

# Paul E. Sacks

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## Education

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**Ph.D.**, Mathematics, 1981  
University of Wisconsin, Madison  
Thesis: *Continuity of Solutions of Degenerate Parabolic Equations*  
Advisor: Michael G. Crandall

**M.S.**, Mathematics, 1978  
University of Wisconsin, Madison

**B.S.**, Mathematics, 1976  
Syracuse University

## Appointments

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- **Professor** (1990 – Present)  
Department of Mathematics, Iowa State University, Ames, Iowa
- **Associate Professor** (1985 – 1990)  
Department of Mathematics, Iowa State University, Ames, Iowa
- **Assistant Professor** (1981 – 1985)  
Department of Mathematics, Iowa State University, Ames, Iowa
- **Visiting Fellow** (October – December 2011)  
Isaac Newton Institute, Cambridge, UK
- **Visiting Member** (August – December 2001)  
Mathematical Sciences Research Institute, Berkeley, California
- **Visiting Member** (January – March 1995)  
Institute for Mathematics and its Applications, Minneapolis, Minnesota
- **Visiting Assistant Professor** (1983 – 1985)  
Center for Applied Mathematics, Cornell University, Ithaca, New York
- **Teaching Assistant** (1976 – 1981)  
Department of Mathematics, University of Wisconsin, Madison, Wisconsin

## Administrative Positions

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- **Director of Graduate Studies** in Mathematics and Applied Mathematics, Iowa State University, 2005-2011
- **Interim Chair**, Department of Mathematics, Iowa State University, 2019-2022

## Research Interests

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- Ordinary and Partial Differential Equations
- Inverse Problems

## Professional and Honorary Societies

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- American Mathematical Society
- Society for Industrial and Applied Mathematics
- Association for Women in Mathematics
- Phi Beta Kappa
- Sigma Xi

## Editorial Boards

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- Journal of Mathematical Analysis and Applications, Associate Editor 2006-2011, Division Editor 2011-present
- Mathematical Methods in the Applied Sciences, Advisory Editor 2002-2008, 2011-present
- Journal of Inverse and Ill-Posed Problems, Editorial Board member, 2008-present

## Refereed Publications

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1. P. E. Sacks, *Continuity of solutions of a singular parabolic equation*, Nonlinear Analysis T. M. A., **7**, 1983, 387-409
2. P. E. Sacks, *The initial and boundary value problem for a class of degenerate parabolic equations*, Comm. P.D.E. **8**, 1983, 693-733
3. H. A. Levine and P. E. Sacks, *Some existence and nonexistence theorems for solutions of degenerate parabolic equations*, J. Diff. Equ. **52**, 1984, 135-161
4. W. M. Ni, P. E. Sacks and J. Tavantzis, *On the asymptotic behavior of solutions of certain quasi-linear parabolic equations*, J. Diff. Equ. **54**, 1984, 97-120
5. P. E. Sacks, *Global behavior for a class of nonlinear evolution equations*, SIAM J. Math. Anal. **16**, 1985, 233-250
6. W. M. Ni and P. E. Sacks, *The number of peaks of positive solutions of semilinear parabolic equations*, SIAM J. Math. Anal. **16**, 1985, 460-471
7. W. M. Ni and P. E. Sacks, *Singular behavior in nonlinear parabolic equations*, Trans. A.M.S. **287**, 1985, 657-671
8. P. E. Sacks and W. W. Symes, *Uniqueness and continuous dependence in a multidimensional hyperbolic inverse problem*, Comm. P.D.E. **10**, 1985, 635-676

9. P. E. Sacks and F. Santosa, *A simple computational scheme for determining the sound speed of an acoustic medium from its surface impulse response*, SIAM J. Sci. Stat. Comp. **8**, 1987, 501-520
10. P. E. Sacks and W. W. Symes, *Recovery of the elastic parameters of a layered half space*, Geophys. J. Roy. Astr. Soc., **88**, 1987, 593-620
11. P. E. Sacks, *An iterative method for the inverse Dirichlet problem*, Inverse Problems **4**, 1988, 1055-1069
12. P. Benilan, M. G. Crandall and P. E. Sacks, *Some  $L^1$  existence and dependence results for semilinear elliptic equations under nonlinear boundary conditions*, Appl. Math. Opt. **17**, 1988, 203-224
13. T. F. Chen, H. A. Levine and P. E. Sacks, *Analysis of a convective reaction-diffusion equation*, Nonlinear Analysis T.M.A. **12**, 1988, 1349-1370
14. K. Bube, P. Lailly, P. E. Sacks, F. Santosa and W. W. Symes, *Simultaneous determination of a source wavelet and velocity profile using impulsive point-source reflections from a layered fluid*, Geophys. J. **95**, 1988, 449-462
15. P. E. Sacks, *The inverse problem for a weakly inhomogeneous two dimensional acoustic medium*, SIAM J. Appl. Math. **48**, 1988, 1167-1193
16. P. E. Sacks, *Universal decay in nonlinear parabolic equations*, Nonlinear Analysis T.M.A. **12**, 1988, 1123-1136
17. H. A. Levine, L. E. Payne, P. E. Sacks and B. F. Straughan, *Analysis of a convective reaction-diffusion equation (II)*, SIAM J. Math. Anal. **20**, 1989, 133-147
18. P. E. Sacks and W. W. Symes, *Velocity inversion using common offset data*, Inverse Problems **5**, 1989, 407-423
19. P. E. Sacks, *A singular limit problem for the porous medium equation*, J. Math. Anal. Appl. **140**, 1989, 456-466
20. P. E. Sacks, *A velocity inversion problem involving an unknown source*, SIAM J. Appl. Math. **50**, 1990, 931-941
21. P. E. Sacks and W. W. Symes, *The inverse problem for a fluid over a layered elastic half space*, Inverse Problems **6**, 1990, 1031-1054
22. P. E. Sacks, *Limiting behavior of solutions of  $u_t = \Delta u^m$  as  $m \rightarrow \infty$* , Rocky Mountain J. Math. **21**, 1991, 779-786
23. P. E. Sacks, *Behavior near  $t=0$  for solutions of the Dirichlet problem for  $u_t = \Delta \phi(u) - f(u)$  in bounded domains*, Comm. P.D.E. **16**, 1991, 771-787
24. W. Rundell and P. E. Sacks, *Reconstruction techniques for classical inverse Sturm-Liouville problems*, Math. Comp. **58**, 1992, 161-184
25. W. Rundell and P. E. Sacks, *Reconstruction of Sturm-Liouville operators*, Inverse Problems **8**, 1992, 457-482
26. M. V. Klibanov and P. E. Sacks, *Phaseless inverse scattering and the phase problem in optics*, J. Math. Phys. **33**, 1992, 3813-3821

27. P. E. Sacks, *Reconstruction of step-like potentials*, Wave Motion **18**, 1993, 21-30
28. J. R. McLaughlin, P. Polyakov and P. E. Sacks, *Reconstruction of a spherically symmetric index of refraction*, SIAM J. Appl. Math., **54**, 1994, 1203-1223
29. M. V. Klibanov and P. E. Sacks, *Use of partial knowledge of the potential in the phase problem of inverse scattering*, J. Comp. Phys **112** , 1994, 273-281
30. W. Rundell and P. E. Sacks, *On the determination of potentials without bound state data*, J. Comp. Appl. Math., **55**, 1994, 325-347
31. M. V. Klibanov, P. E. Sacks and A. Tikhonravov, *The phase retrieval problem*, Inverse Problems, **11**, 1995, 1-28
32. Rakesh and P. E. Sacks, *Impedance inversion from transmission data for the wave equation*, Wave Motion, **24** 1996, 263-274
33. V. O. deHaan, A. A. van Well, P. E. Sacks, S. Adenwalla and G. P. Felcher, *Toward the solution of the inverse problem in neutron reflectometry* , Physica B, **221**, 1996, 524-532
34. P. E. Sacks, *Recovery of singularities from amplitude information*, J. Math. Phys., **38**, 1997, 3497-3507
35. T. Aktosun and P. E. Sacks, *Inverse problems on the line without phase information*, Inverse Problems, **14**, 1998, 211-224
36. P. E. Sacks and V. Yakhno, *The inverse problem for a layered anisotropic half space*, J. Math. Anal. Appl. **228**, 1998, 377-398
37. M. Yan, S. Udpa, S. Mandayam, Y. Sun P. E. Sacks and W. Lord, *Solution of inverse problems in electromagnetic NDE using finite element methods*, IEEE Trans. Mag. **34**, 1998, 2924-2927
38. T. Aktosun and P. E. Sacks, *Inversion of reflectivity data for nondecaying potentials*, SIAM J Appl Math. **60**, 2000, 1340-1356
39. T. Aktosun and P. E. Sacks, *Phase recovery with nondecaying potentials*, Inverse Problems **16**, 2000, 821-838
40. W. Rundell and P. E. Sacks, *Reconstruction of a radially symmetric potential from two spectral sequences*, J. Math. Anal. Appl. **264**, 2001, 354-381
41. T. Aktosun and P. E. Sacks, *Potential splitting and numerical solution of the inverse scattering problem on the line*, Math. Meth. Appl. Sci **25** 2002, 347-355
42. W. Rundell and P. E. Sacks, *Numerical technique for the inverse resonance problem* J. Comp. Appl. Math. **170**, 2004, 337-347
43. P. Sacks, *An inverse problem in coupled mode theory* J. Math. Phys., **45**, 2004, 1699-1710
44. P. E. Sacks and J. Shin, *Computational methods for some inverse scattering problems*, Appl. Math. Comp. **207**, 2009, 111-123
45. Rakesh and P. E. Sacks, *Stability for an inverse problem for a two speed hyperbolic PDE in one space dimension*, Inverse Problems, **26**, 2010, 025005

46. R. Hryniv and P. E. Sacks, *Numerical solution of the inverse spectral problem for Bessel operators*, J. Comp. Appl. Math., **235**, 2010, 120-136
47. Rakesh and P. E. Sacks, *Uniqueness for a hyperbolic inverse problem with angular control on the coefficients*, J. Inv. Ill-Posed Problems, **19**, 2011, 107-126
48. W. Rundell and P. E. Sacks, *An inverse problem for a vibrating string with two Dirichlet spectra*, SIAM J. Appl. Math, **73**, 2013, 1020-1037
49. P. E. Sacks and M. Warma, *Semilinear elliptic and elliptic-parabolic problems with Wentzell boundary conditions and  $L^1$  data*, Disc. Cont. Dyn. Syst., **34**, 2014, 761-787
50. W. Rundell and P. E. Sacks, *Inverse eigenvalue problem for a simple star graph*, Journal of Spectral Theory, **5**, 2015, 363-380
51. T. Aktosun, P. E. Sacks and M. Unlu, *Inverse problems for selfadjoint Schrödinger operators on the half line with compactly supported potentials*, J. Math. Phys. **56**, 2015, 022106
52. M. Altunkaynak, P. E. Sacks and V. G. Yakhno, *Coefficient identification for cubically anisotropic elastic media*, Inv. Prob. Sci. Eng., **24**, 2016, 567-582
53. T. Aktosun, A. Machuca and P. E. Sacks, *Determining the shape of a human vocal tract from pressure measurements at the lips*, Inverse Problems, **33**, 2017, 115002
54. P. E. Sacks, *Transmission inverse problem with partial information about the source*, Eurasian J. Math. Comp. Appl., **7**, 2019, 94-108
55. J. Bowler, N. T. Thành and P. E. Sacks, *Evaluation of electrical conductivity and magnetic permeability variations with depth from surface voltage measurements*, Inv. Prob. Sci. Eng., **29**, 2021, 831-860
56. T. Aktosun, P. E. Sacks and X.-C. Xu, *An inverse problem to determine the shape of a human vocal tract*, Computational and Applied Mathematics, **393**, 2021, 113477
57. Y. Gao, P. E. Sacks and S. Luo, *Semiclassical approximations for space fractional Schrödinger equations: one-dimensional cases*, Comm. Appl. Math. Comp, to appear

## Published Conference Proceedings

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1. P. E. Sacks and W. W. Symes, *Uniqueness and continuous dependence for a multidimensional hyperbolic inverse problem linearized at a stratified reference* in Mathematical and Computational Methods in Seismic Exploration and Reservoir Modeling, W. Fitzgibbon ed., 272-277, SIAM, 1986
2. P. E. Sacks and W. W. Symes, *On uniqueness in the P-SV problem* in Mathematical and Computational Methods in Seismic Exploration and Reservoir Modeling, W. Fitzgibbon ed., 264-267, SIAM, 1986
3. P. E. Sacks, *Behavior near  $t = 0$  for some nonlinear diffusion equations*, in Semigroups, Theory and Applications Vol I, H. Brezis, M. Crandall and F. Kappell ed., 205-213, Pitman, 1986
4. P. E. Sacks, *Some linearized inverse problems for acoustic media* Proc. IEEE Conf. on Decision and Control, 1987, 175-177

5. P. E. Sacks, *Qualitative behavior for a class of reaction-diffusion-convection equations*, in Nonlinear Diffusion Equations and their Steady States II, W. Ni, L. Peletier and J. Serrin, eds., Springer Verlag, 1988, 245-254
6. W. Rundell and P. E. Sacks, *On the numerical determination of potentials*, in Inverse Problems in Scattering and Imaging, M. Fiddy ed., SPIE Proceedings **1767**, 1993, 31-42,
7. M. Fila and P. E. Sacks, *The transition from decay to blow-up in some reaction-diffusion-convection equations*, in Proceedings of the First World Congress of Nonlinear Analysts Vol I, V. Lakshmikantham, ed., DeGruyter, 1996, 455-463
8. M. Klibanov, P. E. Sacks and A. Tikhonravov, *The phase problem in inverse scattering*, in Differential Equations and Mathematical Physics: Proceedings of the International Conference, International Press, 1995, 179-189
9. J. R. McLaughlin, P. E. Sacks and M. Somasundaram, *Inverse scattering in acoustic media using interior transmission eigenvalues*, in Inverse Problems in Wave Propagation, G. Chavent, G. Papanicolaou, P. Sacks and W. Symes, eds., Springer-Verlag, 1997, 357-374
10. M. Yan, M. Afzal, S. Udpa, S. Mandayam, Y. Sun, P. E. Sacks and L. Udpa *Iterative algorithms for electromagnetic NDE signal inversion*, Nondestructive Evaluation (II) - Studies in Applied Electromagnetics and Mechanics, Albanese et al eds. **114**, 1998, 287-296
11. M. Munsif, A. Rothmayer and P.E. Sacks, *Magnetohydrodynamic flows in channels with cross-channel pressure interaction*, Proceedings of International Congress of Theoretical and Applied Mechanics, 2016

## Book

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1. P. E. Sacks, *Techniques of Functional Analysis for Differential and Integral Equations*, Mathematics in Science and Engineering, Elsevier, 2017

## Book Chapter

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1. P. E. Sacks, *Inverse Spectral Problems: 1-D, Algorithms*, in Encyclopedia of Applied and Computational Mathematics, B. Enquist ed., Springer, 2015, 735-740

## Edited Book and Conference Proceedings

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1. G. Chavent, G. Papanicolaou, P. E. Sacks and W. W. Symes, *Inverse Problems in Wave Propagation*, IMA Volume 90, Springer-Verlag 1997

## Ph. D. Students

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- Kurugamega Jayawardena, Ph.D. Iowa State University 1992, Thesis: *A Solution Method to a New Class of Inverse Spectral Problems*
- Thiagaraja Maheswaran, Ph. D. Iowa State University 1993, Thesis: *Recovery of a One Dimensional Impedance Profile From Transmission Data*

- Jaemin Shin, Ph. D. Iowa State University 2008, Thesis: *Inverse Scattering Problems for First-Order Systems*
- Mihaela Drignei, Ph. D. Iowa State University 2008, Thesis: *Inverse Sturm-Liouville Problems using Multiple Spectra*
- Wen Zhou, Ph. D. Iowa State University 2010 (co-advisor with B. Su), Thesis: *Mathematical Modeling of MHC Class II Mediated Immune Responses in Tissues*
- Monalisa Munsu, Ph. D. Iowa State University 2017 (co-advisor with A. Rothmayer), Thesis: *Magneto-hydrodynamic flow in closed channels*
- Leoncio Rodriguez Quinones, Ph. D. Iowa State University 2018 (co-advisor with X. H. Nguyen), Thesis: *Direct and Inverse Problems for a Schrödinger-Steklov Eigenproblem on Different Domains and Spectral Geometry for the First Normalized Steklov Eigenvalue on Domains with One Hole*

## Teaching Experience

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- College Algebra
- Calculus for Science and Engineering
- Calculus for Business
- Numerical Analysis and Scientific Computing (undergraduate level)
- Linear Algebra (undergraduate level)
- Ordinary Differential Equations (undergraduate and graduate levels)
- Partial Differential Equations (undergraduate and graduate levels)
- Real Analysis (undergraduate and graduate levels)
- Complex Analysis (undergraduate and graduate levels)
- Functional Analysis
- Methods of Applied Mathematics
- Continuous Optimization
- Fourier Analysis

## Institutional Service

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- Mathematics Department
  - Colloquium Committee, 1985-1988
  - Undergraduate Committee, 1988-1991, 2002-2005
  - Graduate Committee, 1992-1995, 2005-2011, 2012-2015 (chair 1993-1994, 2012-2014)
  - Advisory Committee, 1997-2000, 2005-2011 (chair 1998-1999, 2009-2011)

- Untenured Faculty Review and Evaluation Committee, 1989-1990,1996-1997,1999-2001, 2015-
- Tenured Faculty Review Committee, 1990-1994,1997-1999,2002-2008,2013-2015
- DEO Search Committee, 2000-2001,2007-2008,2012-2013, 2016-2017,
- Course coordinator for MATH 266/267, 2000-2005, 2014-
- Numerous written qualifying exam committees
- Numerous hiring committees
- Numerous promotion committees
- Numerous ad hoc committees
- Numerous departmental seminars organized
- College of Liberal Arts and Sciences
  - Mathematics Education Committee, 1999-2000
  - Phi Beta Kappa Membership Committee, 2008-2010
  - Academic Standards Committee 2015-2016
- University
  - Graduate Council, 1999-2002
  - Zaffarano Prize Review Committee, 2001
  - Graduate Term Membership Committee, 2002-2004 (chair 2003-2004)
  - Secretary/Treasurer Iowa State University Chapter of Sigma Xi, 2010-2015

## Other Professional Service

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- Regular reviewer for journals in mathematics and physics, funding agencies and textbook publishers
- Regular contributor to Mathematics Reviews
- (Co)-organizer for numerous seminars, conferences and sessions in conferences at ISU and elsewhere
- Ames Community Schools Mathematics Cabinet, 1998-1999
- NSF Panels, 1998, 2004
- University of Northern Iowa Department of Mathematics Advisory Board, 2004-2008
- Treasurer, Central States Section of SIAM, 2019-