

Cristina Zucca

Curriculum Vitae

Dipartimento di Matematica
Università di Torino
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Current Position

January 2005–Present. Researcher MAT/06: Probabilità e Statistica Matematica, Department of Mathematics, University of Torino, Italy.

Education

March 2017 Abilitazione Scientifica Nazionale for Associate Professor settore concorsuale 01/A3: Analisi Matematica, Probabilità e Statistica Matematica.

2002 Ph.D. in “Computational Mathematics and Operation Research” at University of Milano.

1998 Master Degree in Mathematics 110/110 cum laude, University of Torino

Prizes

November 2009. Zonta Prize for woman in mathematics.

September 1999. Optime prize for the master thesis.

Research visits:

September 2008. Visiting at the Department of Mathematical Statistics, Lund University (SWEDEN)

February 2006. Visiting at the Institute of Physiology, Academy of Sciences, Prague, Czech Republic.

February-May 2001. Visiting at the Department of Mathematics, Lehigh University (Pennsylvania - USA).

Organizing activity

Member of the scientific board of Ph. D. Program in Matematica Pura e Applicata of Torino University and Torino Politecnico (from May 2017 -)

Member of the scientific board of Ph. D. Program in Matematica e Statistica per le Scienze Computazionali (MaSSC) of Milano University (01-03-2005 al 01-03-2016)

Member of the Commission CPCR (Commissione Paritetica e commissione del Riesame), Department of Mathematics, University of Torino (2012-2015).

Member of the Internship and Orientation Committee for the Master in Stochastics and Data Science (2015-)

Commissione Orario lezione e appelli for Master Degree in Stochastics and Data Science (2017-)

Participation in the organization of some schools in probabilistic nature.

Member of the Organizing Committee of the “Jülich-Torino Workshop on Computational Neurosciences” Torino, 04-10-2013

Member of the Organizing Committee of one day of scientific dissemination for students of Radboud Universiteit Nijmegen “Curiosando nella Matematica, Browsing through Mathematics” Torino, 28-04-2014

Organizer of the Workshop “Optimal stopping and Application”, Torino- May 22, 2015.

Member of the Organizing Committee of the “First Italian Meeting on Probability and Mathematical Statistics” that will be in Torino, 19-22 June, 2017

Congresses and seminars

Led several conference talks and seminars in various countries.

Research

Research Interests

- Numerical and analytical study of stochastic differential equations. Development of numerical methods for the first passage times of a diffusion process.
- Development of numerical and analytical methods for the study of the inverse first passage time problem for the Wiener process: given the first passage time distribution of a Wiener process across a deterministic boundary, is it possible to obtain informations on the boundary behaviour?
- Study of neuronal models. Application in neuroscience of the methods for the solution of the inverse first passage time problem.
- Study of stochastic ordering for risk processes.
- Study of stochastic models that describe the evolution of the atomic clock error with respect to the SI.
- Detection problem and Optimal stopping problems with applications to atomic clock errors.

Publications

1. Detecting atomic clock frequency trends using an optimal stopping method (with P. Tavella and G. Peskir). *Metrologia*: 53 (3): S89–S95 (2016).
2. Estimation of the dynamics of frequency drift in mature ultra-stable oscillators: A study based on the in-flight performance from New Horizons (with Weaver, G.L., Jensen, J.R., Tavella, P., Formichella, V. and Peskir, G.) *Proceedings of the Annual Precise Time and Time Interval Systems and Applications Meeting, PTTI 2015*: 198–205 (2016).
3. The Gamma renewal process as an output of the diffusion leaky integrate-and-fire neuronal model (with L. Sacerdote and P. Lansky). *Biological Cybernetics*, 110 (2-3): 193–200 (2016).
4. First passage times of two-dimensional correlated processes: analytical results for the Wiener process and a numerical method for diffusion processes (with L. Sacerdote, M. Tamborrino). *Journal of Computational and Applied Mathematics*, 296: 275–292 (2016).
5. A mathematical model for the atomic clock error in case of jumps (with P. Tavella) *Metrologia*, 52, 514–521 (2015).
6. Joint densities of first hitting times of a diffusion process through two time-dependent boundaries (with L. Sacerdote, O. Telve) *Adv. Appl. Prob.* 46 (1): 186–202 (2014).
7. Joint distribution of first exit times of a two dimensional Wiener process with jumps with application to a pair of coupled neurons (with L. Sacerdote) *Mathematical Biosciences* 245: 61–69 (2013).
8. A first passage problem for a bivariate diffusion process: numerical solution with an application to neuroscience when the process is Gauss-Markov (with E. Benedetto, L. Sacerdote) *J. of Computational and Applied Mathematics* 242: 41–52 (2013)
9. Detecting dependencies between spike trains of pairs of neurons through copulas (with L. Sacerdote, M. Tamborrino) *Brain Research*, 1434: 243–256 (2012)
10. On the inverse first-passage-time problem for a Wiener process (with L. Sacerdote) *Ann. Appl. Prob.* 19 (4), 1319–1346 (2009)
11. Statistical study of the Inverse First Passage Time Algorithm (with L. Sacerdote). In: *Noise and Fluctuations in Photonics, Quantum Optics, and Communications*. SPIE. Florence, Italy. 20–27 May 2007. (vol. 6603, pp. 66030N)
12. Input Identification in the Ornstein-Uhlenbeck Neuronal Model with Signal Dependent Noise (with P. Lansky, L. Sacerdote) *LNCS 4729*, pp. 368–377 (2007).
13. Randomness and variability of the neuronal activity described by the Ornstein-Uhlenbeck model (with L. Kostal, P. Lansky) *Network: Computation in Neural Systems*. vol. 18, pp. 63–75 (2007).
14. Optimum signal in a diffusion leaky integrate-and-fire neuronal model. (with P. Lansky, L. Sacerdote) *Math. Biosc.* 207, 261–274 (2007).

15. On the classification of experimental data modeled via a stochastic leaky integrate and fire model through boundary values (with L. Sacerdote, A.E.P. Villa) *Bull. Math. Biol.* 68 (6): 1257-1274 (2006).
16. Stochastic Bounds for the Sparre Andersen Process (with F. Pellerrey) *Methodol. Comput. Appl. Probab.* 7 (2) 225-247 (2005).
17. The Clock Model and its Relationship with the Allan and related Variances (with P. Tavella) *IEEE TUFFC* 52 (2): 289-296, (2005).
18. Inverse First Passage Time Method in the Analysis of Neuronal Interspike Intervals of Neurons Characterized by Time Varying Dynamics (with L. Sacerdote) *LNCS* 3704 pp.69-77 (2005).
19. Stochastic leaky integrate and fire neuronal model: examples of its application to neuronal coding study (with L. Sacerdote, R. Sirovich) *Industry days. ESCULAPIO Pub. Co. Aquilano et. al (NeuroMat III: Neuroscienze Computazionali)* (2005).
20. Stochastic processes for modeling and evaluating atomic clock behavior. (with G. Panfilo, P. Tavella) *Advanced Mathematical and Computational Tools in Metrology VI*, 229-239 (2004)
21. A mathematical model of for the atomic clock error: an overview (with L. Galleani, L. Sacerdote, P. Tavella) *Metrologia*, 40, 3, S257-S264 (2003).
22. Threshold shape corresponding to a gamma firing distribution in an Ornstein-Uhlenbeck neuronal model (with L. Sacerdote) *Scientiae Mathematicae Japonicae*, 8, 375-385, (2003).
23. On the relationship between interspikes interval distribution and boundary shape in the Ornstein-Uhlenbeck neuronal model (with L. Sacerdote) in *Math. Modelling and Computing in Biology and Medicine (ECMTB2002)*, Vol.1, 161-167, (2003).
24. A Monte Carlo method for the simulation of first passage times of diffusion processes (with M.T. Giraud, L. Sacerdote) *Methodol. Comput. Appl. Probab.* 3, 215-231 (2001).

Teaching

Courses for the Degree in Mathematics:

Probability theory II, Stochastic Processes, Statistics for the applications. Laboratory of Mathematical Statistics, Statistical Methods for Time Series.

Tutorship for the courses:

Probability theory (Informatics), Probability theory and statistics (Informatics), Statistics (Mathematics), Statistics (Biology), Mathematical and Statistical Methods (Natural Sciences), Statistics (Master in Economics).

Ph.D. Courses:

Numerical methods for the solution of SDE (Politecnico of Torino), Stochastic Models for the neuronal coding (Univ. di Torino).

Supervisor for several Bachelor and Master degrees. Supervisor of the Master degree "Tempo di primo passaggio del moto browniano integrato: aspetti analitici, numerici e simulativi." by Lidia Sacchetto (2009) winner of the "FEDERICO ORSINGHER 2010" prize for Master degrees in probability;

Further informations

Teaching abilitation for the secondary school: classe: 48/A – Applied Mathematics (November 2000)