

Mario Annunziato

- Dipartimento di Fisica "E. R. Caianiello" - Università degli Studi di Salerno -

Date and place

of Birth: May 25th 1968, Civitavecchia

Nationality: Italian

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Main Interests:

Numerical Analysis of hyperbolic and parabolic PDE and PIDE applied to non-deterministic processes.

Optimal Control of non-deterministic processes.

System of hyperbolic PDE with non-local boundary conditions.

Applications of stochastic processes, Liouville Master Equation and Fokker-Planck Equation.

Markovian and non-Markovian processes, α -stable Lévy statistics.

Volterra-renewal integral equations.

Education:

July 2000: Ph.D. in Physics, "Università degli Studi di Pisa",
Thesis: "On the dynamic approach to non-canonical statistics".

July 1995: Degree of laurea in Physics (with honors) "Rome University - La Sapienza -".

July 1987: High school Diploma of Expert in Electronics (maximum score)

Experiences:

Since Jan. 2004: Researcher at Università degli Studi di Salerno:

Teaching to courses of Numerical Analysis (2004-2010, 2013).

Development and analysis of numerical methods for partial differential and integral equations related to non-deterministic processes and optimal control, and its modellization.

Jan.2002-Dec.2003: employed to an Information Technology company, as Software Analyst Developer (C/C++, JSP):

Development of e-learning and web-conferencing systems;

Tutor for the development of an "expert" e-learning system based on Bayesian Networks;

Development of a portal for on-line trading.

1996-2000: Teaching as Medical Physics Instructor at "Nursing School of University of Rome".

May 1995-May '96: Call-up.

July 1991: Teaching as Math Instructor to an High School summer classes.

Fundings for the scientific activities:

- Project manager for the research project: "METODI NUMERICI INNOVATIVI PER EQUAZIONI DINAMICHE O EVOLUTIVE, ASSOCIATE A PROCESSI STOCASTICI, ANCHE PER PROBLEMI DI CONTROLLO OTTIMALE" (innovative numerical methods for evolutionary or dynamical equations related to stochastic processes, and for optimal controls too), funded by the fundamental research of the Salerno University, annually renewed since August 2011. Amounts between 2700 - 3300 € circa.
- Participation to the European Project "Multi-ITN STRIKE - Novel Methods in Computational Finance" (Marie Curie International Training Network, n. ref. PITN-GA-2012-304617, <http://www-amna.math.uni-wuppertal.de/itn-strike/>) in the research unit of Prof. A. Borzi at the Würzburg University in Germany (from Jan-1st-2013 to Dec-31st-2016). Subsidies for the stay.
- Participation to the international cooperation activity "Form- und Material-Optimierung von mechanischen und optimischen Systemen" (project num. BayIntAn_UniWürzburg_2014_38) funded by the "Bayerische Forschungallianz" carried out at the Würzburg University (Sept. 2014). Subsidy for the stay.
- "Exchange grant" award from the "European Science Foundation". Ref. Num. 3875, Acronym OPTPDE, Title "Optimization with PDE constraints", Unit PESC. Research title: "Optimal control with Fokker-Planck equation for stochastic systems", carried out at the Würzburg University. Amount 3600 €.
- "Exchange grant" award from the "European Science Foundation". Ref. Num. 4099, Acronym OPTPDE, Title "Optimization with PDE constraints", Unit PESC. Research title: "Optimal control with Fokker-Planck equation for stochastic systems", carried out at the Würzburg University. Amount 5500 €.
- Award FFABR from the Italian Government year 2017 (Law. 232/2016 Art. 1, comma 295) 3000 €.
- Subsidies from the "Istituto Nazionale di Alta Matematica", branch GNCS (National Group of Scientific Calculus) (2007-2017), for participation to conferences.
- Subsidies from the Siebold-Collegium - Institute for Advanced Studies of the Würzburg Julius-Maximilians-Universität (2016, 2018)

Publications:

- M. Annunziato, A. Borzi, *A Fokker-Planck control framework for stochastic systems*. [EMS Surveys in Mathematical Sciences 2018](#). DOI:10.4171/EMSS/27.
- M. Annunziato, H. Gottschalk, *Calibration of Lévy processes using optimal control of Kolmogorov equations with periodic boundary conditions*, [Math. Modelling and Analysis, Vol. 23 \(2018\) 390--413](#). DOI:10.3846/mma.2018.024.
- S. Roy, M. Annunziato, A. Borzi, C. Klingenberg, *A Fokker-Planck approach to control collective motion*, [Comp. Optim. Appl. \(2017\) 1-37](#)
- M. Annunziato, E. Messina, *A positive and monotone numerical scheme for Volterra-Renewal equations with space fluxes*. [Journal of Comp. Math. 37 \(2019\) 33--47](#)
- B. Gaviraghi, M. Annunziato and A. Borzi, *A Fokker-Planck based approach to control jump processes*. Chapter 26 in: M. Ehrhardt, M. Günther and J. ter Maten (eds) "Novel methods in Computational finance", Vol. 25 Mathematics in Industry 2017.
- B. Gaviraghi, M. Annunziato and A. Borzi, *Splitting methods for Fokker-Planck equations related to jump-diffusion processes*. Chapter 25 in: M. Ehrhardt, M. Günther and J. ter Maten (eds) "Novel methods in Computational finance", Vol 25 Mathematics in Industry 2017.
- T. H. Breitenbach, M. Annunziato, A. Borzi, *On the optimal control of random walks with jumps and barriers*. [Methodol. Comput. Appl. Probab. Vol. 20 \(2018\) pp. 435-462](#)
- B. Gaviraghi, A. Schindele, M. Annunziato, A. Borzi, *On Optimal Sparse-Control Problems Governed by Jump-Diffusion Processes*. [Applied Mathematics, Vol. 7 \(2016\) pp. 1978-2004](#) (DOI: 10.4236/am.2016.716162)

- B. Gaviraghi, M. Annunziato, A. Borzì, *Analysis of splitting methods for solving a partial integro-differential Fokker-Planck equation*. [Applied Mathematics and Computation, Vol. 294 \(2017\) pp. 1-17](#)
- T. H. Breitenbach, M. Annunziato, A. Borzì, *On the optimal control of random walks*. [IFAC papers online 49 \(2016\), pp. 248-253](#)
- S. Roy, M. Annunziato, A. Borzì, *A Fokker-Planck Feedback Control-Constrained Approach for Modeling Crowd Motion*, [J. Comp. and Theor. Transport \(2016\) pp. 1-17](#)
- V. Thalhoffer, M. Annunziato, A. Borzì, *Stochastic modelling and control of antibiotic subtilin production*, [J. Math. Biol., Vol. 73 \(2016\), pp. 727-749](#)
- M. Annunziato, A. Borzì, M. Magdziarz, A. Weron, *A fractional Fokker-Planck control framework for subdiffusion processes*, [Optimal Contr. Appl. and Meth. Vol. 37 \(2016\), pp. 290-304](#)
- M. Annunziato, A. Borzì, F. Nobile, R. F. Tempone, *On the connection between the Hamilton-Jacobi-Bellman and the Fokker-Planck control frameworks*, [Applied Mathematics Vol. 5 \(2014\), pp. 2476-2484](#)
- M. Annunziato and A. Borzì, *Optimal control of a class of piecewise deterministic processes*, *European Journal of Applied Mathematics* Vol. 25 (2014) pp. 1-25
- M. Annunziato, A. Borzì, *Fokker-Planck-based control of a two-level open quantum system*, *Mathematical Models and Methods in Applied Sciences* [Vol. 23 \(2013\) No. 11, pp. 2039-2064](#)
- M. Annunziato, A. Borzì, *A Fokker-Planck control framework for multidimensional stochastic processes*, [Journal of Comp. and Appl. Math., Vol. 237 \(2013\) No. 1, pp. 487-507](#)
- M. Annunziato, *On the Action of a Semi-Markov Process on a System of Differential Equations*, [Math. Mod. Analysis Vol. 17 \(2012\) No. 5, pp. 650-672](#)
- M. Annunziato, H. Brunner, E. Messina, *Asymptotic stability of solutions to Volterra-renewal Equation with Space Maps*, [Journal of Mathematical Analysis and Applications, Vol. 395 \(2012\) No. 2, pp. 766-775](#)
- M. Annunziato, A. Borzì, *Optimal control of probability density functions of stochastic processes*, [Mathematical Modelling and Analysis, Vol. 15 \(2010\) No. 4, pp. 393-407](#)
- M. Annunziato, E. Messina, *Numerical treatment of a Volterra Integral Equation with Space Maps*, [APNUM 60 \(2010\) pp. 809-815](#)
- M. Annunziato, A. Borzì, *Fast solvers of Fredholm optimal control problems*, [Numer. Math. Theor. Meth. Appl. 3 \(2010\), pp. 431-448.](#)
- M. Annunziato, *A finite difference method for piecewise deterministic processes with memory II*, [Mathematical Modelling and Analysis, 14 \(2009\) pp. 139-158](#)
- M. Annunziato, *Analysis of upwind method for piecewise deterministic Markov processes*, [Comp. Meth. Appl. Math. Vol. 8 \(2008\) No. 1, pp. 3-20](#)
- M. Annunziato, *A finite difference method for piecewise deterministic processes with memory*, [Mathematical Modelling and Analysis, 12 \(2007\) 157-178](#)
- M. Annunziato, *Non-Gaussian equilibrium distributions arising from the Langevin equation*, [Physical Review E 65 \(2002\) 21113](#)
- M. Annunziato, P. Grigolini, B.J. West, *Canonical and Non-Canonical Equilibrium Distribution*, [Physical Review E 64 \(2001\) 11107.](#)
- M. Annunziato, P. Grigolini, *Stochastic versus dynamic approach to Lévy statistics in the presence of an external perturbation*, [Physics Letters A 269 \(2000\) 31.](#)
- M. Annunziato, P. Grigolini, J. Riccardi, *A Fluctuation-Dissipation Process without Time Scale*, [Physical](#)

Talks and Seminars:

- ControlPV2018 - Pavia, Sept 19th 2018, [Optimal Control and Mean Field Games](#). *Optimal control of multi particle stochastic system with mean field approximation.*
- FGI 2017 - Paderborn, Sept 25th 2017, [18th French - German - Italian Conference on Optimization](#). *A numerical solver for the Fokker-Planck optimal control of stochastic jump-diffusion processes.*
- CPDE 2016 - Bertinoro, June 14th 2016, [2nd IFAC Workshop on Control of Systems Governed by Partial Differential Equations](#). *On the optimal control of random walks.* [Abstract](#).
- WIAS - Berlin, Nov 12th 2015, [Direct and Inverse Problems for PDEs with Random Coefficients](#), *An application of the Fokker-Planck-Kolmogorov optimal control framework to the calibration of Lévy processes* (invited lecture). [Abstract](#).
- INRIA - Sophia Antipolis, Jul 1st 2015, 27 th IFIP TC7 Conference 2015 on System Modelling and Optimization, *Optimal control of subdiffusion processes with the fractional Fokker-Planck control framework.*
- CWI - Amsterdam, Feb. 2nd 2015, *Fokker-Planck optimal control of anomalous diffusion processes* (invited lecture).
- Universität Würzburg, Oct. 2nd 2014, [Multi-ITN STRIKE Mini-Workshop in Stochastic Computing and Optimization](#), *A new trend in optimal control of stochastic processes* (invited lecture) [Abstract](#)
- Würzburg July 2014. [Internationale Tage der Nachhaltigkeit](#) (International sustainability Days) "Euro-Ibsa". *Best Control of Uncertainty* (invited lecture).
- NetCO2014 Tours. [New Trends in Optimal Control 2014](#), *Optimal control of stochastic processes via probability density distribution function control.*
- [Italien-German training for stochastic modeling of financial crisis at the University of Wuppertal](#) (Invited lecture, Dec 9th - 16th 2013).
- InterDyn2013 Paris. [Workshop on Modeling and Control of Large Interacting Dynamical Systems 10-12 Sept. 2013](#), Dauphine University. *An innovative framework for the optimal control of stochastic processes* (invited lecture).
- [International School of Mathematics "G. Stampacchia" 59th Workshop Nonlinear Optimization: a Bridge from Theory to Applications 11-6-2013](#). *An optimal control framework for piecewise deterministic processes.*
- Oberwolfach 31-1-2013. *Probability density function optimal control of piecewise deterministic processes.*
- MMA2012 Tallinn. *On the action of semi-Markov processes on differential equations.* [Abstract](#)
- 7th European Conference on Elliptic and Parabolic Problems, Gaeta 2012. *Fokker Planck-based stochastic optimal control.*
- Universität Würzburg, June 30th 2011, Seminar: *Numerical solution to the Liouville Master Equation for piecewise deterministic processes.* [Abstract](#)
- MMA 2011 Sigulda, *An Optimal Control of Probability Density Function of One-Dimensional Stochastic Processes* [Conference Abstracts](#)
- SIAM OP 2011 Darmstadt, *An Optimal Control of Probability Density Functions of Stochastic Processes with the Fokker-Planck Formulation* [Conference Abstracts](#)
- EMG 2010 Ischia, *Fast numerical schemes for optimal control problems with Fredholm constraints*
- SIMAI 2010 Cagliari, *Robust and fast method for Fredholm optimal control problem*

- MMA 2010 Druskininkai, *Numerical schemes for the solution to differential equations driven by semi-Markov processes* [Conference Abstract](#)
- Convegno Parma 2009 - Equazioni Integrali: recenti sviluppi numerici e nuove applicazioni, *Fast solvers of Fredholm optimal control problems* (with A. Borzi).
- Seminar at Trier Universität 2009, *Numerical solution of the Liouville Master Equation for Piecewise Deterministic Processes*.
- ENUMATH 2009 Uppsala, *High order numerical method for piecewise deterministic processes with ENO scheme*.
- GNCS 2009 Montecatini Terme, *Trattamento numerico di un'equazione integrale di Volterra con mappa sullo spazio* (con E. Messina).
- ICCAM 2008 Ghent, *Numerical treatment of a Volterra Integral Equation with Space Maps* (joint work with Eleonora Messina). [Conference Abstract](#)
- MMA-AMOE 2008 Tartu, *A finite difference method for piecewise deterministic processes with memory: monotonicity and conservativity*.
- XVIII Congresso UMI Bari, *Alcuni risultati sul trattamento numerico della "Liouville Master Equation" per Processi Deterministici a Tratti*.
- SciCADE'07 Saint Malo, *Multi-dimensional piecewise deterministic Markov processes: a first order numerical treatment*. [Conference abstract](#)
- MMA2007 Trakai, *A numerical treatment of the Liouville-Master Equation for piecewise deterministic processes with memory: convergence and monotonicity* (invited lecture). [Conference abstract](#)
- NTSEE 2006 Bielefeld, *On a finite-difference scheme for piecewise-deterministic processes with memory and its parallel algorithm implementation*.
- Innovative Methods for Solving Evolutionary Problems with Memory CAPRI, *A finite-difference scheme for piecewise-deterministic processes with memory*.

Others Publications and Preprints

- M. Annunziato, H. Gottschalk: *Calibration of Lévy Processes using Optimal Control of Kolmogorov Equations with Periodic Boundary Conditions* [e-print:arXiv:1506.08439](https://arxiv.org/abs/1506.08439) (2015).
- M. Annunziato, Alfio Borzi: *On a Fokker-Planck approach to control open quantum systems*, NDES 2012.
- M. Annunziato, E. Messina, *Numerical treatment of a Volterra Integral Equation with Space Maps*, Preprint n. 20-2008. DMI - Università di Salerno. (outdated)
- M. Annunziato, *A Legendre polynomials series for the distribution functions of a piecewise deterministic relaxation Markov process*, Preprint n. 14-2008 DMI - Università di Salerno.

[Upwind solver for PDP \(MATLAB Central File Exchange\)](#)

- M. Annunziato, *On a finite difference method for piecewise deterministic processes with memory and its parallel algorithm implementation*, Preprint n. 12-2006 DMI - Università di Salerno (outdated)
- M. Annunziato, *A finite difference method for piecewise deterministic Markov processes*, Preprint n.10-2006 DMI - Università di Salerno, e-print: arxiv.org/abs/math.NA/0606588 (outdated)

Informatics skills:

O.S.: Windows, Linux, DOS

Languages: C/C++ (fluent), Fortran, Assembler x86 details: MPI, Multi-thread and event driven

programming, sockets, multimedia sdk, OLE, COM. Serial RS232 and parallel port. Unicast communications.

Main Tools: Visual Studio, CBuilder, Rational Rose, MatLab/Octave, Mathematica.

Other Knowledges: Analog Electronics, computer data acquisition designing.