Curriculum Vitæ
and
List of publications

Marius BULIGA

Institute of Mathematics of the Romanian Academy, PO-BOX 1-764, 014700 Bucharest, Romania

e-mail: Marius.Buliga@imar.ro

Detailed information and articles online available at:
`http://www.imar.ro/~mbuliga/`

Domains of interest

- Geometric analysis in metric spaces, Sub-Riemannian Geometry,
- Convex Analysis, Nonlinear Elasticity,
- Brittle Fracture Mechanics

Studies:

- 2007 - Habilitation à diriger des recherches, Sciences Mathématiques, Université des Sciences et technologies de Lille, jury: Olivier Allix (ENS Cachan), Pierre Alart (Univ. Montpellier II), Tudor Ratiu (EPFL), Ioan R. Ionescu (Univ. Paris 13), Djimédo Kondo (USTL), Géry de Saxcé (USTL), Claude Vallée (Univ. Poitiers).
- 1997 - Ph.D. in Mathematics, Institute of Mathematics, Romanian Academy. Dissertation title: "Variational formulations in brittle fracture mechanics" (in Romanian). Ph.D. advisor: Eugen Sóos.
- 1995 - D.E.A. in Nonlinear Mechanics École Polytechnique, Paris. Dissertation title: "Modélisation de la décohesion d'interface fibres-matrice dans les matériaux composites".
- 1994 - Diplôme d'auditeur, École Polytechnique, Paris, majeure Science de l'Ingenieur. Dissertation title: "Reconstruction d'un champ de contraintes résiduelles à partir des contraintes mesurées sur des surfaces successives".
- 1992 - Graduation, Solid Media Mechanics Department, Faculty of Mathematics, Bucharest University. Graduation thesis: "The topological substratum of the derivative" (in Romanian).

Positions

- 2000 - senior researcher — Institute of Mathematics, Romanian Academy
- 2001-2006 - academic guest and post-doctoral position at Tudor Ratiu's chair of Geometric Analysis at Ecole Polytechnique Federale de Lausanne
- 1997-1998 - associated professor, Faculty of Mathematics, Hyperion University, Bucharest
- 1995-1999 - scientific researcher — Institute of Mathematics, Romanian Academy
- Feb. 1993 - Dec. 1993 - research assistant — Institute of Civil Engineering and Faculty of Mathematics, Bucharest University
- Sept. 1992 - Feb. 1993 - professor of Informatics — Petru Poni College, Bucharest

Visiting positions

- 2010-2011, 6 months, visiting associate professor, Institute of Mathematics, Universidade Federal do Rio de Janeiro, Brazil
- 2010, a month as guest at IHES, with the project "Dilatation structures: geometric and algebraic aspects of differential analysis in metric spaces"
- 2009 – visiting researcher: LMS-Université de Poitiers, a month
- 2008 - visiting researcher: LMT Cachan, École Normale Supérieure de Cachan, a month
- 2005 - visiting researcher: Département de Mécanique Fondamentale, Université de Lille 1, UFR de Mathématiques Pures et Appliquées, Université des Sciences et des Technologies de Lille (Lille-1), a month
- 2004 - guest at IHES, 15-30 Nov
- 2000 - visiting professor: Département de Mathématiques, École Polytechnique Fédérale de Lausanne, 3 months

Teaching experience

- Courses:
  - Advanced cours: Introduction to metric spaces with dilations, UFRJ, 2010-2011
  - Relativity Theory (4^{th} semester), cours: 24h/semester, for two years at the Faculty of Mathematics, University of Bucharest
  - Solid Media Mechanics (7^{th} semester), cours: 28h/semester, classes: 140h/semester (2h/week for 5 series of students, during 14 weeks), for two years at the Faculty of Mathematics, University of Bucharest
  - classes of Introductory notions in informatics (1^{st} semester), 56h/semester, at the Institute of Civil Engineering, Bucharest.
  - Linear Geometry (first 2 semesters), cours: 84 h/year, classes: 168h/year, for two years at the Faculty of Mathematics, Hyperion University, Bucharest

- Differential geometry (next 2 semesters), cours: 84 h/year, classes: 168h/year, for two years at the Faculty of Mathematics, Hyperion University, Bucharest.
- Classes for the first year Analysis course of Tudor Ratiu at EPFL, 108h/year, for 4 years.
- ocasionally replacing Tudor Ratiu for the Analysis I course, during 4 years.
- electronic support (page web with exercises/solutions) for the mentioned cours at EPFL, during 4 years

- Scientific seminars held at the Institute of Mathematics, Romanian Academy: Free discontinuity problems and spaces of functions with bounded variation, Energetic methods in brittle fracture mechanics.

Scientific activity

- Invited talks, conferences:

1992- Lie-Lobacevski Symposium, Université de Bucharest,

1996- Conférences Nationales de Mécanique des Solides (Roumanie), Constanta 1996, Iasi 1997

1996- Differential Equations and Calculus of Variations, summer school and workshop, Pisa, 1996

1999- M. Buliga, Energetic criterions in brittle fracture mechanics, The Fourth International Congress on Industrial and Applied Mathematics (ICIAM 99), 1999

1999- Applied Analysis and Mechanics Seminars, Hilary Term 1999, Mathematical Institute, Oxford, "Quasiconvexity versus group invariance", invited by J.M. Ball

1999- Scuola Internazionale Superiore di Studi Avanzati, Trieste, "The variational complex of a diffeomophisms group", invited by A. Braides

2000- Département de Mathématiques, École Polytechnique Fédérale de Lausanne, "Variational rigidity", invited by T. Ratiu

2002- Mathematical Institute, University of Bern, "Towards rectifiability in Carnot groups: a theory of irreducible representations of volume preserving bi-Lipschitz homeomorphisms", invited by M. Reimann

2003- Mathematical Institute, University of Bern, two lectures during the Séminaire Borel 2003 "Tangent spaces to metric spaces", IIIéme Cycle Romand de Mathmatiques, Switzerland

2004- Centre Bernoulli, École Polytechnique Fédérale de Lausanne, "A claim about Hamiltonian mechanics", invited by T. Ratiu

2004- Mathematical Institute, University of Bern, "Metric profiles and Mitchell theorem 1", invited by M. Reimann

2004- IMA - EPFL , "Majorisation and multiplicative quasiconvexity", invited by B. Dacorogna

2004- Journées d'automne de la Société Mathématique Suisse, "Curvature of metric profiles"

2004- Universität Stuttgart, Fakultät Mathematik und Physik, "Convexity notions, groups and nonlinear elasticity" invited by A. Mielke.

2005- Mathematical Institute, University of Bern, "Differential structures for sub-Riemannian spaces", invited by M. Reimann.

2005- Centre de Mathématiques et d'Informatique, Université de Provence, Séminaire de Géométrie et Singularités, "Flots hamiltoniens d'isométries" invited by B. Kolev.

2005- Laboratoire de Mécanique de Lille, "Un test pour les critères énérgetiques de rupture", invited by G. De Saxcé.

2006- GAMM 2006, Berlin, Germany, G. De Saxcé, M. Buliga, C. Vallée, C. Lerinţiu, Construction of a bipotential for a multivalued constitutive law

2006- 8-ème Colloque Franco-Roumain de Mathématiques Appliquées, Chambéry, "Convexité de Schur et élastomères nématiques"

2006- Geometric and Asymptotic Group Theory with Applications, Manresa,Spain, satellite conference of ICM2006 Madrid, "Dilatation Structures"

2006- December Monthly Conference of the Institute of Mathemathics of the Romanian Academy, Bucharest, "Travelling salesman through fractals"

2007- Geometric linearization of graphs and groups, January 22-26, 2007, Centre Interfacultaire Bernoulli, EPFL, Lausanne, Switzerland, "Dilatation structures and linearization of self-similar actions"

2007- International Symposium on Defect and Material Mechanics, March 25-29, 2007 - Aussois, France, "Fracture fattening and energy release rates"

2007- 6-th Congress of Romanian Mathematicians, June 28 - July 4, 2007 - Bucharest, Romania, Section: Theoretical Computer Science, Operations Research and Mathematical Programming, "Self-similar dilatation structures and automata"

2007- Viertes Deutsch-Rumänisches Seminar über Geometrie Dortmund, 15-18 July 2007, "Linear dilatation structures and conical groups"

2007- The eight international workshop on differential geometry and its applications, August 19-25, 2007, "Babeş-Bolyai" University, Cluj-Napoca, Romania, "Nonholonomic spaces and geometric group theory"

2008- Petit-dej, LMT Cachan, May 2008, "A hamiltonian associated to the Ambrosio-Tortorelli functional and a proposal concerning a brittle damage model"

2009- Workshop on Differential Geometry and its Applications Iasi, September 2 - 4, 2009, "Approximately symmetric spaces amd their metric geometry"

2009- LMA- Univ.de Provence, Oct. 2009, "Comment utiliser le bipotentiel dans un schéma numérique, suivant Berga et de Saxce"

2010- IECN-Nancy, Séminaire "Groupes de Lie et analyse harmonique", Apr. 2010, "Gómétrie approximative du point de vue algébrique"

2011- IM-UFRJ, Rio de Janeiro, 10-20 Jan. 2011, Summer School on Nonlinear analysis, "Carnot-Carathéodory spaces as metric spaces with dilations"

- Grants:

  - grant owner MCT-ANSTI 627/1998-1999 "Energetic Criteria in Fracture Mechanics"
  - grant member CEEX06-11-12/2006
  - member of the SCOPES funded grant "Lausanne-Bucharest common project on topology, geometry and mechanics"
  - LEA common project (Laboratoire Européen Associé CNRS Franco-Roumain) Math Mode 2009, "Bipotentials for non monotone multivalued operators: fundamental results and applications", with Gery de Saxcé

- research stages:
  - LMS, École Polytechnique, Paris, 1994
  - LPMTM, Université Paris 13, 1995

- scholarships:
  - bourse dans le "Programme Européen" de l' École Polytechnique, Paris, 1994
  - bourse de D.E.A. de l' École Polytechnique, Paris, 1995

Known languages

- Romanian: native language
- French - very good level: fluent in understanding, speaking and writing
- English - very good level: fluent in understanding, speaking and writing

Papers

1. Emergent algebras, 19 pp, submitted
2. Braided spaces with dilations and sub-riemannian symmetric spaces, 17 pp, to appear: in Contemporary Geometry and Topology and Related Topics, Iasi (2010)
3. A characterization of sub-riemannian spaces as length dilatation structures constructed via coherent projections, *Commun. Math. Anal.* **11** (2011), No. 2, 70-111
4. A priori inequalities between energy release rate and energy concentration for 3D quasistatic brittle fracture propagation, *Mathematics and Mechanics of Solids*, (2010), DOI:10.1177/0951629810375347
5. with G. de Saxcé, C. Vallée, Blurred maximal cyclically monotone sets and bipotentials, *Analysis and Applications* 8 (2010), no. 4, 1-14, DOI:10.1142/S0219530510001667
6. with G. de Saxcé, C. Vallée, Blurred constitutive laws and bipotential convex covers, *Mathematics and Mechanics of Solids*(2011), DOI 0:1081286509344878v1

7. with G. de Saxcé, C. Vallée, Bipotentials for non monotone multivalued operators: fundamental results and applications, *Acta Applicandae Mathematicae*, 110, 2(2010), 955-972, DOI 10.1007/s10440-009-9488-3

8. with G. de Saxcé, C. Vallée, Non maximal cyclically monotone graphs and construction of a bipotential for the Coulomb's dry friction law, *J. of Convex Analysis*, **17** (2010), No. 1, 81-94

9. Infinitesimal affine geometry of metric spaces endowed with a dilatation structure, *Houston Journal of Mathematics*, **36** 1 (2010), 91-136

10. with G. de Saxcé, C. Vallée, Bipotentials for unilateral contact with dry friction: fundamentals and numerical algorithms, 7-th EUROMECH Solid Mechanics Conference J. Ambrosio et.al. (eds.) Lisbon, Portugal, 7 - 11 September 2009, 1-17, `http://web.univ-ubs.fr/limatb/EG2M/Disc_Seminaire/ESMC2009/papers/MS-05/pap_0141_MS-05`

11. with G. de Saxcé, C. Vallée, Un critère d'existence et une méthode de construction des bipotentiels, (2009), 19ème Congrès Français de Mécanique, Marseille 24-28 août 2009, 6 pp
`http://documents.irevues.inist.fr/bitstream/handle/2042/36558/438.pdf?sequence=1`

12. Hamiltonian inclusions with convex dissipation with a view towards applications, 24 pp, *Ann. of the AOSR, Mathematics and its Applications*, **1** 2 (2009),228-251

13. Self-similar dilatation structures and automata, Proceedings of the 6-th Congress of Romanian Mathematicians, Bucharest, 2007, vol. 1, 557-564 (2008)

14. Dilatation structures in sub-riemannian geometry, in: Contemporary Geometry and Topology and Related Topics, Cluj-Napoca, Cluj University Press (2008), 89-105

15. Four applications of majorization to convexity in the calculus of variations,*Linear Algebra and its Appl.*, **429**, (2008), 1528-1545

16. with G. de Saxcé, C. Vallée, Existence and construction of bipotentials for graphs of multivalued laws, *J. of Convex Analysis*, **15**, 1, (2008) , 087–104

17. Vrănceanu' nonholonomic spaces from the viewpoint of distance geometry, (in romanian, original title: Spaţiile neolonome ale lui Vrănceanu din punctul de vedere al geometriei distanţei), *Gazeta Matematica A*, **4** (2008), 349-352

18. Dilatation structures I. Fundamentals, *J. Gen. Lie Theory Appl.*, **1** (2007), No 2, 65-95

19. with G. de Saxcé, C. Vallée, C. Lerintiu, Construction of a bipotential for a multivalued constitutive law, *Proc. Appl. Math. Mech.*, vol. **6** , no. 1 (2006), 153-154

20. Lower semi-continuity of integrals with G-quasiconvex potential, *Z. Angew. Math. Phys.*, **53**, 6, 949-961, (2002)

21. Brittle crack propagation based on an optimal energy balance, *Rev. Roum. des Math. Pures et Appl.*, **45**, no. 2, 201–209 (2001)

22. Energy Minimizing Brittle Crack Propagation, *J. of Elasticity*, **52**, 3, 201-238, (1998)

23. Geometric evolution problems and action-measures, *PAMM Appl. Math. Bull.*, vol. **LXXXVI** (1998), T. U. Budapest, 53-58

24. On Special Relativistic Approach to Large Deformations in Continuous Media, *Rev. Roum. de Math. Pures et Appl.*, t. XLI, **1-2**, 5-15, (1996)

25. with P. Ballard, A. Constantinescu, Reconstruction d'un champ de contraintes résiduelles à partir des contraintes mesurées sur des surfaces successives. Existence et unicité. *C. R. Acad. Sci., Paris*, Sér. II 319, No.10, 1117-1122 (1994)

26. Topological Substratum of the Derivative, *Mathematical Reports*, 45, **6**, 453-465, (1993)

27. More than discrete or continuous: a bird's view (2010), `http://arxiv.org/abs/1011.4485`

28. Boring mathematics, artistes pompiers and impressionists (2010), `http://arxiv.org/abs/1011.3465`

29. What is a space? Computations in emergent algebras and the front end visual system (2010), `http://arxiv.org/abs/1009.5028`

30. Introduction to metric spaces with dilations (2010), `http://arxiv.org/abs/1007.2362`

31. Uniform refinements, topological derivative and a differentiation theorem in metric spaces (2009), `http://arxiv.org/abs/0911.4619`

32. Deformations of normed groupoids and differential calculus. First part (2009) `http://arxiv.org/abs/0911.1300`

33. Majorisation with applications to the calculus of variations (2001), the preprint version of the published paper "Four applications of majorization to convexity in the calculus of variations", cited several times as preprint, before the appearance of the published version `http://arxiv.org/abs/math/0105044`

34. Contractible groups and linear dilatation structures (2007) `http://arxiv.org/abs/0705.1440`

35. Dilatation structures with the Radon-Nikodym property, (2007) `http://arxiv.org/abs/0706.3644`

36. On the Kirchheim-Magnani counterexample to metric differentiability, (2007) `http://arxiv.org/abs/0710.1350`

37. Microfractured media with a scale and Mumford-Shah energies, (2007) `http://xxx.arxiv.org/abs/0704.3791`

38. Dilatation structures II. Linearity, self-similarity and the Cantor set, (2006) `http://xxx.arxiv.org/abs/math.MG/0612509`

39. Energy concentration and brittle crack propagation, (2005) `http://arxiv.org/abs/math.AP/0510225`

40. Quasiconvexity versus group invariance, (2005) `http://arxiv.org/abs/math.AP/0511235`

41. Perturbed area functionals and brittle damage mechanics, (2005)
    http://arxiv.org/abs/math.AP/0511240

42. Energy minimizing brittle crack propagation II, (2005)
    http://arxiv.org/abs/math.AP/0511301

43. The variational complex of a diffeomorphisms group, (2005)
    http://arxiv.org/abs/math.AP/0511302

44. Sub-Riemannian geometry and Lie groups. Part II. Curvature of metric spaces, coadjoint orbits and associated representations, (2004)
    http://arxiv.org/abs/math.MG/0407099

45. Curvature of sub-Riemannian spaces, (2003)
    http://arxiv.org/abs/math.MG/0311482

46. Tangent bundles to sub-Riemannian groups, (2003)
    http://arxiv.org/abs/math.MG/0307342

47. Volume preserving bi-Lipschitz homeomorphisms on the Heisenberg group, (2002)
    http://arxiv.org/abs/math.SG/0205039

48. Sub-Riemannian geometry and Lie groups. Part I, (2002)
    http://arxiv.org/abs/math.MG/0210189

49. Symplectic, Hofer and sub-Riemannian geometry, (2002)
    http://arxiv.org/abs/math.SG/0201107

Mémoire pour l'Habilitation à diriger des recherches, Sciences Mathématiques

- M. Buliga, Outils géométriques dans l'étude des grandes déformations, de l'endommagement et de la mécanique non régulière, (2007), Université des Sciences et Technologies de Lille (Lille I)

PhD Thesis, Mathematics

- Variational Formulations in brittle fracture mechanics (in Romanian), PhD Thesis, (1997), Institute of Mathematics of the Romanian Academy

Preprints, mémoires, dissertations, notes

1. *Lower semicontinuity of variational integrals defined on groups of diffeomorphisms*, IMAR preprint 17/1998

2. *Modélisation de la décohesion d'interface fibres-matrice dans les matériaux composites*, mémoire de D.E.A., École Polytechnique, 1995

3. *Energetic criteria in fracture mechanics*, scientific report, grant MCT-ANSTI 627/1998-1999