

Curriculum Vitæ

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

- Geometry and 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 Sós.
- 1995 - D.E.A. in Nonlinear Mechanics École Polytechnique, Paris. Dissertation title: "Modélisation de la décohésion 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

Awards, grants, fellowships

- Spiru Haret Prize of the Romanian Academy (2008)
- winner of a public contest for a visiting associate professor position at the Institute of Mathematics, Universidade Federal do Rio de Janeiro, Brazil, (2010)
- with Laurențiu Leuștean, grant PN-II-ID-PCE-2011-3-0383 "Proof mining in metric analysis, geometric group theory and ergodic theory", (2011)
- LEA common project (Laboratoire Européen Associé CNRS Franco-Roumain) Math Mode 2009, "Bipotentials for non monotone multivalued operators: fundamental results and applications", with G ery de Saxc e and C laude Vall e
- member of the SCOPES funded grant "Lausanne-Bucharest common project on topology, geometry and mechanics"
- MCT-ANSTI 627/1998-1999 "Energetic Criteria in Fracture Mechanics"

- CEEEX06-11-12/2006

Teaching experience

- Courses:

- Introduction to metric spaces with dilations, Instituto de Matemática, Universidade Federal do Rio de Janeiro, 2010-2011
- Relativity Theory (4th semester), cours: 24h/semester, for two years at the Faculty of Mathematics, University of Bucharest, 1993
- Solid Media Mechanics (7th semester), cours: 28h/semester, classes: 140h/semester (2h/week for 5 series of students, during 14 weeks), 1993 at the Faculty of Mathematics, University of Bucharest
- classes of Introductory notions in informatics (1st semester), 56h/semester, at the Institute of Civil Engineering, Bucharest, 1992-1993
- 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.
- occasionally 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-Lobachevski 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 diffeomorphisms 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", III^{ème} Cycle Romand de Mathématiques, 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 énergétiques de rupture", invited by G. De Saxcé.
- 2006- GAMM 2006, Berlin, Germany, G. De Saxcé, M. Buliga, C. Vallée, C. Lerințiu, 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 Mathematics of the Romanian Academy, Bucharest, "Travelling salesman through fractals"
- 2007- Geometric linearization of graphs and groups, January 22-26, 2007, Centre Inter-facultaire 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- 6th 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 and 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, "Géométrie 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"
- 2011- LEA Math Mode Colloque, 28-29 Nov., IMAR, "Non-euclidean analysis of dilation structures"
- 2012- (unfortunately not able to attend but see the course notes on my homepage) CIMPA research school on sub-riemannian geometry, January 30 - February 9, Lebanese University, Beirut (Lebanon), "Metric spaces with dilations and sub-riemannian geometry from an intrinsic viewpoint"

- 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, English, French

Articles

1. Emergent algebras, 19 pp, submitted
2. with G. de Saxcé, C. Vallée, A variational formulation for constitutive laws described by bipotentials, 14 pp, accepted for publication in *Mathematics and Mechanics of Solids* (2012)
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*, **16** (2011), no. 3, 265-282
5. with G. de Saxcé, C. Vallée, Blurred maximal cyclically monotone sets and bipotentials, *Analysis and Applications* 8 (2010), no. 4, 1-14,
6. with G. de Saxcé, C. Vallée, Blurred constitutive laws and bipotential convex covers, *Mathematics and Mechanics of Solids*, **16**(2), (2011), 161-171
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
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. 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
11. Four applications of majorization to convexity in the calculus of variations, *Linear Algebra and its Appl.*, **429**, (2008), 1528-1545
12. 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
13. Dilatation structures I. Fundamentals, *J. Gen. Lie Theory Appl.*, **1** (2007), No 2, 65-95
14. Lower semi-continuity of integrals with G -quasiconvex potential, *Z. Angew. Math. Phys.*, **53**, 6, 949-961, (2002)
15. Brittle crack propagation based on an optimal energy balance, *Rev. Roum. des Math. Pures et Appl.*, **45**, no. 2, 201–209 (2001)
16. Energy Minimizing Brittle Crack Propagation, *J. of Elasticity*, **52**, 3, 201-238, (1998)
17. On Special Relativistic Approach to Large Deformations in Continuous Media, *Rev. Roum. de Math. Pures et Appl.*, t. XLI, **1-2**, 5-15, (1996)

18. 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)
19. Topological Substratum of the Derivative, *Mathematical Reports*, 45, **6**, 453-465, (1993)

Book chapters, proceedings

1. Braided spaces with dilations and sub-riemannian symmetric spaces. in: Geometry. Exploratory Workshop on Differential Geometry and its Applications, eds. D. Andrica, S. Moroianu, Cluj-Napoca (2011), 21-35
2. Self-similar dilatation structures and automata, Proceedings of the 6-th Congress of Romanian Mathematicians, Bucharest, 2007, vol. 1, 557-564 (2008)
3. Dilatation structures in sub-riemannian geometry, in: Contemporary Geometry and Topology and Related Topics, Cluj-Napoca, Cluj University Press (2008), 89-105
4. 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,
5. 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
6. 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
7. Geometric evolution problems and action-measures, *PAMM Appl. Math. Bull.*, vol. **LXXXVI** (1998), T. U. Budapest, 53-58

Vulgarisation

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

ArXiv preprints

1. Computing with space: a tangle formalism for chora and difference (2011), <http://arxiv.org/abs/1103.6007>
2. Maps of metric spaces (2011), edited Appendix of "Computing with space", <http://arxiv.org/abs/1107.2817>
3. Normed groupoids with dilations, improved version of "Deformations of normed groupoids", <http://arxiv.org/abs/1107.2823>

4. More than discrete or continuous: a bird's view (2010),
<http://arxiv.org/abs/1011.4485>
5. Boring mathematics, artistes pompiers and impressionists (2010),
<http://arxiv.org/abs/1011.3465>
6. What is a space? Computations in emergent algebras and the front end visual system (2010), <http://arxiv.org/abs/1009.5028>
7. Introduction to metric spaces with dilations (2010),
<http://arxiv.org/abs/1007.2362>
8. Uniform refinements, topological derivative and a differentiation theorem in metric spaces (2009), <http://arxiv.org/abs/0911.4619>
9. Deformations of normed groupoids and differential calculus. First part (2009)
<http://arxiv.org/abs/0911.1300>
10. 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>
11. Contractible groups and linear dilatation structures (2007)
<http://arxiv.org/abs/0705.1440>
12. Dilatation structures with the Radon-Nikodym property, (2007)
<http://arxiv.org/abs/0706.3644>
13. On the Kirchheim-Magnani counterexample to metric differentiability, (2007)
<http://arxiv.org/abs/0710.1350>
14. Microfractured media with a scale and Mumford-Shah energies, (2007)
<http://xxx.arxiv.org/abs/0704.3791>
15. Dilatation structures II. Linearity, self-similarity and the Cantor set, (2006)
<http://xxx.arxiv.org/abs/math.MG/0612509>
16. Quasiconvexity versus group invariance, (2005)
<http://arxiv.org/abs/math.AP/0511235>
17. Perturbed area functionals and brittle damage mechanics, (2005)
<http://arxiv.org/abs/math.AP/0511240>
18. The variational complex of a diffeomorphisms group, (2005)
<http://arxiv.org/abs/math.AP/0511302>
19. 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>
20. Curvature of sub-Riemannian spaces, (2003)
<http://arxiv.org/abs/math.MG/0311482>

21. Tangent bundles to sub-Riemannian groups, (2003)
<http://arxiv.org/abs/math.MG/0307342>
22. Volume preserving bi-Lipschitz homeomorphisms on the Heisenberg group, (2002)
<http://arxiv.org/abs/math.SG/0205039>
23. Sub-Riemannian geometry and Lie groups. Part I, (2002)
<http://arxiv.org/abs/math.MG/0210189>
24. 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