

## ALVIN BAYLISS

Professor, Department of Engineering Sciences and Applied Mathematics  
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### RESEARCH INTERESTS

Numerical methods for partial differential equations, spectral methods, combustion, fluid dynamics, wave propagation.

### EDUCATION

Ph. D. Mathematics, New York University, 1975  
M. S. Mathematics, New York University, 1973  
B. S. Physics, C. C. N. Y., 1967

### POSITIONS

1999–2004 Chairman, Northwestern University  
Department of Engineering Sciences and Applied Mathematics  
1990– Professor, Northwestern University  
Department of Engineering Sciences and Applied Mathematics  
1990–1999 Professor, Northwestern University  
Department of Electrical and Computer Engineering  
1986–1990 Associate Professor, Northwestern University  
Department of Engineering Sciences and Applied Mathematics  
1986–1990 Associate Professor, Northwestern University  
Department of Electrical Engineering and Computer Science  
1982–1986 Senior Staff Scientist, Exxon Corporate Research  
  
1980–1982 Research Associate Professor, New York University  
  
1976–1980 Research Scientist, ICASE, NASA Langley Research Center  
  
1975–1976 Mathematician, Goddard Institute for Space Studies  
Department of Mathematics

## GRADUATE STUDENT AND POSTDOCTORAL SUPERVISION

1. David J. Lin (Physics); Ph.D. awarded June, 2006
2. Jang H. Park; Ph.D. awarded December, 2006
3. Chris Wahle; Ph.D. awarded December, 2004
4. James Demetriou (EE); Ph.D. awarded December, 2001
5. Chris Raymond; Ph.D. awarded December, 1999
6. Deborah Stevens; Ph.D. awarded December, 1999
7. Tsung-Kuang E. Ma; Ph.D. awarded December, 1997
8. Dan Schult; Ph.D. awarded June 1996
9. Dawn Crumpler; Ph.D. awarded June 1994
10. David Hansen; MS awarded 1990
11. Klaus Deller; MS awarded 1990
12. Timothy Lorello; MS awarded 1989

## SELECTED PROFESSIONAL APPOINTMENTS AND ACTIVITIES

- |                 |  |
|-----------------|--|
| July, 2006      | Member, NSF-DMS CSUMS panel  |
| June, 2005      | Clarence ver Steeg Graduate Faculty Award  |
| February, 2001  | Member, NSF-DMS Applied Partial Differential Equations Panel   |
| May, 2000       | Member, NSF-DMS SCREMS Panel   |
| 1997–           | Associate Editor, Journal of Computational Physics   |
| January, 1997   | Member, NSF-DMS Fluids Panel   |
| September, 1995 | Charles Deering McCormick Professor of Teaching Excellence   |
| September, 1994 | Invited Lectures, Tutorial on Computational Wave Propagation, Institute for Mathematics and Its Applications University of Minnesota |
| June, 1993      | Teaching Award - McCormick School of Engineering and Applied Science   |
| July, 1992      | Exhibitor, Siggraph '92 conference   |

- May, 1992    Invited Lecture, workshop on Scientific Computing for the 90's, Tel Aviv Israel
- April, 1992    Invited Lecture, workshop on Computational Aeroacoustics, ICASE, Hampton, VA
- January, 1992    UNM - CNLS distinguished lecturer, Los Alamos National Laboratory and The University of New Mexico
- February, 1990    Invited Lecture, Workshop on Asymptotic Analysis and Numerical Solution of PDEs, Argonne National Laboratory, Argonne, IL
- March, 1988    NSF panel member to review Science and Technology Proposals
- 1986–        Associate Editor, Applied Numerical Mathematics
- 1986–        Consultant ICASE, ICOMP
- 1982        Invited Lecture, Workshop on Aeroacoustics, ICASE, Hampton, VA
- 1981        Invited Lecture, Symposium on Numerical Boundary Condition Procedures, NASA Ames Research Center
- 1980        NASA Certificate of Recognition for Inventive Contribution (joint award with L. Maestrello)

## LIST OF PUBLICATIONS

1. A. Bayliss and L. Maestrello, *Measurements and Analysis of Farfield Scattering from a Prolate Spheroid*, J. Acoust. Soc. of Amer., **64** (1978), 896-900.
2. A. Bayliss, *Forced Oscillations in Quadratically Damped Systems*, Communications on Pure and Applied Mathematics, **31** (1978) 69-88.
3. A. Bayliss, *A Double Shooting Scheme for Certain Unstable and Singular Boundary Value Problems*, Mathematics of Computation, **32** (1978) 61-71.
4. A. Bayliss, *On the Use of Co-Ordinate Stretching in the Numerical Computation of High Frequency Scattering*, Journal of Sound and Vibration, **60** (1978) 543-553.
5. A. Bayliss and E. Turkel, *Radiation Boundary Conditions for Wave-Like Equations*, Communications on Pure and Applied Mathematics, **33** (1980) 707-725.
6. A. Bayliss and L. Maestrello, *Simulation of Instabilities and Sound Radiation in a Jet*, AIAA J., **19** (1981) 835-841.

7. L. Maestrello, A. Bayliss and E. Turkel, *On the Interaction of a Sound Pulse with the Shear Layer of an Axisymmetric Jet*, Journal of Sound and Vibration, **74** (1981), 281-301.
8. A. Bayliss and L. Maestrello, *On the Interaction of a Sound Pulse with the Shear Layer of an Axisymmetric Jet. II: Heated Jets*, Journal of Sound and Vibration, **86** (1982), 395-409.
9. L. Maestrello and A. Bayliss, *Flowfield and Far Field Acoustic Amplification Properties of Heated and Unheated Jets*, AIAA J., **20** (1982) 1539-1546.
10. A. Bayliss and E. Turkel, *Far Field Boundary Conditions for Compressible Flows*, Journal of Computational Physics, **48** (1982) 182-199.
11. A. Bayliss and E. Turkel, *Outflow Boundary Conditions for Fluid Dynamics*, SIAM J. Sci. Stat. Comput., **3** (1982) 250-259.
12. A. Bayliss, M. Gunzburger and E. Turkel, *Boundary Conditions for the Numerical Solution of Elliptic Equations in Exterior Regions*, SIAM J. Appl. Math. **42** (1982) 430-451.
13. A. Bayliss, G. A. Kriegsmann and C. S. Morawetz, *The Nonlinear Interaction of a Laser Beam with a Plasma Pellet*, Communications on Pure and Applied Mathematics, **36** (1983) 399-414.
14. A. Bayliss, C. I. Goldstein and E. Turkel, *An Iterative Method for the Helmholtz Equation*, Journal of Computational Physics, **49** (1983) 443-457.
15. S. I. Hariharan and A. Bayliss, *Radiation of Sound from Unflanged Cylindrical Ducts*, SIAM J. Sci. Stat. Comput., **6** (1985) 285-296.
16. A. Bayliss, C. I. Goldstein and E. Turkel, *On Accuracy Conditions for the Numerical Computation of Waves*, Journal of Computational Physics, **59** (1985) 396-404.
17. A. Bayliss, C. I. Goldstein and E. Turkel, *The Numerical Solution of the Helmholtz Equation for Wave Propagation Problems in Underwater Acoustics*, Computers and Mathematics with Applications, **11** (1985) 655-665.
18. A. Bayliss, L. Maestrello, P. Parikh and E. Turkel, *Numerical Simulation of Boundary Layer Excitation by Surface Heating/Cooling*, AIAA J., **24** (1986) 1095-1101.
19. A. Bayliss, L. Maestrello and E. Turkel, *On the Interaction of a Sound Pulse with the Shear Layer of an Axisymmetric Jet. III: Non-Linear Effects*, Journal of Sound and Vibration, **107** (1986), 167-175.
20. A. Bayliss, K. E. Jordan, B. J. LeMesurier and E. Turkel, *A Fourth-Order Accurate Finite-Difference Scheme for the Computation of Elastic Waves*, Bulletin Seism. Soc. of Amer., **76** (1986) 1115-1132.
21. B. S. White, A. Norris, A. Bayliss and R. Burrige, *Some Remarks on the Gaussian Beam Summation Method*, Geophysics Journal of the Royal Astronomical Society, **89** (1987) 579-636.
22. A. Bayliss and B. J. Matkowsky, *Fronts, Relaxation Oscillations, and Period Doubling in Solid Fuel Combustion*, Journal of Computational Physics, **71** (1987), 147-168.

23. B. S. White, B. Nair and A. Bayliss, *Random Rays and Seismic Amplitude Anomalies*, *Geophysics*, **53** (1988), 903-907.
24. A. Bayliss, Y. Li and C. S. Morawetz, *Scattering by a Potential Using Hyperbolic Methods*, *Mathematics of Computation* **52** (1989) 321-338.
25. A. Bayliss, B. J. Matkowsky and M. Minkoff, *Adaptive Pseudo-Spectral Computation of Cellular Flames Stabilized by a Point Source*, *Appl. Math. Letters*, **1** (1988) 19-24.
26. L. Maestrello, A. Bayliss, P. Parikh and E. Turkel, *Instability and Sound Emission from a Flow over a Curved Surface*, *Journal of Vibration, Stress and Reliability in Design*, **110** (1988) 538-544.
27. A. Bayliss, B. J. Matkowsky and M. Minkoff, *Cascading Cellular Flames*, *SIAM J. Appl. Math.* **49** (1989) 1421-1432.
28. A. Bayliss, B. J. Matkowsky and M. Minkoff, *Period Doubling Gained, Period Doubling Lost*, *SIAM J. Appl. Math.* **49** (1989) 1047-1063.
29. A. Bayliss, D. Gottlieb, B. J. Matkowsky and M. Minkoff, *An Adaptive Pseudo-Spectral Method for Reaction Diffusion Problems*, *Journal of Computational Physics* **81** (1989) 421-443.
30. A. Bayliss and B. J. Matkowsky, *Spinning Cellular Flames*, *Appl. Math. Letters*, **3** (1990) 75-79.
31. T. Belytschko, J. Fish and A. Bayliss, *The Spectral Overlay on Finite Elements for Problems with High Gradients*, *Computer Methods in Applied Mechanics and Engineering* **81** (1990) 71-89.
32. A. Bayliss, R. A. Kuske and B. J. Matkowsky, *A Two-Dimensional Adaptive Pseudo-Spectral Method*, *Journal of Computational Physics* **91** (1990) 174-196.
33. A. Bayliss and B. J. Matkowsky, *Two Routes to Chaos in Condensed Phase Combustion*, *SIAM J. Appl. Math.* **50** (1990) 437-459.
34. K. Deller, T. Erneux and A. Bayliss, *Asymptotic and Numerical Study of Brusselator Chaos*, *Euro. Journal of Appl. Math.*, **2** (1991) 341-357.
35. L. Maestrello, A. Bayliss and R. Krishnan, *On the Interaction between First- and Second-Mode Waves in a Supersonic Boundary Layer*, *Physics of Fluids A* **3** (1991) 3014-3020.
36. A. Bayliss and B. J. Matkowsky, *Nonlinear Dynamics of Cellular Flames*, *SIAM J. Appl. Math.* **52** (1992) 396-415.
37. A. Bayliss and E. Turkel, *Mappings and Accuracy for Chebyshev Pseudo-Spectral Approximations*, *Journal of Computational Physics*, **101** (1992) 349-359.
38. A. Bayliss, G. K. Leaf and B. J. Matkowsky, *Pulsating and Chaotic Dynamics near the Extinction Limit*, *Combustion Science and Technology*, **84** (1992) 253-278.
39. A. Frendi, L. Maestrello and A. Bayliss, *Coupling between a Supersonic Boundary Layer and a Flexible Surface*, *AIAA J.*, **31** (1993) 708-713.

40. A. Class, A. Bayliss and B. J. Matkowsky, *Localized Ordered Structures and Flame Stretch*, Appl. Math. Letters, **6** (1993) 3-7.
41. A. Bayliss and B. J. Matkowsky, *From Traveling Waves to Chaos in Combustion*, SIAM J. Appl. Math., **54** (1994) 147-174.
42. A. Bayliss, B. J. Matkowsky and H. Riecke, *Structure and Dynamics of Modulated Traveling Waves in Cellular Flames*, Physica D, **74** (1994) 1-23.
43. A. Frendi, L. Maestrello and A. Bayliss, *Coupling between Plate Vibration and Acoustic Radiation*, Journal of Sound and Vibration, **177** (1994) 207-226.
44. A. Bayliss, T. Belytschko, M. Kulkarni and D. A. Lott-Crumpler, *On the Dynamics and the Role of the Imperfection for Localization in Thermo-Viscoplastic Materials*, Modelling and Simulation in Materials Science and Engineering, **2** (1994) 941-964.
45. A. Bayliss, A. Class and B. J. Matkowsky, *Adaptive Approximation of Solutions to Problems with Multiple Layers by Chebyshev Pseudo-Spectral Methods*, Journal of Computational Physics, **116** (1995) 160-172.
46. A. Bayliss, A. Class and B. J. Matkowsky, *Roundoff Error in Computing Derivatives using the Chebyshev Differentiation Matrix*, Journal of Computational Physics, **116** (1995) 380-383.
47. J. L. McGreevy, A. Bayliss and L. Maestrello, *Interaction of Jet Noise with a nearby Panel Assembly*, AIAA J., **33** (1995), 577-585.
48. A. Bayliss, M. Garbey and B. J. Matkowsky, *Adaptive Pseudo-Spectral Domain Decomposition and the Approximation of Multiple Layers*, Journal of Computational Physics, **119** (1995), 132-141.
49. M. Kulkarni, T. Belytschko and A. Bayliss, *Stability and Error Analysis for Time Integrators Applied to Strain-Softening Materials*, Computer Methods in Applied Mechanics and Engineering, **124** (1995), 335-363.
50. A. Bayliss, L. Maestrello, J. L. McGreevy and C. C. Fenno, Jr., *Forward Motion Effects on Jet Noise, Panel Vibration and Radiation*, AIAA J., **34** (1996), 1103-1110.
51. A. Bayliss and B. J. Matkowsky, *Structure and Dynamics of Kink and Cellular Flames Stabilized on a Rotating Burner*, Physica D, **99** (1996), 276-302.
52. C. C. Fenno Jr., A. Bayliss and L. Maestrello, *Panel-Structure Response to Acoustic Forcing by a Nearly Sonic Jet*, AIAA J., **35** (1997), 219-227.
53. D. A. Schult, A. Bayliss and B. J. Matkowsky, *Traveling Waves in Natural Counterflow Filtration Combustion and Their Stability*, SIAM J. Appl. Math., **58** (1998), 806-852.
54. C. C. Fenno Jr., A. Bayliss and L. Maestrello, *Interaction of Sound from Supersonic Jets with Nearby Structures*, AIAA J., **36** (1998), 2153-2169.
55. A. Bayliss and B. J. Matkowsky, *Interaction of Counterpropagating Hot Spots in Solid Fuel Combustion*, Physica D, **128** (1999), 18-40.
56. A. Class, A. Bayliss and B. J. Matkowsky, *Localized Flickering Cellular Flames*, SIAM J. Appl. Math., **59** (1999), 942-964.

57. A. A. Golovin, B. J. Matkowsky, A. Bayliss and A. A. Nepomnyaschy, *Coupled KS-CGL and Coupled Burgers-CGL Equations for Flames Governed by a Sequential Reaction*, Physica D, **129** (1999), 253-298.
58. A. P. Aldushin, A. Bayliss and B. J. Matkowsky, *Dynamics of Layer Models of Solid Flame Propagation*, Physica D, **143** (2000) 109-137.
59. A. Bayliss, E. Ma, B. J. Matkowsky and C. W. Wahle, *The Reactive Rayleigh-Bénard Problem with Throughflow*, SIAM J. Appl. Math., **61** (2000), 1103-1142.
60. C. S. Raymond, A. Bayliss, B. J. Matkowsky and V. A. Volpert, *Transition to Chaos in Condensed Phase Combustion with Reactant Melting*, International Journal of SHS, **10** (2001), 133-149.
61. A. Bayliss, B. J. Matkowsky and A. P. Aldushin, *Dynamics of Hot Spots in Solid Fuel Combustion*, Physica D, **166** (2002), 104-130.
62. A. P. Aldushin, A. Bayliss and B. J. Matkowsky, *Steady State Combustion Wave Characteristics*, International Journal of SHS, **11** (2002), 131-171.
63. V. Panfilov, A. Bayliss and B. J. Matkowsky, *Spiral Flames*, Appl. Math. Letters, **16** (2003), 131-135.
64. J. Park, A. Bayliss and B. J. Matkowsky, *On the Transition from Spinning to Radial Solid Flame Waves*, Applied Math. Letters, **17** (2004), 123-131.
65. J. H. Park, A. Bayliss and B. J. Matkowsky, *Dynamics in a Rod Model of Solid Flame Waves*, SIAM J. Appl. Math., **65** (2005), 521-549.
66. J. H. Park, A. Bayliss, B. J. Matkowsky and A. A. Nepomnyaschy, *On the Route to Extinction in Nonadiabatic Solid Flames*, SIAM J. Appl. Math. **66** (2006), 873-895.
67. A. P. Aldushin, A. Bayliss and B. J. Matkowsky, *On the Transition from Smoldering to Flaming*, Combustion and Flame, **145** (2006), 579-606.
68. D. J. Lin, A. Bayliss and R. E. Taam, *Low Mach Number Modeling of Type I X-Ray Burst Deflagrations*, The Astrophysical Journal, **653** (2006), 545-557.
69. A. P. Aldushin, A. Bayliss and B. J. Matkowsky, *On the Mechanism of Triggering the Transition from Smoldering to Flaming*, Proceedings 31st International Symposium on Combustion (2007), 2497-2504.