Ornella Mattei

Curriculum vitae

Department of Mathematics
San Francisco State University
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Research interests

Space-time microstructures and field patterns; Inverse problems; Bounds on the overall properties of composites; Variational methods for time-dependent problems; Characterization of truss structures under tension.

Education

2016 **PhD in Methods and Mathematical Models for Engineering**, University of Brescia, Italy. Thesis title: *On bounding the effective response of viscoelastic composites in the time domain: The variational approach and the analytic method.* Advisor: Angelo Carini, Co-advisor: Graeme W. Milton. Referees: John R. Willis, Davide Bigoni, Jean-Baptiste Leblond;

2012 **Master Degree in Civil Engineering**, University of Brescia, Italy.

2010 **Bachelor Degree in Civil Engineering**, University of Brescia, Italy.

Professional Appointments

2019- **Assistant Professor**, Department of Mathematics, San Francisco State University, USA.

2018-2019 **Postdoctoral Research Associate**, Department of Mathematics, University of Utah, USA.

2017-2018 **Associate Instructor**, Department of Mathematics, University of Utah, USA.

2016-2018 **Visiting Postdoctoral Scholar**, Department of Mathematics, University of Utah, USA.

2013-2016 **PhD Candidate**, Department of Civil, Environmental, Architectural Engineering and Mathematics, University of Brescia, Italy.

Grants, Awards and Fellowships

- **NSF Grant** DMS-942514985 for the project RUI: Time-dependent composites and inverse problems, August 2020-July 2023;
- **2020 PUMP (Preparing Undergraduates through Mentoring towards Phds) Grant** to support two undergraduate students (Diana Madrigal and Kenny Kong, SFSU) with a $3,000 stipend each, to work on the project *Wave propagation in dynamic materials* during the 2020/2021

academic year, funded by the National Science Foundation grant DMS-1916494 grant (PI: Jordan Schettler, San José State University, Co-PI: Cynthia Flores, CSU Channel Islands);

- **2019 AWM Travel Grant** to participate in the *Workshop New trends and challenges in the mathematics of optimal design*, June 10-14, 2019, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, funded by the Association for Women in Mathematics, USA;
- **2018 Early Career Travel Award** to participate in the *SIAM Conference on Mathematical Aspects of Materials Science*, July 9-13, 2018, Portland, Oregon, USA, funded by the National Science Foundation, USA;
- **2018 Outstanding Postdoc Award**, funded by the Department of Mathematics, University of Utah, USA;
- **Fellowship** to participate in the *6th Midwest Women in Mathematics Symposium*, April 7, 2018, Purdue University, West Lafayette, Indiana, USA, funded by the National Science Foundation;
- **Fellowship** to participate in the IMA Workshop in *Liquid Crystals, Metamaterials, Transformation Optics, Photonic Crystals, and Solar Cells*, February 27 - March 2, 2018, funded by the Institute for Mathematics and its Applications (IMA), Minneapolis, Minnesota, USA;
- **Fellowship** to participate in the IMA Workshop in *Novel Optical Materials*, March 13-17, 2017, funded by the Institute for Mathematics and its Applications (IMA), Minneapolis, Minnesota, USA;
- **Fellowship** to participate in the IMA Annual Thematic Program in *Mathematics and Optics*, September 2016-December 2016, funded by the Institute for Mathematics and its Applications (IMA), Minneapolis, Minnesota, USA;
- **Fellowship** to participate in the Alghero Summer School on *Elastic Metamaterials: From Theory to Applications*, May 22-29, 2016, Alghero, Italy, funded by LIA Coss&Vita, Italy & France;
- **Scholarship** to participate in the CISM-ECCOMAS International Summer School on *Modelling, Simulation and Characterization of Multi-Scale Heterogeneous Materials*, September 28-October 2, 2015, Udine, Italy, funded by CISM, Italy;
- **Scholarship** to participate in the *Workshop on Interdisciplinary Mathematics*, May 8-10, 2015, Williamsport, Pennsylvania, USA, funded by PennState University, USA;
- **PhD scholarship** for the academic years 2013/2014, 2014/2015, 2015/2016 funded by the University of Brescia, Italy.

Visits

1/2020	**Visiting Faculty** (1 week) at the Department of Mathematics, KAIST, Daejeon, South Korea. Collaborator: Mikyoung Lim;
1/2020	**Visiting Faculty** (1 week) at the Department of Mechanical Engineering, Technion, Israel. Collaborator: Gal Shmuel;
7/2019	**Visiting Faculty** (2 weeks) at the Department of Mathematics, KAIST, Daejeon, South Korea. Collaborator: Mikyoung Lim;
7/2017	**Visiting Postdoctoral Scholar** (2 weeks) at the Department of Mathematics, KAIST, Daejeon, South Korea. Collaborator: Mikyoung Lim;
9/2016-12/2016	**Visiting Postdoctoral Scholar** (3 months) at the Institute for Mathematics and its Applications (IMA), Minneapolis, Minnesota, USA;

1/2015-6/2015	**Visiting PhD student** (6 months) at the Department of Mathematics, University of Utah, USA. Advisor: Graeme W. Milton;
11/2013	**Visiting PhD student** (3 weeks) at the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK. Advisor: John R. Willis.

Teaching Experience

San Francisco State University (Principal Instructor):

- **Math 470-Mathematical Modeling**, Fall 2020.
- **Math 477/777-Partial Differential Equations**, Spring 2020.
- **Math 226-Calculus I**, Fall 2019 and Spring 2020.
- **Math 245-Elementary Differential Equations and Linear Algebra**, Fall 2019 and Fall 2020.

University of Utah (Principal Instructor):

- **Math 2250-Differential Equations and Linear Algebra**, Spring 2019.
- **Math 3150-PDEs for Engineers**, Spring 2018 and Fall 2018.
- **Math 1060-Trigonometry**, Fall 2017 and Spring 2018.

Undergraduate Mentoring Experience

- **Advisor of the PUMP project** *Wave propagation in dynamic materials*, Diana Madrigal and Kenny Kong, San Francisco State University, 2020/2021;
- **Advisor of the Summer Undergraduate Research Project** *Wave propagation in functionally graded spatio-temporal materials*, Jenny Diaz, San Francisco State University, 2020;
- **Advisor of the Applied Mathematics Project (I)** *Active chiral fluids*, Ryan Krieger, San Francisco State University, 2020;
- **Advisor of the Applied Mathematics Project (I)** *On bounding the effective properties of viscoelastic composites in time*, Henry Guerrero-Duarte, San Francisco State University, 2020;
- **Advisor of the Applied Mathematics Project (I and II)** *Wave propagation in functionally graded spatio-temporal materials*, Timothy Wolfe, San Francisco State University, 2020;
- **Co-advisor of the Bachelor Degree thesis** *Analytic solutions for the stress state due to bending in sandwich beams: effects of the deformability of the core* (in Italian), P. Bossini, 2014. Advisor: L. Bardella, University of Brescia, Italy;
- **Co-advisor of the Bachelor Degree thesis** *Application of the Newmark model to the analysis of timber-concrete composite beams characterized by variable stud spacing and concentrated loads* (in Italian), G. Pretti, 2014. Advisor: L. Bardella, University of Brescia, Italy.

Outreach Experience

- **Undergraduate Colloquium**: O. Mattei, *The Mathematics of Rainbows*, January 23, 2019, Department of Mathematics, University of Utah, USA;
- **Undergraduate Colloquium**: O. Mattei, *The Mathematics of Rainbows*, November 29, 2018, Department of Mathematics, University of Utah, USA;
- **Undergraduate Colloquium**: O. Mattei, *Waves in strings*, November 29, 2017, Department of Mathematics, University of Utah, USA;

Service as an organizer

Upcoming:

- **Minisymposium organizer** (together with Aaron Welters, Robert Viator and Christian Kern), 2020 SIAM Conference on Mathematical Aspects of Materials Science, May 18-22, 2020, Bilbao, Spain. Minisymposium: *Frontiers in nonreciprocity, metamaterials, and non-symmetric effective tensors.*

Past:

- **Minisymposium organizer** (together with Aaron Welters and Elena Cherkaev), 11th International Conference of Electrical, Transport, and Optical Properties on Inhomogeneous Media, July 16-20, 2018, Krakow, Poland. Minisymposium: *Herglotz-Nevanlinna Function Theory and its Applications.*
- **Minisymposium organizer** (together with Aaron Welters), 2018 SIAM Conference on Mathematical Aspects of Materials Science, July 9-13, 2018, Portland, Oregon, USA. Minisymposium: *Applications of Herglotz-Nevanlinna Function Theory to Electromagnetics, Composites, and Dirichlet-to-Neumann maps.*
- **Local organizing committee member** of the International Symposium IUTAM 2012: *Fracture phenomena in nature and technology*, July 1-5, 2012. University of Brescia, Italy.

Service as a reviewer

Reviewer for the Proceedings of the Royal Society A, the Journal of the Mechanics and Physics of Solids, and the European Journal of Mechanics A/Solids.

Service as a committee member

San Francisco State University (Department of Mathematics):

- **Student Affairs Committee**, Spring 2020;
- **Scholarships Committee**, Spring 2020;
- **Math Department Graduation Ceremony Organizing Committee**, Spring 2020.

Seminars

Upcoming:

1. **Waves Seminar**, TBD, UC Merced, USA;

Past:

1. **Applied Mathematics Seminar**, January 8, 2020, KAIST, Daejeon, South Korea;
2. **Mechanical Engineering Seminar**, January 15, 2020, Technion, Israel.
3. **Applied Mathematics Seminar**, September 11, 2017, University of Utah, USA;
4. **Applied Mathematics Seminar**, July 18, 2017, KAIST, Daejeon, South Korea;
5. **IMA Annual Program Seminar**, November 16, 2016, IMA, University of Minnesota, USA;
6. **Geomechanics Seminar**, October 7, 2016, University of Minnesota, USA;
7. **Applied Mathematics Seminar**, April 13, 2015, University of Utah, USA.

Invited Talks at Conferences

Upcoming:

1. **SIAM Conference on Mathematical Aspects of Materials Science**, Minisymposium: *Soft materials: patterns, instabilities, and controlled deformations*, May 24-29, 2021, Bilbao, Spain;
2. **SIAM Conference on Mathematical Aspects of Materials Science**, Minisymposium: *Variational Models: Theory, Computations, and Applications to Materials*, May 24-29, 2021, Bilbao, Spain;
3. **Workshop on Herglotz-Nevanlinna functions and their applications to dispersive systems and composite materials**, June 7-11, 2021, CIRM, Marseille, France.

Past:

1. **Workshop on Herglotz-Nevanlinna Theory Applied to Passive, Causal and Active Systems**, October 6-11, 2019, Banff International Research Station for Mathematical Innovation and Discovery, Banff, Alberta, Canada;
2. **Workshop on Topology and broken symmetries: from driven quantum matter to active metamaterials**, July 1-3, 2019, Utrecht, The Netherlands;
3. **Workshop on Non-reciprocal and Topological Wave Phenomena in Solids and Fluids**, May 29-31, 2019, University of Missouri in Columbia, MO, USA;
4. **55th Annual Technical Meeting of the Society of Engineering Science**, October 10-12, 2018, Leganés, Madrid, Spain;
5. **11th International Conference of Electrical, Transport, and Optical Properties on Inhomogeneous Media**, July 16-20, 2018, Krakow, Poland;
6. **SIAM Conference on Mathematical Aspects of Materials Science**, July 9-13, 2018, Portland, Oregon, USA;
7. **10th European Solid Mechanics Conference**, July 2-6, 2018, Bologna, Italy;
8. **Summer School on Waves and Particles in Random Media: Theory and Applications**, May 21-25, 2018, Colorado State University, USA;
9. **Applied Mathematics, Modeling and Computational Science Conference AMMCS2017**, August 20-25, 2017, Waterloo, Canada;
10. **The Mathematics of Metamaterials and Materials Workshop**, August 9, 2016, Snowbird, Utah, USA;

11. **XIII Continuum Models Discrete Systems, CMDS Investigators Workshop: At the Frontiers of Computation and Materials**, May 16, 2015, Snowbird, Utah, USA;

12. **Workshop on Interdisciplinary Mathematics**, May 8-10, 2015, Williamsport, Pennsylvania, USA;

Contributed presentations

1. **SIAM Wasatch Student Chapters Conference**, April 6, 2019, Utah State University, Logan, USA;

2. **24th International Congress of Theoretical and Applied Mechanics**, August 21-26, 2016, Montréal, Canada;

3. **22th Congress of the Italian Association of Theoretical and Applied Mechanics**, September 14-17, 2015, Genova, Italy;

4. **4th International Conference on Material Modeling**, May 27-29, 2015, Berkeley, California, USA;

5. **11th World Congress on Computational Mechanics**, July 20-25, 2014, Barcelona, Spain.

Posters

1. **Workshop on New trends and challenges in the mathematics of optimal design**, June 10-14, 2019, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK;

2. **IMA Workshop on Liquid Crystals, Metamaterials, Transformation Optics, Photonic Crystals, and Solar Cells**, February 27-March 2, 2018, Minneapolis, Minnesota, USA;

3. **IMA Workshop Field Patterns in Space-time Microstructures**. O. Mattei, G.W. Milton. *Novel Optical Materials*, March 13-17, 2017, Minneapolis, Minnesota, USA.

Publications

Articles on my work:

1. **New Horizons in the Study of Waves in Space-time Microstructures**. O. Mattei, G.W. Milton. SIAM News, Volume 50/Issue 9 (November 2017).

Book Chapters:

1. **Bounds for the response of viscoleastic composites under antiplane loadings in the time domain**. O. Mattei, G.W. Milton. In *Extending the Theory of Composites to Other Areas of Science*, Edited by G.W. Milton, Milton and Patton Publishing (produced by BookBaby.com), 2016. ISBN: 978-1483569192.

Papers published in peer-reviewed journals:

1. **On the forces that cable webs under tension can support and how to design cable webs to channel stresses**. G. Bouchitté, O. Mattei, G.W. Milton, P. Seppecher, 2019. *Proc. R. Soc. A*, 475. DOI: https://doi.org/10.1098/rspa.2018.0781.

2. **Field patterns: A new type of wave with infinitely degenerate band structure**. O. Mattei, G.W. Milton, 2017. *Europhys. Lett.* 120(5), 54003. DOI: https://doi.org/10.1209/0295-5075/120/54003;

3. **Field patterns without blowup**. O. Mattei, G.W. Milton, 2017. *New J. Phys.* **19** 093022. DO1: https://doi.org/10.1088/1367-2630/aa847d;

4. **Field patterns: A new mathematical object**. G.W. Milton, O. Mattei, 2017. *Proc. R. Soc. A* 20160819. DOI: http://dx.doi.org/10.1098/rspa.2016.0819;

5. **Bounds for the overall properties of composites with time-dependent constitutive law**. O. Mattei, A. Carini, 2017. *Eur. J. Mech. A-Solid*, 61, 408–419. DOI: http://dx.doi.org/10.1016/j.euromechsol.2016.10.015;

6. **A structural model for plane sandwich beams including transverse core deformability and arbitrary boundary conditions**. O. Mattei, L. Bardella, 2016. *Eur. J. Mech. A-Solid* 58, 172-186. DOI: http://dx.doi.org/10.1016/j.euromechsol.2016.01.015;

7. **Variational formulations for the linear viscoelastic problem in the time domain**. A. Carini, O. Mattei, 2015. *Eur. J. Mech. A-Solid*, 54, 146–159. DOI: http://dx.doi.org/10.1016/j.euromechsol.2015.05.007;

8. **On explicit analytic solutions for the accurate evaluation of the shear stress in sandwich beams with a clamped end**. L. Bardella, O. Mattei, 2014. *Compos. Struct.* 12, 157-168. DOI: http://dx.doi.org/10.1016/j.compstruct.2014.01.044;

9. **Corrigendum to "On explicit analytic solutions for the accurate evaluation of the shear stress in sandwich beams with a clamped end".** L. Bardella, O. Mattei, 2014. *Compos. Struct.* 116, 849. DOI: http://dx.doi.org/10.1016/j.compstruct.2014.05.010.

Papers submitted

1. **An extremal problem arising in the theory of composites**. O. Mattei, G.W. Milton, M. Putinar. Available from https://arxiv.org/abs/2007.13964.

Papers in preparation

1. **Extraction of the volume fraction of an inclusion by boundary measurements in time**. O. Mattei, G.W. Milton.

2. **Explicit formula for the plane elastostatic problem with a hard inclusion of arbitrary shape**. M. Lim, O. Mattei.

PhD thesis:

1. **On bounding the effective response of viscoelastic composites in the time domain: The variational approach and the analytic method**. O. Mattei, 2016.