

## CURRICULUM VITAE

George N. Makrakis  
Professor

### PERSONAL DATA

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

### CONTACT INFORMATION

Department of Mathematics & Applied Mathematics  
University of Crete  
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Crete, GREECE  
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### 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

### MILITARY SERVICE (mandatory)

July 1992-February 1994  
Greek Army, Department of Artillery

### 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-December 2014: Associate Professor  
Department of Applied Mathematics,  
University of Crete

December 2014-: Professor  
Department of Mathematics & Applied Mathematics,  
University of Crete

## RESEARCH INTERESTS

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

## 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 (Published online: 08 Jul 2013, DOI:10.1080/00036811.2013.794939).
- A22.** G.N. Makrakis, *Transmutation of non local boundary conditions in ocean acoustics*, Applicable Analysis (Published online: 15 Aug 2013, DOI:10.1080/00036811.2013.829566).
- 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, Vol. 177, No. 3, pp. 1579-1605, 2013.

## **B. Preprints**

- B1.** E.K. Kalligiannaki & G.N. Makrakis, *Perturbation solutions of the semiclassical Wigner equation* (arxiv.org/abs/1402.6194)
- B2.** P. D. Karageorge & G.N. Makrakis, *Asymptotic solutions of the phase space Schrodinger equation: Anisotropic Gaussian approximation* (arxiv.org/pdf/1402.6854.pdf)
- B3.** G.N. Makrakis, *Formal asymptotic expansion of the Faddeev-Green function in unbounded domains* (arxiv.org/abs/1402.4641)
- B4.** K.-S. Giannopoulou & G.N. Makrakis, *An approximate series solution of the semiclassical Wigner equation* (arxiv.org/pdf/1705.06754.pdf)

## **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 "*Semiclassical & 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. Kaligiannaki, *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, 2007, *Asymptotic solutions of the Wigner equation and high frequency propagation near caustics* (current position: Research Scientist, Dept. AMCS, KAUST, S. Arabia)

**C2.** K.-S. Giannopoulou, 2015 *Construction of an approximate solution of the Wigner equation by uniformization of WKB functions* (current position: ERCIM Postdoctoral Fellow, Dept. Math. Sciences, NTNU, Norway)

### **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**

Fluid mechanics (2004, 2006, 2015, 2016), Wave propagation (2005), Methods of Mathematical Physics (2007), Methods of Applied Mathematics (2012), Wave Phenomena (2013), Applied Functional Analysis (2016)

### **F. Undergraduate courses**

Approximation Theory, Introduction to Optimization Theory, Introduction to Fluid Mechanics, Functional Analysis, Introduction to Wave Phenomena, Continuum Mechanics, Mathematical Modeling I & II, Introduction to statistical Mechanics, Classical Mechanics, Physics–Mechanics, Calculus I, Introduction to Applied Mathematics -ODEs, Methods of Applied Mathematics.

### **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-).