaneous

National Science Foundation Graduate Fellowship, 1980

National Science Foundation Mathematical Sciences Postdoctoral Fellowship, 1983

National Science Foundation Presidential Young Investigator Award, 1987

Alfred P. Sloan Foundation Fellowship, 1987

Invited address, American Mathematical Society, Atlanta, January, 1988

Invited address, Canadian Mathematical Society, Waterloo, December, 1990

Invited address, International Congress of Mathematicians, Zürich, 1994

Sabbatical year, Institut des Hautes Études Scientifiques, 1994–1995

Raymond and Beverly Sackler fellow, IHES, January–August, 1996

Prix Institut Henri Poincaré Gauthier-Villars, Analyse Non Linéaire, 1997,
with Guy David

John J. Gergen Memorial Lectures, Duke University, January, 1998

Barnett Lecture, University of Cincinnati, April, 2009

Member of the editorial board, Houston Journal of Mathematics,
January, 1995–present

* Now known as Armstrong Atlantic State University.

Doctoral Dissertation

The Cauchy Integral and Related Operators on Smooth Curves,
Washington University in St. Louis, 1983.

Monographs

Singular Integrals and Rectifiable Sets in \mathbf{R}^n : Au-delà des Graphes Lipschitziens,
with G. David, Astérisque **193**, Société Mathématique de France, 1991.

*A Generalization of Riemann Mappings and Geometric Structures on a Space
of Domains in \mathbf{C}^n ,* Memoirs of the American Mathematical Society **472**, 1992.

Analysis of and on Uniformly Rectifiable Sets,
with G. David, Mathematical Surveys and Monographs **38**,
American Mathematical Society, 1993.

*Fractured Fractals and Broken Dreams: Self-Similar Geometry through Metric
and Measure,* with G. David, Oxford Lecture Series in Mathematics
and its Applications **7**, Oxford University Press, 1997.

Uniform Rectifiability and Quasiminimizing Sets of Arbitrary Codimension,
with G. David, Memoirs of the American Mathematical Society **687**, 2000.

A Graphic Apology for Symmetry and Implicitness,
with A. Carbone, Oxford Mathematical Monographs,
Oxford University Press, 2000.

Some Novel Types of Fractal Geometry,
Oxford Mathematical Monographs, Oxford University Press, 2001.

A Sampler in Analysis, submitted to Oxford University Press.

1. with F. Haimo, *Some complete antinormal subgroups of the infinite symmetric groups*, in *Algebra, Proceedings of the Southern Illinois Algebra Conference, Carbondale, 1980*, Lecture Notes in Mathematics **848**, 262–273, Springer-Verlag, 1981.
2. *Another characterization of H^p , $0 < p < \infty$, with an application to interpolation*, in *Harmonic Analysis, Proceedings of a Conference Held in Cortona, Italy*, Lecture Notes in Mathematics **992**, 212–226, Springer-Verlag, 1982.
3. *Trace ideal criteria for Hankel operators and applications to Besov spaces*, *Integral Equations and Operator Theory* **7** (1984), 241–281.
4. with S. Janson and J. Peetre, *On the action of Hankel and Toeplitz operators on some function spaces*, *Duke Mathematical Journal* **51** (1984), 937–958.
5. with G. David and J.-L. Journé, *Opérateurs de Calderón–Zygmund, fonctions para-accrétive, et interpolation*, *Revista Matemática Iberoamericana* **1** (4) (1985), 1–56.
6. *A counterexample in conformal welding concerning chord–arc curves*, *Arkiv för Matematik* **24** (1986), 141–158.
7. with R. Rochberg, *A decomposition theorem for BMO and applications*, *Journal of Functional Analysis* **67** (1986), 228–263.
8. *The Cauchy integral, chord–arc curves, and quasiconformal mappings*, in *The Bieberbach conjecture: Proceedings of the symposium on the occasion of the proof*, *Mathematical Surveys and Monographs* **21**, 167–183, American Mathematical Society, 1986.
9. with G. David, $|\frac{A(x)-A(y)}{x-y}| \frac{1}{x-y}$ defines a bounded operator on $L^2(\mathbf{R})$ if A is Lipschitz, *Comptes Rendus de l'Académie des Sciences Paris, Sér. I Math.* **303** (1986), 499–502.
10. *Estimates for $(\bar{\partial} - \mu\partial)^{-1}$ and Calderón's theorem on the Cauchy integral*, *Transactions of the American Mathematical Society* **306** (1988), 191–232.
11. *Quasiconformal mappings and chord–arc curves*, *Transactions of the American Mathematical Society* **306** (1988), 233–263.
12. with J.L. Rubio de Francia and R. Coifman, *Multiplicateurs de Fourier de $L^p(\mathbf{R})$ et estimations quadratiques*, *Comptes Rendus de l'Académie des Sciences Paris, Sér. I Math.* **306** (1988), 351–354.
13. with R. Rochberg, *Endpoint results for estimates of singular values of singular integral operators*, in *Contributions to Operator Theory and its Applications*, *Operator Theory: Advances and Applications* **35**, 217–231, Birkhäuser, 1988.
14. *Interpolation of Banach spaces, differential geometry, and differential equations*, *Revista Matemática Iberoamericana* **4** (1988), 155–176. (Special issue in honor of J.L. Rubio de Francia.)
15. with R. Coifman, G. David, and Y. Meyer, *w -Calderón–Zygmund operators*, in *Harmonic Analysis and Partial Differential Equations, Proceedings of the International Conference Held in El Escorial, Spain, 1987*, Lecture Notes in Mathematics **1384**, 132–145, Springer-Verlag, 1989.

16. with R. Rochberg, *Nearly weakly orthonormal sequences, singular value estimates, and Calderón–Zygmund operators*, Journal of Functional Analysis **86** (1989), 237–306.
17. *A criterion for the boundedness of singular integral operators on hypersurfaces*, Transactions of the American Mathematical Society **311** (1989), 501–513.
18. *Nonlinear Fourier Analysis*, Bulletin of the American Mathematical Society (New Series) **20** (1989), 1–18.
19. with W. Beckner, A. Carbery and F. Soria, *A note on the restriction of the Fourier transform to spheres*, Bulletin of the London Mathematical Society **21** (1989), 394–398.
20. with R. Coifman and P. Jones, *Two elementary proofs of the L^2 boundedness of Cauchy integrals on Lipschitz curves*, Journal of the American Mathematical Society **2** (1989), 553–564.
21. with R. Coifman, P.L. Lions, and Y. Meyer, *Compacité par compensation et espaces de Hardy*, Comptes Rendus de l’Académie des Sciences Paris, Sér. I Math. **309** (1989), 945–949.
22. with G. David, *Intégrales singulières et régularité des sous-ensembles de \mathbf{R}^n* , Séminaire d’Analyse Harmonique, Université de Paris — Sud (1989–1990), 18–36.
23. with R. Caflisch, *A nonlinear approximation for vortex sheet evolution and singularity formation*, Physica D **41** (1990), 197–207.
24. with G. David and G. Martin, *Mediatrice de deux arcs de quasicerclé*, Journal d’Analyse Mathématique **55** (1990), 250–270.
25. with R. Coifman, *Real-analytic operator-valued functions defined in BMO*, in *Analysis and Partial Differential Equations: A Collection of Papers Dedicated to Mischa Cotlar*, Lecture Notes in Pure and Applied Mathematics **122**, 85–100, Marcel Dekkar, 1990.
26. with G. David, *Strong A_∞ weights, Sobolev inequalities, and quasiconformal mappings*, in *Analysis and Partial Differential Equations: A Collection of Papers Dedicated to Mischa Cotlar*, Lecture Notes in Pure and Applied Mathematics **122**, 101–111, Marcel Dekkar, 1990.
27. *Square function estimates and the $T(b)$ theorem*, Proceedings of the American Mathematical Society **110** (1990), 721–726.
28. *Analysis vs. geometry on a class of rectifiable hypersurfaces in \mathbf{R}^n* , Indiana University Mathematics Journal **39** (1990), 1005–1035.
29. *Differentiable function theory on hypersurfaces in \mathbf{R}^n (without bounds on their smoothness)*, Indiana University Mathematics Journal **39** (1990), 985–1004.
30. with G. David, *Intégrales singulières et régularité des sous-ensembles de \mathbf{R}^n* , Séminaire s’Analyse Harmonique, Année 1989/90, 18–36, Université de Paris XI, Orsay, 1990.
31. with G. David, *Harmonic analysis and the geometry of subsets of \mathbf{R}^n* , Publications Mathématiques **35** (1991), 237–249. (Special issue devoted to the proceedings of the conference held in June, 1989 in memory of J.L. Rubio de Francia.)
32. with R. Coifman, *L^2 estimates in nonlinear Fourier analysis*, in *Harmonic Analysis, Proceedings of the ICM-90 Satellite Conference*, Edited by S. Igari, 79–95, Springer-Verlag, 1991.

33. *Chord-arc surfaces with small constant I*, Advances in Mathematics **85** (1991), 198–223.
34. *Chord-arc surfaces with small constant II: Good parameterizations*, Advances in Mathematics **88** (1991), 170–199.
35. *Hypersurfaces in whose unit normal has small BMO norm*, Proceedings of the American Mathematical Society **112** (1991), 403–412.
36. with C. Li and A. McIntosh, *Convolution singular integrals on Lipschitz surfaces*, Journal of the American Mathematical Society **5** (1992), 445–481.
37. with R. Harvey, *Zero divisors of atomic functions*, Annals of Mathematics **135** (1992), 567–600.
38. *Complex Monge-Ampère and symplectic manifolds*, American Journal of Mathematics **114** (1992), 495–550.
39. with R. Coifman, *Interpolation of Banach Spaces, Perron processes, and Yang-Mills*, American Journal of Mathematics **115** (1993), 243–278.
40. with R. Coifman, P.L. Lions, and Y. Meyer, *Compensated compactness and Hardy spaces*, Journal de Mathématiques Pures et Appliquées **72** (1993), 247–286.
41. *Bilipschitz mappings and strong A_∞ weights*, Annales Academiæ Scientiarum Fennicæ Mathematica Ser. A I Math. **18** (1993), 211–248.
42. with G. David, *Quantitative rectifiability and Lipschitz mappings*, Transactions of the American Mathematical Society **337** (1993), 855–889.
43. *A primer on Hardy spaces, and some remarks on a theorem of Evans and Müller*, Communications in Partial Differential Equations **19** (1994), 277–319.
44. with G. David, *On a variational problem from image processing*, Proceedings of the Conference in Honor of Jean-Pierre Kahane (Orsay, 1993), Journal of Fourier Analysis and Applications (1995), Special Issue, 161–187.
45. *Finding structure in sets with little smoothness*, Proceedings of the International Congress of Mathematicians (Zürich, 1994), 875–885, Birkhäuser, 1995.
46. with G. David, *On the singular sets of minimizers of the Mumford-Shah functional*, Journal Mathématiques Pures et Appliquées **75** (1996), 299–342.
47. with G. David, *Uniform rectifiability and singular sets*, Annales de l’Institut Henri Poincaré, Analyse Non Linéaire **13** (1996), 383–443.
48. *The homogeneous complex Monge-Ampère equation and infinite-dimensional versions of classical symmetric spaces*, in *The Gelfand mathematical seminars, 1993–1995*, 225–242, Birkhäuser, 1996.
49. with G. David, *Surfaces quasiminimales de codimension 1 et domaines de John*, in *Séminaire sur les Equations aux Dérivées Partielles, 1995–1996*, École Polytechnique, Exposé no. X, 23 Janvier 1996.
50. with G. David, *Surfaces quasiminimales de codimension 1: un morceau de démonstration*, in *Journées "équations aux dérivées partielles" (Saint-Jean-de-Monts, 1996)*, Exposé no. IX, École Polytechnique, 1996.

51. *Good metric spaces without good parameterizations*, Revista Matemàtica Iberoamericana **12** (1996), 187–275.
52. *On the nonexistence of bilipschitz parameterizations and geometric problems about A_∞ weights*, Revista Matemàtica Iberoamericana **12** (1996), 337–410.
53. *Quasisymmetry, Measure, and a Question of Heinonen*, Revista Matemàtica Iberoamericana **12** (1996), 727–781.
54. *Some remarks about metric spaces, spherical mappings, and Sobolev inequalities*, Publicacions Matemàtiques **40** (1996), 411–430.
55. *Finding curves on general spaces through quantitative topology, with applications to Sobolev and Poincaré inequalities*, Selecta Mathematica (New Series) **2** (1996), 155–295.
56. with V. Baladi, A. Kitaev, and D. Ruelle, *Sharp determinants and kneading operators for holomorphic maps*, Proceedings of the Steklov Institute of Mathematics **216** (1997), 186–228 (the volume dedicated to Professor D. Anosov).
57. with J. Heinonen, *Thirty-three yes or no questions about mappings, measures, and metrics*, Conformal Geometry and Dynamics (An electronic journal of the American Mathematical Society) **1** (1997), 1–12.
58. with A. Carbone, *Making proofs without modus ponens: An introduction to the combinatorics and complexity of cut elimination*, Bulletin of the American Mathematical Society (New Series) **34** (1997), 131–159.
59. *Mappings and spaces*, in *Quasiconformal Mappings and Analysis: A Collection of Papers Honoring of F.W. Gehring*, 347–368, Springer-Verlag, 1998.
60. with G. David, *Quasiminimal surfaces of codimension 1 and John domains*, Pacific Journal of Mathematics **183** (1998), 213–277.
61. *Analysis on Metric Spaces*, in *Harmonic Analysis and Partial Differential Equations: Essays in honor of Alberto P. Calderón*, 285–294, The University of Chicago Press, 1999.
62. *Metric Spaces and Mappings Seen at Many Scales*, appendix in *Metric Structures for Riemannian and Non-Riemannian Spaces* by M. Gromov et al., Birkhäuser, 1999.
63. with A. Carbone, *Propositional proofs via combinatorial geometry and the search for symmetry*, in *Collegium Logicum*, Annals of the Kurt-Gödel-Society, Volume 3, 85–98, Institute of Computer Science AS CR Prague, 1999.
64. *Bilipschitz embeddings of metric spaces into Euclidean spaces*, Publicacions Matemàtiques **43** (1999), 571–653.
65. *Measure-preserving quality within mappings*, Revista Matemàtica Iberoamericana **16** (2000), 363–458.
66. with A. Carbone, *Looking from the inside and from the outside*, Synthese **125** (2000), 385–416.
67. with G. David, *Regular mappings between dimensions*, Publicacions Matemàtiques **44** (2000), 369–417.
68. *Derivatives and difference quotients for Lipschitz or Sobolev functions on various spaces*, in *Lecture Notes on Analysis in Metric Spaces*, edited by L. Ambrosio and F. Serra Cassano, 71–103, Scuola Normale Superiore, Pisa, 2000.

69. *Some topics concerning homeomorphic parameterizations*, *Publicacions Matemàtiques* **45** (2001), 3–67.
70. *Real analysis, quantitative topology, and geometric complexity*, *Publicacions Matemàtiques* **45** (2001), 265–333.
71. *Noyaux de la chaleur, marches aléatoires, analyse sur les variétés et les graphes*, *Gazette des Mathématiciens* **95** (2003), 9–28. This is a report on the trimester “Heat kernels, random walks, and analysis on manifolds and graphs” at the Centre Émile Borel, Institut Henri Poincaré, in the spring of 2002, with an introduction in French by the organizers, followed by text in English.
72. *An introduction to analysis on metric spaces*, *Notices of the American Mathematical Society* **50** (2003), 438–443.
73. *An introduction to Heisenberg groups in analysis and geometry*, *Notices of the American Mathematical Society* **50** (2003), 640–646.
74. *Happy fractals and some aspects of analysis on metric spaces*, *Publicacions Matemàtiques* **47** (2003), 261–309.
75. *Some topics related to analysis on metric spaces*, in *Heat Kernels and Analysis on Manifolds, Graphs, and Metric Spaces*, *Contemporary Mathematics* **338**, American Mathematical Society, 2003.
76. (book review) “*Metric Spaces, Convexity, and Nonpositive Curvature*” by A. Papadopoulos, *Bulletin of the American Mathematical Society (New Series)* **43** (2006), 435–438.
77. (book review) “*Harmonic Measure: Geometric and Analytic Points of View*” by L. Capogna, C. E. Kenig, and L. Lanzani, *Jahresbericht der Deutschen Mathematiker-Vereinigung* **110** (2008), Issue 2, 11–12.
78. *Mappings and spaces, 2*, *Pure and Applied Mathematics Quarterly* **7** (2011), 425–453. (Special issue in honor of Fred Gehring.)
79. *Calculus, fractals, and analysis on metric spaces*, *The Journal of Analysis* **18** (2010), 337–348. (Special volume containing the proceedings of the ICM satellite conference on harmonic and quasiconformal mappings.)
80. *Some reflections on papers by Heinonen and Rubio de Francia*, in *All That Math: Portraits of Mathematicians as Young Readers*, edited by A. Córdoba, J. I. Fernández, and P. Fernández, 283–287, *Revista Matemática Iberoamericana*, 2011.

Informal Notes

These notes are available from the archive at www.arxiv.org.

1. *Where the buffalo roam: Infinite processes and infinite complexity*, IHES preprint, M/96/77; math.CA/0302308.
2. *Some remarks about homeomorphisms, “energy”, and so on*, math.CA/0211135.
3. *Some topics pertaining to algebras of linear operators*, math.CA/0211171.
4. *Notes on metrics, measures, and dimensions*, math.CA/0302190.
5. *Complexity and ordinary life, and some mathematics in both*, Math.LO/0303030.
6. *Notes on topological vector spaces*, math.CA/0304032.
7. *Some remarks about Cauchy integrals*, math.CA/0308082.
8. *Some remarks about metric spaces*, math.CA/0308083.
9. *Notes on matrices and calculus*, math.CA/0308293.
10. *Elements of harmonic analysis*, math.CA/0402209.
11. *Elements of harmonic analysis, 2*, math.CA/0402317.
12. *Elements of harmonic analysis, 3*, math.CA/0402337.
13. *Some remarks about Cantor sets*, math.CA/0402414.
14. *Elements of harmonic analysis, 4*, math.CA/0403109.
15. *Some remarks about curves in metric spaces*, math.CA/0403162.
16. *Some topics in complex and harmonic analysis*, math.CA/0403196.
17. *Elements of harmonic analysis, 5*, math.CA/0403274.
18. *Some topics in complex and harmonic analysis, 2*, math.CA/0403290.
19. *Notes on normed algebras*, math.CA/0403363.
20. *Notes on normed algebras, 2*, math.CA/0403368.
21. *Notes on normed algebras, 3*, math.CA/0403372.
22. *Notes on normed algebras, 4*, math.CA/0403397.
23. *Notes on normed algebras, 5*, math.CA/0403435.
24. *Some topics in complex and harmonic analysis, 3*, math.CA/0404140.
25. *Some topics in complex and harmonic analysis, 4*, math.CA/0404164.
26. *Some topics in complex and harmonic analysis, 5*, math.CA/0404170.
27. *A beginner’s guide to analysis on metric spaces*, math.CA/0408024.
28. *Some notes on harmonic and holomorphic functions*, math.CA/0408067.
29. *Notes on functions on the unit disk*, math.CA/0408138.
30. *Notes on groups and representations*, math.CA/0408268.
31. *Potpourri*, math.CA/0409063.
32. *Notes on commutative algebra and harmonic analysis*, math.CA/0409192.

33. *Potpourri*, 2, math.CA/0409255.
34. *Potpourri*, 3, math.CA/0409330.
35. *Potpourri*, 4, math.CA/0409580.
36. *Potpourri*, 5, math.CA/0410228.
37. *Potpourri*, 6, math.CA/0410489.
38. *Potpourri*, 7, math.CA/0410490.
39. *Potpourri*, 8, math.CA/0410508.
40. *Potpourri*, 9, math.CA/0411004.
41. *Potpourri*, 10, math.CA/0411191.
42. *Potpourri*, 11, math.CA/0411530.
43. *Notes on Lie algebras and Lie groups*, math.CA/0412491.
44. *Notes on p-adic numbers*, math.CA/0502560.
45. *Adventures in harmonic analysis*, math/0509602.
46. *Some aspects of algebraic topology: An analyst's perspective*, math.CA/0701425.
47. *Some algebraic notions related to analysis on metric spaces*, math.CA/0702160.
48. *Ode to commutator operators*, math.CA/0702462.
49. *A few remarks about operator theory, topology, and analysis on metric spaces*, math.CA/0703390.
50. *Some remarks about Cauchy integrals and fractal sets*, math.CA/0709.0185.
51. *Analysis on disconnected sets*, math.CA/0709.1129.
52. *A few remarks concerning complex-analytic metric spaces*, math.CA/0709.1448.
53. *What is a metric space?*, math.MG/0709.1676.
54. *Some remarks about Clifford analysis and fractal sets*, math.CA/0709.2356.
55. *Some aspects of calculus on non-smooth sets*, math.CA/0709.2508.
56. *Quasi-fractal sets in space*, math.CA/0709.3480.
57. *An introduction to the geometry of metric spaces*, math.MG/0709.4239.
58. *A few remarks about linear operators and disconnected open sets in the plane*, math.CA/0710.0163.
59. *Complementary self-similarity*, math.CA/0710.1360.
60. *Geometric constructions for fractal sets and related linear operators*, math.CA/0710.2465.
61. *Another introduction to the geometry of metric spaces*, math.MG/0710.2690.
62. *Elementary aspects of the geometry of metric spaces*, math.MG/0710.4869.
63. *An introduction to the geometry of ultrametric spaces*, math.MG/0711.0709.
64. *Cellular structures, quasisymmetric mappings, and spaces of homogeneous type*, math.CA/0711.1333.
65. *Sums, rearrangements, and norms*, math.CA/1008.2459.

66. *Sums and averages*, math.CA/1008.2467.
67. *Some elementary aspects of Hausdorff measure and dimension*, math.CA/1008.2637.
68. *Notes on algebras and vector spaces of functions*, math.CA/1009.1107.
69. *Metric spaces: The definition, and some examples*, math.MG/1012.2056.
70. *p-Adic Heisenberg Cantor sets*, math.CA/1103.5234.
71. *p-Adic Heisenberg Cantor sets, 2*, math.CA/1110.0111.
72. *A sampler in analysis*, math.CA/1111.3218.
73. *p-Adic Heisenberg Cantor sets, 3*, math.CA/1201.1825.
74. *Some remarks about solenoids*, math.CA/1201.2647.
75. *Topics in Fourier analysis*, math.CA/1208.0926.
76. *Some remarks about solenoids, 2*, math.CA/1210.0145.
77. *Some remarks about solenoids, 3*, math.CA/1210.4788.
78. *Groups and Cantor sets*, math.CA/1211.6985.
79. *Some basic aspects of analysis on metric and ultrametric spaces*, math.CA/1306.2421.
80. *Some topics related to real, complex, and Fourier analysis*, math.CA/1311.6710.
81. *Some aspects of analysis related to p-adic numbers*, math.CA/1403.7417.
82. *Some aspects of analysis related to p-adic numbers, 2*, math.CA/1502.04607.
83. *Some topics related to metrics and norms, including ultrametrics and ultranorms*, math.CA/1503.02071.
84. *Some topics related to metrics and norms, including ultrametrics and ultranorms, 2*, math.CA/1506.07390.
85. *Some topics related to metrics and norms, including ultrametrics and ultranorms, 3*, math.CA/1510.03410.