

Camille Carvalho

University of California, Merced
Applied Math
Email: ccarvalho3@ucmerced.edu
Website: <http://camillecarvalho.org/>

Research Interests

Partial Differential Equations, Waves propagation, Electromagnetism, Scattering, Metamaterials and Plasmonics, Modelling, Numerical Analysis, Simulation and Scientific Computing, Finite Elements Method, Spectral theory, waveguides, PMLs, Kondratiev theory, Singularities, Boundary integral methods, Asymptotics

Education

PhD, *Magna cum laude*, École Nationale de Techniques Avancées (ENSTA), 2015.

Major: Applied Mathematics

Dissertation Title: Mathematical and numerical study of plasmonic structures with corners

Advisor: Bonnet-Ben Dhia, A.-S., Ciarlet, P.

MS, *Honors*, Université Pierre et Marie Curie (UMPC), 2012.

Major: Applied Mathematics

Dissertation Title: Partial Differential Equations and Numerical Analysis

Advisor: Hazard, C.

Engineer diploma with mathematical engineering education, Engineer School ENSTA ParisTech, 2012.

Major: Simulation and Modeling

Professional Positions

Assistant Professor, Applied Mathematics, Applied Math, University of California, Merced (2018-2019).

Post-doc, CMAP École Polytechnique, team DEFI, France (METAMATH grant). (2016).

Numerical investigation of interior transmission eigenvalues (work with L. Chesnel and H. Haddar).

Visiting Assistant Professor, Applied Mathematics, Applied Math, University of California, Merced (2016-2018).

Professional Memberships

SIAM. (2017 - Present).

WINASc. (2017 - Present).

Awards and Honors

DGA (Direction Générale de l'Armement) Ph.D fellowship. (October 2012 - September 2015).

Prestigious research fellowship from Defense Ministry for 3 years. Equivalent to an Air Force fellowship.

ENSTA ParisTech Ph.D fellowship, ENSTA. (October 2012 - September 2015).

PhD. fellowship for three years, includes some teaching portion.

RESEARCH

Intellectual Contributions

Journal Articles

9. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chesnel, L., Ciarlet, P. (2016). On the use of Perfectly Matched Layers at corners for scattering problems with sign-changing coefficients. *Journal of Computational Physics*, 322, 224-247. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2016). [Full text of this item is available](#)

Khatri, S., Kim, A. D., Cortez, R., **Carvalho, C.**, Close evaluation of layer potentials in three dimensions. Publisher - Journal of Computational Physics. (Current Status: Revising to Resubmit; Date Re-Submitted- 2019, Date Submitted - July 2018).

Carvalho, C., Khatri, S., Kim, A. D. Asymptotic approximations for the close evaluation of double-layer potentials. *SIAM Journal of Scientific Computing*. (Current Status: Submitted; Date Re-Submitted- April 2019, Date Submitted - October 2018).

Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Ciarlet, P., Jr. (2018). Mesh requirements for the finite element approximation of problems with sign-changing coefficients. 1-38. Publisher - Numerische Mathematik. (Current Status: Published; Date Published - April 2018). [Full text of this item is available](#)

Carvalho, C., Khatri, S., Kim, A. D. (2018). Asymptotic analysis for close evaluation of layer potentials. *Journal of Computational Physics*, 355, 327-341. (Current Status: Published; Date Published - February 2018). [Full text of this item is available](#)

Carvalho, C., Chesnel, L., Ciarlet, P., Jr. (2017). Eigenvalue problems with sign-changing coefficients. *Comptes Rendus Mathématiques*, 355, 671-675. (Current Status: Published; Date Published - June 2017). [Full text of this item is available](#)

Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chesnel, L., Ciarlet, P., Jr. (2013). Plasmonic cavity modes: black-hole phenomena captured by Perfectly Matched Layers. *PROCEEDING of PIERS 2013 in Stockholm*, 638-642. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2013).

Other Published Writings

10. **Carvalho, C., Khatri, S., Kim, A. D.** (2017). Local analysis of near fields in acoustic scattering. In *WAVES*. Minneapolis, USA. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2017). [Full text of this item is available](#)
8. **Carvalho, C.** (2015). *Etude mathématique et numérique de structures plasmoniques avec coins*. Ecole Polytechnique. Publisher - Ecole Polytechnique. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2015).
7. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chambeyron, C., Chesnel, L., Ciarlet, P., Jr., Nicolet, A., Zolla, F. (2015). Curious energy losses at corners of metallic inclusions. In *WAVES*. Karlsruhe, Germany. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2015).
6. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Ciarlet, P., Jr. (2015). Plasmonic waveguides: T-coercivity approach for Maxwell's equations. In *WAVES*. Karlsruhe, Germany. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2015). [Full text of this item is available](#)
5. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chesnel, L., Ciarlet, P., Jr. (2013). Plasmonic cavity modes: black-hole phenomena captured by Perfectly Matched Layers. In *PIERS*. Stockholm, Sweden. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2013).
4. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chesnel, L., Ciarlet, P., Jr., Claeys, X. (2013). Plasmonic cavity modes with sign changing permittivity. In *WAVES*. Tunis, Tunisia. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2013).
3. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chesnel, L., Ciarlet, P., Jr., Demkowicz, L. (2013). Numerical approximation of transmission problems with sign changing coefficients. In *JSA*. Rennes. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2013).
2. Bonnet-Ben Dhia, A.-S., **Carvalho, C.**, Chesnel, L., Ciarlet, P., Jr., Claeys, X., Nazarov, S. A. (2013). Negative materials and corners in electromagnetism. In *Report No.3/2013 of Mathematisches Forschungsinstitut Oberwolfach "Computational Electromagnetism and Acoustics"*. Oberwolfach. (Current Status: Published; Date of Prior Status - June 30, 2018, Date Published - 2013).

Presentations Given

- Carvalho, C., MAFELAP 2019, "The Singular Complement Method for dielectric-metamaterial transmission problems," London, UK. (June 2019).
- Carvalho, C., EMTS 2019, "Asymptotic approximations for transmission boundary-value problems in plasmonic structures," San Diego. (May 2019).
- Carvalho, C., Seminar, "Accurate evaluation of near-fields in plasmonic structures," University of Delaware. (May 2019).
- Carvalho, C., AMS Spring Western and Central Regional Meeting, "Asymptotic approximations of near-fields in plasmonic structures," Hawaii, CA. (March 2019).
- Carvalho, C., Seminar, "Accurate evaluation of near-fields in plasmonic structures," Caltech, CA. (January 2019).
- Carvalho, C., BASCD, "Capturing near-fields in plasmonic structures with corners," Sandia National Lab, Livermore. (December 2018).
- Carvalho, C., Seminar, "Asymptotic approximations of near fields in scattering problems," Tulane University, New Orleans. (November 2018).
- Carvalho, C., INRIA seminar, "The Singular Complement Method in plasmonics," INRIA Sophia-Antipolis. (September 2018).
- Carvalho, C., PIERS, "The Singular Complement Method for scattering problems in plasmonic structures," Toyama. (August 2018).
- Carvalho, C., SIAM AN 18, "Multiscale modeling to capture near-fields in plasmonic structures," Portland. (July 2018).
- Carvalho, C., ICERM Workshop, "Multiscale modeling to capture near-fields in plasmonic structures," Brown. (June 2018).
- Carvalho, C., Seminar, "Close evaluation of layer potentials," Rennes University, France. (January 2018).
- Carvalho, C., SIAM PD 17, "Mesh requirements for transmission problems with sign-changing coefficients," Baltimore. (December 2017).
- Carvalho, C., WAVES, "Local analysis of near fields in acoustic scattering," Minneapolis. (May 2017).
- Carvalho, C., Seminar, "Multi-scale modeling to compute near-fields in plasmonic structures with corners," UC Merced, CA. (February 2017).
- Carvalho, C., Colloquium, "Mathematical and numerical study of plasmonic structures with corners," Oregon State University, OR. (January 2017).
- Carvalho, C., "Mathematical and numerical study of plasmonic structures with corners," UC Merced, CA. (January 2016).
- Carvalho, C., Leaky Days, "Leaky modes in a closed plasmonic waveguide," Palaiseau, France. (2015).
- Carvalho, C., Seminar, "Mesh requirements for transmission problems with sign-changing coefficients," University of Reims. (2015).
- Carvalho, C., WAVES, "Plasmonic waveguides: T-coercivity approach for Maxwell's equations," Karlsruhe. (2015).
- Carvalho, C., "Fredholm theory and T-coercivity," ENSTA, Palaiseau. (2014).
- Carvalho, C., KOZ-Waves, "Revealing guides modes in a plasmonic waveguide using Perfectly Matched Layers at the corners," Newcastle, Australia. (2014).
- Carvalho, C., OWTNM, "Leaky modes in a non dissipative plasmonic waveguide with a bounded cross section," Nice, France. (2014).
- Carvalho, C., PIERS, "Plasmonic cavity modes: black-hole phenomena captured by Perfectly Matched Layers," Stockholm, Sweden. (2013).
- Carvalho, C., WAVES, "Plasmonic cavity modes with sign changing permittivity," Tunis, Tunisia. (2013).

Contracts, Grants and Sponsored Research

Grant

- Carvalho, Camille (Principal Investigator), Khatri, Shilpa (Co-Principal Investigator), Kim, Arnold D (Co-Principal Investigator), "Close evaluation of layer potentials," NSF - National Science Foundation, \$200,000.00. (August 2018 - 2021).

Carvalho, Camille (Principal Investigator), "REU Supplement for Grant "Close evaluation of layer potentials", " NSF - National Science Foundation, \$10,000.00.

Carvalho, Camille, "AWM-NSF Travel Grant," NSF - National Science Foundation, \$1,930.00. (2017).

Carvalho, Camille (Co-Principal Investigator), Khatri, Shilpa (Co-Principal Investigator), Kim, Arnold D (Principal Investigator), "OP: Multiscale modeling and simulation of light scattering by metal nano-particles over a substrate," NSF - National Science Foundation.

Professional Service

W-STEM faculty affairs committee, Officer, Merced, CA, USA, Appointed, Help strengthen the mentorship program organized by the student organization, wrote a case development to seek fundings, organized several gathering to foster community. (July 2018 - Present).

Boundary Integral Equation Research Group (BIER), Co-Organizer. (January 2018 - Present).

Journal of Computational Physics, Journal Article Reviewer. (2017 - Present).

SIAM journal on Imaging Sciences (SIIMS), Journal Article Reviewer. (2017 - Present).

Mini-symposium ICIAM 2019, Co-Organizer, 3 sessions are organized. (2019).

SIAM CSE Mini-symposium, Co-Organizer. (2019).

Postdoc search committee, Chair, 20 applications received, one successful candidate selected. Hiring paperwork currently in progress. (March 2019 - June 2019).

Faculty Equity Inclusion group work, Participant. (2018).

TEACHING

Teaching Experience

University of California, Merced

Spring, 2019

MATH 150, Mathematical Modeling. (Spring 2019)

MATH 195, Upper Div Undergrad Research. (Spring 2019)

Fall, 2018

MATH 291, Applied Mathematics Seminar. (Fall 2018)

MATH 295, Graduate Research. (Fall 2018)

Spring, 2018

MATH 131, Numerical Methods Sci & Engr. (Spring 2018)

MATH 291, Applied Mathematics Seminar. (Spring 2018)

Fall, 2017

MATH 131, Numerical Methods Sci & Engr. (Fall 2017)

MATH 23, Vector Calculus. (Fall 2017)

Spring, 2017

MATH 23, Vector Calculus. (Spring 2017)

Fall, 2016

MATH 23, Vector Calculus. (Fall 2016)

Other Courses Taught

ENSTA, Teaching Assignments, Quadratic optimization (3x15h), Stability and control of dynamic systems (2x15h), Complex analysis (3x15h), (occasionally Finite Elements Method (4h) and Discretization of PDE's (4h)), Tutoring activity for students with difficulties in applied mathematics. (2012)

ENSTA, Teaching Assignments, Quadratic optimization (3x15h), Stability and control of dynamic systems (2x15h), Complex analysis (3x15h), (occasionally Finite Elements Method (4h) and Discretization of PDE's (4h)), Tutoring activity for students with difficulties in applied mathematics. (2013)

ENSTA, Teaching Assignments, Quadratic optimization (3x15h), Stability and control of dynamic systems (2x15h), Complex analysis (3x15h), (occasionally Finite Elements Method (4h) and Discretization of PDE's (4h)), Tutoring activity for students with difficulties in applied mathematics. (2014)

ENSTA, Teaching Assignments, Quadratic optimization (3x15h), Stability and control of dynamic systems (2x15h), Complex analysis (3x15h), (occasionally Finite Elements Method (4h) and Discretization of PDE's (4h)), Tutoring activity for students with difficulties in applied mathematics. (2015)

ENSTA, Teaching Assignments, Quadratic optimization (10h). (Spring 2016)

Directed Individual/Independent Study

August 2018 - December 2018, Bianca Garibay, Advisor Independent study during the semester, worked on new numerical methods for boundary-value problems with boundary integral equations.

May 2018 - August 2018, Xiaolong Chen, Advisor Independent study, learning about surface plasmons, how to derive their expression using Maxwell's equations.

Doctoral Committee

May 2019 - Present, Eunji Yoo, Member Qualifying exam date will be planned this summer.

December 2018 - Present, Fabian Santiago, Member

August 2018 - April 2019, Majerlee Reeves, Advisor Academic advisor for the first year.

Internship

June 2019 - Present, Elsie Cortes, Advisor Develop a code to solve acoustic scattering problem in layered media using boundary integral equations methods.

May 2018 - August 2018, Barabara Gomez-Aldrete, Co-Advisor Undergraduate research through the UROC program, co-advised with Pr. Blanchette. Work on implementing random walks to simulate marine snow aggregates. The student presented a poster at the UROC research mini symposium.

Barbara is a UC LEADS scholar.

Master's Thesis Committee

May 2019 - Present, Lori Lewis, Advisor Master's student working on asymptotic methods to solve boundary-value problems in elongated geometries using boundary integral equation methods. Co-advising with Pr. A.D. Kim

Other

January 2019 - May 2019, Lori Lewis, Ashley De Luna, Jackie Alvarez, Supervisor Weekly meetings to prepare for the calculus preliminary exam. Supervised exercises, discussion of specific topics and corrections.

September 2018 - May 2019, Sandeep Koranne, Mentor Master's student of collaborator Pr. Bokil (Oregon State University). Discussed regularly the project, checked the student's code and report.

2012 - 2015, Mentor Mentor for first-year students at ENSTA

Approximately 15 students each year.

Undergraduate Research Supervision

August 2018 - May 2019, Elsie Cortes, Advisor Worked 2 semesters with me (the second semester she received course units). Study and implementation of Rayleigh-Benard convections. This includes studying and approximating Lorenz system using Runge-Kutta methods.

June 2017 - August 2017, Jacob Stehle, Co-Advisor Co-advised with Pr. Khatri, worked on implementing quadrature rule to solve Laplace's equation using boundary integral methods. Reading course about Stokes problem.

SERVICE

Department Service

Member, Graduate recruitment and admission committee. (September 2018 - May 2019).

Member, LPSOE Hiring committee. (October 2018 - April 2019).

Member, Fellowship Review Committee. (2018).

Member, Graduate recruitment and admission committee. (December 2017 - May 2018).

University Service

Advisor, Applied Math Major Faculty Advising. (2019 - Present).

Mentor, W-STEM mentor. (July 2018 - Present).

Attendee, Learn at lunch. (2019).

Secretary Officer, W-STEM at University of California of Merced. (2016 - June 2018).

Organizer, Social events for the Applied Maths Unit of ENSTA. (2012 - 2015).

Volunteer, Applied Maths Unit of ENSTA at the Science festival. (2013 - 2014).

President, "Arts en Scène" association. (2009 - 2010).

Public Service

Panelist, Dinner with a Scientist. (2018).