Curriculum Vitae

Alexandre S. Freire

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University education and degrees

Ph.D. Mathematics, June 1988, Princeton University, Princeton, New Jersey.
Thesis: The Martin boundary of manifolds of nonpositive curvature
Advisor: Shing-Tung Yau

M.Sc. Mathematics, February 1982, Instituto de Matemática Pura e Aplicada (Rio de Janeiro, Brazil).
Thesis: The geodesic flow of compact manifolds without conjugate points
Advisor: Ricardo Mañé

B.Sc. Mathematics, June 1980, Federal University of Rio de Janeiro (Brazil).

Metallurgical engineering, 1977-1979 (incomplete), Military Institute of Engineering (Rio de Janeiro)

Employment

9/2002-8/2004: Program Director, Division of Mathematical Sciences,
National Science Foundation (Arlington, Virginia)

8/1995-present: Associate Professor, University of Tennessse Knoxville

8/1991- 7/1995: Assistant Professor, University of Tennessee Knoxville

8/1988-7/1991: Szegö Assistant Professor, Stanford University

Extended research visits

1/07-7/07: Max Planck Institut für Gravitationsphysik (Potsdam, Germany)

1/97-6/97: Mathematics Department, Stanford University

10/96-12/96: SFB 256 (Nonlinear Partial Differential Equations),
Universität Bonn, Germany

1/93-7/93 and 7/96-9/96: Forschungsinstitut für Mathematik
Eidgenössische Technische Hochschule, Zürich, Switzerland

4/90-6/90: Mathematics Institute, Warwick University,
Coventry, United Kingdom

Seminars, colloquia and conferences (since 2001)

October 2001: AMS Southeastern Section meeting (Chattanooga, TN)-special session on Geometric Analysis and Partial Differential Equations

October 2002: AMS Section meeting (Madison, WI)- special session on partial differential equations

August 2003- Banff International Research Station (Canada)- workshop on pattern formation equations- invited speaker

October 2003: Georgetown University, Washington DC (colloquium)

March 2004: University of Minnesota, Twin Cities (Geometric Analysis seminar)

April 2004: University of Maryland (Applied PDE seminar)

March 2005- 7th Southeast Geometry Seminar, Emory University (Atlanta, GA)- invited speaker

April 2005- Purdue University- colloquium speaker

July 2005- IMPA, Rio de Janeiro, Brazil - 8th international conference on Partial Differential Equations and Applications- invited 50 min speaker

September 2005- Stanford University (CA)- Conference for Leon Simon's 60th birthday- invited participant

January 2006- Universidad del Valle (Cali, Colombia)- Conference in memory of Jose F. Escobar- member of the Scientific Committee

March 2006- Mathematics Colloquium, University of Notre Dame

April 2006- Differential Geometry seminar, Duke University

February 2007- Geometric Analysis seminar, Albert Einstein Institut (Potsdam, Germany)

March 2007- Geometric Analysis seminar, National and Capodistrian University of Athens

June 2007- Geometric Analysis seminar, Freie Universität Berlin (Germany)

July 2007-Mathematics Colloquium, Albert-Ludwigs Universität Freiburg (Germany)

July 2007-Workshop 'Partielle Differentialgleichungen', Oberwolfach Mathematics Institute, Germany-invited participant.

August 2008-invited speaker, conference 'Nonlinear PDE at IMPA' (Rio de Janeiro, Brazil)

October 2008-Geometric Analysis Seminar, Columbia University

June 2009-Mathematical Challenges Motivated by Multiphase Materials-international conference in Anogia, Crete-invited speaker

December 2009-Mathematics Department Colloquium, University of Arkansas at Fayetteville

December 2009-Southeast Geometry Seminar XV (Birmingham, AL)-invited speaker

March 2010- AMS meeting in Lexington, KY-special session on PDE in Geometry- speaker

June 2011-Applied Analysis Seminar, University of Athens (Greece)

June 2011-Mathematics Department Colloquium, University of Athens (Greece)

August 2013-Mathematical Conference of the Americas (Guanajuato, Mexico)-invited speaker, Special Session on Differential Geometry

Research Publications

A. Geometric Ergodic Theory.

1. Entropy of the Geodesic Flow on Manifolds without Conjugate Points (with R. Mañé), *Inventiones Mathematicae*, **69** (1982) 375 - 392.
2. An Invariant Measure for Rational Maps (with A.O. Lopes and R. Mañé), *Bol. Soc. Brasil. Mat.*, **14** (1983) 45 - 62.
3. Nonnegatively Curved Leaves in Foliations (with S.R. Adams), *Journal of Differential Geometry*, **34** (1991)681-700.

B. Harmonic Functions and L^2 spectrum of complete non-compact manifolds.

4. Positive Harmonic Functions on Hadamard Manifolds, Princeton University, June 1988 (Ph.D. thesis). Thesis advisor: Shing-Tung Yau.
5. On the Martin boundary of Riemannian Products, *Journal of Differential Geometry*, **33** (1991)215-232.
6. The Spectrum of The Laplacian of Manifolds of Positive Curvature (with J.F. Escobar), *Duke Mathematical Journal* **65** (1992) 1-21.
7. The Differential Form Spectrum of Manifolds of Positive Curvature (with J.F. Escobar), *Duke Mathematical Journal* **69** (1993) 1-41.
8. L^2 vanishing theorems for complete manifolds of nonnegative curvature (with J.F. Escobar and M. Min-Oo), *Indiana University Mathematics Journal* **42** (1993) 1545-1554.

C. Harmonic Map Flow and Wave Maps.

9. Uniqueness for the harmonic map flow in two dimensions, *Calculus of Variations and Partial Differential Equations*, **3** (1995) 95-105.
10. Uniqueness for the harmonic map flow from surfaces to general targets, *Comentarii Mathematici Helvetici*, **70** (1995), 310-338.Correction, *CMH* **71** (1996) 330-337.
11. Weak solutions of the harmonic map flow and related problems, *Proceedings of the 3rd. school in geometry, partial differential equations and numerical analysis*, Colombian Academy of Sciences Memoirs (1996)
12. Global weak solutions of the wave map system to compact homogeneous spaces, *Manuscripta Math.* **91** (1996) 525-534
13. Weak Convergence of Harmonic maps from (2+1)-dimensional Minkowski space to Riemannian manifolds (with S. Müller and M. Struwe), *Inventiones Math* **130** (1997) 589-617.
14. Weak compactness of wave maps and harmonic maps (with S. Müller and M. Struwe), *Annales Institut H.Poincare'* **15**(6) (1998) 725-754.

D. Mean curvature flow and networks.

15. The normalized mean curvature flow for a small bubble on a Riemannian manifold (with N. Alikakos), *J. Differential Geometry* **64** (2003) 247-303.
16. Existence of Steiner networks in strictly convex domains, arXiv:0806.0632 *Archive for Rational Mechanics and Analysis* 200 v.2 (2011) 361-404.
17. Mean curvature motion of graphs with constant contact angle at a free boundary, arXiv:0812.1573 *Analysis and Partial Differential Equations*, Volume 3, Issue 4, 2010, 359-407.
18. Mean curvature motion of triple junctions of graphs in two dimensions, arXiv:0809.0636, Communications in Partial Differential Equations, Volume 35(2), 3010, 302-327.

E. Positive Scalar Curvature and mass-type invariants.

19. Mass-Capacity inequalities for Conformally Flat Manifolds with Boundary (with F. Schwartz), *Preprint, July 2011.* arXiv: 1107.1407 (*to appear in* Communications in PDE.)

Research Awards

5/89-8/90: Postdoctoral associate, N.S.F. grant, 'Differential Geometry and Partial Differential Equations' (Geometric Analysis), DMS 88-13977. Principal Investigator: Richard M. Schoen, Stanford University.

4/90-6/90: Warwick University, United Kingdom: support for academic visit (special year in Geometry/PDE).

1/93-6/93: ETH Zurich, visiting professorship, special year in PDE.

5/94-7/94: UTK Development award for tenure-track faculty, category:research. 'Parabolic and Hyperbolic Harmonic Maps.'

7/94-8/96: National Science Foundation, research award: 'Differential Geometry and Partial Differential Equations', DMS 9404089 (Geometric Analysis). Principal Investigator: A.Freire.

4/95: Science Alliance research award, 1995.

4/96: Science Alliance research award, 1996.

7/96-7/01: National Science Foundation, research award: 'Differential Geometry and Partial Differential Equations, DMS 9626721 (Geometric Analysis). Principal Investigator: A. Freire.

10/96-12/96: Sonderforschungsbereich 256, DFG- Academic visit to Universität Bonn.

5/97: Science Alliance Research Award, 1997.

5/98: Science Alliance Research Award, 1998.

5/00-2/01: National Science Foundation: 'New Directions in Differential Geometry' (Barrett Lectures, University of Tennessee)-DMS-0080037

1/07-6/07: Max Planck Society (Germany): stipend for research visit to the Albert Einstein Intitute (Potsdam)

Activity as conference organizer

Spring 1995: 1995 Barrett Lectures: Nonlinear Partial Differential Equations in Geometry and Physics, lecturers: R.Fintushel, S.Klainerman, F.-H. Lin, M.Struwe.Co-organizer with G.Baker. Lectures published by Birkhäuser (Progress in Nonlinear Partial Differential Equations vol. 29- G.Baker and A.Freire, eds.)

Fall 1998: Trends in Mathematical Physics (international conference organized jointly by the UTK Mathematics and Physics departments) Co-organizer with V.Alexiades, G.Canright, M.Guidry, G.Siopsis (proceedings published by International Press)

Spring 2000: New Directions in Differential Geometry (Barrett Lectures)- survey lectures by A.Chang, T.Colding, K.Grove, J.Wolfson. Co-organizer with B. Guan and C. Plaut. Lectures published by American Mathematical Society (Conformal, Riemannian and Lagrangian Geometry, University Lecture Series no. 27- A. Freire, editor)

Spring 2011: Barrett Lectures in General Relativity, University of Tennessee. Co-organizer with C. Plaut and F.Schwartz.

Service to the profession

September 2002 to August 2004: Program Director, Division of Mathematical Sciences, National Science Foundation

2002-2003: Co-managed the Geometric Analysis program, the Mathematical Physics panel and the Collaborations in Mathematical Geosciences competition (CMG).

2003-2004: Co-managed the Geometric Analysis program, the Analysis program (partial differential equations), the Mathematical Physics panel and the CAREER competition.

Teaching and advising experience, 1991-2012

A. Lower division. (Introductory courses for science and engineering students)
Calculus II (integration), Calculus III (multivariable), Differential Equations, Linear Algebra

B. Upper division. (Mathematics and engineering majors and graduate students)

Advanced Calculus, Ordinary Differential Equations, Partial Differential Equations
Real Analysis, Complex Variable, Advanced Linear Algebra

C. Graduate courses (Mathematics)

Riemannian Geometry, Complex Analysis

D. Topics courses. (Advanced graduate level)

Spring 2008, Fall 2012: Ricci flow and mean curvature flow
Fall 2001: Lie groups, Lie algebras and representation theory
Spring 1999: Integrable systems in differential geometry
Fall 1998: Lie groups and Lie algebras

E. Graduate advising.

Mr. Joshua Brewer, *Uniform Density Perfect Fluid Static Stars*, M.Sc. thesis (December 2012)