Ennio Fedrizzi
Curriculum Vitae et Studiorum

Personal Information

Place and date of birth: Trento, Italy, 13/01/1985.
Address: 9, rue Marie Madeleine Fourcade, 69007 Lyon (France)**.**
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Nationality: Italian.
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Positions and Teaching

Since 10/2019: Co-op collaborating partner, Demain Supermarché: Operations management and logistics for the first cooperative supermarket in the city of Lyon.

02-04/2020 : Data Analyst, Forum Réfugiés Cosi, Villeurbanne : Data collection (creation and maintenance of the user interface), statistical analysis and reporting using mainly: Power BI, SQL, NuBuilder, PhpMyAdmin.

10/2019 – 02/2020: Professor of Mathematics, volunteer, Habitat et Humanisme Rhone.

09/2018-06/2019: Assistant professor, EPITA-Lyon, Lyon (informatics engineering school):

- Teacher in charge of first year mathematics lectures (Bachelor L1).

09/2017-08/2018: Assistant professor, ENSTA ParisTech, Palaiseau :

- Different small (TD) and main (Amphi) classes : Stochastic analysis (Master 2) ; Markov Chains (Master 1) ; Probability and Statistics (Bachelor L3) ;
- Referent teacher for different research internships (Master 1) ;
- Class on stochastic analysis for faculty members.

09/2016-04/2017: Post-doc, Max Planck Institute for mathematics in the sciences, Leipzig: "Stochastic Burgers equation", with Prof. Benjamin Gess.

09/2015-08/2016 : ATER (fixed term teaching and research position), Ecole Centrale de Marseille, I2M:

- Main class and small classes (TD/TP with Python) : Probability (Bachelor L3) ;
- Small classes (TD/TP with Scilab) : Probability and Statistics (Master 1) .

09/2013-08/2015: Post-doc, sponsored by **Labex MILyon**, Institut Camille Jordan, Université Lyon 1: "Stochastic kinetic equations", with Prof. Julien Vovelle.

03/2015 :Vacataire (temporary lecturer), EMLYON Business School, Lyon: Course "Probability for finance", (Master 1).

2014-2015 : Vacataire, INSA, Lyon: small class (TD) in Analysis (Bachelor L1).

01/2010-12/2012 : PhD in Applied Mathematics, LPMA, Université Paris 7 Diderot, Paris.

2010-2012 : Moniteur (PhD lecturer), Université Paris 7 Diderot, Paris, for 2 years:

- Different small classes (TD) Finite probability (Bachelor L1) ;
- Supervision of research projects on applications of mathematics (Bachelor L1 and L2).

2010 : Vacataire, Université Paris 6, Paris. Small class in Analysis (Bachelor L2).

2004-2009 : Student at the **Scuola Normale Superiore** di Pisa in Sciences, Mathematics.

Graduate Studies

2020, ongoing: Professional Certificate in Data Science, IBM, through Coursera.

2010-2012: PhD, Paris 7 Diderot University: "Partial Differential Equations and Noise" under the supervision of Professor Josselin Garnier. Defense: December 13th, 2012, "mention très honorable".

2010-2012: Member of the French Agence Nationale de la Recherche (**ANR)** project Manureva (ANR–08–SYSC–019 2009-2012) : "Modélisation mathématique et étude expérimentale des instabilités non linéaires, des vagues scélérates et des phénomènes extrêmes", which has received the award ANR du Numérique 2013 "recherche pluridisciplinaire".

2004-2009: Student at the **Scuola Normale Superiore** di Pisa (Italy) in Sciences, Mathematics. **Master degree (**Licenza) in Mathematics (70/70 cum LAUDE), december 21st, 2009.

2007-2009: Master degree (Laurea Specialistica) in Mathematics **(**110/110 cum LAUDE) at Pisa University (Italy). Thesis title: "Uniqueness and flow theorems for SDEs with low regularity of the drift", under the supervision of Prof. Franco Flandoli, Defense: September 25th, 2009.

2008: Semester of exchange ERASMUS at ENS-Cachan, Paris (France). Local supervisor: Prof. Arnaud Debussche.

2007: **Bachelor Degree** (Laurea Triennale) in Mathematics **(**110/110 cum LAUDE), at Pisa University. Thesis title: "Una formula probabilistica di rappresentazione di soluzioni molto deboli di equazioni paraboliche a coefficienti poco regolari", under the supervision of Prof. F. Flandoli, September 27th, 2007.

2004: Awarded one of the 40 scholarships of INDAM for the Degree in Mathematics. (Renounced to accept the scholarship of the Scuola Normale Superiore di Pisa).

2004: Baccalauréat (Diploma di maturità scientifica P.N.I.) 100/100, Lycée Galileo Galilei, Trento (Italy).

Scientific Publications

1. "On a class of stochastic transport equations for L^2_loc vector fields", with W. Neves and C. Olivera, *Annali della Scuola Normale Superiore di Pisa*, 2018.
2. "Regularity of stochastic kinetic equations", with F. Flandoli, E. Priola and J. Vovelle, *Electronic Journal of Probabilit*y, 2017.
3. "High frequency analysis of imaging with noise blending", *Discrete and Continuous Dynamical Systems – B*, 2014.
4. "Stability of solitons under rapidly oscillating random perturbations of the initial conditions", *Annals of Applied Probability*, 2014.
5. "Noise prevents singularities in linear transport equations", with F. Flandoli, *Journal of Functional Analysis*, 2013.
6. "Hölder Flow and Differentiability for SDEs with Nonregular Drift", with F. Flandoli, *Stochastic Analysis and Applications,* 2013.
7. "Imaging with noise blending", with M. de Hoop, J. Garnier, and K. Sølna, *Contemporary Mathematics*, 2012.
8. "Pathwise Uniqueness and Continuous Dependence for SDEs with Nonregular Drift", with F. Flandoli, *Stochastics: An International Journal of Probability and Stochastic Processes*, 2011.

Thesis

2012 PhD Thesis: Partial Differential Equations and Noise. Available at http://tel.archives-ouvertes.fr/tel-00759355

2009 Master Thesis: Uniqueness and flow theorems for SDEs with low regularity of the drift. Available at http://etd.adm.unipi.it/

Awards

2011: Best Master thesis in probability award of "La Sapienza" foundation, Rome, edition 2011.

2004: Gold medal at both Italian Mathematics and Physics Olympiads.

2003: Gold medal at the Italian Mathematics Olympiad and honorary mention at the Italian Physics Olympiad.

Languages

Italian (mother tongue), **English** (excellent written and oral level - Cambridge Advanced Certificate), **French** (good level, working language for several years), **Spanish** (good level), **German** (basic level).

Conferences, seminars and short visitings

2018 **Seminar** EDPs-Proba, Ecole Polytechnique, Palaiseau. CEMRACS **summer school**: "Numerical and mathematical modeling for biological and medical applications: deterministic, probabilistic and statistical descriptions" (Marseille, France)

2017 **Seminars:** of the mathematics department, Trento (Italy) ; Probability-Statistics-Control at ENSTA-ParisTech (Palaiseau) ; of Probability (Grenoble); EDPs2 (Chambéry).

2016 **Invited speaker** at the "Topics on Stochastic Regularization" workshop (Toulouse); "SPDE and Related Fields" **conference** (Bielefeld, Germany) ; CIME **summer school**: "Singular Random Dynamics" (Cetraro, Italy); **Winterschool** "Stochastic homogenization" (Augsburg, Germany).
Seminars: Applied analysis (I2M, Marseille); GdT Math-Cancer (Marseille);

2015 **Invited speaker** at the "Journées Jeunes EDPistes Français" conference (centre Henri Lebesgue, Rennes) ; **Conference**: "EquaDiff2015" (Lyon).
Seminars: GdT EDP-Proba, (Marseille); GdR analysis and applications (ICJ, Lyon).

2014 **Invited speaker** to the *4th international workshop on applied mathematics and modelling* (Université 8 Mai 1945, Guelma, Algeria) ; **invited speaker** "*International conference on stochastic analysis and related topics*" (UNICAMP Universidade Estatual de Campinas, Brazil); **conference** *HYP2014*, (IMPA, Rio de Janeiro, Brazil); **conference** *EDP non linéaires avec conditions aléatoires*, (trimester *EDP & Probabilités,* CIMI, Toulouse) ; **conference** 9th *International meeting on stochastic partial differential equations and applications*, (Levico, Italy); **scientific day** at Lyon University: *La complexité: quels défis pour demain ?* (Lyon).
Seminar at the seminari di analisi matematica (Torino, Italy).
Visiting scholar, UNICAMP Campinas University (Brazil).

2013 **Invited speaker** to the workshop *Two days in stochastic analysis*, (UNICAMP, Universidade Estatual de Campinas, Brazil); **summer school** Brazilian School of Probability, (Mambucaba, Rio de Janeiro, Brazil).
Seminar: Journées MMCS (Lyon).
Visiting scholar, UNICAMP Campinas University (Brazil).

2012 **Conference** of the semester *Stochastic Processes and Applications* (Centre Interfacultaire Bernoulli et EPFL, Lausanne, Suisse) ; **Summer school** *of probability*, (Saint Flour).
Visiting : invited as young researcher to the semester *Stochastic Processes and Applications*, Bernoulli Center and EPFL, Lausanne (Suisse).

2011 35th *Stochastic Processes and Applications* **conference**, (Oaxaca, Mexico).
Seminar: Groupe de travail des thésards of LPMA, Paris.
Visiting: Università di Pisa (Italy).

2010 **Summer school** *of probability*, (Saint Flour).

2004 **Stage** in preparation to the selection for the International Physics Olympiad at Trieste University and SISSA, Trieste (Italy).

2003 **Stage** in preparation to the International Mathematics Olympiad at SNS, Pisa (Italy). Physics **summer school**, organized by the Italian Physics Olympiad committee, Sassoferrato.

Software

- LaTex
- Python
- SQL
- Power BI
- NuBuilder
- PhpMyAdmin
- R
- Scilab
- Fortran
- C++
- Office

Publications Presentation

1. "On a class of stochastic transport equations for L^2_loc vector fields", with W. Neves and C. Olivera, *Annali della Scuola Normale Superiore di Pisa,* 2018.
   In this work we continue the analysis of regularization by noise phenomena for transport equations. We introduce the notion of quasiregular solutions and present a new technique based on fine properties of stochastic exponentials which allows us to prove existence and uniqueness of quasiregular solutions when the drift coefficient is only locally integrable. This result seems to be a starting point to study the well-posedness of the stochastic Muskat problem.

2. "Regularity of Stochastic Kinetic Equations", with F. Flandoli, E. Priola and J. Vovelle, *Electronic Journal of Probability,* 2017.
   We consider the linear Vlasov kinetic equation (collisionless Boltzmann equation), with a rough force term. We first obtain a well-posedness result in appropriate Besov spaces for an associated hypoelliptic degenerate PDE with a rough source term. Using the regularizing properties of this PDE, we are then able to construct a weakly differentiable stochastic flow for a degenerate SDE with Sobolev coefficients. This SDE is the equation of characteristics for the Vlasov kinetic equation with a force term having the same Sobolev regularity, perturbed by a multiplicative white noise. Thanks to the regularizing effects of the noise, the stochastic equation is well-posed and the appearance of shocks is prevented.

3. "High frequency analysis of imaging with noise blending", *Discrete and Continuous Dynamical Systems – B*, 2014.
   In this paper I analyze the imaging algorithm with random sources considered in the paper "Imaging with noise blending" in the high frequency regime. This allows me to obtain quantitative results on the statistical stability of the algorithm and the quality (average and typical) of the image obtained.

4. "Stability of solitons under rapidly oscillating random perturbations of the initial conditions", *Annals of Applied Probability*, 2014.
   Here I analyze soliton solutions of the nonlinear Schrödinger and Korteweg-de-Vries equations with random perturbations of the initial condition. I do so by means of the inverse scattering transform, which transforms these equations into coupled systems of differential equations where the initial condition enters as a potential. Using an infinite-dimensional diffusion-approximation theorem that I obtained, it is then possible to study the stability of the stochastic flow associated to these systems under very general rapidly oscillating perturbations of the initial condition. One possible application illustrated in the paper is to the study of the stability of solitons with respect to such random perturbations. Indeed, using a perturbative approach it is possible to obtain explicit formulas for the correction terms to the parameters which describe the solitons under a weak random perturbation.

5. “Noise prevents singularities in linear transport equations”, with F. Flandoli, *Journal of Functional Analysis*, 2013.
   We obtain an existence and uniqueness result for solutions of a stochastic transport equations with only integrable drift. This result is obtained in a class of weak (in PDE sense, strong in probabilistic sense) solutions with a certain degree of Sobolev regularity. A representation formula in terms of the (stochastic) characteristics is also provided. Characteristics are here solution to the same SDE we had studied in previous works. This result shows how for linear transport equations the addition of a Stratonovich multiplicative noise term improves the qualitative theory, as in this case the appearance of shocks (classical in the deterministic setting under such weak regularity assumptions) is prevented.

6. “Hölder Flow and Differentiability for SDEs with Nonregular Drift”, with F. Flandoli, *Stochastic Analysis and Applications,* 2013.
   Modifying the strategy used in the previous paper “Pathwise uniqueness and continuous dependence for SDEs with nonregular drift” and using the regularization effect of a different parabolic PDE, we construct a flow of Hölder continuous homeomorphisms for an SDE with only integrable drift. The flow is also differentiable in mean. The strategy is based on the use of a C^1 diffeomorphism to transform the SDE into a new equation with more regular coefficients. For this new SDE it is easier to prove the regularity results desired, which can then be brought back to the original SDE thanks to the regularity of the transformation. The regularity of this transformation is in turn linked to the regularity of solutions of a parabolic PDE.

7. “Imaging with noise blending”, with M. de Hoop, J. Garnier, and K. Sølna, *Contemporary Mathematics*, 2012.
   We study an imaging algorithm based on the solution of an inverse problem for the wave equation. The main problem in the industrial exploitation of imaging algorithms is given by the computational costs, often prohibitively high. We show how with the use of certain carefully chosen random sources it is possible to use a simultaneous-sources approach, therefore considerably reducing computational costs, without degrading the image quality.

8. “Pathwise Uniqueness and Continuous Dependence for SDEs with Nonregular Drift”, with F. Flandoli, *Stochastics: An International Journal of Probability and Stochastic Processes*, 2011.
   We provide a new proof (constructive rather than by contradiction) of an important result of Krylov and Röckner (2005) on existence and (pathwise) uniqueness of solutions of an SDE with integrable drift. This allows us to obtain also some regularity results of solutions. A general principle clearly appears: if it is possible to construct a good regularity theory for the heat equation with a source term having the same regularity of the drift, then we have the main tool to prove strong (pathwise) uniqueness for the SDE.