

Camille Carvalho

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CURRENT POSITION

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| Associate Professor <i>Institut Camille Jordan, team MMCS</i> | INSA Lyon, France 01/2022 – Present |
| Assistant Researcher <i>Applied Math Department</i> | University of California Merced, USA 01/2023 – Present |

EDUCATION

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| PhD in Applied Mathematics <i>ENSTA Paris, France</i> <ul style="list-style-type: none">Title: Mathematical and numerical study of plasmonic structures with corners.Advisors: Anne-Sophie Bonnet-Ben Dhia, Patrick Ciarlet. Funded by ENSTA Paris and DGA (Direction Générale de l'Armement) | 10/2012 – 12/2015 |
| Master's degree in Applied Mathematics <i>Sorbinne Université, France</i> <ul style="list-style-type: none">Partial Differential Equations and Numerical Analysis. Master with honors. | 2011 – 2012 |
| Engineer diploma <i>ENSTA Paris, France</i> <ul style="list-style-type: none">Mathematics and Simulation. | 2009 – 2012 |

RESEARCH EXPERIENCE

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| Assistant Professor <i>Applied Math Department</i> | 07/2018 – 12/2022 <i>University of California Merced, CA, USA</i> |
| Visiting Assistant Professor <i>Applied Math Department</i> | 07/2016 – 06/2018 <i>University of California Merced, CA, USA</i> <ul style="list-style-type: none">Research on close evaluation for layer potentials. Collaboration with Arnold Kim and Shilpa Khatri |
| Postdoctoral researcher <i>CMAP - INRIA team Defi</i> | 01/2016 – 06/2016 <i>Ecole Polytechnique, France</i> <ul style="list-style-type: none">Contour integrations for the Interior Transmission Eigenvalue Problem.Advisors: Lucas Chesnel and Houssein Haddad. Funded by the METAMATH ANR. |

TEACHING EXPERIENCE

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| Lecturer at INSA de Lyon <i>Math first year</i> <i>P2I7: numerical modeling, math module</i> <i>P2I8: signal processing, math module</i> <i>MNTES: mathematical and numerical tools for engineers</i> <i>SGM-3: Math (Fourier and Laplace transforms)</i> <i>Math first year</i> | 01/2022 – Present <i>Spring 2022, 2023</i> <i>Spring 2023</i> <i>Spring 2022, 2023</i> <i>AY 2022</i> <i>Fall 2022</i> <i>Spring 2022</i> |
| Lecturer at the University of California Merced <i>Instructor of record (72h per course)</i> <i>Math 122: Complex Analysis (upper division, 45 students)</i> <i>Math 150: Mathematical Modeling (upper division, 30 students)</i> <i>Math 298: Boundary Integral Equations (graduate, 10 students)</i> <i>Math 24: Differential Equations and Linear Algebra (lower division, 150 students)</i> <i>Math 131: Numerical Methods for Engineers and Scientists (upper division, 150 students)</i> <i>Math 23: Vector Calculus (lower division, 120 students)</i> | 07/2016 – 12/2021 <i>Fall 2021, 2019</i> <i>Spring 2021, 2020, 2019</i> <i>Fall 2020</i> <i>Fall 2020</i> <i>Fall 2017, Spring 2018</i> <i>Fall 2016, 2017, Spring 2017</i> |

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| Quadratic optimization | 2012 – 2016 |
| Stability and Control of dynamical systems | 2013 – 2015 |
| Complex analysis | 2013 – 2015 |

PUBLICATIONS

Peer-reviewed journals

* indicates corresponding author, + indicates students and postdocs

1. A.-S. BONNET-BEN DHIA, C. CARVALHO, L. CHESNEL*, AND P. CIARLET JR, *On the use of perfectly matched layers at corners for scattering problems with sign-changing coefficients*, Journal of Computational Physics, 322 (2016), pp. 224–247
2. C. CARVALHO, L. CHESNEL*, AND P. CIARLET JR, *Eigenvalue problems with sign-changing coefficients*, Comptes Rendus Mathematique, 355 (2017), pp. 671–675
3. A.-S. BONNET-BEN DHIA, C. CARVALHO, AND P. CIARLET*, *Mesh requirements for the finite element approximation of problems with sign-changing coefficients*, Numerische Mathematik, 138 (2018), pp. 801–838
4. C. CARVALHO, S. KHATRI*, AND A. D. KIM, *Asymptotic analysis for close evaluation of layer potentials*, J. Comput. Phys., 355 (2018), pp. 327–341
5. P. SAKKAPLANGKUL⁺, V. A. BOKIL, AND C. CARVALHO*, *A fully fourth order accurate energy stable finite difference method for maxwell's equations in metamaterials*, IEEE Journal on Multiscale and Multiphysics Computational Techniques, 4 (2019), pp. 260–268
6. C. CARVALHO*, S. KHATRI, AND A. D. KIM, *Asymptotic approximations for the close evaluation of double-layer potentials*, SIAM J. Sci. Comput., 42 (2020), pp. A504–A533
7. S. KHATRI*, A. D. KIM, R. CORTEZ, AND C. CARVALHO, *Close evaluation of layer potentials in three dimensions*, Journal of Computational Physics, 423 (2020), p. 109798
8. C. CARVALHO*, A. D. KIM, L. LEWIS⁺, AND Z. MOITIER⁺, *Quadrature by Parity Asymptotic eXpansions (QPAX) for scattering by high aspect ration particles*, SIAM Multiscale Modeling and Simulation, 19 (2021), pp. 1857–1884
9. C. CARVALHO*, *Modified representations for the close evaluation problem*, Mathematical and Computational Applications, 21 (2021), p. 69
10. C. CARVALHO*, P. CIARLET, AND C. SCHEID, *Limiting amplitude principle and resonances in plasmonic structures with corners: numerical investigation*, Computer Methods in Applied Mechanics and Engineering, 388 (2022), p. 114207
11. C. CARVALHO AND Z. MOITIER^{+,*}, *Scattering resonances for unbounded transmission problems with sign-changing coefficient*, IMA Journal of Applied Mathematics, (accepted, 2023)

Peer-reviewed Conference Proceedings

12. A.-S. BONNET-BEN DHIA, C. CARVALHO*, L. CHESNEL, L. CHESNEL, P. CIARLET JR, AND X. CLAEYS, *Plasmonic cavity modes with sign-changing permittivity*, WAVES Tunis, (2013)
13. A.-S. BONNET-BEN DHIA, C. CARVALHO*, L. CHESNEL, AND P. CIARLET JR, *Plasmonic cavity modes: Black-hole phenomena captured by perfectly matched layers.*, PIERS Proceedings, (2013)
14. A.-S. BONNET-BEN DHIA*, C. CARVALHO, C. CHAMBEYRON, L. CHESNEL, P. CIARLET JR, A. NICOLLET, AND F. ZOLLA, *Curious energy losses at corners of metallic inclusions*, WAVES Karlsruhe, (2015)
15. A.-S. BONNET-BEN DHIA, C. CARVALHO*, AND P. CIARLET JR, *Plasmonic waveguides: Tcoercivity approach for maxwell's equations*, WAVES Karlsruhe, (2015)

16. C. CARVALHO*, S. KHATRI, AND A. D. KIM, *Local analysis of near fields in acoustic scattering*, WAVES Minneapolis, (2017)
17. C. CARVALHO*, A. D. KIM, AND Z. MOITIER, *Quadrature by parity asymptotic expansions (qpax) for light scattering by high aspect ratio plasmonic particle*, in WAVES, 2022
18. C. CARVALHO, A. KIM, AND B. LATHAM*+, *Capturing plasmonic behaviors in light scattering by spheres using finite element methods and asymptotic quadrature*, in WAVES, 2022
19. C. CARVALHO, A. KIM, AND C. MCCULLOUGH*+, *Asymptotic analysis for sound-hard acoustic scattering by two closely-situated spheres*, in WAVES, 2022
20. C. CARVALHO, E. A. CORTES*+, AND C. TSOGKA, *Boundary integral equation methods for optical cloaking models*, in WAVES, 2022
21. M. BUSSONNIER* AND C. CARVALHO, *Papyri: better documentation for the scientific ecosystem in jupyter*, in 21st Python in Science Conference (SciPy), 2022, pp. 75–82

Thesis

22. C. CARVALHO, *Mathematical and numerical study of plasmonic structures with corners*, Ph.D, (2015)

Software

23. C. CARVALHO*, *Subtraction_techniques* doi:10.5281/zenodo.3934284, 2020
24. Z. MOITIER* AND C. CARVALHO, *Asymptotic_metacavity* doi:10.5281/zenodo.4716362, 2021
25. —, *Scattering_BIE_QPAX*, doi:10.5281/zenodo.4692601, 2021

TALKS

International Conferences

- Quadrature by Parity Asymptotic eXpansions (QPAX) for light scattering by high aspect ratio plasmonic particle, SIAM CSE23, Amsterdam, 2023
- Quadrature by Parity Asymptotic eXpansions (QPAX) for light scattering by high aspect ratio plasmonic particle, WAVES, Palaiseau, 2022
- On the use of Perfectly Matched Layers for light scattering problems in plasmonic structures, CIRM, Marseille, 2022
- Subtraction techniques for the close evaluation of layer potentials, SIAM CSE, Spring 2021
- The Singular Complement Method for dielectric-metamaterial transmission problems, MAFELAP, London, 2019
- Asymptotic approximations for transmission boundary-value problems in plasmonic structures, EMTS, San Diego, 2019
- The Singular Complement Method for scattering problems in plasmonic structures, PIERS, Toyama, 2018
- Multiscale modeling to capture near-fields in plasmonic structures, SIAM AN18, Portland, 2018
- Mesh requirements for transmission problems with sign-changing coefficients, SIAM PD17, Baltimore, 2017
- Local analysis of near fields in acoustic scattering, WAVES, Minneapolis, 2017
- Plasmonic waveguides: T-coercivity approach for Maxwell's equations, WAVES, Karlsruhe, 2015
- Leaky modes in a closed plasmonic waveguide, Leaky Days, Palaiseau, France, 2015
- Leaky modes in a non dissipative plasmonic waveguide with a bounded cross section, OWTNM, Nice, France, 2014
- Revealing guides modes in a plasmonic waveguide using Perfectly Matched Layers at the corners, KOZWaves, Newcastle, Australia, 2014
- Plasmonic cavity modes: black-hole phenomena captured by Perfectly Matched Layers, PIERS, Stockholm, Sweden, 2013
- Plasmonic cavity modes with sign changing permittivity, WAVES, Tunis, Tunisia, 2013

Seminars and invited talks

- Numerical methods for the close evaluation of layer potentials in three dimensions, UML-UNC Computational Math seminar, 2022
- Quadrature by Parity Asymptotic eXpansions (QPAX) for light scattering by high aspect ratio particle, MMCS team day, France, 2022
- Accurate evaluation of near-fields in plasmonic structures, Institut Camille Jordan, France, 2022
- Accurate evaluation of near-fields in plasmonic structures, University of Nice, 2021
- Accurate evaluation of near-fields in plasmonic structures, Fresnel Institute, 2020
- Limiting amplitude principle for plasmonic structures, UC Merced, 2020
- Close evaluation of layer potentials in three dimensions, FSU, 2020
- Subtraction techniques for the close evaluation of layer potentials, UC Merced, 2020
- Boundary integral methods for optical cloaking, UC Merced, 2019
- How to accurately compute near-fields in plasmonic structures, Portland State University, 2019
- Accurate evaluation of near-fields in plasmonic structures, Caltech, 2019
- Capturing near-fields in plasmonic structures with corners, BASCD, Livermore, 2018
- Asymptotic approximations of near fields in scattering problems, Tulane University, New Orleans, 2018
- The Singular Complement Method in plasmonics, INRIA Sophia-Antipolis, Nice, 2018
- Multiscale modeling to capture near-fields in plasmonic structures, ICERM, Brown, 2018.
- Close evaluation of layer potentials, Université de Rennes, France, 2018
- Multi-scale modeling to compute near-fields in plasmonic structures with corners, UC Merced, CA, 2017
- Mathematical and numerical study of plasmonic structures with corners, Oregon State University, OR, 2017
- Mathematical and numerical study of plasmonic structures with corners, UC Merced, CA, 2016
- Mesh requirements for transmission problems with sign-changing coefficients, University of Reims, 2015
- Leaky modes in a closed plasmonic waveguide, Leaky Days, Palaiseau, France, 2015
- Fredholm theory and T-coercivity, ENSTA, Palaiseau, 2014

MENTORING

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| Postdoctoral researchers | 2018 – Present |
| <i>Zoïs Moitier (Asymptotics for metamaterial cavities)</i> | 11/2019 – 10/2020 |
| Graduate students | 2018 – Present |
| <i>(PhD students and M.S. students)</i> | |
| <i>Benjmain Latham (PhD, Finite element methods for plasmonic particles in 3D)</i> | 08/2019 – Present |
| <i>Cory McCullough (PhD, co-advised, Boundary integral methods for acoustic radiation forces)</i> | 05/2020 – Present |
| <i>Elsie Cortes (PhD, co-advised, Boundary integral equations for optical cloaking)</i> | 08/2020 – Present |
| <i>Lori Lewis (M.S., co-advised, Asymptotic for boundary integrals in regions of high curvature)</i> | 08/2018 – 05/2020 |
| Undergraduate students | 2017 – Present |
| <i>(Summer internships and semester independent research studies)</i> | |
| <i>Elsie Cortes (Boundary integral methods for scattering)</i> | 08/2018– 12/2019 |
| <i>Bianca Garibay (Nyström methods for Laplace’s equation)</i> | 08/2018 – 12/2018 |
| <i>Barbara Gomez-Aldrete (UROC, co-advised, Trapezoïd rule for Poisson problems)</i> | 05/2018 – 08/2018 |
| <i>Jacob Stehle (co-advised)</i> | 05/2017 – 08/2017 |
| Tutoring at ENSTA ParisTech | 2012 – 2015 |
| <i>Mentor for 15 students each year</i> | |

SERVICES

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| NSF panel review <i>Participated in a review panel for the NSF DMS Applied Math program.</i> | 2021 NSF |
| Lecturer supervisor <i>Observing and evaluating lecturers.</i> | 2020 – Present UC Merced |
| On-campus WSTEM faculty advisor <i>Advising the student organization for Women in Science Technology Engineering and Math</i> | 2019 – Present UC Merced |
| Chair of the WSTEM faculty affairs committee <i>Organize monthly panel discussions about WSTEM issues</i> | 2019 – Present UC Merced |
| Co-founder and co-organizer of the Waves seminar <i>Bi-weekly seminars about wave propagation phenomena</i> | 2018 – Present UC Merced |
| Co-organizer of mini-symposia at international conferences <i>Conferences ICIAM 19, SIAM CSE 19, SIAM CSE 21</i> | 2019 – Present |
| Reviewer for peer-reviewed journals <i>J. Comp. Phys., SIAM J. Appl. Math., ESAIM M2AN, SIAM J. Imag. Sci.</i> | 2018 – Present |
| Member of doctoral committees <i>Member of six doctoral committees</i> | 2018 – Present UC Merced |
| Chair of the Applied Math social events <i>Applied Math Weekly, Mid-semester receptions, Coffe Hour</i> | 2018 – Present UC Merced |
| Member of a hiring committee for a teaching faculty <i>Member for two searches</i> | 2018 – 2020 UC Merced |
| Co-founder and co-organizer of the Boundary integral equation research seminar <i>Bi-weekly seminars about integral methods</i> | 2018 – 2020 UC Merced |
| Chair of a postdoctoral hiring search | 2019 UC Merced |
| Member of the graduate recruitment and admissions committee <i>Member for two recruitment sessions</i> | 2017 – 2019 UC Merced |
| Applied Math seminar <i>Co-organizer of the department's seminar</i> | 2018 UC Merced |

CURRENT AND PENDING FUNDING

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| PI, NSF Applied Math DMS-2009366(\$295k) <i>A novel Finite Element Toolbox for Interface Phenomena in Plasmonics</i> | 08/2020 – 07/2023 Single PI |
| PI, NSF Computational Mathematics DMS-1819052(\$200k) <i>Close evaluation of layer potentials</i> | 08/2018 – 07/2021 Co-PIs: S. Khatri, A. D. Kim |
| PI, UC Merced Senate Research Grant (\$5,000) <i>Asymptotic methods for plasmonic problems</i> | 08/2020 – 07/2021 Co-PI: Z. Moitier |
| PI, AWM-NSF Travel Award (\$1,930) <i>Travel award to attend the 13th International WAVES conference in Minneapolis</i> | 2017 |