

Curriculum Vitæ

Paolo Piovano

CONTACT INFORMATION

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RESEARCH INTERESTS

P.'s research area is PDEs and the Calculus of Variations, and his research program involves the investigation of Continuum and Molecular Mechanics models that find applications in Materials Science. The focus is on free boundary problems and atomistic models motivated by applications in the study of the epitaxial growth of thin films, the optimal shapes of crystal interfaces, and the stability of molecular structures. The methodology includes configurational energy minimization, isoperimetric characterization, Γ -convergence, dimension reduction, and the minimizing-movement method.

EMPLOYMENT INFORMATION

Sep 2017 - Now **Senior Research Scientist and Project Leader**, Department of Mathematics, University of Vienna, Austria, with personal research group "Variational Methods and Applications".
Sep 2013 - Aug 2017 **Universitätsassistent**, Department of Mathematics, University of Vienna, Austria
Mentor Prof. Ulisse Stefanelli
Jun 2016 - Dec 2016 **Adjunct Professor**, Department of Mathematics, Webster University Vienna, Austria
Sep 2012 - Aug 2013 **Postdoctoral Associate**, National Research Council (CNR-IMATI), Pavia, Italy
Mentor Prof. Ulisse Stefanelli

EDUCATION

Sep 2009 - Jun 2012 **Ph.D. Studies**, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, USA. Ph.D. defense on June 29, 2012.
Supervisors Prof. Irene Fonseca and Prof. Giovanni Leoni
Dissertation *Evolution and Regularity Results for Epitaxially Strained Thin Films and Material Voids*
Aug 2007 - Sep 2009 **M.Sc. in Mathematics**, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, USA.
Supervisors Prof. Irene Fonseca and Prof. Giovanni Leoni
Feb 2007 - Jul 2007 **Research Assistant** (MIUR Grant PRIN 05), Department of Mathematics, University of Torino, Italy
Mentor Prof. Paolo Cermelli
Sep 2004 - Jul 2006 **M.Sc. in Mathematics**, Department of Mathematics, University of Turin, Italy, grade: *Summa cum Laude et Mentione*.

Supervisor Prof. Paolo Caldirolì
 Dissertation *Travelling Waves for Suspension Bridge Type Equations*

Sep 2001 - Sep 2004 **B.Sc. in Mathematics**, Department of Mathematics, University of Turin, Italy, grade: *Summa cum Laude*.

Supervisor Prof. Paolo Cermelli
 Dissertation *Power Laws and Phase Transitions: an Application to Human Language*

SCIENTIFIC VISITS

Sep 2015 - jun 2017 *Visiting Scholar* at the Institute of Information Theory and Automation, Academy of Sciences, Prague, Czech Republic under the invitation of Prof. Martin Kružík in the periods: September 16 - 20, 2015; March 20 - 25, 2016; June 27 - 30, 2017.

May 30 - Jul 15, 2016 *Invitation to the Thematic Program* on “Nonlinear Flows” held at the ESI, Vienna.

Jan 2013 - Feb 2015 *Visiting Scholar* at the Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, PA, USA under the invitation of Prof. Irene Fonseca in the periods: Jan 31 - Feb 8, 2015; Mar 15 - 23, 2014; May 24 - June 7 2013; Jan 6 - 13, 2013.

Sep 29 - Nov 21, 2014 *Invitation to the Thematic Program* on “Minimal Energy Point Sets, Lattices and Designs” held at the ESI, Vienna.

Jul 12 - 20, 2014 *Participation in the IAS/PCMI Research Program* at the 24th Annual Summer Session on “Mathematics and Materials” held at IAS/PCMI, Salt Lake City, UT, USA.

Mar 3-8, Apr 3-13, '13 *Intensive Period* on “Evolution Problems in Fracture Mechanics” at SISSA, Trieste, Italy.

Oct 2011 - Mar 2012 *Visiting Scholar* at the Department of Mathematics and Application, University of Naples, Italy, under the mentorship of Prof. Nicola Fusco.

PUBLICATIONS

- P. Piovano, Evolution and Regularity Results for Epitaxially Strained Thin Films and Material Voids, *ProQuest; Thesis (Ph.D.)—Carnegie Mellon University* 2012, Vol. **74-01(E)**, Sect. B., p. 108. ISBN: 9781267655349. Available at <http://repository.cmu.edu/dissertations/> and at <http://adsabs.harvard.edu/abs/2012PhDT.....93P>.
- P. Piovano, Evolution of Elastic Thin Films with Curvature Regularization via Minimizing Movements, *Calc. Var. Partial Differential Equations*, **49** (2014), 337–367 ([pdf](#)).
- E. Mainini, P. Piovano, and U. Stefanelli, Finite Crystallization in the Square Lattice, *Nonlinearity*, **27** (2014), 4:717-737 ([pdf](#)).
- E. Mainini, P. Piovano, and U. Stefanelli, Crystalline and Isoperimetric Square Configurations, *Proc. Appl. Math. Mech.*, **14** (2014), 1045–1048 ([pdf](#)).
- E. Mainini, H. Murakawa, and P. Piovano, and U. Stefanelli, Carbon-Nanotube Geometries: Analytical and Numerical Results, *Discret. Contin. Dyn. Syst. Ser. S*, **10-1** (2017), 141–160 ([pdf](#)).
- E. Davoli, P. Piovano, and U. Stefanelli, Wulff Shape Emergence in Graphene, *Math. Models Methods Appl. Sci.*, **26-12** (2016), 2277–2310 ([pdf](#)).
- M. Friedrich, P. Piovano, and U. Stefanelli, The Geometry of C_{60} : A rigorous Approach via Molecular Mechanics, *SIAM J. Appl. Math.*, **76-5** (2016), 2009–2029 ([pdf](#)).
- E. Davoli, P. Piovano, and U. Stefanelli, Sharp $N^{3/4}$ Law for the Minimizers of the Edge-Isoperimetric Problem on the Triangular Lattice, *J. Nonlinear Sci.*, **27-2** (2017), 627–660 ([pdf](#)).
- E. Mainini, H. Murakawa, P. Piovano, and U. Stefanelli, Carbon-Nanotube Geometries as Optimal Configurations, *Multiscale Model. Simul.*, **76-5**, 2009–2029 ([pdf](#)).
- M. Friedrich, E. Mainini, P. Piovano, and U. Stefanelli, Characterization of optimal carbon nanotubes under stretching and validation of the Cauchy-Born rule, *submitted*, (2017), ([pdf](#)).

- E. Davoli and P. Piovano, Analytical validation of the Young-Dupré law for epitaxially-strained thin films, *submitted*, (2017), ([pdf](#)).
- P. Piovano, Regularity Results for Local Minimizers of Energies Defined on Set-Function Pairs, *preprint*.

GRANTS, PROJECTS, AND AWARDS

- December 2016 *Principal investigator* for the grant awarded by the Vienna Science and Technology Fund (WWTF) in the framework of the [2016 Program “Mathematics and...”](#); project title: *Modeling and design of epitaxially strained nanoislands*, 4 years starting on July 1st, 2017 with budget of 596,200.00€ and Co-PI Prof. Ulrike Diebold, Institute of Applied Physics, TU Vienna. [Project website: https://modena.univie.ac.at](https://modena.univie.ac.at).
- December 2016 *Principal investigator* for the grant awarded by the Austrian Science Fund (FWF) in the framework of the [Stand-Alone Projects](#); project title: *Optimal shapes of crystal interfaces*, 4 years starting on September 1st, 2017 with budget: 332,262.00€. [Project website: https://osci.univie.ac.at](https://osci.univie.ac.at).
- Sep 2015-Now *Team member* for the research projects: IFWF-GACR Joint International Project *Variational structures in thermomechanics of solids* (Pi: U. Stefanelli, 2016-2019, 109K€), WWTF “Mathematics and ..” Grant *Variational modeling of carbon nanostructures* (Pi: U. Stefanelli, 2015–2018, 540K€), WTZ Scientific and Technological Cooperation Project of the OeAD *Thermomechanics of solids: modeling, analysis, and simulations* (Pi: U. Stefanelli, 2016–2017, 7K€), FWF Grant *Global variational methods for nonlinear evolution* (Pi: U. Stefanelli, 2015-2017, 330K€).
- Sep 2007 - Jun 2012 *Research Fellowships* granted to support Ph.D. studies funded by the National Science Foundation under Grant No. DMS-0401763 of Prof. I. Fonseca (Sep '07 – May '08, Sep '08 – Jun '09), under Grant No. DMS-0905778 of Prof. I. Fonseca (Sep '09 – Jul '10, Jun '12), under Grant No. DMS-0708039 of Prof. G. Leoni (Jul and Aug '09), and under Grant No. DMS-1007989 of Prof. G. Leoni (Jun and Jul '11, Sep '11 – May '12).
- Nov 2011 *AMS Grad Student Travel Grant* for the Joint Mathematics Meetings, Boston, MA, January 4 - 7, 2012.
- Jul 2011 *SIAM Student Travel Award* to attend the SIAM Conference on “Analysis of Partial Differential Equations (PD11)” held in San Diego, CA, November 14 - 17, 2011.
- Aug 2010 - May 2011 *Teaching assistantship* granted to support Ph.D. studies funded by the Department of Mathematical Sciences, Carnegie Mellon University.
- Feb 2007 - Jul 2007 *Research fellowship* in the framework of a MIUR founded research project (PRIN 05), Department of Mathematics, University of Torino, Italy.

PERSONAL RESEARCH GROUP

- Name: “Variational Methods and Applications”, Faculty of Mathematics, University of Vienna.
- Postdoc Members: - Shokhrukh Kholmatov (<http://www.math.sissa.it/users/shokhrukh-kholmatov>) from October 1, 2017;
- Leonard Kreutz (<http://www.gssi.infn.it/people/students/students-maths/item/470-kreutz-leonard>) from September 18, 2017.

SUPERVISED STUDENTS

- Fall 2016 Mr. Filipp Lausch, Bachelor thesis at the Department of Mathematics, University of Vienna with thesis dissertation on January 20, 2016.

PRESENTATIONS

- July 5-9, 2018 *Scheduled Invited Talk* in the session “Mathematics and materials: models and applications” at the 12th AIMS Conference on “Dynamical Systems, Differential Equations and Applications” held in Taipei, Taiwan.

- May 25, 2017 *Invited Talk* on “Analytical validation of the Young-Dupré law for epitaxially-strained thin films” at the International Conference on “Elliptic and Parabolic Problems” held Gaeta, Italy.
- April 4, 2017 *Invited Talk* on “Analytical validation of the Young-Dupré law for epitaxially-strained thin films” at the Workshop “Modern challenges in continuum mechanics” held at the University of Zagreb, Croatia.
- Nov 10, 2016 *Invited Lecture* at the Augsburg-Munich Seminar, Institut für Mathematik, Universität Augsburg, Germany.
- Sep 12, 2016 *Invited Lecture* on “Optimal Epitaxially-Etrained Islands Deposited on Deformable Substrates” at the University of Zagreb, Croatia.
- Jun 15, 2016 *Invited Talk* on “Wulff-Shape Emergence in Graphene” at the Workshop on “Entropy methods, dissipative systems, and applications”, held at the Erwin Schrödinger International Institute for Mathematical Physics (ESI), Vienna, Austria (May 30 - 15).
- Mar 21, 2016 *Invited Lecture* on “Wulff Shape Emergence in Graphene” at the “Nečas Seminar on Continuum Mechanics” held at the Mathematical Institute of Charles University, Prague, Czech Republic.
- Feb 24, 2016 *Invited Talk* on “Wulff Shape Emergence and Sharp $n^{3/4}$ Law for Crystals” at the ERC Workshop on “Modeling Materials and Fluids Using Variational Methods” held at Weierstraß-Institut für Angewandte Analysis und Stochastik (WIAS), Berlin, Germany.
- Jul 2, 2015 *Invited Talk* on “Wulff Shape and Isoperimetric Characterization of Crystals” at the Workshop on “Trends in Non-Linear Analysis” held at SISSA, Trieste, Italy (July 1 - 3).
- Apr 30, 2015 *Lecture* on “The Crystallization Problem and the Emergence of the Wulff Shape of Crystals” at the Analysis and Geometry Seminar of the American University of Beirut, Lebanon.
- Mar 27, 2015 *Talk* on “Wulff Shape and Isoperimetric Characterization of Crystals” at GAMM Annual Meeting (S14 - Applied analysis), Lecce, Italy (March 23 - 27).
- Oct 16, 2014 *Invited Talk* on “Wulff Shape and Isoperimetric Characterization of Crystals” at the Workshop on “Optimal Point Configurations and Applications”, held at the Erwin Schrödinger International Institute for Mathematical Physics (ESI), Vienna, Austria (October 13 - 17).
- Sep 8, 2014 *Contributed Talk* on “Crystalline and Isoperimetric Configurations” at the XIXth Symposium on Trends in Applications of Mathematics to Mechanics (STAMM), held in Poitiers, France (September 8 - 11).
- Apr 23, 2014 *Invited Talk* on “The Structure of Ground States in 2D-Cubic Systems” at SFB ViCoM: Young Researchers Meeting held in Vienna, Austria (April 22 - 23).
- Mar 11, 2014 *Invited Talk* on “Finite Crystallization in the Square Lattice” at GAMM Annual Meeting (Minisymposium organized by Drs. B. Zwicknagl and M. Goldman) hosted by FAU Erlangen-Nürnberg, Germany (March 10 - 14).
- Jun 9, 2013 *Poster Presentation* on “Evolution Results for Epitaxially Strained Thin Films” at the SIAM Conference on “Mathematical Aspects of Materials Science (MS13)” held in Philadelphia, PA, USA (June 9 - 12).
- May 30 - Jun 7, 2013 *Poster Presentation* at the CNA Summer School on “Topics in Nonlinear PDEs and Calculus of Variations, and Applications in Materials Science” held at Carnegie Mellon University, Pittsburgh, PA, USA.
- Feb 7, 2013 *Contributed Talk* on “Evolution Results for Epitaxially Strained Thin Films” at the conference “XXIIIth Convegno Nazionale di Calcolo delle Variazioni”, held in Levico Terme, Italy (February 4 - 8).
- Sep 25, 2012 *Seminar* on “Evolution and Regularity Results for Epitaxially Strained Thin Films and Material Voids” held at IMATI-CNR, Pavia, Italy.
- Sep 10 - 12, 2012 *Poster Presentation* on “Evolution of elastic thin films with curvature regularization via minimizing movements” at the workshop “Variational Models and Methods for Evolution” held in Levico Terme, Italy.

- Feb 21, 2012 *Seminar* on “Crystal Surface Instabilities Driven by the Competition between Elastic Energy and Surface Energy” held at the Institute for Computational and Applied Mathematics, University of Münster, Germany.
- Jan 6, 2012 *Invitation* to present a seminar at the AMS Special Session on “Some Nonlinear Partial Differential Equations: Theory and Application, III” at Joint Mathematics Meetings held in Boston (January 4 - 7).
- Nov 14, 2011 *Contributed Talk* on “Evolution of Elastic Thin Films with Curvature Regularization via Minimizing Movements” at SIAM Conference on “Analysis of Partial Differential Equations (PD11)” held in San Diego, California (November 14 - 17).

WORKSHOPS, CONFERENCES, AND SCHOOLS

- Nov 12 - 13, 2015 *Workshop* on “CENTRAL Trends in PDEs”, held at University of Vienna, Austria.
- Nov 9 - 12, 2015 1st *CENTRAL School* on “Analysis and Numerics for Partial Differential Equations” held at University of Vienna, Austria.
- Sep 18 - 20, 2015 *Workshop* on “Geometrical Analysis” held at Charles University, Prague, Czech Republic.
- Feb 9 - 13, 2015 *Workshop* on “Crystals, Quasicrystals and Random Networks”, held at ICERM, Brown University Providence, RI, USA.
- Mar 31 - Apr 4, 2014 *International Workshop* “From Atomistic to Continuum Models in Materials Science”, held at Gran Sasso Science Institute, L’Aquila, Italy.
- Feb 10 - 14, 2014 *Winter School* on “Calculus of Variations in Physics and Materials Science” held at the University of Würzburg, Germany.
- Nov 24 - 30, 2013 *Oberwolfach Seminar* on “The Mathematics of Quantum Chemistry” held at Mathematisches Forschungsinstitut Oberwolfach, Germany.
- Oct 1 - 4, 2012 *School* on “Topics in Calculus of Variations and Applications” held at the Department of Mathematics of the University of Parma, Italy.
- Sep 12 -14, 2012 *ERC Workshop* on “Geometric Partial Differential Equations” held at Centro De Giorgi, Pisa, Italy.
- May 30 - Jun 1, 2012 *Workshop* on “Heterostructured Nanocrystalline Materials”, held at ICERM, Brown University Providence, RI, USA.
- Feb 5 - 10, 2012 *Conference* “XXII Convegno Nazionale di Calcolo delle Variazioni”, held in Levico Terme, Italy.
- Jan 8 - 13, 2012 *Winter School* on “Calculus of Variations in Physics and Materials Science” held at the University of Würzburg, Germany.
- May 26 - 28, 2011 *Workshop* on “Macroscopic Modeling of Materials with Fine Structure”, Carnegie Mellon University, Pittsburgh, PA, USA.
- Jun 13 - 18, 2010 *GNAMPA-ERC Summer School* on “Calculus of Variations and PDEs” held in Ischia, Italy.
- Jun 7 - 12, 2010 *CNA Summer School* on “New Vistas in Image Processing and PDEs” held at Carnegie Mellon University, Pittsburgh, PA, USA.
- Aug 27 - 29, 2009 *Workshop* on “Energy-Driven Systems”, Carnegie Mellon University, Pittsburgh, PA, USA.
- May 29 - Jun 7, 2008 *CNA Summer School* on “Contemporary Topics in Nonlinear PDEs” held at Carnegie Mellon University, Pittsburgh, PA, USA.
- Mar 13 - 15, 2008 *Workshop* on “New Trends in Calculus of Variations and Mass Transport”, Carnegie Mellon University, Pittsburgh, PA, USA.
- Sep 2007 - May 2012 *CNA Seminar Series* (see complete list at <http://www.math.cmu.edu/cna/cnaseminars.php>) and *working groups* held at Carnegie Mellon University, Pittsburgh, PA, USA.

COMMITTEES, ORGANIZATIONS, AND REVIEWS

- Jun 2016 - Now Member of the *commission for the habilitation* at the University of Vienna of Dr. Dietmar Ölz, School of Mathematics and Physics, University of Queensland, Australia

- Feb 2016 - Now Affiliated to INDAM/GNAMPA at the research unit of National Research Council (CNR-IMATI), Pavia, Italy
- Feb 2015 - Now Reviewer for *Discrete and Continuous Dynamical Systems - S (DCDS-S)*, American Institute of Mathematical Sciences.
- Jan 2014 - Now Member of The International Society for the Interaction of Mechanics and Mathematics (ISIMM)
- Oct 2, 2013 *Invitation to the Roundtable Session* on “The International Researcher” at the ERC-PIRE Workshop on “Evolution Problems for Material Defects: Dislocations, Plasticity, and Fracture” held at SISSA, Trieste, Italy (September 30 - October 4).
- Jun 24 - 26, 2013 Participation in the *organization of the ERC Workshop* on “Variational Views in Mechanics and Materials” held at the University of Pavia, Italy.

TEACHING TRAINING

- Sep 2017 - Jun 2018 Nominated by the Faculty of Mathematics, University of Vienna to attend the “Teaching Competence Plus” certificate course (<https://ctl.univie.ac.at/veranstaltungen/zertifikatskurs/>) from Center for Teaching and Learning (CTL), University of Vienna.
- Apr 2012 CNA (Center for Nonlinear Analysis, CMU)-PIRE Workshop on *Course and Syllabus Design* held by Marie Norman, associate director of Eberly Center for Teaching Excellence (<http://www.cmu.edu/teaching/eberly/>).
- Sep 2008 - Sep 2011 *Teaching Training* at the Intercultural Communication Center, Carnegie Mellon University (<http://www.cmu.edu/icc/>).
- Apr 2010 *International Teaching Assistant (ITA) Test* was passed. ITA Test is required by both Pennsylvania Law and Carnegie Mellon policy for nonnative speakers before they can work as teaching assistants.
- Spring 2010 Successful attendance of the course on *Language and Culture for Teaching* held by P. A. Heidish, Director of the Intercultural Communication Center, Carnegie Mellon University.

TAUGHT COURSES

- Oct 2013 - Aug 2017 *Teaching Assistant* at the University of Vienna, Department of Mathematics for the following courses:
 - Fall 2016 “Partielle Differentialgleichungen”, undergraduate level.
 - Spring 2016 “Analysis”, undergraduate level (see <http://www.univie.ac.at/complexanalysis/Teaching.html>).
 - Fall 2015 “Höhere Analysis und Differentialgeometrie”, undergraduate level (see <http://www.mat.univie.ac.at/~stefanelli/hoehereanalysis.html>).
 - Spring 2015 “Analysis”, undergraduate level (see <http://www.mat.univie.ac.at/~stefanelli/analysis.html>).
 - Fall 2014 “Einführung in die Analysis”, undergraduate level (see <http://www.mat.univie.ac.at/~stefanelli/einfuehrung.html>);
 - Fall 2014 “Einführung in das mathematische Arbeiten”, undergraduate level (see <http://www.mat.univie.ac.at/~einfbuch/index.html>);
 - Fall 2013 “Modellierung”, undergraduate level (see <http://homepage.univie.ac.at/christian.schmeiser/MOD-WS1314.htm>);
- Jun 2016 - Dec 2016 *Lecturer* at Webster University Vienna, for the following course:
 - Fall 2016 “College Algebra”, undergraduate level (see <http://webster.ac.at/mathematics>).
- Aug 2010 - May 2011 *Teaching Assistant* at Carnegie Mellon University, Department of Mathematics for the following courses:
 - Spring 2011 “Calculus in Three Dimensions”, undergraduate level (around 100 students);
 - Fall 2010 “Differential Equations”, undergraduate level (around 100 students).

LANGUAGES

- German B2/2 Level, certificate from Innovationszentrum, University of Vienna on September 6, 2017.
- English Fluent, ITA Test successfully passed at Carnegie Mellon University on April 23, 2010.
- Italian Mother tongue.