

Costas Smaragdakis

Assistant Professor, University of the Aegean

<https://kesmarag.github.io>



1 Personal Information

- Born: August 15, 1982 in Heraklion Crete, Greece.
- Marital Status: Married (Irene Kasotaki) with 2 Children (Renos b.2012, Emmy b.2016).
- Languages: Greek and English.
- Military Obligations: Fulfilled.

2 Research Interests

Computational Mathematics, Mathematical Modelling, Numerical Analysis, Deep Learning.

3 Affiliations

(Since 2024): Assistant Professor, Department of Statistics and Actuarial–Financial Mathematics, School of Sciences, University of the Aegean.

(Since 2024): Member of IDEAL Lab, DSAFM and DFME, University of the Aegean.

(Since 2022) Member of FEMO Lab, School of Applied Mathematical and Physical Sciences, National Technical University of Athens (NTUA).

4 Education

(2005) **BSc in Applied Mathematics**, Department of Applied Mathematics, University of Crete.

(2008) **MSc in Mathematical Modeling and Scientific Computing**, Departments of Mathematics and Applied Mathematics, University of Crete. (Supervisor : Michael Taroudakis)

(2019) **PhD in Applied Mathematics**, Department of Mathematics and Applied Mathematics, University of Crete. (Supervisor : Michael Taroudakis)

- PhD thesis : Acoustic Signal Characterization using Hidden Markov Models with applications in Acoustical Oceanography.

5 Past Employments

- (11) 2021/05-2022/02: Postdoctoral Researcher (TURNKEY - HORIZON), Institute of Geodynamics, National Observatory of Athens.
- (10) 2020/02-2023/09: Adjunct Faculty, Department of Mathematics and Applied Mathematics, University of Crete.
- (9) 2020/01-2020/03: Postdoctoral Researcher (KRHPIS/POLITEIA - General Secretariat for Research and Technology), IACM/FORTH.
- (8) 2019/08-2019/11: Postdoctoral Researcher (KRHPIS/PERAN - General Secretariat for Research and Technology), IACM/FORTH.
- (7) 2018/08-2019/07: Research Fellow (KRHPIS/PERAN - General Secretariat for Research and Technology), IACM/FORTH.
- (6) 2017/04-2018/04: Research Fellow (ARCHERS - Stavros Niarchos Foundation), IACM/FORTH.
- (5) 2016/01-2016/10: Research Fellow (SIEMENS - General Secretariat for Research and Technology), IACM/FORTH.
- (4) 2013/09-2015/08: Research Fellow (KRHPIS/PEFYKA - General Secretariat for Research and Technology), IACM/FORTH.
- (3) 2010/08-2015/06: Tutor for high-school students in a tuition center in Heraklion, Crete (Themelio).
- (2) 2006-2008 and 2012-2019: Teaching Assistant at Department of Mathematics and Applied Mathematics.
- (1) 2003/02-2003/06: Work Placement, Sensitivity Kernels of the Green function in Ocean Acoustic Waveguides, IACM/FORTH (Supervisor : Emmanuel Skarsoulis).

6 Publications

6.1 Preprints / Submitted for Publication

- (2) G. Akrivis, C. G. Makridakis, C. Smaragdakis: **Runge-Kutta Physics Informed Neural Networks: Formulation and Analysis**. Preprint and submitted for publication, 2024. [[arXiv:2412.20575](https://arxiv.org/abs/2412.20575)]
- (1) E.H. Georgoulis, A. Papapantoleon, C. Smaragdakis: **A deep implicit-explicit minimizing movement method for option pricing in jump-diffusion models**. Preprint and submitted for publication, 2024. [[arXiv:2401.06740](https://arxiv.org/abs/2401.06740)]

6.2 Under Preparation

- (2) Papadakis N, Taroudakis M., Dimari G, Smaragdakis C.: **A Fresh Frame of Reference on the Greek Migration Policy: Using a Pilot Prediction Model for Migration Flows to Generate Evidence-Based Policy Scenarios**.
- (1) Smaragdakis C. and Melis N.: **Near-Field Ground Motion Simulations**.

6.3 Published

- (10) Smaragdakis, C., Taroudaki, V., Taroudakis, M.I.: **Using Machine Learning Techniques in Inverse Problems of Acoustical Oceanography**. Stud Appl Math. 2024.;153:e12704
- (9) Papadakis N, Taroudakis M., Dimari G, Smaragdakis C. and Kosmadakis N.: **The Absence of a Rationalized Migration Data Policy in Greece and the Discontinuity of Greek Migration Policy: A Glance at the First Results of the PreMiGro Project**. HAPSc Policy Briefs Series, 4(2), 45–5, 2024.
- (8) Taroudaki V., Smaragdakis C. and Taroudakis M.I.: **Deblurring Acoustic Signals for Optimum Perception**. Advances in Social Sciences Research Journal, 9(11), 221–242, 2022.
- (7) Smaragdakis C., Mastrokalos J. and Taroudakis M.I.: **Statistical Characterization of Seismic Signals**. Journal of Theoretical and Computational Acoustics. DOI: 10.1142/S25917285225000-49, 2022
- (6) Smaragdakis C. and Taroudakis M.I.: **Acoustic signal characterization based on Hidden Markov Models with applications to geoacoustic inversions**. Journal of the Acoustical Society of America Vol. 148, pp 2337-2350, 2020
- (5) Smaragdakis C. and Taroudakis M.I.: **Probabilistic Characterisation of Acoustic and Seismic Signals**. ERCIM News 122, Special Theme: Solving Engineering Problems with Machine Learning, pp. 35-36, 2020.
- (4) Taroudakis M., Smaragdakis C and Chapman N.R.: **De-noising procedures for inverting underwater acoustic signals in applications of acoustical oceanography**. J. Comp. Acous. Vol. 25, pp. 1750015-1-23, 2017
- (3) Taroudakis M.I., Smaragdakis C. and Chapman, N.R.: **Inversion of acoustical data from the 'Shallow Water 06' experiment, using a statistical method for signal characterization**. Journal of the Acoustical Society of America Vol. 136, pp. EL336-EL342, 2014
- (2) Taroudakis M.I. and Smaragdakis C.: **Inversions of statistical parameters of an acoustic signal in range-dependent environments with applications in ocean acoustic tomography**. Journal of the Acoustical Society of America Vol. 134, pp 2814-2822, 2013
- (1) Taroudakis M.I. and Smaragdakis C.: **Tomographic and Bottom Geoacoustic Inversions Using Genetic Algorithms and a Statistical Characterization of the Acoustic Signal**. Acta Acustica united with Acustica Vol 95, No 5, pp 814-822, 2009

7 Conference Talks/Proceedings and Workshops

- (26) (invitation only event) Smaragdakis C.: **A deep implicit-explicit minimizing movement method for option pricing in Levy models**. 24w5257 - Modeling, Learning and Understanding: Modern Challenges between Financial Mathematics, Financial Technology and Financial Economics, Banff, Alberta, Canada, 10-15 November, 2024.
- (25) (Organizer of the minisymposium entitled Machine Learning Methods in Finance) Smaragdakis C.: **A deep implicit-explicit minimizing movement method for option pricing in jump-diffusion models**. International Conference on Computational Finance, Amsterdam, 2-5 April 2024.
- (24) (Member of the scientific committee) Smaragdakis C.: **Characterization of the migration dynamics in Greece using hidden Markov models**. Migration, Migration Flows Prediction Models and Migration Policy: trends, socio-political challenges and policy scenarios, International (online) workshop, 8 April 2024.
- (23) Dimari G., Papadakis N., Smaragdakis C., Taroudakis M.: **Migration Flows Prediction Models and their Impact on the 'Politicalness' of Everyday Lives in Host States: the PreMiGro case**. ECPR General Conference, Charles University, 4-8 September 2023, Prague.

- (22) Smaragdakis C., Papapantoleon A., Georgoulis E.: **A Splitting Deep Ritz Method for Option Pricing in Lévy Models**. Workshop: Stochastic Methods in Finance and Physics, 17-21 July 2023, Heraklion.
- (21) Smaragdakis C., Papapantoleon A., Georgoulis E.: **A Splitting Deep Ritz Method for Option Pricing in Lévy Models**. SIAM Conference on Financial Mathematics and Engineering 2023, 6-9 June, Philadelphia, USA.
- (20) Smaragdakis C., Maris I., Taroudakis M.: **Identification of normal modes in underwater acoustic propagation using convolutional neural networks**. in Proceedings of 11th Acoustic Conference of HELINA, Thessaloniki (In Greek), 2022.
- (19) Smaragdakis C., Melis N.: **Strong ground motion simulation in the near field: An application to the M7.0 Samos 2020 earthquake.**, 37th General Assembly of the European Seismological Commission, 19 - 24 September 2020, virtual.
- (18) Sambataro O., Smaragdakis C. and Taroudakis M.: **A comparison of processing techniques applied to time-frequency representation of acoustic signals intended for geoacoustic inversions**. in Proceedings e-Forum Acusticum 2020, pp 1769-1775.
- (17) Smaragdakis C., Taroudakis M.: **Acoustic Signal Characterization using Hidden Markov Models with applications in Acoustical Oceanography**. Abstract in Proceedings ICA 2019 and EAA Euroregio, 9 - 13 September 2019, Aachen, Germany, pp 5399
- (16) Smaragdakis C., Mastrolakos J. and Taroudakis M.: **Classification of acoustic and seismic signals based on the statistics of their wavelet sub-band coefficients**. The Journal of the Acoustical Society of America 144(3):1914-1914 DOI: 10.1121/1.5068386, 2018.
- (15) Taroudaki V., Taroudakis M. and Smaragdakis C.: **Statistical optimal filtering method for acoustical signal deblurring**. The Journal of the Acoustical Society of America 144(3):1689-1689 DOI: 10.1121/1.5067509, 2018.
- (14) Smaragdakis C., Taroudakis M.: **Similarity measurements of acoustical and seismic signals using Hidden Markov Models**. In Proceedings of 9th Acoustic Conference of HELINA, Patras (In Greek), 2018.
- (13) Smaragdakis C. and Taroudakis M.: **A probabilistic approach based on Hidden Markov Models for the estimation of the geoacoustic parameters of the sea bottom** 4th Underwater Acoustics Conference and Exhibition, Skiathos, Greece, 2017.
- (12) Taroudaki V., Smaragdakis C. and Taroudakis M.: **Statistical Near-Optimal Filtering Method with Application to Underwater Acoustics**. Abstract of Paper Proceedings in AMS Meetings, Vol 38 No 1, Issue 187, p 220, 2017.
- (11) Taroudaki V., Smaragdakis C. and Taroudakis M.: **Deblurring acoustic signals for statistical characterization in application of ocean acoustic tomography**. in the Journal of the Acoustical Society of America 140(4):3135-3135, 2016.
- (10) Taroudakis M. and Smaragdakis C.: **Ocean acoustic tomography using a three-phased probabilistic model-based inversion scheme**. in Proceedings of the ICA 2016, Buenos Aires.
- (9) Smaragdakis C. and Taroudakis M.: **Hidden Markov Models feature extraction for inverting underwater acoustic signals using wavelet packet coefficients**. EuroRegio2016, Porto, Portugal.
- (8) Smaragdakis C., Taroudakis M.: **Ocean acoustic tomography using a three-phased probabilistic model-based inversion scheme**. In Proceedings of the 8th Acoustic Conference of HELINA, Piraeus (In Greek), 2016.
- (7) Taroudakis M. and Smaragdakis C.: **De-noising procedures for inverting underwater acoustic signals in applications of acoustical oceanography**. in Proceedings of EuroNoise 2015 31 May - 3 June, Maastricht.

- (6) Taroudakis M. and Smaragdakis C.: **A hybrid approach for ocean acoustic tomography in range dependent environments based on statistical characterization of the acoustic signal and the identification of modal arrivals** in Proceedings of FORUM ACUSTICUM 2014 (CD edition), Krakow, Poland, 2014.
- (5) Smaragdakis C and Taroudakis M.: **Characterization of underwater acoustic signals, using a bio-mathematical model of the psycho-acoustic mechanisms of Humpback whales.** in Proceedings of 7th Acoustic Conference of HELINA, Thessaloniki (In Greek), 2014.
- (4) Taroudakis M. and Smaragdakis C.: **A hybrid approach for ocean acoustic tomography based on statistical characterization of the acoustic signal and the identification of modal arrivals.** in Proceedings of the 2nd Underwater Acoustics Conference edited by J.S. Papadakis and L. Bjorno, Rhodes, Greece, pp 691-698, 2014.
- (3) Taroudakis M. and Smaragdakis C.: **Inversions of Statistical Parameters of an Acoustic Signal in Range-Dependent Environments, with Applications in Ocean Acoustic Tomography.** in Proceedings of the 11th European Conference on Underwater Acoustics, Edinburgh, pp 962-969, 2012.
- (2) Papadakis P., Smaragdakis C., Taroudakis M. and Tolstoy A.: **Hybrid inversion techniques for geoaoustic inversion.** in Proceedings of the 9th European Conference on Underwater Acoustics, Istanbul, 2010.
- (1) Taroudakis M. and Smaragdakis C.: **Underwater Acoustic Signal Characterization in the presence of Noise.**, in Internoise 2010, CD Rom edition, Lisbon.

8 Invited Lectures / Talks / Summer-Schools

- (5) 11/09/2024 - 21th Summer Meeting in Risk, Finance and Stochastics, Athens – RFS-2024: **Deep learning methods for option pricing in jump-diffusion models.**
- (4) 19-23/06/2023 - 5th Summer School in Mathematics of Machine and Statistical Learning, National Technical University of Athens: **Hands-On Training: Learning the Black-Scholes price formula.**
- (3) 03/03/2023 - National Technical University of Athens (workshop - New Challenges in Financial Mathematics and Mathematical Economics) : **A splitting deep Ritz method for option pricing in Lévy models.**
- (2) 08/12/2021 - FORTH : **Classification of Acoustic and Seismic Signals.**
- (1) 28/04/2021 - Eastern Washington University (USA) : **Characterization of Time-Series using Hidden Markov Models.**

9 Teaching

9.1 University of the Aegean

- (1) Calculus II, (2) Differential Equations, (3) Financial Mathematics I, (4) Numerical Analysis (2 times).

9.2 University of Crete

- (1) Analytical Geometry and Complex Numbers, (2) Applied Statistics, (3) Descriptive Statistics (4 times), (4) Parametric Statistics, (5) Partial Differential Equations, (6) Topics in Probability and Statistics – Mathematical Finance, (7) Wave Propagation – Mathematical Seismology.

10 Supervision

10.1 University of the Aegean

- (1) Sofia Vlami, PhD candidate (to be started).

10.2 University of Crete

- (1) Olga Sambataro, role:Assistant mentor, Erasmus+ EQF level 7 (2019).
- (2) Pantelis Sfakianakis, Diploma thesis (2020) Applying Machine Learning Techniques for Preventive Maintenance of Professional Equipment.
- (3) Stelios Grammatikakis, Diploma thesis (2022) Statistical Analysis of Seismicity in Arkalochori.
- (4) Vassiliki Kalogera, Diploma thesis (2022) Machine Learning and Geographic Information Systems.
- (5) Dionysia Petropoulou, Diploma thesis (2022) Music genre classification using machine learning techniques.
- (6) Alvertos Poponidis, Diploma thesis (to be started).

11 Short-Term Visits

- (3) 2023/09/03-2023/09/12: Institute of Applied Mathematics, TU Delft (invited by Prof Antonis Papapantoleon)
- (2) 2023/05/24-2023/06/01: Applied Mathematics and Computational Science, KAUST (invited by Prof Raul Tempone)
- (1) 2022/12/11-2022/12/18: Institute of Applied Mathematics, TU Delft (invited by Prof Antonis Papapantoleon)

12 Technical Skills

12.1 Programming Languages

- (1) C, (2) C++, (3) EMACS Lisp, (4) Python, (5) Rust

12.2 Operating Systems

- (1) GNU/Linux (Fedora, RHEL, Gentoo)

12.3 Computer Codes

- (1) GrMot (Strong Ground Motion Library) – [link](#)
- (2) hmm-gmm-tf2 (Hidden Markov Model Library) – [link](#)
- (3) stationary-wavelet-packet-transform (Library) – [link](#)
- (4) Smaller projects in my public repository – [link](#)