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Athanasios Polimeridis

Research Interests

Research in computational methods for problems in physics and engineering.

Computational electromagnetics, Simulation and modeling for Magnetic Resonance Imaging. Simulation and modeling for quantum/thermal electromagnetic fluctuations (Casimir forces, radiative heat transfer, Raman scattering, fluorescence, spontaneous emission). Integral equation methods. Multilayered Green's functions. Multidimensional singular integrals. Inverse problems. Numerical Linear Algebra. Applied mathematics

Education

2004–2008 **Ph.D. in EECS**, *Aristotle University of Thessaloniki*, Greece.
Ph.D. Thesis: Solution of scattering and radiation problems in planar stratified media via integral equations method (in Hellenic)

1998–2003 **Diploma/M.Eng. in EECS**, *Aristotle University of Thessaloniki*, Greece.

Work Experience

2018–now **VP, Scientific Computing**, *Q Bio*, CA, USA.

2015–2018 **Assistant Professor**, *Skolkovo Institute of Science and Technology*, (Skoltech), Russia.
Principal investigator of the Computational Prototyping Group.

2012–2015 **Postdoctoral Research Associate**, *Massachusetts Institute of Technology*, (MIT), USA.
Member of the RLE Computational Prototyping Group, working with Prof. Jacob K. White. Research in computational methods for problems in physics and engineering (classical electromagnetics, quantum/thermal electromagnetic fluctuations, MRI), with emphasis on the development and implementation of integral-equation based algorithms.

2008–2012 **Postdoctoral Research Associate**, *Swiss Federal Institute of Technology*, (EPFL), Switzerland.
Member of the Laboratory of Electromagnetics and Acoustics, working with Prof. Juan R. Mosig. Research in electromagnetic field theory and related numerical techniques. Participation in several projects of the European Space Agency. Technical adviser of several doctoral candidates.

2004–2008 **Graduate Research Assistant**, *Aristotle University of Thessaloniki*, Greece.
Member of the *Applied and Computational Electromagnetics Laboratory* group.

Other Experience and Professional Memberships

2016–2018 **Advisory Board Member**, *Q.bio*, (https://q.bio), CA, USA.

Scholarships and Awards

2017 **23th Annual ISMRM meeting**, Magna Cum Laude Merit Award.
Top 15 % of accepted papers

2016 **IEEE Senior Member**.

2015 **21th Annual ISMRM meeting**, Magna Cum Laude Merit Award.
Top 15 % of accepted papers

2014 **20th Annual ISMRM meeting**, Summa Cum Laude Merit Award.
Top 3 % of accepted papers

2012 **Swiss National Science Foundation (SNSF)**, Fellowship for Advanced Researchers.

2005 **Greek State Scholarships Foundation**, Scholarship for Postgraduate Studies.

Research Projects - Grants

2016–2018 **Skolkovo Foundation**, *Skoltech-MIT Next Generation Program*.
"Next Generation Fast Methods for Medical and Nanoscale Technology".

2015–2016 **Skolkovo Institute of Science and Technology**, *Skoltech Translational Research and Innovation Program*.
"CompuLife: A simulation platform for modeling interactions of electromagnetic waves with biological tissue in next-generation MRI systems".

2012–2014 **Swiss National Science Foundation (SNSF)**, *Research Fellowships for Advanced Researchers*, Contract No. PA00P2-142060.
"Enabling technologies for next-generation MEMS-NEMS: Modeling of Casimir forces by means of surface integral equation formulations".

2010–2012 **Swiss National Science Foundation (SNSF)**, *Confederation's Innovation Promotion Agency (CTI)*, CTI-Poseidon Project/Contract No. 11568/PFIW-IW (PI. Dr. Michael Mattes).
"Development of a novel platform for the numerical analysis and synthesis of next-generation microwave devices and technologies".

2008–2012 **European Union**, *COST Action IC0803* , (PI. Dr. Michael Mattes).
"RF/Microwave communication subsystems for emerging wireless technologies (RFCSET)".

2007–2011 **European Union**, *COST Action IC0603* , (PI. Prof. Juan Mosig).
"Antenna systems & sensors for information society technologies (ASSIST)".

2009–2010 **European Space Agency (ESA)**, *ESTEC/Contract No. AO/1-5822/08/NL/ST*, (PI. Prof. Juan Mosig).
"MAST: Miniaturized multi-functional antenna system for micro/nano-satellites".

2009–2010 **European Space Agency (ESA)**, *ESTEC/Contract No. 19307/05/NL/JA*, (PI. Prof. Juan Mosig).
"POLARIS: P-Band Ice Sounding Radar Enhancement".

2005–2008 **Greek General Secretariat of Research and Technology (GSRT)**, *Research Personnel Support Programme (PENED Scholarship)*, (PI. Prof. Theodoros Tsiboukis).
"Design & Implementation of Innovative Microwave and Optical Communication Circuits".

Invited Seminars

2018 **University of Minnesota, Minneapolis, USA**, *CMRR Seminar*, April 25, *Host*: Prof. Kamil Ugurbil.
MR-specific electromagnetic modeling: From RF coil design and ultimate bounds in MRI scanners to global Maxwell tomography

2017 **ITMO University, St. Petersburg, Russia**, *MetaLab Seminar*, May 26, *Host*: Prof. Pavel Alexandrovich Belov.
Fast numerical methods in science and engineering design: From global Maxwell tomography and ultimate bounds in MRI scanners to quantum fluctuations

2016 **Russian Academy of Sciences**, *Institute of Numerical Mathematics Seminar*, April 20, *Host*: Prof. Eugene Tyrtyshnikov.
Fast numerical methods in science and engineering design: From global Maxwell tomography and ultimate bounds in MRI scanners to quantum fluctuations

Technical University of Munich, Germany, *High Frequency Engineering Seminar*, April 6, *Host*: Prof. Thomas Eibert.
Fast numerical methods in science and engineering design: From global Maxwell tomography and ultimate bounds in MRI scanners to quantum fluctuations

2014 **NYU Center for Biomedical Imaging, NY, USA**, *MRI Seminar*, September 25, *Host*: Prof. Daniel Sodickson.
Accelerated integral equation methods for the comprehensive electromagnetic analysis of magnetic resonance imaging systems

2013 **Massachusetts Institute of Technology, MA, USA**, *EECS Seminar*, October 22, *Host*: Prof. Martin Rinard.
Fast integral equation methods in engineering design: An MR Imaging case study

Massachusetts Institute of Technology, MA, USA, *Imaging and Computing Seminar*, October 3, *Host*: Prof. Laurent Demanet.
On fast volume integral equation solvers

Universidad Rey Juan Carlos, Madrid, Spain, *Applied Mathematics Seminar*, September 5, *Host*: Prof. Emanuele Schiavi.
Fast integral equation solver for EM analysis of high-field MRI

École Polytechnique Fédéral de Lausanne, Switzerland, *EE Seminar*, January 21, *Host*: Prof. Juan Mosig.
MRI-specialized fast EM solvers for patient-specific field optimization

2012 **The University of Houston, TX, USA**, *EE Seminar*, May 15, *Host*: Prof. Donald Wilton.
LEMA's contributions on computing Sommerfeld integrals

2011 **Aalto University, Finland**, *Department of Radio Science and Engineering*, April 18, *Host*: Dr. Pasi Yla-Oijala.
Fast and accurate computation of singular Galerkin impedance matrix elements in CEM

Invited Research Visits

2017 **Massachusetts Institute of Technology, MA, USA**, *Invitation by Prof. Jacob White*, July (one month).

2016 **Massachusetts Institute of Technology, MA, USA**, *Invitation by Prof. Jacob White*, September-December.

2015 **Massachusetts Institute of Technology, MA, USA**, *Invitation by Prof. Jacob White*, June (one month).

2015 **Princeton University, NJ, USA**, *Invitation by Prof. Alejandro Rodriguez*, June (one week).

2015 **NYU Center for Biomedical Imaging, NY, USA**, *Invitation by Prof. Daniel Sodickson*, June (one week).

2014 **Princeton University, NJ, USA**, *Invitation by Prof. Alejandro Rodriguez*, August (one week).

2012 **Massachusetts Institute of Technology, MA, USA**, *Invitation by Prof. Jacob White*, May (two weeks).

2012 **The University of Houston, TX, USA**, *Invitation by Prof. Donald Wilton*, May (one week).

2011 **Aalto University, Finland**, *Invitation by Dr. Pasi Yla-Oijala*, April (one week).

Teaching Experience

2015-2018 **Skolkovo Institute of Science and Technology**, MSc level.
Great Computational Methods.
Introduction to Numerical Simulation.
Computational Science and Engineering I: Modelling and Simulation.

2011 **European School of Antennas**, *PhD level*, Lausanne, Switzerland.
PhD Course on Advanced Computational Electromagnetics for Antenna Analysis.

2008–2012 **PhD Thesis Mentoring**, *École Polytechnique Fédéral de Lausanne, School of Engineering*.
Mentoring PhD thesis students working on Computational Electromacnetics.

2004–2008 **Graduate Teaching Assistant**, *Aristotle University of Thessaloniki, EECS*, MSc level.
Microwaves I, Microwaves II, Computational Electromagnetics I, Computational Electromagnetics II, Synthesis of Antennas

Professional Service

Reviewer for the following journals

IEEE Transactions on Antennas and Propagation, IEEE Transactions on Microwave Theory and Techniques, IEEE Antennas and Wireless Propagation Letters, International Journal for Numerical Methods in Engineering, Computer Modeling in Engineering and Sciences, Journal of Electromagnetic Waves and Applications, Progress in Electromagnetics Research, ET Microwaves, Antennas and Propagation, Journal of Computational and Theoretical Nanoscience

Conference organization

2017 Computational Cubism *(Convened Session Chair)*, in Progress In Electromagnetics Research Symposium, St. Petersburg, Russia

2012 Integral Equation Techniques *(Invited Session Chair)*, in EuCAP 2012, 6th European Conference on Antennas and Propagation, Prague, Czech Republic

2011 Integral Equation Techniques *(Invited Session Chair)*, in EuCAP 2011, 5th European Conference on Antennas and Propagation, Rome, Italy

Software Development

2015 **FVC**, *https://github.com/thanospol/fvc*.
Fluctuating Volume Current Matlab suite for the analysis of incandescence and luminescence in arbitrary geometries, including inhomogeneous dielectric bodies with temperature gradients or spatially varying permittivities.

2015 **MARIE**, *https://github.com/thanospol/MARIE*.
MAgnetic Resonance Integral Equation suite: a MATLAB-based open source software for the fast electromagnetic analysis of MRI systems.

2012 **DIRECTFN**, *https://github.com/thanospol/DIRECTFN*.
Fully-numerical algorithms for the evaluation of singular and near-singular integrals arising in Galerkin EM surface integral equation formulations over planar and curvilinear triangular tessellations (C codes).

2011 **DEMCEM**, *https://github.com/thanospol/DEMCEM*.
Semi-analytical algorithms for the evaluation of singular integrals arising in Galerkin EM surface integral equation formulations over planar triangular tessellations (Matlab and C codes).

Scientific Publications

Refereed Journal Articles (Google Scholar h-index = 16)

[40] I.P. Georgakis, I. I. Giannakopoulos, Mikhail S. Litsarev, and **A. G. Polimeridis**, "A fast volume integral equation solver with linear basis functions for the accurate computation of electromagnetic fields in MRI," (in preparation), 2020.

[39] I. I. Giannakopoulos, Jose E.C. Serralles, L. Daniel, D. K. Sodickson, **A. G. Polimeridis**, J. K. White, and R. Lattanzi, "Magnetic-resonance-based electrical property mapping using Global Maxwell Tomography with an 8-channel head coil at 7 Tesla: a simulation study," (submitted), 2020.

[38] I.P. Georgakis, **A. G. Polimeridis**, and R. Lattanzi, "Ultimate intrinsic transmit efficiency for radiofrequency shimming," (submitted), 2020.

[37] S. P. Groth, **A. G. Polimeridis**, and J. K. White, "Accelerating the discrete dipole approximation via circulant preconditioning," *J. Quantum Spect. Rad. Transfer*, vol. 240, Jan. 2020.

[36] Jose E.C. Serralles, I. I. Giannakopoulos, B. Zhang, C. Ianniello, M. A. Cloos, **A. G. Polimeridis**, J. K. White, D. K. Sodickson, L. Daniel, and R. Lattanzi, "Noninvasive estimation of electrical properties from magnetic resonance measurements via global Maxwell tomography and match regularization," *IEEE Trans. Biomed. Eng.*, vol. 67, no. 1, pp. 3-15, Jan. 2020.

[35] B. Fuchs, and **A. G. Polimeridis**, "Reduced-order models for fast antenna characterization," *IEEE Trans. Antennas Propag.*, vol. 67 no. 8, pp. 5673-5677, Aug. 2019.

[34] S. P. Groth, **A. G. Polimeridis**, A. Tambova, and J. K. White, "Circulant preconditioning in the volume integral equation method for silicon photonics,"*JOSA A*, vol. 36, no. 6, pp. 1079-1088, Jun. 2019.

[33] I. I. Giannakopoulos, M. S. Litsarev, and **A. G. Polimeridis**, "Memory footprint reduction for the FFT-based volume integral equation method via tensor decompositions," *IEEE Trans. Antennas Propag.*, vol. 67, no. 12, pp. 7476-7486, Dec. 2019.

[32] M. T. Homer Reid, O. D. Miller, **A. G. Polimeridis**, A. W. Rodriguez, E. M. Tomlinson, and S. G. Johnson, "Photon Torpedoes and Rytov Pinwheels: Integral-Equation Modeling of Non-Equilibrium Fluctuation-Induced Forces and Torques on Nanoparticles," (submitted), 2018.

[31] A. Tambova, S. P. Groth, J. K. White, and **A. G. Polimeridis**, "Adiabatic absorbers in photonics simulations with the volume integral equation method," *J. Lightw. Technol.*, vol. 36, no.17, pp. 3765-3777, Sep. 2018.

[30] A. C. Yucel, I. P. Georgakis, **A. G. Polimeridis**, H. Bagsi, and J. K. White, "VoxHenry: FFT-accelerated inductance extraction for voxelized geometries," *IEEE Trans. Microw. Theory and Techniques*, vol. 66, no. 4, pp. 1723-1735, Apr. 2018.

[29] A. Tambova, M. Litsarev, G. Guryev, and **A. G. Polimeridis**, "On the generalization of DIRECTFN for singular integrals over quadrilateral patches," *IEEE Trans. Antennas Propag.*, vol. 66, no. 1, pp. 301-314, Jan. 2018.

[28] B. Guerin, J. F. Villena, **A. G. Polimeridis**, E. Adalsteinsson, L. Daniel, J. K. White, B. R. Rosen, and L. L. Wald, "Computation of the ultimate electromagnetic hyperthermia treatment performance in non-uniform body models: Impact of treatment frequency and tumor location" *International Journal of Hyperthermia*, 34 (1):87-100 2018.

[27] B. Guerin, J. F. Villena, **A. G. Polimeridis**, E. Adalsteinsson, L. Daniel, J. K. White, and L. L. Wald, "The ultimate signal-to-noise ratio in realistic body models" *Magn. Reson. Med*, 78 (5): 1969-1980, 2017. **[This paper has been selected to appear on the cover of MRM]**

[26] W. Jin, C. Khandekar, A. Pick, **A. G. Polimeridis**, and A. W. Rodriguez, "Amplified and directional spontaneous emission from arbitrary composite bodies: a self-consistent treatment of Purcell effect below threshold," *Phys. Rev. B 93: 125415*, 2016.

[25] W. Jin, **A. G. Polimeridis**, and A. W. Rodriguez, "Temperature control of thermal radiation from heterogeneous bodies," *Phys. Rev. B 93: 121403(R)*, 2016.

[24] O. D. Miller, **A. G. Polimeridis**, M. T. H. Reid, , C. W. Hsu, B. G. Delacy, J. D. Joannopoulos, M. Soljacic, and S. G. Johnson, "Fundamental limits to the optical response of lossy media," *Optics Express, 24 (4): 3329-3364*, 2016.

[23] J. F. Villena, **A. G. Polimeridis**, Y. Eryaman, E. Adalsteinsson, L. L. Wald, J. K. White, and L. Daniel, "Fast electromagnetic analysis of MRI transmit RF coils based on accelerated integral equation methods," *IEEE Trans. Biomed. Eng.*, vol. 63, no. 11, pp. 2250-2261, 2016. **[This paper has been selected to appear on the cover of IEEE TBM]**

[22] **A. G. Polimeridis**, M. T. H. Reid, W. Jin, S. G. Johnson, J. K. White, and A. W. Rodriguez, "Fluctuating volume-current formulation of electromagnetic fluctuations in inhomogeneous media: incandescence and luminescence in arbitrary geometries," *Phys. Rev. B 92: 134202*, 2015.

[21] **A. G. Polimeridis**, M. T. H. Reid, S. G. Johnson, J. K. White, and A. W. Rodriguez, "On the computation of power in volume integral equation formulations," *IEEE Trans. Antennas Propag.*, vol. 63, no. 2, pp. 611-620, Feb 2015.

[20] A. Hochman, J. F. Villena, **A. G. Polimeridis**, L. Daniel, and J. K. White, "Reduced order models for electromagnetics," *IEEE Trans. Antennas Propag.*, vol. 62, no. 6, pp. 3150-3162, June 2014.

[19] **A. G. Polimeridis**, J. F. Villena, L. Daniel, and J. K. White, "Stable FFT-JVIE solvers for fast analysis of highly inhomogeneous dielectric objects," *Journal of Computational Physics*, vol. 269, pp. 280-296, 2014.

[18] R. M. Golubović, **A. G. Polimeridis**, and J. R. Mosig, "The weighted averages method for semi-infinite range integrals involving products of Bessel functions," IEEE Trans. Antennas Propag., vol. 61, no. 11, pp. 5589-5596, Nov. 2013.

[17] **A. G. Polimeridis**, F. Vipiana, J. R. Mosig and D. R. Wilton, "DIRECTFN: Fully numerical algorithms for high precision computation of singular integrals in Galerkin SIE methods," *IEEE Trans. Antennas Propag.*, vol. 61, no. 6, pp. 3112-3122, Jun. 2013.

[16] J. Kataja, **A. G. Polimeridis**, J. R. Mosig and P. Ylä-Oijala, "Analytical shape derivatives of the MFIE system matrix discretized with RWG functions," *IEEE Trans. Antennas Propag.*, vol. 61, no. 2, pp. 985-988, Feb. 2013.

[15] **A. G. Polimeridis**, S. Järvenpää, P. Ylä-Oijala, L. J. Gray, S. P. Kiminki and J. R. Mosig, "On the evaluation of hyper-singular double normal derivative kernels in surface integral equation methods," *Engineering Analysis with Boundary Elements*, vol. 37, no. 2, pp. 205-210, 2013.

[14] **A. G. Polimeridis**, I. D. Koufogiannis, M. Mattes and J. R. Mosig, "Considerations on double exponential-based cubatures for the computation of weakly singlar Galerkin inner products," *IEEE Trans. Antennas Propag.*, vol. 60, no. 5, pp. 2579-2582, May 2012.

[13] R. M. Golubović, **A. G. Polimeridis**, and J. R. Mosig, "Efficient algorithms for computing Sommerfeld integral tails," *IEEE Trans. Antennas Propag.*, vol. 60, no. 5, pp. 2409-2417, May. 2012.

[12] **A. G. Polimeridis**, and J. R. Mosig, "On the direct evaluation of surface integral equation impedance matrix elements involving point singularities,"*IEEE Antennas Wireless Propag. Lett.*, vol. 10, no. 6, pp. 599-602, 2011.

[11] **A. G. Polimeridis**, J. M. Tamayo, J. M. Rius and J. R. Mosig, "Fast and accurate computation of hyper-singular integrals in Galerkin surface integral equation formulations via the direct evaluation method," *IEEE Trans. Antennas Propag.*, vol. 59, no. 6, pp. 2329-2340, Jun. 2011.

[10] S. L. Peña, **A. G. Polimeridis**, and J. R. Mosig, "On the analytic-numeric treatment of weakly singular integrals on arbitrary polygonal domains," *Progress In Electromagnetics Research*, vol. 117, pp. 339-355, 2011.

[9] R. M. Golubović Nićiforović, **A. G. Polimeridis**, and J. R. Mosig, "Fast computation of Sommerfeld integral tails via direct integration based on double exponential type quadrature formulas," *IEEE Trans. Antennas Propag.*, vol. 59, no. 2, pp. 694-699, Jun. 2011.

[8] **A. G. Polimeridis**, R. M. Golubović Nićiforović, and J. R. Mosig, "Acceleration of slowly convergent series via the generalized weighted-averages method," *Progress In Electromagnetics Research M*, vol. 14, pp. 233-245, 2010.

[7] **A. G. Polimeridis**, and J. R. Mosig, "Complete semi-analytical treatment of weakly singular integrals on planar triangles via the direct evaluation method," *Int. J. Numerical Methods Eng.*, vol. 83, pp. 1625-1650, 2010.

[6] **A. G. Polimeridis**, and J. R. Mosig, "Evaluation of weakly singular integrals via generalized Cartesian product rules based on the double exponential formula," *IEEE Trans. Antennas Propag.*, vol. 58, no. 6, pp. 1980-1988, Jun. 2010.

[5] **A. G. Polimeridis**, and T. V. Yioultsis, "On the direct evaluation of weakly singular integrals in Galerkin mixed potential integral equation formulations," *IEEE Trans. Antennas Propag.*, vol. 56, no. 9, pp. 3011-3019, Sep. 2008.

[4] **A. G. Polimeridis**, and T. V. Yioultsis, "On the efficient computation of closed-form Green's functions in planar stratified media," *International J. of RF and Microw. CAE*, vol. 18, no. 2, pp. 118-126, 2008.

[3] **A. G. Polimeridis**, T. V. Yioultsis, and T. D. Tsiboukis, "A robust method for the computation of Green's functions in stratified media," *IEEE Trans. Antennas Propag.*, vol. 55, no. 7, pp. 1963-1969, Jul. 2007.

[2] **A. G. Polimeridis**, T. V. Yioultsis, and T. D. Tsiboukis, "Fast numerical computation of Green's functions for unbounded planar stratified media with a finite-difference technique and Gaussian spectral rules," *IEEE Trans. Microw. Theory and Techniques*, vol. 55, no. 1, pp. 100-107, Jan. 2007.

[1] **A. G. Polimeridis**, T. V. Yioultsis, and T. D. Tsiboukis, "An efficient pole extraction technique for the computation of Green's functions in stratified media using a sine transformation," *IEEE Trans. Antennas Propag.*, vol. 55, no. 1, pp. 227-229, Jan. 2007.

Refereed Conference Proceedings

>50 conference papers (>20 since 2016)