

curriculum vitae
Paul E. Barbone, PhD
Associate Professor of Mechanical Engineering
Boston University

Contents

1	Contact Information	2
2	Field and Specialization	2
3	Education	2
4	Honors and Awards	3
5	Professional Positions and Experience	4
6	Professional Affiliations & Memberships	4
7	Other Professional Activities	4
7.1	Professional Society Work	4
7.2	Consulting	5
7.3	Conference Organizing	5
8	Publications	6
8.1	Book Chapters	6
8.2	Papers in Review	6
8.3	Refereed Journal Articles	7
8.4	Refereed Proceedings Articles	10
8.5	Other Proceedings Articles and Reports	11
9	Selected Presentations	13
10	Grants and Research Contracts	14
11	Mentorship	15
11.1	Junior Faculty	15
11.2	PostDoctoral Researchers	15
11.3	Graduate Students	16
12	Lecture Courses Taught	17
12.1	Boston University	17
12.1.1	Undergraduate	17
12.1.2	Postgraduate	17
12.2	Outside Boston University	17

1 Contact Information

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2 Field and Specialization

Theoretical Acoustics & Applied Mechanics: Theoretical and computational (bio-)acoustics. continuum (bio-)mechanics, inverse problems, imaging, structural acoustics, asymptotics, finite element formulations.

3 Education

Stanford University, Stanford, California	1987-1991
Ph.D. in Mechanical Engineering	December 1991
Thesis Advisor:	Professor Joseph B. Keller
Dissertation title:	“Acoustic Wave Interaction with Surfaces of Inhomogeneous Solids”

Stanford University, Stanford, California	1986-1987
M.S. in Mechanical Engineering with concentration in Solid Mechanics.	

Georgia Institute of Technology, Atlanta, Georgia	1983-1986
B.E.S.M. Bachelor’s in Engineering Science and Mechanics, <i>with High Honor.</i>	

4 Honors and Awards

- 2008 MTS Visiting Professorship, University of Minnesota, Department of Civil and Environmental Engineering, March 2008.
- 2007 Elected Fellow of *Acoustical Society of America*. For: contributions to structural acoustics and acoustical imaging.
- 2007 Physics in Medicine and Biology Highlights of 2007.
<http://www.iop.org/EJ/journal/-page=extra.highlights2007/0031-9155>
- 2006 Physics in Medicine and Biology Highlights of 2006.
<http://www.iop.org/EJ/journal/-page=extra.highlights2006/0031-9155>
- 2000 Fulbright Distinguished Scholar Award, from the *J. William Fulbright Foundation*. For: Quantitative free-hand acoustic elastography for the detection and diagnosis of breast cancer
- 2000 Elected Fellow of *Royal Society for encouragement of Arts, Manufactures and Commerce (RSA)*.
- 2000 Haddow Fellow, *Institute of Cancer Research*, London, UK. For: Quantitative free-hand acoustic elastography for the detection and diagnosis of breast cancer.
- 1999 R. Bruce Lindsay Award, from the *Acoustical Society of America*, awarded annually to member under 35 for substantial contributions to acoustics. For: ... *developing novel theoretical and computational acoustics techniques*.
- 1995 Young Investigator Award from US *Office of Naval Research*. For: *Hybrid Asymptotic-Numerical Methods in Scattering*.
- 1994 Research Initiation Award from US *National Science Foundation*. For: *Asymptotic Methods in Medical Ultrasound*

5 Professional Positions and Experience

Associate Professor 1999-present
Aerospace & Mechanical Engineering, Boston University. Boston MA

Haddow Research Fellow 2000-2001
Institute of Cancer Research & Royal Marsden Hospital, Sutton, London, UK
Collaboration on Elasticity Imaging with Jeffrey C. Bamber, Ultrasound Imaging Group, Medical Physics Department.

Assistant Professor 1994-1999
Aerospace & Mechanical Engineering, Boston University, Boston MA

Research Associate January 1992-December 1993
University of Cambridge. Cambridge, UK
Supervised by Professor David G. Crighton, Dept. Applied Mathematics and Theoretical Physics.
Worked on structural acoustics, fluid-structure interaction.

Lecturer September 1992
School for Advanced Studies in Industrial and Applied Mathematics (SASIAM). Valenzano, Italy
Lectured two-week concentrated introductory graduate level course "Partial Differential Equations".

6 Professional Affiliations & Memberships

Acoustical Society of America	Fellow (since 2007)
Acoustical Society of America.	Associate Member (since 1996)
Inverse Problems International Association	Founding Member (since 2007)
Center for Subsurface Sensing and Imaging Systems (BU/NEU/RPI)	Member (since 2000)
Royal Society for the Arts, Manufactures, and Commerce (UK)	Past Member (2000-2001)
Center for BioDynamics, Boston University	Member (since 1999)
Bioengineering, Forsyth Institute, Boston, MA	Research Affiliate (since 1998)
US Association for Computational Mechanics	Member (since 1997)
American Association for the Advancement of Science	Member (since 1997)
Society for Industrial and Applied Mathematics	Past Member (2006)
American Academy of Mechanics	Past Member (1997-2000)

7 Other Professional Activities

7.1 Professional Society Work

- Journal Acoustical Society of America Associate Editor for Ultrasonics and Physical Acoustics (since 2004)

- ASA Rep to BIROW Represent the Acoustical Society of America at Biomedical Imaging Research Opportunities Workshop planning meetings (since 2007).
- ASA Tutorials Committee Plan tutorial lectures for Acoustical Society of America (since 2007).
- National Screening Committee, Science UK, Institute of International Education, United Nations, Dec 2002, 2003, 2005.

7.2 Consulting

- Room Acoustics, Northgate Senior Center, 100 Trotter Circle, Goshen, NY 10924. 2002.
- Technical Advisory Board: Fibrasonics, 5312 N. Elston Ave., Chicago, IL 60630. 1998.
- NOVA Online: Structural mechanics of bridge design. Consulted for web-based bridge design game at www.pbs.org/wgbh/nova/bridge; see also www.pbs.org/wgbh/nova/bridge/resources.html. July 1997.

7.3 Conference Organizing

- *Session Chair*, Regularly invited to chair sessions for Forward and Inverse Problems, International Congress on Ultrasonic Imaging and Measurement of Tissue Elasticity, Annually, 2001-2007.
- *Session Chair*, Regularly invited to chair at meetings of Acoustical Society of America.
- *Inverse Problems*, Co-Organized MiniSymposium at 9th US National Congress on Computational Mechanics, San Francisco, July 2007.
- *Inverse Problems*, Co-Organized MiniSymposium at 7th US National Congress on Computational Mechanics, Albuquerque, July 2003.
- *David G. Crighton Memorial MiniSymposium* Organized the minisymposium and chaired Sessions I,II,III, 141st Mtg Acoust Soc Am., June 2001, Chicago, IL.
- *Acoustical Sensing, Imaging and Inverse Problems*, Symposium as part of International Mechanical Engineering Congress and Exposition, November 14-19, 1999, Nashville, TN. Sponsored by ASME Noise Control and Acoustics Division.
- 23rd *International Symposium on Acoustical Imaging*. Boston, MA, April 13-16, 1997. Member of Local Organizing Committee.
- *Structural Acoustics and Vibration: Wiener-Hopf Methods in Structural Acoustics*, 130th Meeting of the Acoustical Society of America, St. Louis, MO, November 27–December 1, 1995.
- *European Workshop for Young Investigators in Structural Acoustics*. University of Cambridge. Cambridge, U.K. Principal organizer and fund raiser for conference. Financially supported more than 25 near-graduation Ph.D. students to take part in this unique tutorial style workshop. June 30-July 2, 1993.

8 Publications

8.1 Book Chapters

1. "A review of the mathematical and computational foundations of biomechanical imaging," Paul E. Barbone and Assad A. Oberai. invited chapter in *Computational Methods in Biomechanics*, Ed. Suvranu De, Springer, (in review) 2008.
2. D. Givoli, P.E. Barbone and I. Patlashenko, "Recent Advances in Modal Reduction of Vibrating substructures," Chapter 20 (pp. 417-438) in *Innovation in Computational Structures Technology*, Ed. B.H.V. Topping, G. Montero and R. Montenegro, Saxe-Coburg Publications, Stirlingshire, UK, 2006.
3. Paul E. Barbone, "A theory to account for phase variation and diffraction in ultrasound image formation," *Acoustical Imaging, vol. 25: Proceedings of the 25th International Symposium on Acoustical Imaging, Bath, UK, March 2000.* pp. 317–324. M. Halliwell and P.N.T. Wells, Eds. Plenum Press, New York, 2001.
4. I. Harari, P.E. Barbone, P. Barai, M. Slavutin, and S. Shmulman, "Treffitz infinite elements for acoustic computation in unbounded domains," *Developments in Computational Mechanics with High Performance Computing* (ed. B.H.V. Topping). Civil-Comp Ltd., Edinburgh, 1999.
5. Isaac Harari, Rami Shalom, Michael Slavutin, and Paul E. Barbone, "Boundary Infinite Elements for Acoustics," *Computational Mechanics, New Trends and Applications*, CIMNE, Barcelona, 1998. E. Oñate and S.R. Idelsohn, Eds.
6. Rebecca B. Shuman and Paul E. Barbone, "Renormalized Born Inversion," pp. 641–646, *Acoustical Imaging, vol. 23.* S. Lees and L.A. Ferrari, Eds. Plenum Press, New York, 1997.

8.2 Papers in Review

7. "Quantitative ultrasonic elastography for gel dosimetry," Remo A Crescenti; Jeffrey C Bamber; Assad A Oberai; Paul E Barbone; Joseph P Richter; Carlos Rivas; Nigel L Bush; Steve Webb, **Ultrasound in Medicine and Biology**, submitted Oct. 2008.
8. "Error bounds for eigenproblems solved by Krylov Subspace Methods," Christophe Lecomte, Paul E. Barbone, and J. Gregory McDaniel. **SIAM J. Mat. Anal. Appl.**, (SIMAX), submitted September 2008.
9. "Linear and Nonlinear elasticity imaging of soft tissue in-vivo: Demonstration of feasibility," Assad A. Oberai, Nachiket H. Gokhale Sevan Goenezen, Paul E. Barbone, Timothy J. Hall, Amy M. Sommer, Jingfeng Jiang. **Phys. Med. Biol.**, submitted August 2008.
10. "Lanczos iterated time-reversal," Assad A. Oberai, Gonzalo R. Feijoo, Paul E. Barbone. **J. Acoust. Soc. Am. Express Letters**, submitted August 2008.
11. "Quantitative three dimensional elasticity imaging from quasi-static deformation: a phantom study Michael S. Richards, Paul E. Barbone, and Assad A. Oberai, **Phys. Med. Biol.**, in second review, Sept. 2008.

8.3 Refereed Journal Articles

12. "Solution of the non-linear elasticity imaging inverse problem: the compressible case," Nachiket H. Gokhale, Assad A. Oberai, Paul E. Barbone, **Inverse Problems**, 24(4), August 2008.
13. "Customization of the acoustic field produced by a piezoelectric array through inter-element delays," Parag Chitnis, Paul E. Barbone, and Robin O. Cleveland, **J. Acoust. Soc. Am.**, 123(6), June 2008, pp. 4174–4185.
14. "The spatio-temporal strain response of oedematous and non-oedematous tissue to sustained compression *in vivo*," Gearóid P. Berry, Jeffrey C. Bamber, Peter S. Mortimer, Nigel L. Bush, Naomi R. Miller, Paul E. Barbone. **Ultrasound in Medicine and Biology**, Volume 34, Issue 4, April 2008, Pages 617–629.
15. "Two error bounds for dynamic condensation methods," by Christophe Lecomte, J. Gregory McDaniel and Paul E. Barbone, **AIAA Journal**, 46(1), pp. 166–176, Jan. 2008.
16. "Adjoint weighted variational formulation for direct computational solution of an inverse heat conduction problem," Paul E. Barbone, Assad A. Oberai, and Isaac Harari, **Inverse Problems**, 23, pp. 2325–2342, 2007.
17. "Reconstructing the adhesion stiffness distribution in a laminated elastic plate: Exact and approximate inverse scattering solutions." Ricardo Leiderman, Paul E. Barbone, and Arthur M.B. Braga. **J. Acoust. Soc. Am.**, 122(4), pp. 1906–1916, Oct. 2007.
18. "The adjoint weighted equation for steady advection in a compressible fluid," A. Oberai, P. E. Barbone, and I. Harari, **Int. J. Num. Meth. in Fluids**, 54:683–693, 2007.
19. "Elastic modulus imaging: some exact solutions of the compressible elastography inverse problem," Paul E Barbone and Assad A Oberai, **Physics in Medicine and Biology**, 52, pp. 1577–1593, 2007. Included in Highlights of 2007:
<http://www.iop.org/EJ/journal/-page=extra.highlights2007/0031-9155>.
20. "Coupling between elastic strain and interstitial fluid flow: Ramifications for poroelastic imaging," R Leiderman, PE Barbone, AA Oberai, JC Bamber. **Physics in Medicine and Biology**, 51 (24), pp. 6291-6313, 2006. Included in Highlights of 2006:
<http://www.iop.org/EJ/journal/-page=extra.highlights2006/0031-9155>.
21. "Towards an acoustic model-based poroelastic imaging method: II. Experimental investigation," Gearóid P. Berry, Jeffrey C. Bamber, Naomi R. Miller, Paul E. Barbone, Nigel L. Bush, Cecil G. Armstrong **Ultrasound in Medicine and Biology**, 32(12), pp. 1869-1885, 2006.
22. "Towards an acoustic model-based poroelastic imaging method: I. Theoretical foundation." GP Berry, JC Bamber, CG Armstrong, NR Miller, PE Barbone. **Ultrasound in Medicine and Biology**, 32(4), pp. 547–567, 2006.
23. "Scattering of ultrasonic waves by defective adhesion interfaces in submerged laminated plates," Ricardo Leiderman, Paul E. Barbone and Arthur M. B. Braga, **J. Acoust. Soc. Am.**, 118(4): 2154–2166, Oct 2005.
24. "Which are the important modes of a subsystem?" Dan Givoli, Paul E. Barbone, Igor Patlashenko. **Int. J. Numer. Meth. Engng.**, 59 (12): 1657-1678, March 28 2004.

25. "Elastic modulus imaging: on the uniqueness and nonuniqueness of the elastography inverse problem in two dimensions," Paul E. Barbone, Nachiket H. Gokhale, **Inverse Problems**, 20 (1): 283-296 Feb 2004.
26. "Efficient high-order frequency interpolation of structural dynamic response," Christophe Lecomte, J. Gregory McDaniel, Paul E. Barbone, and Allan D. Pierce, **AIAA Journal** 41 (11): 2208-2215 Nov 2003.
27. "Optimal Modal Reduction of Vibrating Substructures," Paul E. Barbone, Dan Givoli, Igor Patlashenko. **Int. J. Numer. Meth. Engng.**, May 2003; 57:341-369.
28. "Quantitative Elasticity Imaging: What can and cannot be inferred from strain images," Paul E. Barbone and Jeffrey C. Bamber, **Physics in Medicine and Biology**, 47(12), 2147-2164, June 2002.
29. "Estimating Natural Frequencies and Mode Shapes from Forced Response Calculations," J.G. McDaniel, Paul E. Barbone, F. Widjaja and A.D. Pierce, **AIAA Journal**, 40(4), 758-764, April 2002.
30. "Progress in Freehand Elastography of the Breast," Jeffrey C. Bamber, Paul E. Barbone, Nigel L. Bush, David O. Cosgrove, Marvin M. Doyley, Frank G. Fuechsel, Paul M. Meaney, Naomi R. Miller, Tsuyoshi Shiina, and François Tranquart. **IEICE Trans. Inf. & Syst.**, Vol. E85-D, No. 1, pp. 5-14, January 2002.
31. "Time-Stepping Schemes for Systems of Volterra Integro-Differential Equations," Igor Patlashenko, Dan Givoli, and Paul Barbone, **Computer Methods in Applied Mechanics and Engineering**, 190:5691-5718, August 2001.
32. "Nearly H^1 -optimal Finite Element Methods," Paul E. Barbone and Isaac Harari, **Computer Methods in Applied Mechanics and Engineering**, 190:5679-5690, August 2001.
33. "Three-dimensional Infinite Elements Based on a Trefftz Formulation," Isaac Harari, Parama Barai and Paul E. Barbone, **Journal of Computational Acoustics**, Vol. 9, No. 2, pp. 381-394 June 2001.
34. "Time reversal invariance and the nonlinear absorbing wave equation," Ibrahim M. Hallaj, Robin O. Cleveland, Paul E. Barbone, Steven G. Kargl and Ronald A. Roy, **Ultrasonics**, 38:885-889 (Sept. 2000).
35. "Multiple length and time scales in acoustics," Paul E. Barbone, **Aerotecnica Missili e Spazio**, 79(3-4):65-74, 2000.
36. "Canonical representations of complex vibratory subsystems: Time domain Dirichlet to Neumann maps," Paul E. Barbone, Aravind Cherukuri and Daniel Goldman, **Internat. J. of Solids and Struct.**, vol. 37, pp. 2825-2857, 2000.
37. "Numerical and Spectral Investigations of Trefftz Infinite Elements," Isaac Harari, Parama Barai and Paul E. Barbone, **Int. J. Numer. Meth. Engng.**, Vol. 46, pp. 553-577, 1999.
38. "A Phase-Plane Description of Nonlinear Traveling Waves in Bubbly Liquids," A. Nadim, D. Goldman, J.J. Cartmell and Paul E. Barbone, **Journal of Computational Acoustics**, Vol 7(2), pp. 71-82, June 1999.

39. "Scattering from submerged objects by a hybrid asymptotic-boundary integral equation method," Paul E. Barbone and Ofer Michael, **Wave Motion**, Vol 29, pp. 137–156, 1999.
40. "Scattering by a Hybrid Asymptotic/Finite Element Method," Paul E. Barbone, Joshua M. Montgomery, Ofer E. Michael and Isaac Harari, **Computer Methods in Applied Mechanics and Engineering**, Vol. 164, Nos. 1-2, pp. 141–156, October 1998.
41. "Higher-order boundary infinite elements," Isaac Harari, Rami Shalom and Paul E. Barbone, **Computer Methods in Applied Mechanics and Engineering**, Vol. 164, Nos. 1-2, pp. 107–119, October 1998.
42. "Galerkin Formulation and Singularity Subtraction for Spectral Solutions of Boundary Integral Equations," Ofer Michael & Paul E. Barbone, **International Journal for Numerical Methods in Engineering**, Vol. 41, pp. 95–111, 1998.
43. "High Modal Density Approximations for Equipment in the Time Domain," Aravind Cherukuri and Paul E. Barbone. **Journal of the Acoustical Society of America**, vol 104(4), pp. 2048-2053, October 1998.
44. "Diffraction from simple shapes by a hybrid asymptotic-numerical method," Joshua M. Montgomery and Paul E. Barbone, **Journal of the Acoustical Society of America**, vol 104(4), pp. 1964–1972, October 1998.
45. "Boundary Infinite Elements for the Helmholtz Equation in Exterior Domains," Isaac Harari, Paul E. Barbone, Michael Slavutin and Rami Shalom, **International Journal for Numerical Methods in Engineering**, Vol. 41, pp. 1105–1131, 1998.
46. "Finite Element Formulations for Exterior Problems: Application to Hybrid Methods, Non-reflecting Boundary Conditions, and Infinite Elements," Isaac Harari, Paul E. Barbone and Joshua M. Montgomery, **International Journal for Numerical Methods in Engineering**, Vol. 40, 1997, pp. 2791–2805.
47. "Approximate Diffraction Coefficients by the Method of Matched Asymptotic Expansions," Paul E. Barbone, **Wave Motion**, Vol. 22, pp. 1-16, 1995.
48. "Stability of Harmonic Waves in a Periodic System and the Radiation Condition," Paul E. Barbone, **ASME Journal of Applied Mechanics**, Vol. 61, No. 4, pp. 980–983, 1994.
49. "Vibrational Modes of Submerged Elastic Bodies," Paul E. Barbone & D.G. Crighton, invited paper in **Applied Acoustics**, Vol. 43, pp. 295–317, 1994.
50. "Disorder and Localization in Ribbed Structures with Fluid Loading," M. Spivack & Paul E. Barbone, **Proc. R. Soc. Lond. A**, vol. 444, 73-89, 1994.
51. "Active Suppression of Radiating Wavenumbers in the Dynamic Response of Submerged Plates," Paul E. Barbone & A.M.B. Braga, **Radiofisika Journal**, Vol. 36, No. 8, pp.848–852, 1993.
52. "Suppression of Sound Reflected from a Piezoelectric Plate," A.M.B. Braga, B. Honein, Paul E. Barbone, & G. Herrmann, **J. Intel. Mat. Sys. & Struct.**, vol 3, pp. 209–223, 1992.
53. "Wave Propagation in Piezoelectric Layered Media with Applications," B. Honein, A.M.B. Braga, Paul E. Barbone, & G. Herrmann, **J. Intel. Mat. Sys. & Struct.**, vol 2, pp. 542–557, 1991.

54. "Wave Propagation in Fluid-Loaded Laminated Cylindrical Shells," A.M.B. Braga, Paul E. Barbone, & G. Herrmann, **Appl. Mech. Rev.**, vol 43, no 5, Part 2, pp. S359–S365, May 1990.
55. " N_2O_5 Photolysis: Quantum Yields for NO_3 and $O(^3P)$," A.R. Ravishankara, P.H. Wine, C.A. Smith, Paul E. Barbone, & A. Torabi, **Journal of Geophysical Research**, vol 91, no D5, pp. 5355–60, April 1986.

8.4 Refereed Proceedings Articles

56. A stabilized B-splines FEM formulation for the solution of an inverse elasticity problem arising in medical imaging, Carlos E. Rivas, Paul E. Barbone, and Assad A. Oberai. Proceedings of IMECE ASME International Mechanical Engineering Congress and Exposition October 31- November 6, 2008, Boston, MA, IMECE2008-66700, in press.
57. "Adjoint-weighted variational formulation for the direct solution of plane stress inverse elasticity problems," Paul E. Barbone, Carlos E. Rivas, Isaac Harari, Uri Albocher, Assad A. Oberai, Sevan Goenzen, to appear in **Journal of Physics: Conference Series**, 2008.
58. "Divergence of finite element formulations for inverse problems treated as optimization problems," Carlos Rivas, Paul E. Barbone, Assad A. Oberai, to appear in **Journal of Physics: Conference Series**, 2008.
59. "Time Reversal and Lanczos Iterations," Assad A. Oberai, Gonzalo R. Feijoo, Paul E. Barbone, to appear in **Journal of Physics: Conference Series**, 2008.
60. "Interaction of ultrasonic waves and imperfect adhesion layers: The inverse problem," Ricardo Leiderman, Paul E. Barbone and Arthur M.B. Braga. Inverse Problems, Design and Optimization Symposium, Rio de Janeiro, Brazil, May 2004.
61. "Simultaneous Elastic Image Registration and Elastic Modulus Reconstruction," Nachiket Gokhale, Mike Richards, Assad Oberai, Paul Barbone, and Marvin Doyley, Proceedings ISBI 2004: From Nano to Macro, IEEE 2nd International Symposium on Biomedical Imaging, 15-17 April 2004, Arlington VA. IEEE Press, 2004, pp. 543–546.
62. "Parabolic Representations of Scattering Green's Functions," Paul E. Barbone, Proc. ASME Noise Control and Acoustics Division, **1999 International Mechanical Engineering Congress**, Nashville, TN, November 14–19, 1999. ASME Press, New York.
63. "Effective Dynamical Properties," Paul E. Barbone, Proc. ASME Noise Control and Acoustics Division, No. G0 1089, **1998 International Mechanical Engineering Congress**, Anaheim, CA, November 15–20, 1998. ASME Press, New York, pg. 333–339.
64. "Dirichlet to Neumann Maps for the Representation of Equipment with Weak Nonlinearities," Daniel Goldman and Paul E. Barbone, **Proc. ASME Noise Control and Acoustics Division**, Vol. NCA22, pp. 71–76, Proceedings of the 1996 International Mechanical Engineering Congress, Atlanta, GA, November 17–22, 1996.
65. "Equipment Representations for Shock Calculations: Time Domain Dirichlet to Neumann Maps," Paul E. Barbone, BU Dept. Aerospace & Mechanical Engineering Technical Report No. AM-95-012, also in **Acoustics, Vibrations, and Rotating Machines**, Vol. 3, Part B,

pp. 223–228, Proceedings of the 1995 Design Engineering Technical Conferences, Sept. 17–20, 1995. ASME Press, New York.

66. “How Hard is a Hard Surface?” Paul E. Barbone, **Acoustic Radiation and Wave Propagation**, Proceedings of the 1994 Symposium on Structure-Sound Interaction ASME Press, New York, Sean Wu, ed. 1994.
67. “Diffraction of Acoustic Waves from Material Discontinuities,” Paul E. Barbone & Joseph B. Keller, **Flow-Structure and Flow-Sound Interactions**, Proceedings of the 1992 Symposium on Flow-Induced Vibration and Noise, ASME Press, New York, TM Farabee & MP Paidoussis, eds.

8.5 Other Proceedings Articles and Reports

The list below excludes reports which are substantially preprints of articles listed above.

68. “Imaging the Elastic Nonlinearity of Tissues,” Hall, T.; Oberai, A. A.; Barbone, P. E.; Sommer, A. M.; Gokhale, N. H.; Goenezen, S.; Jiang, J.; **IEEE Ultrasonics Symposium**, 2007. 28-31 Oct. 2007 pp:452-455.
69. “Ultrasonic Elastography and Plane Strain Inverse Algorithms for Polymer Gel Dosimetry,” Crescenti, R. A.; Bamber, J. C.; Oberai, A. A.; Barbone, P. E.; Richter, J. P.; Bush, N. L.; Webb, S.; **IEEE Ultrasonics Symposium**, 2007. 28-31 Oct. 2007 pp:2025 - 2027.
70. “Numerical Solution of Systems of Integro-differential Equations,” Igor Patlashenko, Paul Barbone and Dan Givoli, BU Dept. Aerospace & Mechanical Eng. Technical Report No. AM-99-008, June 1999.
71. “Dispersion Free Finite Element Methods for Helmholtz Equation,” Paul E. Barbone and Isaac Harari, **Proc. 16th International Congress on Acoustics and 135th Meeting Acoustical Society of America**, Vol. 1, pp. 199-200, Acoustical Society of America, 1998. P.K. Kuhl and L.A. Crum, eds.
72. “Numerical and Spectral Investigations of Novel Infinite Elements,” Parama Barai, Isaac Harari, and Paul E. Barbone, **27th Israel Conference on Mechanical Engineering**, 19-20 May 1998.
73. “Forward and Inverse Scattering in Media with Microstructure,” Rebecca B. Shuman and Paul E. Barbone, BU Dept. Aerospace & Mechanical Eng. Technical Report No. AM-98-025, May 1998.
74. “FEM, BEM, Spectral FEM or Spectral BEM?” Ofer Michael and Paul E. Barbone, BU Dept. Aerospace & Mechanical Eng. Technical Report No. AM-97-028, October 1997.
75. “Nearly H^1 Optimal Finite Element Method for the Helmholtz Equation,” Paul E. Barbone and Isaac Harari, BU Dept. Aerospace & Mechanical Eng. Technical Report No. AM-97-011, May 7, 1997.
76. “Acoustic Scattering Calculations by a Hybrid Asymptotic-Numerical Method,” Joshua M. Montgomery and Paul E. Barbone, BU Dept. Aerospace & Mechanical Engineering Technical Report No. AM-96-018, 1996.

77. "Time Domain Dirichlet to Neumann Maps for Representing Complex Dynamical Subsystems," Aravind Cherukuri and Paul E. Barbone, BU Dept. Aerospace & Mechanical Engineering Technical Report No. AM-96-017, 1996.
78. "Pressure-density relation and acoustics in bubbly liquids," Ali Nadim, Paul E. Barbone, and Daniel Goldman, BU Dept. Aerospace & Mechanical Engineering Technical Report No. AM-95-008.
79. "Use of Guided Waves for Detection of Interior Flaws in Layered Materials," Gordon G. Krauss, Julie Chen & Paul E. Barbone, **Review of Progress in Quantitative Nondestructive Evaluation**, proceedings of symposium held in Snowmass, CO, July 1994.
80. "REU Report: Dynamics of Bubble Clouds," Jeremy Milikow & Paul E. Barbone, BU Dept. Aerospace & Mechanical Engineering Technical Report No. AM-94-019, 1994.
81. "Dynamic and Stochastic Wave Research in Nizhny Novgorod, Russia," Paul E. Barbone, **European Science Notes Information Bulletin**, Office of Naval Research European Office, ESNIB 92-07, pp. 450–455, 1992.
82. "Acoustics Department, Moscow State University," Paul E. Barbone & J. Dugan, **ONR European Office Oceanography Newsletter # 35**, August 20, 1992.
83. "Wave Propagation in Piezoelectric Layered Media," B. Honein, A.M.B. Braga, Paul E. Barbone, & G. Herrmann, **Proceedings of the 2nd ISME International Symposium on the Application of Electromagnetic Forces**, J. Tani, ed., Elsevier Press, 1991.
84. "Dynamic Response of Fluid-Loaded Laminated Cylindrical Shells," A.M.B. Braga, Paul E. Barbone, & G. Herrmann, **6^o Simpósio Brasileiro Sobre Tubulações e Vasos de Pressão**, Rio de Janeiro, Brasil, December 1990.

9 Selected Presentations

I have delivered several hundred presentations, some contributed and some invited, at professional conferences and workshops. A listing of a few selected invited lectures and seminars follows.

1. "Biomechanical Imaging: Noninvasive measurement of tissue mechanical properties," Civil and Environmental Engineering, Cornell University, 24 March 2008.
2. "Lets see how you feel: Some solid mechanics inverse problems in medical imaging," Civil Engineering, University of Minnesota, 7 March 2008.
3. "Let's see how you feel: Elastic inverse problems in medical imaging," Joint Materials/Solid Mechanics Seminar, Brown University, 17 September 2007.
4. "Inverse Potential Problems with Interior Data," Workshop on a unified framework for inverse problems, Gordon-CenSSIS Center, 20 August 2007.
5. "A few inverse problems in solid mechanics," Applied Ocean Physics and Engineering Department, Woods Hole Oceanographic Institute, Woods Hole, MA, 11 April 2007.
6. "Inferring Biomechanical Properties from Quasistatic Deformations: An introduction to associated Inverse Problems." Paul Barbone, Invited Keynote Tutorial, Fourth International Conference on the Ultrasonic Measurement and Imaging of Tissue Elasticity, Austin TX, 16 October 2005.
7. "Well-posedness of an elastic inverse problem arising in medical imaging," Mathematics Department Seminar, New Jersey Institute of Technology, 5 September 2003.
8. "An elastic inverse problem in medical imaging and medical image registration: Mathematical formulation and efficient computational solution," PE Barbone and AA Oberai, Workshop on Solid Mechanics, Inverse Problems Center at RPI, March 24, 2004.
9. "If I could see what you feel: Imaging tumor biomechanical function with ultrasound," Edwin L. Steele Lab, Massachusetts General Hospital, Harvard Medical School, 27 June 2003.
10. "Elastic Modulus Imaging in Breast Cancer Management," in Advanced Imaging Techniques for Breast Tumor Detection, CenSSIS Research and Industrial Collaboration Conference, 29-30 January 2002.
11. "The vibration of infinitely complicated structures," Dept. of Applied Mathematics and Theoretical Physics, University of Cambridge, 29 January 2001.
12. "Vibration of infinitely complicated structures," Mathematics Dept., Imperial College London, 18 May 2001.
13. "The elastic inverse problem." The conference for ultrasonics in biophysics and bioengineering, Allerton Park, Monticello, IL., May 2001.
14. "Multiple length and time scales in acoustics," Paul E. Barbone, special seminar in honor of the awarding of R. Bruce Lindsay prize from Acoustical Society of America. Seminar sponsored by College of Engineering, Boston University, June 10, 1999.

10 Grants and Research Contracts

1. "3-D Visualization and Prediction of Spine Fractures," Sponsor: NIH R01, Dates TBD. PI: Elise F. Morgan. Co-Is: Glenn Barest, Assad A. Oberai, Paul E. Barbone. Award \$2,024,704
2. "Feasibility of in-vivo determination of absolute elastic tissue properties in 3D," Sponsor: NIH-NCI R21, March 2008 – Feb 2010. PI: Timothy J. Hall. Co-Is: Assad A. Oberai, Paul E. Barbone. Award: \$490,350
3. "Analysis and solution of an inverse elasticity problem arising from medical imaging," Sponsor: US-Israeli Binational Science Foundation, Oct. 2005 – Sept. 2009. BU-PIs: Assad A. Oberai & Paul E. Barbone; Israeli PI: Isaac Harari. Award: \$196,000
4. "Quantitative elasticity imaging," Sponsor: CenSSIS, under NSF ERC Program (award number EEC-9986821). Sept. 2007 - Aug. 2008. PI: Paul E. Barbone. Award: \$55,000
5. "Towards the early detection of breast cancer in young women," Sponsor: DOD CDMRP Breast Cancer Research Program, Oct. 2004 – Sept. 2006. PIs: Assad A. Oberai & Paul E. Barbone. Award: \$121,000
6. "Three dimensional elasticity imaging," Sponsor: CenSSIS, under NSF ERC Program (award number EEC-9986821). Sept. 2004 - Aug. 2006. PI: Paul E. Barbone. Award: \$110,000
7. "Elastic and Poroelastic Imaging," Sponsor: CenSSIS, under NSF ERC Program (award number EEC-9986821). Sept. 2002 - Aug. 2004. PI: Paul E. Barbone. Award: \$143,352
8. "Quantitative Free-hand Acoustic Poroelastic Imaging," Sponsor: CenSSIS, under NSF ERC Program (award number EEC-9986821). Sept. 2000 - Aug. 2002. PIs: Paul E. Barbone & J.C. Bamber. Award: \$97,065
9. "Quantitative Elastography for Breast Cancer Applications," Sponsor: NIH:1-F33-CA90045-01. Oct. 2000 - Aug. 2001. PI: Paul E. Barbone. Award: \$40,711
10. "Quantitative elasticity imaging with applications to breast cancer treatment and detection," Sponsor: J. William Fulbright Foundation. Sept. 2000 - Aug. 2001. PI: Paul E. Barbone. Award: £15,000 (approx. \$22,000)
11. "Computationally Efficient Representation of Dynamical Subsystems." Sponsor: US-Israeli Binational Science Foundation. Sept. 1998 - Sept. 2001. PIs: Paul E. Barbone and Dan Givoli. Award: \$90,690.
12. "Graduate Computing Facilities." Sponsor: United Technologies Corp. Sept. 1996 – August 1997. PI: Paul E. Barbone. Award: \$8,500.
13. "Novel Approaches to Infinite Elements." Sponsor: ONR. Duration: January 1996 – January 1999. PI: Isaac Harari. Co-PI: Paul E. Barbone. Award: \$193,854.
14. "Hybrid Asymptotic-Numerical Methods in Scattering." Sponsor: ONR. Duration: May 1995 – May 1998. PI: Paul E. Barbone. Award: \$225,000.
15. "Shock survivability of dynamical systems." Sponsor: ONR. Duration: December 1994 – December 1997. PI: Paul E. Barbone. Award: \$298,733.

16. "The Influence of Bubbles on the Propagation and Scattering of Sound near the Ocean Surface."
Sponsor: ONR. Duration: Oct. 1994 – Sept. 1996.
PI: Ali Nadim. Co-PI: Paul E. Barbone. Award: \$49,289. + AASERT Award: \$54,000
17. "Object detection near randomly rough interfaces." Sponsor: North Atlantic Treaty Organization. Duration: December 1994 - December 1997.
PI: Mark Spivack. Co-PI: Paul E. Barbone. Award: 160,000 BFr. (\approx \$6,000.)
18. "Asymptotic Methods in Medical Ultrasound." Sponsor: NSF. Duration: Sept. 1994 – August 1997. PI: Paul E. Barbone. Award: \$88,757.

11 Mentorship

11.1 Junior Faculty

We do not have a formal mentorship program in my department. Nevertheless, since earning tenure and promotion to Associate Professor, I have taken on the unofficial role of mentor to the following individuals.

- Elise F. Morgan. Assistant Professor, Aerospace and Mechanical Engineering, Boston University. She will apply for tenure and promotion in Spring 2008, and I expect her to be granted both in 2009.
- Assad A. Oberai. Associate Professor, Mechanical, Aerospace and Nuclear Engineering, Rensselaer Polytechnic Institute. Earned tenure and promotion at RPI in 2007.

11.2 PostDoctoral Researchers

- Ricardo Leiderman 2005-2007. Current position: Research Assistant Professor, Department of Mechanical Engineering, Federal University of Rio de Janeiro, Brazil.
- Daniel Goldman 1994-1996. Current position: Assistant Professor of Mathematical Sciences and Biomedical Engineering, New Jersey Institute of Technology.
- Ofer Michael 1996-1998. Currently at EMC Corporation, Irvine, CA.

11.3 Graduate Students

Name	Date	Degree	Thesis title
Carlos Rivas Aroni	pending	PhD	(tentative)Finite element formulations for inverse problems
Christophe Lecomte [†]	9/07	PhD	Analysis of condensation methods for large structural dynamic systems
Nachiket Gokhale [†]	1/07	PhD	Nonlinear elasticity imaging using the adjoint method
Michael Richards	1/07	PhD	Quantitative 3D Elasticity Imaging
Sunil S. Ahuja	9/03	MS	Low dimensional representations of flow past a cylinder
Nachiket Gokhale [†]	9/03	MS	Elasticity imaging using the adjoint method
Jerome J. Cartmell [†]	1/01	PhD	Shock Waves in Bubbly Media
Gordon G. Krauss [†]	1/99	PhD	Inspection of Bonded Composites Using Selectively Excited Ultrasonic Modes
Rebecca B. Shuman	5/98	MS	Wave Propagation and Inverse Scattering in Media with Microstructure
Gretchen H. Dougherty [†]	6/97	MS	Determination of the Interfacial Properties of a Metal Core/Polymer Shell Femoral Component
Joshua M. Montgomery	10/96	MS	Acoustic Scattering Calculations by a Hybrid Asymptotic-Numerical Method
Aravind Cherukuri	6/96	MS	Time Domain Dirichlet to Neumann Maps for representing Complex Dynamical Subsystems

[†] Co-Advised with another faculty member.

12 Lecture Courses Taught

12.1 Boston University

12.1.1 Undergraduate

1. *Mechanics of Materials*: Fall 1996, 2001, 2002, 2003, 2004, 2005, 2006.
2. *Mechanics I*: Fall 2001, 2007.
3. *Mechanics II*: Spring 1999, Fall 1999.
4. *Structural Mechanics*: Fall 1998.
5. *Introduction to Fluid Mechanics*: Spring 1995.

12.1.2 Postgraduate

1. *Theory of Elasticity*, Spring 1997, 2002, 2004, 2007
2. *Continuum Mechanics*, Fall 2007
3. *Bio-fluids and Structural Mechanics* (Multiphase continuum mechanics with applications to biomechanics), Spring 2003, 2006.
4. *Perturbation Methods in Mechanics*, Spring 1996, 1998, 2005.
5. *Diagnostic Medical Ultrasound Imaging* (co-developed and taught with T. Szabo), Spring 2000.
6. *Finite elements analysis*, Spring 2000.
7. *Vibration of Complex Systems*, Fall 1998, 1999.
8. *Dynamics*, Spring 1999.
9. *Variational Methods in Applied Math. and Mechanics*, Spring 1997.
10. *Applied Elasticity*, Fall 1994, 1995.

12.2 Outside Boston University

- *Ultrasound Elastography: Quantitative Approaches*, Invited Short Course, 2008 IEEE International Ultrasonics Symposium, Beijing, China, November 2-5, 2008, with Jeffrey C. Bamber.
- *Inferring Biomechanical Properties from Quasistatic Deformations: An introduction to associated Inverse Problems*. Invited Tutorial, Fourth International Conference on the Ultrasonic Measurement and Imaging of Tissue Elasticity, Austin TX, 16 October 2005.
- *Introduction to Partial Differential Equations*, School for Advanced Study in Industrial and Applied Mathematics, Valenzano, Italy. Two week course, Fall 1992.