

# Curriculum Vitae

## Alessandro Giacomini

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Full professor of Mathematical Analysis  
DICATAM, Sezione di Matematica  
Università degli Studi di Brescia  
via Branze 43, 25123 Brescia  
telefono: 030-3715740  
e-mail: alessandro.giacomini@unibs.it

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### Appointments

- January 2005-October 2014: Assistant professor in Mathematical Analysis, University of Brescia
- November 2014-December 2018: Associate professor in Mathematical Analysis, University of Brescia
- Since January 2019: Full professor in Mathematical Analysis, University of Brescia

### Education

- Degree in Mathematics: Università Cattolica del Sacro Cuore, Brescia, 1999. Degree thesis: “*Geodesics on Lorentzian Manifolds*”, supervisor Prof. Marco Degiovanni.
- Ph.D. in Functional Analysis: S.I.S.S.A. Trieste, 2004. Ph.D. thesis: “*Asymptotic problems and approximation results in variational models of quasistatic crack growth*”, supervisor Prof. Gianni Dal Maso.

### Research interests

- Free discontinuity problems.
- Variational methods in fracture mechanics.
- Elliptic equations in irregular domains.
- Variational methods in plasticity.

### Invited lectures

- “*Connessione geodetica su spazi tempo di tipo Kerr*” during the meeting of the national group of nonlinear analysis organized by prof. V. Benci, Sammommé (Pistoia), April 9-11, 2001.

- “*Una generalizzazione del teorema di Götzg*” during “Incontro di lavoro su Questioni di Teoria Geometrica della Misura e di Calcolo delle Variazioni”, Levico Terme (Trento), February 17-22, 2002.
- “*Approssimazione di Ambrosio-Tortorelli per la crescita di fratture*” during “Incontro di lavoro su Questioni di Teoria Geometrica della Misura e di Calcolo delle Variazioni”, Levico Terme (Trento), February 16-21, 2003.
- “*Approssimazione di Ambrosio-Tortorelli per la crescita di fratture*” during the workshop “Materiali Speciali e Memorie: Problemi Modellistici e Analitici”, Salò (Brescia), July 3-5, 2003.
- “*Effetti di scala per crescita di fratture*” during “Incontro di lavoro su Questioni di Teoria Geometrica della Misura e di Calcolo delle Variazioni”, Levico Terme (Trento), February 2-9, 2004.
- “*Stability of one-sided minimality properties for free discontinuity problems*”, on invite of Prof. Patrizia Donato, in *Group of travaille sur l'homogenisation*, Laboratoire J.L.Lions, Université Paris VI *Pierre et Marie Curie*, May 2, 2004.
- “*Stability of unilateral minimality properties in fracture mechanics*”, in the workshop “Analysis of Rate-Independent Processes”, Université de Paris 13, August 31- September 2, 2004, organized by G.A. Francfort e A. Mielke.
- “*Iniziazione di fratture in corpi elastici*” during “Incontro di lavoro su Questioni di Teoria Geometrica della Misura e di Calcolo delle Variazioni”, Levico Terme (Trento), January 31- February 4, 2005.
- “*A density result for two dimensional Sobolev spaces and applications to stability of Neumann problems*”, Ecole Polytechnique, Paris, May 31, 2005.
- “*Crack initiation in elastic bodies*”, Convegno SIMAI 2006, Ragusa, May 22-26, 2006.
- “*Quasistatic evolution for a model in strain gradient plasticity*”, Université de Metz, May 31, 2007.
- “*Crack initiation in brittle materials*”, Laboratoire de Mathématiques, Université de la Savoie, Chambéry, September 21, 2007.
- “*Evoluzione quasistatica per un modello di plasticità con gradiente*” during “Incontro di lavoro su Questioni di Teoria Geometrica della Misura e di Calcolo delle Variazioni”, Levico Terme (Trento), February 11-15, 2008.
- “*Evoluzione quasistatica per un modello di plasticità con gradiente*”, University of Pavia, May 8, 2008.
- “*Crack initiation in brittle materials*” during the meeting “*30 anni di analisi matematica alla SISSA: il contributo degli ex allievi*”, Trieste, November 24-27, 2008.

- “*Introduction to functions of bounded variation*”: short course (3 lectures) delivered at Laboratoire de Mathématiques, Université de la Savoie, Chambéry, April 21-23, 2009.
- “*Non-interpenetration of matter for SBV-deformations*, during the meeting “*Mathematical Models and Analytical Problems for Special Materials*”, Brescia, July 9-11, 2009.
- “*Un approccio variazionale alla disuguaglianza isoperimetrica per il primo autovalore del problema di Robin*” during the workshop “Incontro di lavoro su Questioni di Teoria Geometrica della Misura e di Calcolo delle Variazioni”, Levico Terme (Trento), February 22-26, 2010.
- “*Two-scale homogenization for a model in strain gradient plasticity*” during the workshop “*Microstructures in Solids: From Quantum Models to Continua*” organized by A. Mielke and M. Ortiz, Oberwolfach, March 14-20, 2010.
- “*Two-scale homogenization for a model in strain gradient plasticity*” during the workshop “Meeting on Applied Mathematics and Calculus of Variations”, June 10-12, 2010, Roma.
- “*Existence of strong solutions for quasi-static evolution in brittle fractures*”, SISSA (Trieste), March 21, 2012.
- “*Perfect plasticity for heterogeneous materials*”, during the minisymposium “*Partial differential equations in materials science*” organized by L. Giacomelli e G. Tomassetti within the workshop “7th European Conference on Elliptic and Parabolic Problems”.
- “*Existence of strong solutions for quasi-static evolution in brittle fractures*”, during the workshop “*Evolution problems in damage, plasticity and fracture: mathematical models and numerical analysis*” organized by D. Knees and R. Toader, September 19-21, 2012, Udine.
- “*Quasi-static Evolutions for Linearly Elastic-Perfectly Plastic Heterogeneous Materials*”, during the workshop “*New Materials and New Problems in Continuum Mechanics*”, 50<sup>th</sup> Annual Meeting of the Society for Natural Philosophy, CISM, Udine, October 22-24, 2012.
- “*Evoluzioni elasto-plastiche in materiali multifase*”, during the workshop *XXIII Convegno Nazionale di Calcolo delle Variazioni*, Levico Terme, February, 3-8, 2013.
- “*Quasi-static Evolutions for Linearly Elastic-Perfectly Plastic Heterogeneous Materials*”, during the PIRE-SISSA workshop “*Evolution Problem for Material Defects: Dislocation, Plasticity, and Fracture*”, organized by A. DeSimone, G. Dal Maso, I. Fonseca e F. Otto, Trieste, September 30-October 4, 2013.
- “*Quasi-static Evolutions for Linearly Elastic-Perfectly Plastic Heterogeneous Materials*”, Laboratoire de Mathématiques, Université de la Savoie, Chambéry, November 15, 2013.

- “*Problemi a discontinuità libera e disuguaglianze di tipo Faber-Krahn*”, during the workshop *XXIV Convegno Nazionale di Calcolo delle Variazioni*, Levico Terme, January, 27-31, 2014.
- “*Optimization problems for elastically supported membranes*”, during the workshop “*Variational Modeling in Solid Mechanics*”, organized by R. Paroni and R. Toader, Udine, September 22-24, 2014.
- “*Quasi-static Evolutions in Perfect Plasticity*” Université Joseph Fourier, Grenoble, February 26, 2015.
- “*Free discontinuity problems and Robin boundary conditions*”. Short course delivered at SISSA (Trieste) during the intensive period “*Variational Methods for Plasticity and Dislocations*” organized by G. Dal Maso, May 4-8, 2015.
- “*Free discontinuity problems and Robin boundary conditions*” during the workshop “*Geometric Measure Theory, and Calculus of Variations: theory and applications*”. Institut Fourier, Grenoble, June 29- July 4, 2015.
- “*A relaxed framework for the optimization of Robin eigenvalues*” during the workshop “*Workshop on ”Advances in Nonlinear Problems from Materials Science and Shape Optimization*” organized by G. Buttazzo, M.S. Gelli and M. Novaga, Pisa, June 27-29, 2016.
- “*A free discontinuity approach for the optimization of the Robin-Laplacian eigenvalues*” during the meeting “*Workshop in Geometric Measure Theory, Shape Optimisation and Free Boundaries*” organized by G. De Philippis and G. Franzina, SISSA, Trieste, October 25-28, 2016.
- “*Shape optimization with Robin conditions and free discontinuity problems*” during the workshop “*Shape Optimization, Isoperimetric and Functional Inequalities*” organized by D. Bucur, G. Buttazzo, A. Henrot e A. Pratelli, CIRM, Luminy, November 21-25, 2016.
- “*Optimal constants in Poincaré inequalities with traces*” during the workshop *Miniworkshop on dislocations, plasticity, and fracture*, organized by G. Dal Maso and R. Toader, SISSA, February 13-16, 2017.
- “*A free discontinuity approach for the optimization of the Robin-Laplacian eigenvalues*”, Università di Pavia, March 22, 2017.
- “*A free discontinuity approach for the optimization of the Robin-Laplacian eigenvalues*”, during the workshop “*From Solid Mechanics to Mathematical Analysis: a workshop in the occasion of Gilles Francfort’s 60th birthday*, Institute Henry Poincaré, Paris, June 15-16, 2017.
- “*Local minimality for the Mumford-Shah functional via monotonicity*”, during the workshop “*Brescia-Trento Nonlinear Day. Second Edition*” organized by D. Mazzoleni, A. Pinamonti, M. Squassina, Brescia, May 25, 2018.

- “*Local minimality for the Mumford-Shah functional via monotonicity*”, during the workshop “*New trends in the variational modeling of failure phenomena*”, organized by E. Davoli, M. Friedrich, R. Scala, Erwin Schrödinger International Institute for Mathematics and Physics (ESI), Wien, August 20-25, 2018.

## Visiting positions

- Laboratoire J.L.Lions, Université Paris VI *Pierre et Marie Curie*, Paris, France, February 15-August 15, 2004.
- Max-Planck Institute for the Mathematics in the Sciences, Leipzig, Germany, October 1-December 31, 2004.
- Ecole Polytechnique, Paris, France, May 30-June 13, 2005.
- University of Metz, Metz, France, May 25-June 2, 2007.
- Ecole Polytechnique, Paris, France, June 18-30, 2007.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, September 17-21, 2007.
- Ecole Polytechnique, Paris, France, April 21-25, 2008.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, April 20-24, 2009.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, June 22-26, 2009.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, April 6-9, 2010.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, June 13-17, 2011.
- Université de Paris XIII, Villetaneuse, France, February 20-24, 2012.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, April 23-26, 2012.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, June 25-28, 2012.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, November 14-16, 2013.
- Université de Paris XIII, Villetaneuse, France, March 3-7, 2014.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, June 30-July 4, 2014.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, February 23-27, 2015

- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, June 9-12, 2015
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, March 8-11, 2016
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, July 5-8, 2016
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, February 27-March 1, 2017
- Courant Institute of Mathematics, New York, USA, May 1-5, 2017.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, July 10-13, 2017
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, February 26-March 2, 2018.
- Laboratoire de Mathématiques, Université de la Savoie, Chambéry, France, June 25-29, 2018.

## Publications

### Published and accepted papers

1. M. DEGIOVANNI, A. GIACOMINI: Geodesical connectedness on stationary Lorentzian manifolds with nonsmooth boundary, in "Third World Congress of Nonlinear Analysts" (Catania, 2000), V. Lakshmikantham, ed., *Nonlinear Anal.* **47** (2001), 5041-5052.
2. A. GIACOMINI: A generalization of Göğab theorem and applications to fracture mechanics, *Math. Models and Methods Appl. Sci.* **12** (2002) 1245-1267.
3. A. GIACOMINI, M. SQUASSINA: Multi-peak solutions for a class of degenerate elliptic equations, *Asymptotic Anal.* **36** (2003) (2), 115-147.
4. A. GIACOMINI, M. PONSIGLIONE: A discontinuous finite element approximation of quasi-static growth of brittle fractures, *Numer. Funct. Anal. Optim.* **24** (2003), 813-850.
5. A. GIACOMINI: A stability result for Neumann problems in dimension  $N \geq 3$  *J. Convex Anal.* **11** (2004) 41-58.
6. A. GIACOMINI: Ambrosio-Tortorelli approximation of quasi-static evolution of brittle fractures, *Calc. Var. Partial Differential Equations* **22** (2005), 129-172.
7. A. GIACOMINI: Size effects on quasi-static growth of cracks. *SIAM J. Math. Anal.* **36** (2005), 1887-1928

8. A. GIACOMINI, M. PONSIGLIONE: A discontinuous finite element approximation of quasistatic crack growth in finite elasticity. *Math. Models and Methods Appl. Sci.* **16** (2006), no. 1, 77–118.
9. A. GIACOMINI, M. PONSIGLIONE: A  $\Gamma$ -convergence approach to stability of unilateral minimality properties in fracture mechanics and applications. *Arch. Ration. Mech. Anal.* **180** (2006), no. 3, 399–447.
10. A. CHAMBOLLE, A. GIACOMINI, M. PONSIGLIONE: Piecewise rigidity. *J. Funct. Anal.* **244** (2007) 134–153.
11. A. GIACOMINI, P. TREBESCHI: A density result for two dimensional Sobolev spaces and applications to stability of nonlinear Neumann problems. *J. Differential Equations* **237** (2007) 27–60.
12. A. CHAMBOLLE, A. GIACOMINI, M. PONSIGLIONE: Crack initiation in brittle materials. *Arch. Ration. Mech. Anal.* **188** (2008), 309–349.
13. D. BUCUR, A. GIACOMINI AND P. TREBESCHI: Whitney property in two dimensional Sobolev spaces. *Proc. Amer. Math. Soc.* **136** (2008), no. 7, 2535–2545.
14. A. GIACOMINI, M. PONSIGLIONE: Non interpenetration of matter for *SBV*-deformations of hyperelastic brittle materials. *Proc. Roy. Soc. Edinburgh Sect. A.*, **138A** (2008), 1019–1041.
15. L. BARDELLA, A. GIACOMINI: Influence of material parameters and crystallography on the size effects describable by means of strain gradient plasticity. *J. Mech. Phys. Solids* **56** (2008), no. 9, 2906–2934
16. A. GIACOMINI, L. LUSSARDI: Quasistatic evolution for a model in strain gradient plasticity. *SIAM J. Math. Anal.* **40** (2008), no. 3, 1201–1245.
17. G. DAL MASO, A. GIACOMINI, M. PONSIGLIONE: A variational model for quasistatic crack growth in nonlinear elasticity: some qualitative properties of the solutions. *Boll. Un. Mat. Ital. (9)*, **2** (2009), 371–390.
18. A. CHAMBOLLE, A. GIACOMINI, L. LUSSARDI: Continuous limits of discrete perimeters. *ESAIM Math. Model. Numer. Anal.* **44** (2010), 207–230.
19. D. BUCUR, A. GIACOMINI: A variational approach to the isoperimetric inequality for the Robin eigenvalue problem. *Arch. Ration. Mech. Anal.* **198** (2010), 927–961
20. A. GIACOMINI, A. MUESTI: Two-scale homogenization for a model in strain gradient plasticity. *ESAIM Control Optim. Calc. Var.* **17** (2011) 1035–1065.
21. A. GIACOMINI: On the energetic formulation of the Gurtin and Anand model in strain gradient plasticity. *Discrete Contin. Dyn. Syst. Ser. B* **17** (2012), 527–552.
22. G. FRANCFORT, A. GIACOMINI: Small strain heterogeneous elasto-plasticity revisited. *Comm. Pure Appl. Math.* **65** (2012), 1185–1241.

23. G. FRANCFORT, A. GIACOMINI, AND A. MUESTI: On the Fleck and Willis homogenization procedure in strain gradient plasticity. *Discrete Contin. Dyn. Syst. Ser. S*, **6**, no. 1, (2013) 43-62.
24. A. GIACOMINI, A. MUESTI: Quasi-static evolutions in linear perfect plasticity as a variational limit of finite plasticity: a one-dimensional case. *Math. Models and Methods Appl. Sci.* **23** (2013), no. 7, 1275–1308.
25. A. SALVADORI, A. GIACOMINI: The most dangerous flaw orientation in brittle materials and structures. *Int. J. Fract.* **183** (2013), 19–28.
26. G. FRANCFORT, A. GIACOMINI: On periodic homogenization in perfect elasto-plasticity. *J. Eur. Math. Soc. (JEMS)* **16** (3) (2014), 409–461.
27. J.-F. BABADJIAN, A. GIACOMINI: Existence of strong solutions for quasi-static evolution in brittle fracture. *Ann. Sc. Norm. Super. Pisa Cl. Sci. (5)*, Vol. XIII (2014), 925–974 .
28. D. BUCUR, A. GIACOMINI: Faber-Krahn inequalities for the Robin-Laplacian: a free discontinuity approach. *Arch. Ration. Mech. Anal.* **218** (2015), 757-824.
29. G. FRANCFORT, A. GIACOMINI: The role of a vanishing interfacial layer in perfect elasto-plasticity. *Chin. Ann. Math. Ser. B* **36** (2015), 813-828.
30. D. BUCUR, A. GIACOMINI: The Saint-Venant inequality for the Laplace operator with Robin boundary conditions. *Milan J. Math.* **83** (2015), 327-343.
31. G. FRANCFORT, A. GIACOMINI, J.-J. MARIGO: The taming of plastic slips in Von Mises elasto-plasticity. *Interfaces Free Bound.* **17** (4) (2015), 497–516
32. G. FRANCFORT, A. GIACOMINI, J.-J. MARIGO: A case study for uniqueness of elasto-plastic evolutions: the bi-axial test. *J. Math. Pures Appl.* **105** (2016), 198-227.
33. D. BUCUR, A. GIACOMINI: Shape optimization problems with Robin conditions on the free boundary. *Ann. Inst. H. Poincaré Anal. Non Linéaire* **33** (2016), no. 6, 1539–1568.
34. M. DISCACCIATI, P. GERVASIO, A. GIACOMINI, A. QUARTERONI: The Interface Control Domain Decomposition (ICDD) Method for Stokes-Darcy coupling. *SIAM J. Numer. Anal.* **54** (2), 1039–1068.
35. G. FRANCFORT, A. GIACOMINI, J.-J. MARIGO: The elasto-plastic exquisite corpse: a Suquet legacy. *J. Mech. Phys. Solids* **97** (2016), 125–139.
36. D. BUCUR, A. GIACOMINI, P. TREBESCHI: The Robin-Laplacian problem on varying domains. *Calc. Var. Partial Differential Equations* **55** (2016), no. 6, 55–133. .
37. B. BOGOSEL, D. BUCUR, A. GIACOMINI: Optimal shapes maximizing the Steklov eigenvalues. *SIAM J. Math. Anal.* **49** (2017), no. 2, 1645–1680.



38. D. BUCUR, I. FRAGALÀ, A. GIACOMINI: Optimal partitions for Robin Laplacian eigenvalues. *Calc. Var. Partial Differential Equations* **57** (2018), no. 5, article 122.
39. G. FRANCFORT, A. GIACOMINI, O. LOPEZ-PAMIES: Fracture with healing: a first step towards a new view of cavitation. *Anal. PDE* **12** (2019), no. 2, 417–447.

### Preprints

1. D. BUCUR, A. GIACOMINI: Minimization of the  $k$ -th eigenvalue of the Robin-Laplacian. Preprint 2017, submitted for publication.
2. D. BUCUR, A. GIACOMINI, P. TREBESCHI: Best constant in Poincaré inequalities with traces: a free discontinuity approach. Preprint 2017, submitted for publication.
3. D. BUCUR, I. FRAGALÀ, A. GIACOMINI: Local minimality results for the Mumford-Shah functional via monotonicity. Preprint 2018. Submitted for publication.
4. D. BUCUR, I. FRAGALÀ, A. GIACOMINI: Multiphase Free Discontinuity Problems: Monotonicity Formula and Regularity Results. Preprint 2018. Submitted for publication.

### Proceedings

1. L. BARDELLA, A. GIACOMINI: Size effects and strain gradient plasticity: how many length scales should be involved in the modelling? *XVIII Congresso Associazione Italiana di Meccanica Teorica e Applicata*, Brescia, 11-14 settembre 2007.
2. A. GIACOMINI: Two-scale homogenization for a model in strain gradient plasticity. Oberwolfach Report No. 14/2010.

Some of my papers are described in detail or quoted in the following book.

- Bourdin B., Francfort G. A., Marigo, J.-J.: *The Variational Approach to Fracture*, Reprinted from *Journal of Elasticity*, Springer, 2008.

### Teaching activity

Unless otherwise stated, the courses have been delivered at the Faculty of Engineering of the University of Brescia.

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| 2004-2005 | <ul style="list-style-type: none"> <li>• Teaching assistant for the course <i>Analisi Matematica B</i>.</li> <li>• Teaching assistant for the course <i>Metodi matematici per l'ingegneria</i>.</li> </ul> |
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- 2005-2006
  - Teaching assistant for the course *Complementi di Analisi Matematica*.
  - Teaching assistant for the course *Analisi Matematica C*.
  - *Analisi Matematica B*.
- 2006-2007
  - Teaching assistant for the course *Analisi Matematica C*.
  - Teaching assistant *Analisi Matematica B*.
- 2007-2008
  - Teaching assistant for the course *Analisi Matematica C*.
  - *Analisi Matematica B*.
- 2008-2009
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I*
  - *Istituzioni di Geometria Superiore 2*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
- 2009-2010
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I* .
  - *Calcolo delle variazioni*.
  - *Istituzioni di Geometria Superiore 2*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
- 2010-2011
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I*.
  - *Calcolo delle variazioni*.
  - Teaching assistant for the course *Istituzioni di Geometria Superiore 1*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  - *Istituzioni di Geometria Superiore 2*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
- 2011-2012
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I*.
  - *Istituzioni di Geometria Superiore 2*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.

- 2012-2013
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I*.
  - *Calcolo delle variazioni*.
  - *Equazioni differenziali*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  - *Analisi Matematica b*.
  
- 2013-2014
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I*.
  - *Calcolo delle variazioni*.
  - *Teoria della misura*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  
- 2014-2015
  - Teaching assistant for the course *Analisi Matematica II*.
  - *Analisi Matematica I*.
  - *Calcolo delle variazioni*.
  - *Teoria della misura*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  
- 2015-2016
  - *Analisi Matematica I*.
  - *Teoria della misura*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  
- 2016-2017
  - *Analisi Matematica I*.
  - *Teoria della misura*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  
- 2017-2018
  - *Analisi Matematica I*.
  - *Calcolo delle variazioni*.
  - *Teoria della misura*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.
  
- 2018-2019
  - *Analisi Matematica I*.
  - *Calcolo delle variazioni*.
  - *Teoria della misura*, Department of Mathematics, Università Cattolica del Sacro Cuore, Brescia.