

CURRICULUM VITAE

GIOVANNI BELLETTINI

Date of birth: October 30, 1963

City, country of birth: Bologna, Italy.

Citizenship: Italian.

Married.

home address: via Roma 33, 00040 Monte Porzio Catone (Roma), Italy. Tel.: +39 349 7352070.

EDUCATION

- November 21, 1988: Degree in Mathematics (mark: 110/110 cum laude). Institution: University of Pisa, Italy. Supervisor: Prof. L. Modica.

- October 28, 1993: Ph.D. in Functional Analysis and Applications. Institution: International School for Advanced Studies SISSA/ISAS, Trieste, Italy. Title of the Ph.D. thesis: "Geometric problems involving curvatures in the Calculus of Variations". Supervisor: Prof. G. Dal Maso.

Diploma of piano at the Academy of Music L. Boccherini, Lucca Italy, 1988.

Language skills: Italian (native), English (fluent), French (basic), Spanish (initial).

PRESENT POSITION

Full Professor of Mathematical Analysis, University of Roma Tor Vergata, Department of Mathematics: November 1, 2001-.

ICTP Trieste, consultant: January 1, 2012 - August 31, 2012; January 1, 2013 - August 31, 2013; January 1, 2014 - August 31, 2014, January 1, 2015 - August 31, 2015.

SISSA Trieste, member of the Faculty for Mathematical Analysis and Applications, 2013-.

INFN associate at Laboratori Nazionali di Frascati, Roma: October 1, 2004-.

LIST OF QUALIFICATIONS

- Researcher, University of Bologna, Department of Mathematics: July 1, 1991 - October 31, 1994.

- Researcher, University of Pisa, Department of Applied Mathematics: November 1, 1994 - October 31, 1998.

- Associate Professor, University of Roma Tor Vergata, Department of Mathematics: November 1, 1998 - October 31, 2001.

PRESENT ADDRESS

Dipartimento di Matematica, Università di Roma Tor Vergata, via della ricerca scientifica 1, 00133 Roma, Italy. Tel.: +39 06 72594612, fax: +39 06 72594699, e-mail: belletti@mat.uniroma2.it.

1. RESEARCH ACTIVITY

- Geometric evolution equations. Mean curvature flow. Barriers, fattening, minimizing movements, higher order approximations. Anisotropic and crystalline mean curvature flow. The total variation flow. Evolution of partitions. See for instance [11], [17], [19], [25], [18], [29], [21], [30], [39], [36], [31], [32], [41], [38], [40], [46], [47], [43], [45], [49], [50], [52], [54], [55], [57], [71], [65], [66], [67], [95], [76], [88], [82], [89], [96], [99], [102], [116], [126], [131], [133]. The book by G. Bellettini: *Lecture Notes on Mean Curvature flow, Barriers and Singular Perturbations, Scuola Normale Superiore, Pisa 2013*, pp. xviii-325 (see the list of publications), is an introduction to the evolution of a hypersurface by its mean curvature. The aim of the book is to give an introduction to mean curvature flow using, as much as possible, a parametrization free approach. Some relevant aspects of mean flow are described, such as the role of the signed distance function and the comparison principle, and their use in the theory of barriers. Some examples of singularities are discussed. In the last chapters, also making use of a formal asymptotic inner and outer expansion, the convergence of the parabolic Allen-Cahn's equation to mean curvature flow for sufficiently short times is proven, together with an error estimate.
- Calculus of variations. Minimal surfaces, surfaces with prescribed mean curvature and their variational and numerical approximations. Relaxation of the area functional for graphs in codimension two, and connection with the Plateau's problem. Coverings and Plateau's problem. Higher order problems, the elastica functional. Phase transitions and Γ -convergence. Non local functionals. Applications to Image Segmentation. See for instance [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [13], [14], [15], [20], [12], [16], [22], [33], [24], [26], [27], [28], [34], [35], [37], [48], [44], [70], [62], [61], [64], [73], [75], [84], [79], [108], [109], [129], [128], [130], [132], [134].
- Backward-forward parabolic equations. Gradient flows of nonconvex functionals in dimension one. The Perona-Malik equation. Weak solutions, fourth-order approximations, discretizations. See for instance [72], [94], [68], [77], [80], [69], [98], [101], [114], [123], [122], [124].
- Nonlinear hyperbolic equations. Scalar conservation laws. The nonlinear wave equation of Ginzburg-Landau type. Classical relativistic strings. See for instance [106], [104], [107], [110], [121].
- Numerical Analysis. Finite differences and finite elements approximations of parabolic partial differential equations. Discrete Γ -convergence. See for instance [2], [3], [4], [9], [8], [12], [23].
- Image Segmentation. Reconstruction of three-dimensional shapes from apparent contours; topological and variational problems in computer vision. Apparent contours and their invariants. See for instance [56], [86], [91], [78], [97], [100], [103]. The book by B. Bellettini, V. Beorchia, M. Paolini, F. Pasquarelli, *Shape Reconstruction from Apparent Contours. Theory and Algorithms, Computational Imaging and Vision*, Springer 2015 (see the list of publications), is concerned with the problem of reconstructing a (not necessarily connected) shape

starting from information on its apparent contour. Starting from a variational model concerning the depth of the objects in a picture and the problem of hidden and illusory contours, we investigate one of the central problems of computer vision: the topological and algorithmic reconstruction of a smooth three dimensional scene starting from the visible part of an apparent contour. We focus our attention on the manipulation of apparent contours using a finite set of elementary moves, corresponding to diffeomorphic deformations of three dimensional scenes. The book is intended also as a user's guide to the software code `appcontour`, written for the manipulation of apparent contours and their invariants.

- **Mathematical aspects of Statistical Mechanics.** Nonlocal functionals in phase transitions, nonlocal parabolic equations. See for instance [26], [27], [51], [74], [75], [87], [90].

- **Miscellanea.** Regularization of the two-body problem, systems of PDEs, general relativity, encyclopediae. See for instance [53], [42], [60], [59], [58], [63], [81], [85], [117], [118], [125].

2. SEMINAR ACTIVITY

Invited speaker at meetings abroad. Pont à Mousson, Metz (1991, 1994), Oberwolfach (1994, 1998, 2000, 2001, 2004(2), 2006, 2007(2), 2008, 2010, 2011 (2), 2013), (2014), (2015), Berlin (1996), Freiburg (1998), Barcellona (2000), Paris (2000), Debrecen (2003), Edinburgh (2005), Lyon (2005), Roscoff (2007), Bedlewo (2007), Zürich (2007), Hausdorff Center, Bonn (2008), Max Planck Institute, Leipzig (2008), Carnegie Mellon Univ., Pittsburgh PA, USA (2009), Poros, Greece (2009), Max Planck Institute Golm, Germany (2009), Paris XI (2010), Dortmund, Germany (2011), Tuebingen, Germany (2011), Banach Center, Warsaw, Poland (2012), Chiemsee, Germany (2012), Athens, Greece (2012), ICTP (2013), Madrid (2013), Paris (IHP, 2014), Frankfurt (2015), Univ. of Sussex (UK, 2015).

Invited speaker at meetings in Italy. Trento (1990, 1991, 1992, 1993, 1994, 1996, 1999), Catania (1991), Padova (1992, 1995), Perugia (1993), Bologna (1994), Firenze (1994), Montecatini Terme (1995), Pavia (1996), Pisa (1996, 2002), Cortona (1997, 1998, 2000), Capri (1997), Scuola Normale Superiore, Pisa (1997, 2001, 2003, 2006(2), 2008, 2009, 2010, 2012), Isola d'Elba (1997), Roma (1999, 2000, 2003, 2006, 2010 (Indam)), Levico Terme (2000, 2003, 2004, 2006, 2008, 2009, 2011, 2013), Ischia (2000), L'Aquila (2002), Lecce (2003, 2004), SISSA, Trieste (2008), Vulcano (2012).

Seminars held at universities and research centers abroad. Newton Institute, Cambridge (1995), University of Montpellier II (1996), University of Basel (1997), Institute Henry Poincaré, Centre Emile Borel, Paris (1998), Ecole Polytechnique Federale de Lausanne (2003), Max Planck Institute in the Sciences, ETH Zürich (2004), Leipzig (2005), University of Pisa (2006), Max Planck Institute for Gravitational Physics, Golm (2006), University of Zürich (2007), University of Freiburg (2008), Hausdorff Center, University of Bonn (2008), Max Planck Institute in the Sciences, Leipzig (2010), Ecole Polytechnique, Paris (2012), Dortmund TU (2014), NYUAD Abu Dhabi (2015).

Seminars held at universities and research centers in Italy. University of Trento (1989, 1995, 2002, 2006), University of Milano (1993, 1997), University of Roma "Tor Vergata" (1994, 1997, 1999), University of Roma "La Sapienza" (1994, 1999, 2002, 2005), University of Firenze (1996), University of L'Aquila (1996, 1997, 2004, 2007), Istituto per le Applicazioni del Calcolo, Roma (1999), University of Napoli (2000), University of Padova (2002), University of Bologna (2003), University of Trieste (2009), University of Pavia (2009), University of Udine (2009), University of Brescia (2010), ICTP (2011), SISSA (2014), University of Bologna (2015), University of Napoli (2015) . University of Trieste (2015) . University of Roma La Sapienza (2015) .

Visiting Professor. University of Maryland (United States), University of Montpellier II (France), Newton Institute (University of Cambridge, United Kingdom), University of Basel (Switzerland), University of Ciudad Real (Spain), University of Toulon-Du Var (France), Max Planck Institute in the Sciences (Leipzig, Germany), Max Planck Institute for Gravitational Physics (Golm, Germany), Hausdorff Center (University of Bonn, Germany), University Pompeu Fabra (Barcelona, Spain), Stockholm, KTH (Sweden), Newton Institute (Cambridge, UK), NYUAD Abu Dhabi, Emirates.

Consultant. I am consultant at the ICTP: ICTP is an extraterritorial institution of UNESCO, and its mission is the dissemination of science (mostly physics, mathematics and meteorology) around the world and in particular in developing countries. My duties at ICTP are: teaching, give advices to the Mathematics Group, concerning Mathematical Analysis, Applied Mathematics, to give research guidance to postdoctoral fellows and visitors in the above fields, to help in the selection of participants and in the organization of scientific activities

3. EDITORIAL AND REFEREE ACTIVITY

Associate Editor:

Interfaces and Free Boundaries (European Mathematical Society), 2013-;
 Geometric Flows (De Gruyter), 2014-;
 Scientific Secretary for Ann. Sc. Norm. Super. Pisa Cl. Scienze, 1999-.

Referee for the following journals: Adv. Calc. Var., Ann. Inst. H. Poincaré Anal. Non Lin., Annali Mat. Pura Appl., Annali Sc. Norm. Sup. Pisa, Arch. Ration. Mech. Anal., Atti Accad. dei Lincei, Bull. London Math. Soc., Calc. Var. Partial Differential Equations, Comm. Cont. Math., Comm. Math. Phys., Comm. Partial Differential Equations, Comm. Pure Appl. Anal., Discrete Cont. Dyn. Systems, Electronic J. Differential Equations, Esaim: Control, Opt. and Calc. Var., Interfaces Free Bound., J. Comp. Phys., J. Control, Opt. Calculus of Variations, J. Convex Anal., J. Differential Equations, J. Differential Geom., J. Evolution Equations, J. Geom. Anal., J. Reine Angew. Math., Manuscripta Math., Math. Ann., Math. Meth. Appl. Sci., Meth. Appl. Anal., Pacific J. Math., Phys. A, Rendiconti Mat. Appl., Rendiconti Univ. Padova, Revista Mat. Iberoamericana, Siam J. Imaging Sci., Siam J. Math. Anal., Transactions Amer. Math. Soc.

Other referee activities: 2003: referee for the Swedish Research Council.
 2004: referee for the award of a Senior Fellowship of the Croucher Foundation (Hong Kong).
 2007: member of a Committee for a full professorship position in Italy.
 2008: referee for a Ph.D. thesis at the Univ. de Bretagne Occidentale (France).
 2009: member of the Committee for the evaluation of a Ph.D. Thesis at the Lab. J. Kuntzmann, Mathématiques Appliquées-Informatique, Univ. de Grenoble (France).
 2010: member of a Committee for a full professorship position in Italy.
 2011: member of a Committee for an associate professorship at Georgetown University (Usa).
 2011: member of a Committee for confirmation of associate professorships in Italy.
 2011: member of the Committee for assigning the positions for the Laurea Magistrale at SISSA/ISAS (Trieste).
 2011: referee for a Ph.D. Thesis at the Université Pierre et Marie Curie, Paris.
 2012 Peer referee VQR for the evaluation of research programs 2004-2010.
 2014: member of a Committee for confirmation of associate professorships in Italy.
 2014 External member of the Committee for the Doctoral School in Applied Mathematics at the International School for Advanced Studies SISSA-ISAS, Trieste.
 2014: member of the Committee for the positions for the Laurea Magistrale at SISSA/ISAS (Trieste).
 2014: referee for a Ph.D. thesis at the Univ. de la Lorraine (France).
 2015: referee for a professorship position W2 at the University of Hamburg (Germany).

4. TEACHING ACTIVITY

Advanced teaching activity: *Some aspects of motion by mean curvature I, II, III, IV*, Crete (Greece), 1998.

Geometric Evolution Problems, Minicorsi di Analisi Matematica, Padova 2003.

Anisotropic and crystalline mean curvature flow, Rome 2004.

Variational principles for geometric evolutions I, II, KTH, Stockholm (Sweden), 2007.

An introduction to mean curvature flow I, II, III, IV, University of Castilla La Mancha (Spain), 2008.

An introduction to mean curvature flow, University of Trieste (Italy), 2009.

Soluzioni deboli del flusso per curvatura media: barriere minime, SISSA (Trieste), Italy, 2009.

An introduction to mean curvature flow I, II, III, IV, Centro De Giorgi, Scuola Normale Superiore di Pisa, Pisa 2009.

An introduction to anisotropic and crystalline mean curvature flow I, II, III, IV: tutorial course, Hokkaido University, Hokkaido, Sapporo (Japan), 2010.

Mean curvature flow and singular perturbations I, II, III, in Winter School on "Geometric Evolution Equations and Related Topics", Regensburg, October 8-10, 2012.

Ph.D. Courses: *Geometric evolutions of manifolds, motion by mean curvature*, Pisa 1998.

Partial Differential Equations, Rome 1999.

Calculus of Variation in one dimension: classical theory, Rome 2000.

Motion by mean curvature, Rome 2000.

Geometric Measure Theory, Rome 2001.

Calculus of Variations, Rome 2002.

Minimizing Movements, Rome 2003.

Una introduzione alle equazioni differenziali, INDAM, Rome 2005.

Anisotropic evolution problems, Rome 2006.

Mean curvature flow and singular perturbations, SISSA (Trieste), 2012.

Variational models depending on curvatures in image reconstruction, SISSA (Trieste), 2013.

Anisotropic and crystalline mean curvature flow, SISSA (Trieste), 2014.

The Plateau problem and related questions, SISSA (Trieste), 2015.

Functional Analysis and Partial Differential Equations, ICTP Trieste, 2011, 2012, 2013, 2014, 2015.

Teaching activity on Mathematical Analysis, Differential Equations and Functional Analysis.

5. ADVISING ACTIVITY

Degree students. Masala M.: *Sulla funzione distanza al quadrato da una varietà*, (Univ. Roma Tor Vergata 2004).

Rossi R.: *A variational model for cracking in one-dimensional elasticity*, (Univ. Roma Tor Vergata 2004).

Doronzo M.: *Applications of Feynman-Kac formulas*, (Univ. Roma Tor Vergata 2005).

Bosco A.: *Simulation and experimental tests of the thermo-optical and mechanical properties of the LARES satellite for a precise measurement of the Lense-Thirring effect in General Relativity*, (Univ. Roma Tor Vergata 2005).

Palandra A.: *Probability and Finance*, (Univ. Roma Tor Vergata 2006).

Senatore M.: *Theoretical study and analysis of the thermal perturbations for the measurement of the Lense-Thirring effect with Lageos satellites*, (Univ. Roma Tor Vergata 2007).

Paoli D.: *Theoretical study and analysis of the thermal perturbations for the measurement of the Lense-Thirring effect with Laves satellites*, (Univ. Roma Tor Vergata 2007).

Biasutto S.A.: *Some economics applications of Calculus of Variations in one dimension*, (Univ. Roma Tor Vergata 2007).

Caselli F.: *Γ -convergence and the least squares method: applications to differential equations*, (Univ. Roma Tor Vergata 2008).

Gentile, S.:

Optical characterization of the NASA LAGEOS "sector" and the relationships with the de Sitter effect in General Relativity, (Univ. Roma Tor Vergata 2008),

Gagliardi, D.: *Equazioni di Hamilton-Jacobi e applicazioni*, (Univ. Roma Tor Vergata 2008),

Palandra, L.: *Accurate software modeling of the GNSS laser retroreflector array characterized at the SCF-LAB for the Etrusco-2 ASI-INFN project*, (Univ. Roma Tor Vergata 2013),

Piergentili, F.: *Positioning metrology, thermal control and analysis of GNSS laser retroreflector array characterized at the SCF-Lab*, (Univ. Roma Tor Vergata 2013),

Marra, M.: *Thermal-vacuum-optical characterization of the GNSS laser retroreflector array (GRA) at the SCF-Lab*, (Univ. Roma Tor Vergata 2013),

Capotorto, G.: *Thermal-orbital modeling of the GNS laser retroreflector array (GRA) and its validation with SCF-Lab test data*, (Univ. Roma Tor Vergata 2013).

ICTP Diploma students. Nguyen Thuong Ngoc Quoc: *Reaction-diffusion approximations of mean curvature flow*, ICTP Trieste, 2011.

Yaptieu Djengue Odette Sylvia: *On some properties of mean curvature flow with forcing and a pressure term*, ICTP Trieste, 2011.

Ngouanfou Fopa Edith Laure: *Introduction to mathematical optimal control theory*, ICTP Trieste, 2012.

Abdoul Aziz Gueye Dabakh: *Some topics on ordinary differential equations in mechanics and geometry*, ICTP Trieste, 2012.

Mohammad Khosravi: *Minimizing movements for differential equations*, ICTP Trieste, 2012.

Issa Tahir Bachar: *A recent variational approach to semilinear wave equations*, ICTP Trieste, 2012.

Udrakh Batzorig: *Spectrum of bounded linear operators*, ICTP Trieste, 2013.

Guengar Ngarteibaye: *Elliptic-type regularization for semilinear wave equations*, ICTP Trieste, 2013.

Ikromova Dildora: *The Dirichlet problem for Laplace and second elliptic operators: existence*, ICTP Trieste, 2014.

Alsammani Abdallah Alhadi Mahadi: *The Alexander polynomial of a knot*, ICTP Trieste, 2014.

Aryam Fatima: *Some notes on the Navier-Stokes equations*, ICTP Trieste, 2014.

Khachatryan Mariam: *The Brownian motion*, ICTP Trieste, 2015.

Abdulrashid Ismail: *The GN Theorem*, ICTP Trieste, 2015.

Ph.D. students. L. Mugnai: *Relaxation and variational approximation of curvature-dependent functionals in two dimensions*, Pisa 2003.

G. Riey: *Partition energies: approximation and first variation*, Rome 2004.

M. Chermisi: *Crystalline flows of planar networks and a geometric approach for systems of PDEs*, Rome 2006.

C. Tornese: *Convergence of discrete schemes for the Perona-Malik equation*, Rome 2008.

L. Tealdi (SISSA, Trieste): *The relaxed area of maps from the plane to the plane with a line discontinuity, and the role of semicartesian surface*, Trieste 2015.

S. Amato (SISSA, Trieste): *Some results on anisotropic mean curvature and other phase transition problems for Plateau's type problem*, Trieste 2015.

S. Holmatov (SISSA, Trieste): work in progress.

6. ORGANIZING ACTIVITY

Research projects:

- Italian coordinator of the bilateral project "Calculus of Variations: semicontinuity, relaxation, optimal design and approximation", Italia-Spagna.

- Coordinator of the Gnampa project entitled "Energie anisotrope, policristalline e di partizioni, e loro evoluzione secondo la massima discesa", Rome 2003.

- Coordinator of the Gnampa project entitled "Evoluzioni di interfacce e loro regolarizzazione mediante equazioni del quarto ordine", Rome 2004.
- Coordinator of a research group (2004 -) at the Centro De Giorgi (Scuola Normale Superiore, Pisa) on the subject "Interface Evolutions". Other components: V. Caselles (Barcelona) (up to 2013), A. Chambolle (Ecole Polytechnique, Paris), and M. Novaga (Pisa).

Conferences and workshops:

- Organizer of the workshop "Variational Problems with Free Interfaces", Pisa, 1997.
- Organizer of the workshop "Interface Evolutions and Applications", Centro De Giorgi, Scuola Normale Superiore, Pisa, 2004.
- Organizer of the workshop "Gradient flows of nonconvex functionals and related topics", Centro De Giorgi, Scuola Normale Superiore, Pisa, 2005.
- Organizer of the "Second School on Analysis and Applied Mathematics", Univ. Roma La Sapienza, 2005.
- Organizer of the "One day workshop on geometric evolution problems", Centro De Giorgi, Scuola Normale Superiore, Pisa, 2005.
- Organizer of the workshop "Recent advances on the Perona-Malik equation", Centro De Giorgi, Scuola Normale Superiore, Pisa, 2006.
- Organizer of the workshop "Geometric Evolutions and Applications", Centro De Giorgi, Scuola Normale Superiore, Pisa, 2006.
- Member of the Organizing Committee of the workshop on "Nonlocal and abstract parabolic equations and their applications" Bedlewo (Poland), Banach Center, Polish Academy of Science, 2007.
- Organizer of the workshop "Geometric Evolutions and Minimal Surfaces in Lorentzian Manifolds", Centro De Giorgi, Scuola Normale Superiore, Pisa, 2010. September 7-10, 2010.
- Co-organizer of the focus session "Singular Geometric Evolutions of Free Boundaries", at the Free Boundary Problem 2012 Conference, June 11-15 Chiemsee, Germany.