

Cinzia Elia

Contacts

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Università di Bari,
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Research activity

Stability analysis for smooth dynamical systems. Numerical approximation of stability spectra. Smooth decomposition of matrices.
Non smooth dynamical systems: sliding solutions for Filippov's discontinuous dynamical systems; periodic orbits, stability.

Position

Assistant Professor, since January 2004.

University of Bari
Department of Mathematics

Education

University of Bari, Italy

Ph.D. in Mathematics, March 2005

Dissertation Title: "SVD based techniques for the approximation of spectra: Theoretical and Numerical aspects"

Advisor: Prof. Luca Dieci

University of Bari, Italy

Laurea in Mathematics, July 2000

Dissertation Title: "Geodesic based numerical methods for matrix flows on the Grassmann manifold"

Advisor: Prof. Luciano Lopez.

Research Visits

Georgia Institute of Technology, Atlanta, GA, USA

July-August 2017. Visiting Researcher.

July-August 2016. Visiting Researcher.

February 2016. Visiting Researcher.

February 2015. August 2015. Visiting Researcher.

January-March 2014. August-September 2014. Visiting Researcher.

January-October 2013. Visiting Researcher.

January-July 2012, January-July 2011. Visiting Professor.

August-December 2005. Visiting Professor.

January 2001-December 2003. Visiting student.

University of Florence, Florence, Italy. May 2017. October 2008.

Unicamp, Campinas, Sao Paulo, Brazil. November 2016.

Universidade de Sao Paulo, USP, Sao Carlos, Brazil. November 2016.

University of Kansas, Lawrence, Kansas, USA. February 2015.

Publications

- Dieci, L. and Elia, C. and Pi, D., *Limit cycles for regularized discontinuous dynamical systems with a hyperplane of discontinuity*, Discrete and Continuous Dynamical Systems -B, 22 (8), pp. 3091-3112, (2017). Codice SCOPUS: 2-s2.0-85021121618; Web Of Science: 000409958800006.
- L. Dieci, C. Elia, *Piecewise smooth systems near a co-dimension 2 discontinuity manifold: can one say what should happen?*, Special Issue in DCDS-S, 9,4, (2106), 1039-1068.
- Dieci L., Elia C., Lopez L., *Uniqueness of Filippov Sliding Vector Field on the Intersection of Two Surfaces in \mathbb{R}^3 and Implications for Stability of Periodic Orbits*, Journal of Nonlinear Science, vol. 25,6 (2105), pp. 1453-1471.
- Dieci L., Elia C., Lopez L., *Sharp sufficient attractivity conditions for sliding on a codimension 2 discontinuity surface*, Mathematics and Computers in Simulation, vol. 110, 1, (2015) pp. 3-14.
- Dieci L., Elia C., *Periodic orbits for planar piecewise smooth dynamical systems with a line of discontinuity*, JDDE, vol. 26, (2104), pp. 1049-1078.
- Del Buono N, Elia C, Lopez L., *On the equivalence between the sigmoidal approach and Utkin's approach for piecewise-linear models of gene regulatory networks*, SIADS, vol. 13, (2014) pp. 1270-1292.
- L. Dieci, C. Elia, L. Lopez, *A Filippov sliding vector field on an attracting co-dimension 2 discontinuity surface, and a limited loss-of-attractivity analysis*, JDE, vol. 254, (2103) pp. 1800-1832.
- C. Elia, R. Fabbri, *Rotation Number and Exponential Dichotomy for Linear Hamiltonian Systems: From Theoretical to Numerical Results*, JDDE, vol. 25, (2103) pp. 95-120.
- L. Dieci, C. Elia, E. Van Vleck, *Detecting Exponential Dichotomy On The Real Line*, BIT 51 (2011), no. 3, pp. 697-722.
- L. Dieci, C. Elia, E. Van Vleck, *Exponential Dichotomy on the real line: SVD and QR methods*, JDE 248 (2010), no. 2, pp. 287-308.
- L. Dieci, C. Elia *SVD algorithms to approximate spectra of dynamical systems*. Journal of Mathematics and Computers in Simulation, 79 (2008), no. 4, pp. 1235-1254.
- L. Dieci, C. Elia *The singular value decomposition to approximate spectra of dynamical systems I: Theoretical aspects*. JDE 230 (2006), pp. 502-531.
- L. Dieci, C. Elia, L. Lopez, *Smooth SVD on the Lorentz group with applications to computations of Lyapunov exponents*, J. Comp. Appl. Math, Vol. 164-165, (2004), pp. 255-264.
- C. Elia, L. Lopez, *Exponential monotonicity of quadratic forms in ODEs and preserving methods*, FGCS 19(7) (2003), pp. 1187 - 1195.
- N. Del Buono, C. Elia, *Computation of few Lyapunov exponents by geodesic based algorithms*, Special Issue on Geometric Numerical Algorithms, FGCS 19(3) (2003), pp 425-430.

- N. Del Buono, C. Elia, L. Lopez, *Symplectic methods based on the matrix variational equation for Hamiltonian systems*, Lecture Notes in Computer Science Series. Springer-Verlag, 2329, Vol III, (2002) pp.467-477.
- N. Del Buono, C. Elia, *Some remarks on numerical methods for second order differential equations on the orthogonal matrix group*, Lecture Notes in Computer Science Series. Springer-Verlag, 2329, Vol III, (2002), pp.526-536.
- N. Del Buono, C. Elia, *Numerical methods for matrix flows on Grassmann manifold*, Proceedings of HERCMA, 2001.

Invited Presentations

- *On periodic orbits of discontinuous dynamical systems*, The Third International Conference on the Dynamics of Differential Equations, March 13-18 2018, Hiroshima University, Japan.
- *Periodic orbits of discontinuous DEs: numerical remarks*, GTMAP Workshop 10 to 60, December 6 2017, Georgia Institute of Technology, Atlanta, Georgia.
- *On periodic orbits of discontinuous dynamical systems*, GTMAP Workshop dedicated to Shui-Nee-Chow, August 10-11 2017, Georgia Institute of Technology, Atlanta, Georgia.
- *On periodic orbits of discontinuous dynamical systems*, NANS Conference in honor of Russell Johnson's 70th birthday, January 31-February 3 2017, Florence, Italy.
- *On stable sliding solutions of discontinuous dynamical systems*, SIMAI2016, Milano, Italy, 13-16 September 2016.
- *On stable motion of piecewise smooth dynamical system*, Workshop on Non-Autonomous Dynamical Systems, Valladolid, Spain, November 2015.
- *On typical motion of piecewise smooth dynamical systems*, Georgia Institute of Technology, Atlanta, August 2015.
- *Gene regulatory networks: equivalence between Utkins and sigmoidal approach*, GAMM 2015, Lecce, Italy, 23-27 March 2015.
- *Periodic Orbits for Planar Piecewise Smooth Dynamical Systems*, AIMS 2014, Madrid, Spain, July 2014.
- *Numerical techniques for exponential dichotomy*, First International Conference on Dynamics of Differential Equations, Atlanta, GA, March 2013.
- *Rotation number and QR based techniques for exponential dichotomy: numerical comparisons*, 9th AIMS Conference on Dynamical Systems, Orlando, FL, July 1-5, 2012.
- *Detecting Exponential Dichotomy on the Real Line*, Siam Conference on Application of Dynamical Systems, Snowbird, UT, May 2011.
- *Tecniche numeriche per la dicotomia esponenziale*, Università di Firenze, September 2008.
- *Numerical Techniques for Exponential Dichotomy*, 7th AIMS Conference on Dynamical Systems and Differential Equations, University of Texas at Arlington, Texas, USA, 18 - 21 Maggio, 2008.
- *The smooth SVD to Approximate Spectral Intervals*, Emory University, Atlanta, GA, November 2005.
- *Using Svd to Approximate Spectral Intervals of Continuous Dynamical Systems*, Siam Conference on Applications of Dynamical Systems, Snowbird, UT, May 2005.

- *SVD based techniques for the approximation of spectra*, FOCM05, Foundations of Computational Mathematics , Santander, July 2005.

Other selected presentations

- *On periodic orbits of discontinuous dynamical systems*, SCICADE 2017, September 14 2017, Bath, UK.
- *Filippov type discontinuous systems and regularizations near a co-dimension 2 discontinuity manifold* , Unicamp, Campinas, Brazil, November 19 2016.
- *On stable motion of discontinuous dynamical systems*, SDS2016, June 17 2016, Capitolo, Monopoli, Italy.
- *Sistemi differenziali discontinui: aspetti teorici e numerici*, Convegno GNCS 2016, 2-4 Febbraio 2016, Montecatini.
- *PWS systems in the neighborhood of a co-dimension 2 discontinuity manifold: can one say what should happen?*, Scicade 2015, September 17 2015, Potsdam, Germany.
- *Periodic orbits of planar piecewise smooth dynamical systems*, SDS2014, June 13 2014, Capitolo, Monopoli, Italy.

Funding

- Coordinatore Progetto Ateneo 2014: *Sistemi dinamici: aspetti teorici, simulazioni numeriche e applicazioni*, Università degli Studi di Bari.
- Partecipazione al progetto GNCS: *Metodi numerici per equazioni di evoluzione infinito-dimensionale e non smooth*, responsabile Prof. Maset.
- Partecipazione al Progetto GNCS: *Analisi numerica di certi tipi non classici di equazioni di evoluzione*, responsabile Prof. Maset.
- Partecipazione al progetto GNCS: *Analisi numerica di problemi differenziali infinito-dimensionali e discontinui*, responsabile Prof. Guglielmi.
- Partecipazione al progetto GNCS: *Analisi numerica di problemi differenziali infinito-dimensionali e discontinui*, responsabile Prof. Guglielmi.
- Partecipazione al Progetto di Ateneo: *Metodi Numerici per Sistemi Differenziali Discontinui*, Università degli Studi di Bari, responsabile Prof. Lopez.
- Partecipazione al Progetto di Ateneo: *Metodi Numerici per Problemi Differenziali Discontinui* , Università degli Studi di Bari, responsabile Prof. Lopez.
- Partecipazione al progetto di Ateneo: *Metodi Numerici per Sistemi Dinamici Discontinui*, Università degli Studi di Bari, responsabile Prof. Lopez.
- Partecipazione al Progetto Prin: *Metodi numerici per sistemi differenziali con struttura e con struttura variabile*, responsabile Prof. Bellen.
- Partecipazione al Progetto di Ateneo 2007: *Metodi numerici avanzati per sistemi dinamici e questioni di algebra lineare connesse*”, Università degli Studi di Bari, responsabile Prof. Lopez.
- Partecipazione al Progetto di Ateneo 2006: *Metodi numerici per sistemi dinamici con vincoli di eguaglianza e disequaglianza e questioni di algebra lineare connesse* , Università degli Studi di Bari, responsabile Prof. Lopez.

**Organization of
Congresses and
Minisymposia**

- SDS2018, SDS2016, SDS2014, SDS2010, SDS2008, SDS2006, SDS2005 Workshops on Structural Dynamical Systems: Computational Aspects, Capitolo, Italy.
- Minisymposium *Dynamical systems with discontinuities*, Scicade 2017, Bath, UK, September 2017, together with Luciano Lopez.
- Minisymposium *Discontinuous dynamical systems: theory and numerical methods*, Scicade 2015, Potsdam, Germany, September 2015, together with Luciano Lopez.
- Minisymposium *Discontinuous dynamical systems: theory and numerical methods*, Scicade 2013, Valladolid, Spain, September 2013, together with Luciano Lopez.

**Teaching
experience**

University of Bari

Laurea: Triennale, Magistrale, Specialistica.

- Metodi Numerici e Modelli Matematici, Calcolo Numerico, Analisi Numerica, Laboratorio di Programmazione.

Georgia Institute of Technology, Atlanta, GA

Instructor

- Calculus I, Calculus III, Ordinary Differential Equations.