

CURRICULUM VITAE

Ciprian S. Borcea

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Education

B.Sc. Mathematics, University of Bucharest, Romania, 1976

M.Sc. Mathematics, University of Bucharest, Romania, 1977
Specialization in *Complex Analytic Geometry*

Ph.D. Mathematics, University of Bucharest, Romania, 1983
THESIS TITLE: “Deformations of Complex Structures”
ADVISOR: Dr. Constantin Bănică.

Appointments

1. Professor of Mathematics, Rider University, since 1997.
2. Associate Professor, Rider University, 1990-1997, with tenure conferred in 1993.
3. Member, Institute for Advanced Study, Princeton, 1989-1990.
4. Research Mathematician, National Institute for Scientific and Technical Creation, INCREST, Bucharest, 1979-1988.
5. Programmer at Computing Center, Bucharest. 1978-1979.

Research Interests

Algebraic Geometry, with special regard to Mirror Symmetry and articulated systems.

Awards

Silver Medal at International Mathematical Olympiad, 1972

Grigore Moisil Award of the Romanian Academy, 2006

Dominick A. Iorio Research Award, Rider University, 2006

Invited Lectures at Symposia

- ICERM Workshop on “Unusual Configuration Spaces”, Providence, RI, September 12-16, 2016.
- 11th International Workshop on “Automated Deduction in Geometry” (ADG 2016), Strasbourg, France, June 27-29, 2016.
- ICMS Conference on “Geometric Rigidity Theory and Applications”, Edinburgh, UK, May 30 - June 3, 2016.
- SIAM Conference on “Mathematical Aspects of Materials Science”, Philadelphia, Pennsylvania, May 8, 2016.
- Conference on “Mathematics of Robotics”, St. Anne’s College, University of Oxford, UK, September 9-11, 2015.
- “Symposium on Theory of Machines and Mechanisms” (TrISToMM 2015), Izmir Institute of Technology, Izmir, Turkey, June 2015.
- 10th International Workshop on “Automated Deduction in Geometry” (ADG 2014), Coimbra, Portugal, July 9-11, 2014.
- Conference “Advances in Robot Kinematics” (ARK 2014), Ljubljana, Slovenia, June 29-July 3, 2014.
- Workshop “Geometric Structures with Symmetry and Periodicity”, Kyoto University, Japan, June 8-9, 2014.
- Special Session on *Discrete geometry in Crystallography*, American Mathematical Society Meeting 1098, University of Maryland, Baltimore, MD, March 2014.
- Workshop “Foams and Minimal Surfaces - 12 Years On”, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, February 24-28, 2014.
- Special Session on *Articulated systems: combinatorics, geometry and kinematics*, American Mathematical Society International Meeting 1091, Alba Iulia, Romania, June 27-30, 2013.
- “Computational Kinematics”, Barcelona, Spain, May 2013.
- “Algebraic Geometry and Geometric Modeling”, Workshop at Banff International Research Station, January 2013.
- International Workshop on “*Automated Deduction in Geometry*”, University of Edinburgh, UK, September 2012.
- “Rigidity Theory: Progress, Applications and Key Open Problems”, Workshop at Banff International Research Station, July 15-20, 2012.

- International Symposium on “Advances in Robot Kinematics”, Innsbruck, Austria, June 2012.
- Special Session on *Modeling Crystalline and Quasi-Crystalline Materials*, American Mathematical Society Meeting 1079, Tampa, Florida, 2012.
- Royal Society Meeting on “Rigidity of periodic and symmetric structures in nature and engineering”, Kavli Centre, UK, February 2012.
- Workshop on Rigidity and Symmetry, Fields Institute, Toronto, October 2011.
- London Mathematical Society Workshop on “Rigidity of Frameworks and Applications”, Lancaster, UK, July 2010.
- Conference on Reconfigurable Mechanisms and Robots, King’s College, London, UK, June 2009
- Special Session on Topological Robotics, American Mathematical Society Meeting 1050, Worcester Polytechnic Institute, April 2009
- Symposium on Computational Geometry, Gyeongju, South Korea, June 2007
- Non-Linear Computational Geometry, Institute for Mathematics and its Applications, University of Minnesota, May/June 2007
- ASCM 2005: Seventh Asian Symposium in Computer Mathematics, Seoul, Korea, December 2005
- MEGA05 Conference “Effective Methods in Algebraic Geometry”, Porto Conte, Sardinia, Italy, May 2005
- Workshop on “*Komplexe Analysis*”, Mathematisches Forschungsinstitut Oberwolfach, Germany, August 2004
- Special Session on *Algebraic geometry and Mirror Symmetry*, Meeting 997, Rider University, Lawrenceville, NJ, 2004
- Special Session on *Algebraic Geometry*, American Mathematical Society Meeting 949, Charlotte, NC, 1999
- Special Session on *Mirror Symmetry and Toric Varieties*, AMS Meeting 914, Rider University, Lawrenceville, 1996
- Special Session on *Toric Varieties*, American Mathematical Society Meeting 898, Hartford, Connecticut, 1995
- Workshop on *Recent Developments in Mirror Symmetry*, Oklahoma State University, Stillwater, Oklahoma, 1995

- Special Session on *Algebraic Geometry*, American Mathematical Society Meeting 890, Lexington, Kentucky, 1994
- Workshop on *Surfaces and Threefolds*, University of Warwick, 1991
- Special Session on *Algebraic Geometry*, American Mathematical Society Meeting 861, University of North Texas, Denton, 1990

Invited Lectures at University Seminars

Technische Universität München, 2013
 Princeton University, 2014, 2012, 2011, 1999 and 1991
 Technische Universität Wien, 2007
 Université de Nice, 2013, 2006
 Technische Universität Berlin, 2006
 Academia Sinica, Beijing, China, 2005
 Korea Institute for Advanced Study, Seoul, Korea, 2005
 Research Institute for Mathematical Sciences, Kyoto, 2005
 École Normale Supérieure, Paris, 2003
 Stanford University, 2003
 University of Chicago, 2001
 CUNY, 2000
 Universidad de Cantabria, Santander, 2000
 Rutgers University, 1999
 Universitat Politècnica de Catalunya, Barcelona, 1998
 University of Utah, 1990

Service to the profession

- Site Director in the Institute for Advanced Study/Park City Mathematics Institute (PCMI) High School Teacher Program 1997-99.
- Organizer of Special Sessions at American Mathematical Society Meetings: 1996, 2004, 2013.
- Program Committee member for the conference “Mathematics of Robotics”, St. Anne’s College, University of Oxford, UK, 2015.
- Invited Research Fellow in residence, in the thematic semester “Topology in motion” (September 6 to December 9, 2016) organized by the Institute for Computational and Experimental Research in Mathematics (ICERM) at Brown University in Providence, RI.

Colloquia and Research Seminars Organized at Rider University

Student Seminar on Periodic Frameworks, 2015, 2016.
Symposium “Mathematical models with applications in crystallography and protein structure”, April 4, 2014.
Colloquium “100 Years of X-Ray Crystallography”, 2011.
Student Seminar on Line Configurations, 2007 and 2008.
Seminar on Polygon spaces, 1999-2000.
Seminar on Toric Varieties, Summer 1994.
Seminar on Topics in Algebraic Geometry, 1990-1991.

Courses taught at Rider University

Finite Mathematics	<i>Topics in Advanced Mathematics:</i>
Calculus I, II, III	Number Theory
Advanced Calculus	Algebraic Geometry
Differential Equations	Differential Geometry
Linear Algebra	Riemann Surfaces
Modern Algebra	Geometry of Curves and Surfaces
Modern Geometry	Galois Theory
Complex Analysis	Fourier Analysis
Probability Theory	

Mentoring of student research projects (selected topics)

Complex Variables
Algebraic Varieties
Euclidean and Non-Euclidean Geometries
Representations of finite groups
Cycloids and trochoids
The rhombic dodecahedron as a linkage
Periodic frameworks with expansive deformations

Grants

- NSF CCF-AF 1319389: “*Mathematical foundations of reconfiguration algorithms for geometrically constrained structures*”, 2013-2016. PI,
- NIH 1R01GM109456: “*Rigidity and flexibility of large bio-molecular assemblies*”, 2013-2018. Co-PI, Collaboration with Ileana Streinu, Smith College and George Phillips, Jr., Rice University.
- DARPA “23 Mathematical Challenges” grant: “*Combinatorial and Algorithmic Rigidity: Beyond Two Dimensions*”, 2008-2012. Co-PI, Collaboration with Ileana Streinu, Smith College.

Publications

1. *Ecuatii Analitice cu Derivate Partiale Cvasiliniare in Involutie, (Involutive Analytic Quasi-Linear Partial Differential Equations)*, Studii si Cerc. Mat. **1**, 1979, 53-61.
2. *Some Remarks on Deformations of Hopf Manifolds*, Revue Roumaine Math. Pures et Appl. **10**, 1981, 1287-1294.
3. *Despre Clasa Chern a Unui Divizor, (On the Chern Class of a Divisor)*, Studii si Cerc. Mat. **4**, 1982, 305-308.
4. *Complex Structures on $R_1 \times R_g$* , Bollettino U.M.I. **6/2-A**, 1983, 139-145.
5. *Families of Smooth Hypersurfaces on Certain Compact Homogeneous Complex Manifolds*, Math. Proc. Camb. Phil. Soc. **93**, 1983, 315-321.
6. *Smooth Global Complete Intersections in Certain Compact Homogeneous Complex Manifolds*, J. Reine und Angew. Math. **344**, 1983, 65-70.
7. *Moduli for Kodaira Surfaces*, Compositio Math. **52**, 1984, 373-380.
8. *Deformari de Structuri Complexe, (Deformations of Complex Structures)*, Studii si Cerc. Mat. **6**, 1984, 481-510.
9. *K3 Surfaces and Complex Multiplication*, Revue Roumaine Math. Pures et Appl. **31**, 1986, 499-505.
10. *Diffeomorphisms of a K3 Surface*, Math. Annalen **275**, 1986, 1-4.
11. *Deforming Varieties of k-planes of Projective Complete Intersections*, Pacific J. Math. **143**, 1990, 25-36.
12. *Nodal Quintic Threefolds and Nodal Octic Surfaces*, Proceedings AMS **109**, 1990, 627-635.
13. *Homogeneous Vector Bundles and Families of Calabi-Yau Threefolds*, Duke Math. Journ. **61**, 1990, 395-415.
14. *Homogeneous Vector Bundles and Families of Calabi-Yau Threefolds, II*, Proc. Symp. Pure Math. **52**, part 2, 1991, 83-91.
15. *On Desingularized Horrocks-Mumford Quintics*, J. Reine und Angew. Math. **421**, 1991, 23-41.
16. *Calabi-Yau Threefolds and Complex Multiplication*, Essays on Mirror Manifolds, edited by S. -T. Yau, International Press, Hong Kong, 1992.
17. *K3 Surfaces with Involution and Mirror Pairs of Calabi-Yau Manifolds*, Mirror Symmetry II, edited by B. Greene and S. -T. Yau, AMS/IP Studies in Advanced Mathematics, 1996.

18. *Association for flag configurations*, in “Commutative Algebra, Singularities and Computer Algebra”, NATO Science Series, vol. 115, Kluwer 2003, p.1-8.
19. *The number of embeddings of minimally rigid graphs* (with I. Streinu), *Discrete and Computational Geometry* **31**, 2004, 287-303. A preliminary version appeared in Proc. 18th Symposium on Computational Geometry, Barcelona, Spain, June 2002, pp. 25-32.
20. *Polygon spaces, tangents to quadrics and special Lagrangians*, Oberwolfach Reports (2004), published by the European Mathematical Society, 2181-2183.
21. *Algebraic geometry for constraint problems*, Proc. 7th Asian Symposium in Computer Math. (ASCM 2005), Editors: Sung-il Pae, Hyungju Park, KIAS, 112-114.
22. *Common tangents to spheres in R^3* (with X. Goaoc, S. Lazard and S. Petitjean), *Discrete and Computational Geometry* **35**, 2006, 287-300.
23. *Line transversals to disjoint balls* (with X. Goaoc and S. Petitjean), *Discrete and Computational Geometry* **39** No.1-3, 2008, 158-173. A preliminary version appeared in Proc. 23rd Annual ACM Symposium on Computational Geometry 2007 (SoCG’07), Gyeongju, South Korea. ACM Press, pp.245-254, 2007.
24. *Infinitesimally flexible skeleta of cross-polytopes and second-hypersimplices*, *Journal for Geometry and Graphics* **12**, No.1, 2008, 1-10.
25. *Extremal configurations of manipulators with revolute joints* (with I. Streinu), In “Reconfigurable Mechanisms and Robots”, Jian S. Dai, Matteo Zoppi and Xianwen Kong (eds.), KC Edizioni, 2009, 279-284.
26. *How far can you reach?* (with I. Streinu), in ACM-SIAM Symposium on Discrete Algorithms (SODA) 2010 Proceedings.
27. *Periodic frameworks and flexibility* (with I. Streinu), *Proc. Royal Society A* **466**, 2633-2649, 2010.
28. *Minimally rigid periodic graphs* (with I. Streinu), *Bulletin LMS* **43**, 1093-1103 (2011), doi:10.1112/blms/bdr044
29. *Extremal reaches in polynomial time* (with I. Streinu), Proc. 27th Symp. Comp. Geometry (SoCG11), pp. 472480. ACM Press (2011).
30. *Exact workspace boundary by extremal reaches* (with I. Streinu), Proc. 27th Symp. Comp. Geometry (SoCG11), pp. 481490. ACM Press (2011).
31. *Flexible crystal frameworks* (with I. Streinu), Proc. CCCG 2012, Charlot-tetown, P.E.I., August 8-10, 2012; see also: arXiv:1110.4661.

32. *Positional workspace boundary for serial manipulators with revolute joints* (with I. Streinu), in “Latest Advances in Robot Kinematics”, *J. Lenarčič* and *M. Husty* editors, 325-332, Springer, 2012.
33. *Realizations of volume frameworks* (with I. Streinu), in “Automated Deduction in Geometry”, Editors: Tetsuo Ida and Jacques Fleuriot, Springer 2013, p. 110-119.
34. *Singularity locus for the endpoint map of serial manipulators with revolute joints* (with I. Streinu), in “Computational Kinematics”, Proceedings of the 6th International Workshop on Computational Kinematics (CK2013), F. Thomas and A. Perez Garcia editors, 271-279, Springer, 2014.
35. *Frameworks with crystallographic symmetry*, (with I. Streinu) Philosophical Transactions of the Royal Society, series A, Mathematical, Physical and Engineering Sciences, vol. 372, 2014; doi: 10.1098/rsta.2012.0143
36. *Kinematics of expansive planar periodic mechanisms*, (with I. Streinu) in “Advances in Robot Kinematics”, *J. Lenarčič* and *O. Khatib* editors, 395-407, Springer, 2014.
37. *Symmetries of the positive semidefinite cone*, Forum Mathematicum. Volume 26, Issue 4, Pages 983-986, ISSN (Online) 1435-5337, ISSN (Print) 0933-7741, DOI: 10.1515/form.2011.171, (Jul 2014).
38. *Periodic body-and-bar frameworks* (with I. Streinu and S. Tanigawa), SIAM J. Discrete Math. 29(1), 93-112 (2015). A preliminary version appeared in Proc. 28th Symp. Computational Geometry (SoCG’12), Chapel Hill, NC, USA, June 17-20, 2012, 347356, 2012.
39. *Liftings and stresses for planar periodic frameworks* (with I. Streinu), Discrete and Computational Geometry **53** (2015), 747-782. A preliminary version appeared in Proc. 30th Symp. Computational Geometry (SoCG’14), Kyoto, Japan, June 8-11, 2014.
40. *Volume frameworks and deformation varieties* (with I. Streinu), in “Automated Deduction in Geometry”, Editors: F. Botana and P. Quesada, p. 21-36, Springer 2015.
41. *Geometric auxetics* (with I. Streinu), Proc. Royal Society A **471**, 20150033, 2015.
42. *Deforming diamond* (with I. Streinu), IMA Journal of Applied Mathematics, **82**, No. 2, 371-383, doi:10.1093/imamat/hxw055, 2017.