

CURRICULUM VITAE
George N. Makrakis
Associate Professor

PERSONAL DATA

Date of birth: January 22, 1963
Place of birth: Atalanti, Greece
Marrital status: Married, two children

CONTACT INFORMATION

Department of Applied Mathematics
University of Crete
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RESEARCH INTERESTS

Wave propagation
Asymptotic techniques & perturbation methods
Inverse scattering
Applied partial differential equations
Mechanics, acoustics, mathematical geophysics

EDUCATION

October 1986: Diploma in Naval Architecture and Marine Engineering, National Technical University of Athens
July 1992: Ph.D. in Solid Mechanics, Department of Naval Architecture & Marine Engineering, National Technical University of Athens

ACADEMIC EMPLOYMENT

February 1986-July 1992, Research Assistant
Dept. Naval Architecture and Marine Engineering,
National Technical University of Athens, Greece

February 1994- August 1994, Visiting Lecturer
Dept. Mathematics, University of Crete, Greece

September 1994-April 1995, Research Fellow
Dept. Mathematics II, Science University of Tokyo, Japan
(funded by a Fellowship of the Japanese-German Center of Berlin)

May 1995-November 1997: Researcher (level D)
Institute of Applied & Computational Mathematics,
Foundation for Research & Technology-Hellas (FORTH)

December 1997-November 2001: Researcher (level C)
Institute of Applied & Computational Mathematics,
Foundation for Research & Technology-Hellas (FORTH)

November 2001-February 2004: Researcher (level B)
Institute of Applied & Computational Mathematics,
Foundation for Research & Technology-Hellas (FORTH)

February 2004-now: Associate Professor
Department of Applied Mathematics,
University of Crete

MILITARY SERVICE (mandatory)

July 1992-February 1994
Greek Army, Department of Artillery

PUBLICATIONS

A. Journal publications

- A1.** P.S. Theocaris and G.N. Makrakis, *The kinked crack solved by Mellin transform*, Journal of Elasticity, Vol. 16, pp. 393-411, 1986.
- A2.** P.S. Theocaris and G.N. Makrakis, *Crack kinking in anti-plane shear solved by the Mellin transform*, International Journal of Fracture, Vol. 34, pp. 251-262, 1987.
- A3.** P.S. Theocaris and G.N. Makrakis, *Caustics and quasi-conformality. A new method for the evaluation of stress singularities*, Journal of Applied Mathematics and Physics (ZAMP), Vol. 40, pp. 410-424, 1989.
- A4.** P.C. Xirouchakis and G.N. Makrakis, *Edge crack in an elastic strip on a liquid foundation*, Journal of Ship Research, Vol. 33, pp. 214-220, 1989.
- A5.** G.A. Athanassoulis and G.N. Makrakis, *A function-theoretic approach to a two-dimensional wave-body interaction problem*, Applicable Analysis, Vol. 54, No. 3-4, pp. 283-303, 1994.
- A6.** G.N. Makrakis, *Parabolic approximation of nonlocal boundary conditions in ocean acoustics*, Applicable Analysis, Vol.66, pp. 323-332, 1997.
- A7.** G.N. Makrakis, *Asymptotic study of the elastic seabed effects in ocean acoustics*, Applicable Analysis, Vol. 66, pp. 357-375, 1997.
- A8.** G.N. Makrakis and M. Yamamoto, *A transient inverse scattering problem for acoustic waveguides*, Applicable Analysis, Vol. 69, pp. 285-302, 1998.
- A9.** T. Katsaounis, G.T. Kossioris and G.N. Makrakis, *Computation of high-frequency fields near caustics*, Mathematical Methods and Models in Applied Sciences, Vol. 11, No. 2, pp. 1-30, 2001.
- A10.** S. Izumiya, G.T. Kossioris and G.N. Makrakis, *Multivalued solutions to the eikonal equation in stratified media*, Quarterly of Applied Mathematics, Vol. 59, No. 2, pp. 365-390, 2001.
- A11.** M. Ikehata, G.N. Makrakis and G. Nakamura, *Inverse boundary value problem in ocean acoustics*, Mathematical Methods in Applied Sciences, Vol. 24, pp. 1-8, 2001.
- A12.** R.P. Gilbert and G.N. Makrakis, *Low shear asymptotics for elastic seabeds*, Mathematical and Computer Modelling, Vol. 33, pp. 877-882, 2001.
- A13.** G.N. Makrakis, *Parabolic approximation of nonlocal boundary conditions for elastic seabeds*, Applicable Analysis, Vol. 77(3-4), pp. 371-382, 2001.
- A14.** E. Kalligiannaki, Th. Katsaounis and G.N. Makrakis, *High frequency waves near cusp caustics*, Quarterly of Applied Mathematics, Vol. XLI(1), pp. 111-129, 2003.
- A15.** S. Filippas and G.N. Makrakis, *Semiclassical Wigner function and geometrical optics*, SIAM Multiscale Modeling & Simulation, Vol. 1, No.4, pp.674-710, 2004.
- A16.** M. Ikehata, G.N. Makrakis and G. Nakamura, *Inverse boundary value problem for ocean acoustics using point sources*, Mathematical Methods in Applied Sciences, Vol. 27, pp. 1367-1384, 2004.

- A17.** G.N. Makrakis and E.K. Skarsoulis, *Asymptotic approximation of ocean-acoustic pulse propagation in the time domain*, , Journal of Computational Acoustics, Vol. 12,, No. 2, pp. 197-215, 2004.
- A18.** S. Filippas and G.N. Makrakis, *On the evolution of semiclassical Wigner functions in higher dimensions*. , European Journal of Applied Mathematics, Vol.17, pp. 33-62, 2006.
- A19.** G.S. Piperakis, E.K. Skarsoulis and G.N. Makrakis *Rytov approximation of tomographic receptions in weakly range-dependent ocean environments*, Journal of the Acoustical Society of America, Vol. 120, No. 1, pp. 120-134, 2006.
- A20.** E. Kalligiannaki and G.N. Makrakis, *Conservation equations for the semiclassical Schrodinger equation near caustics*, Applicable Analysis, Vol. 86, No. 8, pp. 917-944, 2007.
- A21.** K.S. Giannopoulou and G.N. Makrakis, *Uniformization of WKB functions by Wigner transform*, Applicable Analysis (to appear, 2013).
- A22.** G.N. Makrakis, *Transmutation of non local boundary conditions in ocean acoustics*, Applicable Analysis (to appear, 2013).
- A23.** S. Yu. Dobrokhotov, G. N. Makrakis, V. E. Nazaikinskii and T. Ya. Tudorovskii *New formulas for Maslov's canonical operator in a neighborhood of focal points and caustics in 2D semiclassical asymptotics*, Theoretical and Mathematical Physics (to appear, 2013).

B. Preprints

- B1.** E.K. Kalligiannaki and G.N. Makrakis, *Perturbation solutions of the semiclassical Wigner equation*
- B2.** P. Karageorge and G.N. Makrakis, *Asymptotic solutions of the phase space Schrodinger equation: Anisotropic Gaussian approximation*
- B3.** G.N. Makrakis, *Asymptotic expansion of the Faddeev-Green function in unbounded domains*

C. Publications in proceedings (selection)

- C1.** G.A. Athanassoulis and G.N. Makrakis, *An unusual wave equation arising in water-wave theory* , in Differential Equations, Lecture Notes in Pure and Applied Mathematics Vol. 118, Proceedings of the EQUADIF' 87 Conference, (Eds. Dafermos, C.M., Ladas,G., and Papanicolaou,G.), pp. 49-55., 1987.
- C2.** G.A. Athanassoulis and G.N. Makrakis, *Causality and radiation condition in free-surface hydrodynamics problems* , Proceedings of the 2nd National Congress in Mechanics, Hellenic Society for Theoretical and Applied Mechanics, 1989.
- C3.** G.N. Makrakis, *Low-frequency asymptotic expansions of the displacement and stress Green tensors for the generalized Lamb problem* , Proceedings of the 3rd National

Congress in Mechanics, Hellenic Society for Theoretical and Applied Mechanics, 1992, pp. 638-646.

C4. G.A. Athanassoulis, G.N. Makrakis and M. Papalexandris, *Numerical evaluation of half-plane Green functions for the acoustic and the modified Helmholtz equations*, Proceedings of the 3rd National Congress in Mechanics, Hellenic Society for Theoretical and Applied Mechanics, 1992, pp. 621-628.

C5. G.N. Makrakis, G. Nakamura and K. Onishi, *Boundary integral equations for low-frequency elastodynamic radiation*, Proceedings of the 6th China-Japan Symposium on Boundary Element Methods, (Eds. Q. Du, M. Tanaka and X. Ji), pp. 221-229, 1994.

C6. M. Ikehata, G.N. Makrakis, and G. Nakamura, *Inverse boundary value problem in ocean acoustics*, Proceedings of the PDE Seminar, Faculty of Science, Ibaraki University, Japan, October 1997.

C7. A.G. Ramm and G.N. Makrakis, *Scattering by obstacles in acoustic waveguides*, in *Spectral and scattering theory* (Ed. A.G. Ramm), Plenum, New York, 1998, pp. 89-110.

C8. M. Ikehata, G.N. Makrakis, and G. Nakamura, *Inverse boundary value problem for ocean acoustics*, in the *Proceedings of the 4th Hellenic-European Conference in Computer Mathematics and its Applications (HERCMA '98)* (Ed. E. A. Lipitakis), Vol.1, 1998, pp. 134-138.

C9. A.P. Blanc, G.T. Kossioris and G.N. Makrakis *Geometrical Optics and Viscosity Solutions in Numerical methods for viscosity solutions and applications* (Eds. M. Falcone & Ch. Makridakis), Series on Advances in Mathematics for Applied Sciences-Vol. 59, World Scientific, 2001.

C10. S. Yu. Dobrokhotov, G. N. Makrakis and V. E. Nazaikinski, *Fourier integrals and a new representation of Maslov's canonical operator near caustics*, to appear in the *Proceedings of the International Conference "Spectral Theory and Differential Equations (STDE-2012)" in honor of Vladimir A. Marchenko's 90th birthday*, AMS, 2014.

D. BOOKS

D1. I. Athanasopoulos, G. Makrakis and J.F. Rodrigues (Eds.), *Free boundary problems: theory and applications*, Chapman & Hall, CRC, 1999.

D2. M.I. Taroudakis and G.N. Makrakis (Eds.), *Inverse problems in underwater acoustics*, Springer-Verlag, 2001.

E. ACADEMIC WORKS

E1. G.N. Makrakis, *Evaluation of the order of stress singularity in elastic fields by the method of pseudocaustics*, Diploma Thesis, Nat. Tech. Univ. Athens, Section of Engineering Sciences, October 1985.

E2. G.N. Makrakis, *Elastic wave propagation in a half plane with a hole*, Ph.D. Thesis, Nat. Tech. Univ. Athens, Dept. Naval Arch. Marine Eng., July 1992.

PARTICIPATION IN CONFERENCES, WORKSHOPS & SEMINARS

1. G.N. Makrakis, *Numerical evaluation of the generalized Lamb-Green tensors* , Workshop on Wave Propagation Problems in Solids and Fluids, Aristotle University of Thessaloniki, November 8, 1991, Thessaloniki, Greece.
2. G.A. Athanassoulis, G.N. Makrakis and E.K. Skarsoulis, *A wave-theoretic inversion scheme for acoustic parameter identification and its application to ocean tomography* , 2nd Workshop on Wave Propagation Problems, Foundation for Research and Technology, Institute for Computational and Applied Mathematics, June 16-17, 1992, Heraklion, Crete, Greece.
3. G.N. Makrakis, *Sound propagation in a fluid layer with an elastic bottom* , Russian-Japan Symposium on Inverse and Ill-posed Problems, Tokyo Metropolitan University, September 24-25, 1994, Tokyo, Japan.
4. G.N. Makrakis, *Low-frequency diffraction by defects in an elastic half-space* , Symposium on "The fracture criterion from the mathematical point of view" , Dept. Comp. Science, Hiroshima-Denki Institute of Technology, Jan. 27-28, 1995, Kanazawa, Japan (invited talk).
5. G.N. Makrakis, *Elastic-bottom effects in ocean acoustic-wave propagation* , Conference on Inverse problems in Applied Sciences, Dept. Math., Univ. of Tokyo, Feb. 9-11, 1995, Tokyo, Japan.
6. G. Nakamura and G. N. Makrakis, *Global uniqueness for ocean acoustic tomography*, 3rd International Congress on Industrial and Applied Mathematics, July 3-8, 1995, Hamburg, Germany.
7. G.N. Makrakis, *The influence of elastic bottom in underwater sound propagation*, International Seminar "Days of Diffraction", Mathematical Institute of the Russian Academy of Sciences, June 4-6, 1996, St. Petersburg, Russia (invited talk).
8. G.N. Makrakis and M. Yamamoto, *Generalized moment problems in transient inverse scattering for acoustic waveguides* , World Congress of Nonlinear Analysts, Athens, July 10-17, 1996.
9. G.N. Makrakis and M. Yamamoto, *Integral-geometric equations for transient inverse scattering in acoustics waveguides* , 3rd Hellenic-European Conference on Mathematics and Informatics (HERMIS 96), Athens, September 26-28, 1996.
10. A.G. Ramm and G.N. Makrakis, *Scattering by obstacles in acoustic waveguides* , ISAAC Congress, Univ. Delaware, June 4-8, 1997.
11. G.N. Makrakis and M. Yamamoto, *A dynamic inverse scattering problem for acoustic waveguide* , ISAAC Congress, Univ. Delaware, June 4-8, 1997 (invited talk).
12. M. Ikehata, G.N. Makrakis, and G. Nakamura, *Uniqueness for an inverse boundary value problem in ocean acoustics*, Japan-Korea Joint Scientific Seminar on "Inverse Problems and Related Topics", Kobe Institute (St. Catherine's College, University of Oxford), Kobe , Japan, Feb. 6-10, 1998.
13. S. Izumiya, G.T. Kossioris and G.N.. Makrakis, *Canonical operators and relevant functions in multiphase geometric optics*, TMR Workshop "Hyperbolic aspects

- of moment closure problems”, Institute of Applied & Computational Mathematics, FO.R.T.H., April 1-4, 1998.
14. M. Ikehata, G.N. Makrakis and G. Nakamura, *Inverse boundary value problem for ocean acoustics using point sources*, First Workshop on ”Inverse Problems in Underwater Acoustics, Institute of Applied & Computational Mathematics, FO.R.T.H., May 17-19, 1999.
 15. E. Kalligiannaki, T. Katsaounis, G.T. Kossioris and G.N. Makrakis, *High frequency asymptotic computations for stratified acoustic waveguides*, 4th International Conference on Theoretical & Computational Acoustics, Trieste, May 10-14, 1999.
 16. G.N. Makrakis, *Asymptotic expansion of the Faddeev-Green function*, 2nd International ISAAC Congress, Fukuoka, August 15-21, 1999.
 17. Participation to the EuroSummerSchool ”*New Analytic and Geometric Methods in Inverse problems*”, and the Euroconference: *Recent Developments in the Wave Field and Diffuse Tomographic Inverse Problems*, Heriot-Watt Univ., Edinburgh, July 24-August 5, 2000.
 18. G.N. Makrakis, *Inverse scattering for acoustic waveguides*, Workshop on ”Imaging in Noisy Environments”, Institute of Applied & Computational Mathematics, FO.R.T.H., June 19-21, 2001.
 19. G.N. Makrakis and S. Filippas *High frequency energy densities via Wigner transform*, First EMS-SIAM Conference ”Applied Mathematics in our Changing World”, Berlin, September 2-6, 2001.
 20. E. Kalligiannaki, Th. Katsaounis and G.N. Makrakis, *Particle method for the Wigner equation in high-frequency propagation*, First EMS-SIAM Conference ”Applied Mathematics in our Changing World”, Berlin, September 2-6, 2001.
 21. G.N. Makrakis, *Wignerization of caustics*, Acoustics, mechanics, and the related topics of mathematical analysis (ARTMA), International Conference to celebrate R.P. Gilbert’s 70th birthday, CAES de CNRS, Frejus, France, 18-22 June, 2002.
 22. E.K. Skarsoulis, G. Piperakis and G.N. Makrakis, *Tangent linear and second order models from the Born and Rytov approximation*, 151st Meeting of the Acoustical Society of America, Providence, R.I., June 5-9, 2001.
 23. G.N. Makrakis, *Asymptotic expansion of the solution of the Wigner function near caustics*, in Wave propagation, scattering, asymptotics, 6th Int. Congress on Industrial & Applied Mathematics (ICIAM 07), Zurich, July 2007.
 24. G.N. Makrakis, *High frequency asymptotics of the Wigner equation near caustics*, Workshop on ”Computational high frequency waves, Wolfgang Pauli Institute, University of Vienna, February 26-28, 2007 (invited talk)
 25. G.N. Makrakis, *Semiclassical asymptotics of the Wigner equation near caustics*, Workshop on Applied Analysis & Fast Computations in Phase Space, Wolfgang Pauli Institute, University of Vienna, September 2-5, 2008 (invited talk)
 26. G.N. Makrakis, *Evolution of semiclassical Wigner function (the higher dimensional case)*, Workshop on Fast Computations in Phase Space, Wolfgang Pauli Institute, University of Vienna, November 2-5, 2008 (invited talk)

27. G.N. Makrakis, *Wigner transform approach to multiphase geometrical optics*, PDE Seminar. Department of Mathematics, Hokkaido University, Sapporo, Japan, March 17, 2011.
28. S.Yu. Dobrokhotov, G.N. Makrakis and V. Nazaikinskii, *Beam dynamics, focal points and Lagrangian manifolds*, Days of Diffraction 2012, St. Petersburg, May28-Jun1, 2012 (International Conference organised by St. Petersburg Department of Steklov Mathematical Institute and Euler International Mathematical Institute of the Russian Academy of Sciences).
29. G.N. Makrakis, *Uniformization by Wignerization*, Workshop on Confined quantum systems: Modeling, Analysis and Computation”, Wolfgang Pauli Institute, University of Vienna, February 4-8, 2013 (invited talk)

ORGANIZATION OF WORKSHOPS

1. Co-organizer (with M. Taroudakis, Univ. Crete) of the First Workshop on *“Inverse Problems in Underwater Acoustics”*, Institute of Applied & Computational Mathematics, FO.R.T.H., May 17-19, 1999.
2. Co-organizer (with G. Papanicolaou, Stanford Univ.) of the workshop *“Imaging in noisy environments”*, Institute of Applied & Computational Mathematics, FO.R.T.H., June 19-21, 2001.
3. Organizer of the: EMS Lectures *“Waves and transport in random media”* (by G. Papanicolaou, Stanford), Dept. Appl. Math., Univ, Crete, June 19-21, 2001.
4. Co-organizer(with C. Makridakis and A. Tzavaras) of the workshop *“Differential Equations with Applications in Science and Engineering”* (DEASE Annual Meeting), IACM-FORTH, June 2009.
5. Co-organizer (with P. Markowich, T. Paul and A. Tzavaras) of the Workshop *“Semi-classical & multi scale aspects of wave propagation”*, ACMAC, Univ. Crete, May 28-June 1, 2012.

RESEARCH GRANTS

1. *ACMAC, Archimedes Center for Modeling Analysis and Computation*, EU Programme FP7-REGPOT-2009-1, Grant Agreement number: 245749 (2010-2013).
2. (coordinator) *Modeling and Computations in Wave Propagation-MCWAVE*, Marie Curie Development Host Fellowships, EU Project No MCFH-2001-00637, Improving Human Research Potential and the Socio-economic Knowledge Base (2002-2004).
3. *SIGMA, Sediment Identification for Geotechnics by Marine Acoustics*, EU Marine Science and Technology MAST-III Programme PL96-111 (1997-2001).
4. *Viscosity solutions and their applications*, Training and Mobility of Researchers, EU Project FMRX-CT98-0234, Improving Human Research Potential and the Socio-economic Knowledge Base (1997-2000).
5. *Hyperbolic conservation laws*, Training and Mobility of Researchers, EU Project FMRX-CT96-0033, Improving Human Research Potential and the Socio-economic Knowledge Base (1996-2000).

6. (coordinator) *Asymptotic and numerical investigation of the Wigner equation for high frequency propagation near caustics*, Graduate fellowship for the PhD candidate E. Kalligiannaki, Heraklitos Research Grant 88735, funded by the Greek Ministry of Education (2005-2006).

7. *European Doctoral School in Mathematics: Differential Equations with Applications in Science and Engineering*, Marie Curie Early Stage Training multi Site (MEST) financed by the EU 6th Framework Programme, Project. DEASE: MEST-CT-2005-021122 (2005-2009)

EDUCATIONAL ACTIVITIES

A. Supervision of diploma theses

A1. E. Kalligiannaki, *Computation of high frequency fields near cusp caustics*, Dept. Math., Univ. Crete, February 1999.

A2. M. Zaxarioudaki, *Inverse scattering in stratified media. Layer stripping technique for a linear layer*, Dept. Math., Univ. Crete, June 2000.

A3. E. Fergadakis, *Numerical investigation of the Kravtsov-Ludwig system near fold caustics*, Dept. Math., Univ. Crete, September 2001.

B. Supervision of MSc theses

B1. E.K. Kalligiannaki, *Particle method for the Wigner equation in high frequency paraxial propagation*, Dept. Mathematics, Univ. Crete (2002)

B2. E.Fergadakis, *Numerical experiments with the particle method for the Wigner equation in high frequency paraxial propagation*, Dept. Mathematics, Univ. Crete (2004)

B3. S.K. Giannopoulou, *Uniformization of multiphase WKB solutions via Wigner transform*, Dept. Appl. Math. (2009)

C. Supervision of doctoral theses

C1. E.K. Kalligiannaki *Asymptotic solutions of the Wigner equation and high frequency propagation near caustics* (completed-2007)

C2. E.K. Giannopoulou, *Eigenfunction expansions of Wigner functions in phase space* (in progress)

D. Supervision of postdoctoral researchers

D1. Pedro Gonzalez (MCWAVE project, 2005) Research subject: *Optical imaging for small particles in the diffusion approximation* (current position: Universidad Carlos III de Madrid, Theoretical & Computational Biomedical Imaging Group)

D2. P. Karageorge (ACMAC project, 2010/11) Research subject: *Wave packet propagation in phase space*

E. Graduate courses (selection)

Fluid mechanics (2004, 2006), Wave propagation (2005), Methods of Mathematical Physics (2007), Methods of Applied Mathematics (2012), Wave Phenomena (2013).

F. Undergraduate courses (selection)

Approximation Theory (1994), Introduction to Optimization Theory (1995), Introduction to Fluid Mechanics (2001), Functional Analysis (1997), Introduction to Wave Phenomena (1999), Continuum Mechanics (2000/2001), Mathematical Modeling I,II (2002/2003), Introduction to statistical mechanics (2008), Classical Mechanics (2009), Physics–Mechanics (2011), Calculus I (2012). Methods of Applied Mathematics (2013), Introduction to Applied Mathematics -ODEs (2013).

ADMINISTRATIVE ACTIVITIES

Chairman, Dept. Appl. Math., Univ. Crete (Oct. 2006–Aug. 2011)

Member of the Scientific Council, IACMFORTH (2008 –now)

OTHER PROFESSIONAL ACTIVITIES

1. Reviewer for the journals: Inverse Problems, Applicable Analysis, Asymptotic Analysis, Acta Acustica, Journal of Computational Acoustics, Journal of the Acoustical Society of America, Journal of Physics A., and the publishers: Princeton University Press, SIAM, Kluwer Academic Publishers.

2. Member of SIAM(1995-), AMS(1995-), Hellenic Institute of Acoustics(2000-), Technical Chamber of Greece (1985-).