Ludovic Goudenège

CentraleSupélec
Fédération de Mathématiques - FR CNRS 3487
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Single, 36 years old
Date of birth: 1983, November 10th
French

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Ph. Doctor of École Normale Supérieure de Cachan
Researcher in the CNRS
Associate professor at CentraleSupélec
Habilitated to supervise PhD students

Education and Experience

2018 : **Habilitation à Diriger des Recherches**

Defended in 2018, December 11^{th} at CentraleSupélec - University Paris-Saclay.
Diploma of University Paris-Sud.
(French post-doctoral degree allowing its holder to supervise PhD students).
Title : Numerical algorithms for stochastic problems.

Anne DE BOUARD	Prof. - CNRS - École Polytechnique	(external examiner)
Pauline LAFITTE	Prof. - CentraleSupélec	(internal examiner)
Gabriel James LORD	Prof. - Heriot Watt University	(external reviewer)
Bertrand MAURY	Prof. - Université Paris Sud	(internal reviewer)
Annie MILLET	Prof. - Université Paris 1	(external reviewer)
Francesco RUSSO	Prof. - ENSTA	(internal reviewer)
Denis TALAY	Prof. - Inria - Sophia-Antipolis Méditerranée	(president)

2014-2020 : **Researcher in the CNRS** First class, in section 41, mathematics
affected in "Fédération de Mathématiques de CentraleSupélec".
(https://fd-math.pages.centralesupelec.fr/index.html)

2010-2013 : **Researcher in the CNRS** Second class, in section 41, mathematics
affected in Laboratory of Applied Mathematics in University Paris-Est - Marne-la-Vallée.
(http://umr-math.univ-mlv.fr/)

2011-2012: **Scientific Consultant in insurance** at AXA - Group Risk Management.

2009-2010: **Postgraduate Degree in Probability and Finance (DEA El Karoui-Pagès-Yor)**
in the University Pierre et Marie Curie (Paris VI), in Paris (http://finance.math.upmc.fr/).

2006-2009: **Ph. D. in Applied Mathematics** (defended in 2009, November 27^{th}).
Subject : Stochastic partial differential equations - Numerical simulations - Finite elements methods
Simulations of Wiener processes - Cahn-Hilliard equations.

Title : Some results on deterministic and stochastic Cahn-Hilliard equation.
Director : Arnaud Debussche (ENS Cachan - Antenne de Bretagne).

M. Franck Boyer	Prof. - Université Paul Cézanne, Marseille	(president)
M. Tadahisa Funaki	Prof. - Tokyo University	(external reviewer)
M. Nicolas Fournier	Prof. - Université Paris Est	(external reviewer)
M. Lorenzo Zambotti	Prof. - Université Pierre et Marie Curie	(external examiner)
M. Daniel Martin	Ass. Prof. - Université de Rennes 1	(internal examiner)
M. Ying Hu	Prof. - Université de Rennes 1	(internal examiner)
M. Arnaud Debussche	Prof. - ENS Cachan - Antenne de Bretagne	(director)

Teacher in the École Normale Supérieure de Cachan (top French school of mathematicians), in the team of Stochastic Processes and in the team of Numerical Analysis of the IRMAR institute in the University of Rennes 1 - UMR CNRS 6625 (http://irmar.univ-rennes1.fr/)

2003-2006: Student in the École Normale Supérieure de Cachan (http://www.ens-cachan.fr/)

Postgraduate Degree in Mathematics, speciality "Analysis and Applications" in the University of Rennes 1, rank 2.

Concours d'Agrégation Externe de mathématiques: fifth year of university study in preparation for teaching in French high schools.

Master's Degree in Mathematics in the University of Rennes 1.

Bachelor's Degree in Mathematics in the University of Rennes 1.

Special Skills

Informatique

Systems	Unix, Windows, Mac OS X.
Languages	C, C++, FORTRAN, Julia, Pascal, Delphi, Python, Pelican, VBA, Jinja, HTML, CSS, PHP, SQL, C-Shell, LaTeX, Beamer.
Library	NAG, Numerical Recipies, FFTW, dSFMT, PELICANS.
Software	FreeFem++, FEniCS, Matlab, Scilab, Maple, SAS, R, TensorFlow, Office.

Spoken languages

French	native.
English	fluent.

Research

Thematic of research

Analysis of PDEs :
Analysis of differential equations and partial differential equations. Existence and uniqueness of parabolic and hyperbolic equations. Allen-Cahn and Cahn-Hilliard equations. Gradient systems. α-Navier-Stokes model. Coupling Navier-Stokes/Cahn-Hilliard. Order of finite elements method of high degrees. Asymptotic behavior and analysis of stable and meta-stable states. Inverse numerical analysis. Order of convergence of numerical algorithms via infinite Kolmogorov equations. Kolmogorov equations for Piecewise Deterministic Markov Processes.

Stochastic processes :
Analysis of stochastic differential equations and stochastic partial differential equations. Integration by parts formulae for Gaussian measures on Hilbert spaces. Invariant measures of stochastic processes. Ergodicity. Harnack inequalities. Large deviations. Analysis of Piecewise Deterministic Markov Processes with boundary. Levy's processes. Unbiased estimators for rare events. Central Limit Theorem for estimators. Wright-Fisher model. Particles models for turbulence.

Finance and Insurance :
Simulation of Insurance products. Variable annuities of type "Guarantee Minimal Withdrawal Benefits" and assimilate products. Study and simulation of constant proportion portfolio insurance products. Static and semi-static replications. Gap options. Analysis of Heston, Vasicek and Hull-White and Bates models. Numerical methods: finite differences, Monte-Carlo method, tree algorithms, hybrid methods, Fourier-Cosine method, gaussian process regression, neural networks.

Numerical simulations :
Finite differences methods. Finite elements methods. Finite volumes for PDMP. Monte-Carlo simulations. Tree algorithms. Simulations of Levy's processes. FFT programming. Numerical simulations for hedging and replication. Numerical methods for PIDE, PDE, SPDE and SDE. ADI methods and splitting operators for Heston, Vasicek, Hull-White and Bates models. Development of finite elements library. Estimation of invariant measures. Statistical simulations of rare events. Numerical algorithms for stochastic PDE. Multi-level Monte-Carlo. Splitting algorithms. Simulation of particles in turbulent fluid. Machine learning and Neural Network.

Scientific projects

PREMIA : Library for the pricing of financial products developed by INRIA. MathRisk project leaded by Agnès Sulem. Member of the project since 2010. https://www.rocq.inria.fr/mathfi/Premia/
Development of numerical algorithms for PDEs : finite differences, finite volumes, ADI methods, Fourier-Cosine. Development of stochastic algorithms for PDEs and SDEs : Monte-Carlo methods, tree methods, hybrid methods, regression, neural network.

XLIFE++ : C++ library for finite elements calculations. Based on Mélina library (IRMAR and POems) and Montjoie (INRIA). (https://uma.ensta-paris.fr/soft/XLiFE++/)

PELICANS : Improvement of a C++ library for finite elements methods of a coupling of Navier-Stokes, Cahn-Hilliard and transport equations. (https://www.irsn.fr/EN/Research/Scientific-tools/Computer-codes/PELICANS/Pages/PELICANS-software-platform.aspx)
Interaction with physicists of soft matter for the development of a software to compute transport of surfactant species (project ANR HydroSurfDyn).

Teaching

École Nationale de la Statistique et de l'Administration Économique (ENSAE)	Introduction to stochastic processes Lecture of Éric Gautier **Teaching Assistant**, Bachelor's Degree, 12h	2009-...-2012
	Optimisation and Applications Lecture of Michel Grun-Rehomme **Teaching Assistant**, Bachelor's Degree, 12h	2011
	Introduction to Scilab (numerical software) **Teaching Assistant**, Bachelor's Degree, 12h	20011 et 2012
Université de Cergy-Pontoise	Introduction to C++ **Teacher**, Master's Degree, 18h	2011
École Supérieure d'Informatique, Électronique, Automatique (ESIEA)	Stochastic Processes **Teacher**, Bachelor's Degree, 18h	2012
Institut Polytechnique des Sciences Avancées (IPSA)	Stochastic Processes **Teacher**, Master's Degree, 18h	2012
Université de Paris-Est Marne-la-Vallée	Introduction to C++ **Teacher**, Master's Degree, 15h	2012
	Numerical Methods and Structured Products in actuarial science **Teacher**, Master's Degree, 15h	2015-...-2019
Université d'Évry	Structured Products in Finance and Insurance **Teacher**, Master's Degree, 14h	2013 et 2014
Central University of Finance and Economics (Pékin)	Numerical Methods in Finance **Teacher**, Master's Degree, 4h	2014
École Centrale Paris	Analysis (Lebesgue's theory) Probability (discrete, density, gaussian vectors) Partial Differential Equations **Teaching Assistant**, Bachelor's Degree, 27h	2011-...-2017
École Nationale des Ponts et Chaussées (ENPC)	Scientific Computations (finite elements, optimisation, conservation laws). Lecture of Alexandre Ern. **Teaching Assistant**, Bachelor's Degree, 27h	2013-...-2015

École Supérieure des Siences Commerciales d'Angers (ESSCA)	Inferential Statistics **Teacher**, Bachelor's Degree, 42h	2018 et 2019
École Nationale Supérieure de Techniques Avancées (ENSTA)	Introduction to Matlab (numerical software) **Teacher**, Bachelor's Degree, 21h	2011-...-2020
CentraleSupélec	Convergence, Integration, Probability, PDE **Teaching Assistant**, Bachelor's Degree, 24h	2018
	Convergence, Integration, Probability **Teacher**, Bachelor's Degree, 6h Full batch of 800 students (4 teachers share this lecture of 24h)	2019
	Partial Differential Equations **Teacher**, Bachelor's Degree, 6h Full batch of 800 students (4 teachers share this lecture of 24h)	2020
	Stochastic Partial Differential Equations **Teacher**, Master's Degree, 24h	2016-...-2020

Supervision of students and researchers

Post-doctoral researchers :

- Charles-Édouard Bréhier and Maxime Gazeau. 1 proceeding and 1 publication (ESAIM Proc. 2014 - Anal. Appl. Prob. 2016). During the summer school CEMRACS 2013.
- Andrea Molent. A one-year Post-doctoral position started in June 2018. Co-funding of Fédération de Mathématiques de CentraleSupélec and University of Udine in Italy. 2 publications in 2018. Invited by the Industrial Chaire BNP and the team FiQuant of CentraleSupélec in 2019. 1 publication.

PhD students :

- J. Doghman. Supervising of a PhD thesis started in October 2019 on convergence of numerical methods for stochastic PDE of α-Navier-Stokes.

- Collaboration - A. Mollent. 4 publications during his PhD from 2014 to 2017 (IME 2016 - JGPG 2016 - TEL 2018 - CMS 2018). Surpervisor : A. Zanette. University of Udine, Italy.
- Collaboration - D. Mercier. 1 publication : ESAIM Proc. in 2019. Supervising during summer school CEMRACS 2018. Surpervisors : M. Massot and A. Vié. Laboratory EM2C in CentraleSupélec.
- Collaboration - J. Llobell. 1 publication : ESAIM Proc. in 2019. Supervising during summer school CEMRACS 2018. Surpervisors : T. Goudon and S. Minjeaud. Laboratory Dieudonné in Nice. Team Inria COFFEE.

Master's degree students : Supervising of master internship.

- K. Rinaldy. 2012. Bifurcations dans les systèmes binaires avec la mobilité d'Onsager.
- D. Iampietro. 2013. Analyse et simulation de systèmes aléatoires en grande dimension.
- L. Tudela. 2014. Central Limit Theorem for Adaptive Multilevel Splitting Estimators in an Idealized Setting. 1 proceeding (MCQMC - 2016).
- M. Zhang. 2014. Closed-form solutions for Guaranteed Minimum Accumulation Benefits.
- A. Sitbon. 2015. Introduction aux équations aux dérivées partielles stochastiques. Existence et Unicité de solutions pour des équations linéaires ou bien posées.
- M. Du. 2016. Fourier-Cosine Expansion Method for GLWB.
- Y. Zhou. 2016. Quantitative analysis of model risk and method risk for equity-linked policies.
- A. Lanza. 2018. Méthode de directions implicites alternées pour les modèles d'Heston.
- D. Fourcade. 2019. Système de particules dans un fluide turbulent.
- A. Y. Kamri, N. Delisle, S. Kazdaghli. 2020. Projet long 1 an. Méthodes de deep learning pour le pricing en très hautes dimensions. Challenge Natixis.

School of Engineers : Supervising of students

A special course of three years to have immersion in a laboratory of research

Finished:

- Q. Peyras (2013) : Processus de Markov Déterministes par morceaux.
- C. Gontier (2014) : Processus de Markov Déterministes par morceaux.
- A. Jarret (2015) : Chaînes de Markov en biologie. Modèle de Wright-Fisher.
- E. Miri (2016) : Équations aux dérivées partielles stochastiques.

In progress:

- I. Ayadi (2017) : Processus de Lévy, simulations numériques et estimations.
- T. Sainrat (2018) : Résolution d'EDP en grandes dimensions par méthode de deep learning.
- K. Khaldi (2019) : Résolution par réseaux de neurones d'EDS rétrogrades.
- C. Jestin-Scanvion (2019) : Modélisation d'EDP en grandes dimensions par réseaux de neurones.

Administration and Collective Responsability

2017-2020: **Leader of research axes** "Analysis of PDEs" of Fédération de Mathématiques in CentraleSupélec (**FDM**).
2017-2020: **Communication manager**, and webmaster of Fédération de Mathématiques de CentraleSupélec. https://fd-math.pages.centralesupelec.fr/
2017-2020: **Member of Board of Directors** of the Scientific Society of Applied and Industrial Mathematics (**SMAI**). Member of IT Commission.
2016-2019: **Member of Studies Council** of CentraleSupélec.

2014-2018: **Member of Scientific Council** of the National Institute of Mathematical Sciences and their Interactions (**INSMI**) in CNRS. Member of Board of Directors as secretary.
2010-2018: **Member of Opération Postes** : Help to young researchers to obtain position.

Member of selection committees for the recruitment of lecturers.

- 2014 - position in 26^{th} section - University of Lille - Applied Mathematics, with priority in scientific computations, numerical analysis and PDEs.
- 2015 - position in 26^{th} section - École Centrale Paris - Mathematics with specific knowledge in probabilities and statistics.
- 2017 - position in 26^{th} section - École Centrale Lyon - In the field of partial differential equations with research activities in modeling, analysis, numerical analysis and/or scientific computation.
- 2017 - two positions in 26^{th} section - École Polytechnique - In the field of probabilities and PDEs, and statistics and data sciences.

Organisation of Workshops

January 2016 : **Journées franciliennes des doctorants en sciences mathématiques** organisées par la FMJH, la FSMP et le Labex Bézout (DIM RDM IDF) les 5 et 6 January 2016.
80 participants et 20 conférenciers.

June 2016 : **Organisateur d'un mini-symposium** dans "The final conference of the Thematic Cycle on Monte-Carlo Techniques" organisée par le **LabEx Louis Bachelier**. Sur le sujet des stress tests et des évènements rares, les 5, 6, 7 et 8 juillet 2016.
https://www.louisbachelier.org/evenement/the-final-conference-of-the-thematic-cycle-on-monte-carlo-techniques/
195 participants. 12 conférences plénières, 16 mini-symposiums.

November 2016 : **Journées franciliennes des doctorants en sciences mathématiques** organisées par la FMJH et la FSMP avec le soutien de la Région Ile-de-France les 14 et 15 November 2016.
100 participants et 20 conférenciers.

March 2019 : **Congrès Math.en.Jeans à CentraleSupélec** les 22, 23 et 24 March 2019.
https://www.mathenjeans.fr/congres2019/saclay
650 participants, 120 stands de présentation, 50 ateliers, 4 conférences plénières.

April 2019 : **Journée d'accueil des nouveaux entrants en mathématiques** à l'IHP sponsorisée par les sociétés savantes (SMAI, SMF, SFDS) et les instituts CNRS/INRIA/INRA.
http://postes.smai.emath.fr/apres/accueil/index2019.php
∼80 participants, tables rondes, témoignages, présentations d'organismes, de communautés, etc.

June 2020 : **Congrès Math.en.Jeans à CentraleSupélec** les 5 et 6 June.
https://www.mathenjeans.fr/congres2020/saclay
450 participants, 80 stands de présentation, 40 ateliers, 4 conférences plénières.

November 2020 : **Conférence internationale NASPDE** au CIRM les 5 et 6 November 2020.
https://conferences.cirm-math.fr/2408.html
50 participants, 9 conférences plénières.

Member of jury

Reviewer for the journals : Applied Mathematics Research eXpress, Applied Mathematics and Optimization, Applied Mathematics Research Express, BIT Numerical Mathematics, Computational Management Science, Discrete and Continuous Dynamical Systems - Series-A, EPJ Nuclear Sciences & Technologies, ESAIM: Mathematical Modelling and Numerical Analysis, IMA Journal of Numerical Analysis, Journal of Applied Mathematics and Computing , Journal of Mathematical Analysis and Applications, Mathematics and Computers in Simulation, Mathematical Methods in the Applied Sciences, Numerische Mathematik, Quantitative Finance, SIAM Journal on Financial Mathematics, SIAM Journal on Mathematical Analysis, SIAM Journal on Numerical Analysis, Stochastics: An International Journal Of Probability And Stochastic Processes.

PhD Thesis :

Reviewer :

- Guillaume Fenger - Analyse d'équations dispersives avec modulation stochastique.

Member of jury - Examiner :

- Romain Poncet - Méthodes numériques pour la simulation d'équations aux dérivées partielles stochastiques non-linéaires en condensation de Bose-Einstein sous la direction d'Anne De Bouard.
- Marc-Arthur N'Guessan - Space adaptive methods with error control based on adaptive multi resolution for the simulation of low-Mach reactive flows, sous la direction de Marc Massot et Christian Tenaud.

Reviewer of project : for the National Agency of Research (the French agency).

École Polytechnique & École Normale Supérieure : Jury for national examination (les écrits de la banque X-ENS - Filière MP, PC et Info - Épreuve Maths C). Examinateur pour les oraux de l'ENS Cachan et Rennes. 2015, 2016 et 2017.

ENSAE - CAPESA : Rédacteur du sujet de concours pour le CAPESA (Centre d'Appui pour les Écoles de Statistiques Africaines). Correcteur des écrits. Depuis 2013.

Agrégation : Correcteur de l'épreuve écrite d'analyse. Examinateur pour les oraux de l'agrégation de mathématiques pour les options Calcul Scientifique, Probabilités et Informatique. 2018-2020.

CentraleSupélec : Jury 2018-2019 de recrutement de CentraleSupélec pour les admissions parallèles (anciennement jury CASTING).

TFJM : Member of jury in 2015 of "tournoi français des jeunes mathématiciennes et mathématiciens". https://tfjm.org/ Le TFJM^2 est une compétition par équipe de 4 à 6 lycéens. Chaque équipe est accompagnée d'un ou deux encadrants, des professeurs de mathématiques, des doctorants ou encore d'anciens participants. Les élèves travaillent sur une série de problèmes mathématiques publiés en January. Il s'agit de problèmes difficiles qui touchent plusieurs domaines des mathématiques. Pendant les deux mois précédant la rencontre, les équipes travaillent avec leurs encadrants et cherchent des solutions à ces problèmes. Les équipes se rencontreront lors d'un week-end fin March. Pendant ce week-end, à deux reprises elles seront confrontées à un jury par poules de 3 ou 4 équipes. Le tournoi national et le tournoi régional se déroulent à l'École polytechnique, à l'ENSTA-Paristech, ou à l'École Centrale Paris.

Université du Val de Marne :
Jury du prix de l'université du Val de Marne qui récompense les thèses de qualité. Ces thèses peuvent avoir été soutenues dans différents domaines, bien plus largement que les mathématiques. 2016-2017-2018-2019.

Scientific projects - Grants

Porteur du projet ANR SIMALIN - 107 k€
SIMulations ALéatoires en dimension INfinie
URL: https://anr.fr/Projet-ANR-19-CE40-0016
GRANT_NUMBER: ANR-19-CE40-0016 Du 1er October 2019 jusqu'au 30 septembre 2023.

Membre du projet MAESTRO (porté par Marco Saitta) Equipe Projet Junior ISCD - 166 k€
MAterials for Energy through STochastic sampling and high peRformance cOmputing.
URL: https://iscd.sorbonne-universite.fr/research/sponsored-junior-teams/maestro-2/
Institut des Sciences du Calcul et des Données (ISCD) - Sorbonne Université
https://iscd.sorbonne-universite.fr/ Du 1er January 2020 jusqu'au 31 December 2021.

Membre associé du projet ANR (porté par Benjamin Brigaud) UpGeo - 690 k€.
Changement d'échelle et simulation des flux de chaleur pour améliorer l'efficacité des systèmes géothermiques profonds.
URL: https://anr.fr/Projet-ANR-19-CE05-0032
GRANT_NUMBER: ANR-19-CE05-0032-01 Du 1er January 2020 jusqu'au 31 December 2023.

Financement du LabEx LMH
Projet international pour une collaboration avec l'Université d'Udine - 3 k€
Recrutement d'un post-doc 30 k€ Du 1er June 2018 jusqu'au 31 mai 2019.

Membre de ReaDiNet, "International Research Network" (IRN CNRS)
Reaction-Diffusion Network in Mathematics and Biomedicine
URL: http://readinet.iecl.univ-lorraine.fr/index.html
Anciennement ReaDiLab (2007-2015) puis GDR International ReaDiNet (2015-2019).

Membre créateur du projet XLIFE++
De 2011 à 2014, financement par le "SIMPOSIUM European Project".
De 2015 à 2018, financement par "DGA/MRIS" (Direction Générale de l'Armement).
URL: https://uma.ensta-paris.fr/soft/XLiFE++/

Membre du projet ANR (porté par Jacopo Seiwert) HydroSurfDyn - 370 k€.
Coupling between HYDRODYNamics and SURFactant transport at interfaces: experimental and numerical challenges.
URL: https://app.dimensions.ai/details/grant/grant.4527771
GRANT_NUMBER: ANR-13-PDOC-0014 Du 1er January 2014 jusqu'au 30 June 2017.

List of publications

Reviews and Journals

[A1] Ludovic Goudenège. Stochastic Cahn-Hilliard equation with singular nonlinearity and reflection. *Sto. Proc. Appl.*, 119(10):3516–3548, 2009.

[A2] Arnaud Debussche and Ludovic Goudenège. Stochastic Cahn-Hilliard equation with double singular nonlinearities and two reflections. *SIAM J. Math. Anal.*, 43(3):1473–1494, 2011.

[A3] Ludovic Goudenège, Daniel Martin, and Grégory Vial. High order finite element calculations for the Cahn-Hilliard equation. *J. Sci. Comput.*, 52(2):294–321, 2012.

[A4] Ludovic Goudenège, Aymeric Kalife, and Saad Mouti. Managing gap risks in iCPPI for life insurance companies: a risk/return/cost analysis. *Insurance Markets and Companies: Analyses and Actuarial Computations*, 5(2), 2014.

[A5] Ludovic Goudenège. Numerical methods for piecewise deterministic Markov processes with boundary. *ESAIM*, 45:338–348, September 2014.

[A6] Ludovic Goudenège and Luigi Manca. Asymptotic properties of stochastic Cahn-Hilliard equation with singular nonlinearity and degenerate noise. *Sto. Proc. Appl.*, 125(10):3785–3800, October 2015.

[A7] Ludovic Goudenège and Pierre-André Zitt. A Wright-Fisher model with indirect selection. *Journal of Mathematical Biology*, 71(6):1411–1450, December 2015.

[A8] Ludovic Goudenège, Andrea Molent, and Antonino Zanette. Pricing and Hedging GLWB in the Heston and in the Black-Scholes with Stochastic Interest Rate Models. *Insurance: Mathematics and Economics*, 70:38–57, September 2016.

[A9] Charles-Edouard Bréhier, Maxime Gazeau, Ludovic Goudenège, Mathias Rousset, and Tony Lelièvre. Unbiasedness of some generalized Adaptive Multilevel Splitting algorithms. *Ann. Appl. Probab.*, 26(6):3559–3601, 2016.

[A10] Ludovic Goudenège, Andrea Molent, and Antonino Zanette. Variable Annuities: New Solution to Long-Term Investment Problem. *Journal Global Policy and Governance*, 5(2):35–49, December 2016.

[A11] Christiane Cocozza-Thivent, Robert Eymard, Ludovic Goudenège and Michel Roussignol. Numerical methods for piecewise deterministic Markov processes with boundary. *IMA J. Numer. Anal.*, 37(1):170–208, 2017.

[A12] Ludovic Goudenège, Andrea Molent, Xiao Wei and Antonino Zanette. Fourier-cosine method for pricing and hedging insurance derivatives. *Theoretical Economics Letters*, 8(3):282–291, February 2018.

[A13] Ludovic Goudenège, Andrea Molent and Antonino Zanette. Pricing and hedging GMWB in the Heston and in the Black-Scholes with stochastic interest rate models. *Computational Management Science*, 16:217–248, February 2019.

[A14] Ludovic Goudenège, Adam Larat, Julie Llobell, Marc Massot, David Mercier, Olivier Thomine and Aymeric Vié. Statistical and probabilistic modeling of a cloud of particles coupled with a turbulent fluid. ESAIM ProcS, 65 (2019) 401–424. CEMRACS Proceedings.

[A15] Charles-Edouard Bréhier and Ludovic Goudenège. Analysis of some splitting schemes for the stochastic Allen-Cahn equation. *Discrete & Continuous Dynamical Systems - B*, 2019, 24(8):4169-4190.

[A16] Ludovic Goudenège, Andrea Molent and Antonino Zanette. Computing Credit Valuation Adjustment solving coupled PIDEs in the Bates model. *Computational Management Science*, Springer, to appear, April 2020.

[A17] Ludovic Goudenège and Luigi Manca. Stochastic phase field α-Navier-Stokes vesicle-fluid interaction model. *arXiv preprint arXiv:1901.01335*, JMAA, to appear, 2020.

[A18] Charles-Edouard Bréhier and Ludovic Goudenège. Weak convergence rates of splitting schemes for the stochastic Allen-Cahn equation. *Bit Numerical Mathematics*, 2019. DOI: 10.1007/s10543-019-00788-x

[A19] Ludovic Goudenège, Andrea Molent and Antonino Zanette. Machine Learning for Pricing American Options in High-Dimensional Markovian and non-Markovian models. *Quantitative Finance*, 20(4):573–591, 2020.

[A20] Ludovic Goudenège and Bin Xie. Ergodicity of stochastic Cahn-Hilliard equations with logarithmic potentials driven by degenerate or nondegenerate noises. *Journal of Differential Equations*, accepted, 2020.

Communications in congress, workshop, symposium, proceedings

[C1] Ludovic Goudenège, Robert Eymard, Christiane Cocozza-Thivent and Michel Roussignol. Numerical methods for piecewise deterministic Markov processes with boundary. *Congrès SMAI*, 2013.

[C2] Charles-Edouard Bréhier, Maxime Gazeau, Ludovic Goudenège and Mathias Rousset. Analysis and simulation of rare events for SPDE. *ESAIM Proceedings*, January 2014.

[C3] Charles-Edouard Bréhier, Ludovic Goudenège and Loïc Tudela. Central Limit Theorem for Adaptive Multilevel Splitting Estimators in an Idealized Setting. *Monte Carlo and Quasi-Monte Carlo Methods. Springer Proceedings in Mathematics & Statistics*, 163:245–260, June 2016.

Book, handout and works

[B1] [PhD-Thesis] Ludovic Goudenège. *Some results about the stochastic and deterministic Cahn-Hilliard equation.* École Normale Supérieure de Cachan - Antenne de Bretagne, November 2009.

[B2] [Handout] Ludovic Goudenège, Mathieu Leroy-Lerêtre and Grégory Vial. *Handout for practical courses in LaTeX.* École Normale Supérieure de Cachan - Antenne de Bretagne, March 2010.

[B3] [Handout] Ludovic Goudenège. *Introduction to stochastic differential equations and stochastic partial differential equations.* Handout of lecture given at CentraleSupélec. 2016.

[B4] [Handout] Ludovic Goudenège. *Numerical Methods and Structured Products in Actuarial Science.* Handout of lecture given at University Paris-Est - Marne-la-Vallée. 2018.

[B5] [Book](Chapter on numerical and theoretical results for finite volumes) Christiane Cocozza-Thivent and Ludovic Goudenège. *Markov renewal processes Piecewise deterministic Markov processes.* French version available on the Internet. 2014. English version submitted for publication. 2018.

[B6] [Handout] Ludovic Goudenège and Adam Larat. *Partial and Stochastic Differential Equations: Theoretical and Numerical Aspects.* Handout of lecture given at IHES. 2014.

[B7] [HDR-Thesis] Ludovic Goudenège. *Numerical algorithms for stochastic problems.* Diploma of University Paris-Sud - University Paris-Saclay. 2018

Softwares

[L1] FORTRAN library of finite elements MELINA, 2006-2010.

[L2] C++ library of finite elements XLIFE++, 2012-2016.

[L3] PREMIA software of MathRisk project at Inria, 2010-2020.

Preprints

[P1] Charles-Edouard Bréhier, Maxime Gazeau, Ludovic Goudenège, Tony Lelièvre, and Matthias Rousset. Unbiasedness of some generalized adaptive multilevel splitting algorithms. *arXiv preprint arXiv:1505.02674*, 2015. Extended version of the published one in Annals of Applied Probability.

[P2] Ludovic Goudenège, Andrea Molent, and Antonino Zanette. The Impact of Taxation on GMWB Contract in a Stochastic Interest Rates Framework. *arXiv preprint arXiv:1901.11296* , 2019.

[P3] Ludovic Goudenège, Andrea Molent, and Antonino Zanette. Gaussian Process Regression for Pricing Variable Annuities with Stochastic Volatility and Interest Rate. *arXiv preprint arXiv:1903.00369*, 2019.

[P4] Ludovic Goudenège, Andrea Molent, and Antonino Zanette. Variance Reduction Applied to Machine Learning for Pricing Bermudan/American Options in High Dimension *arXiv preprint arXiv:1903.11275*, 2019.

Communications and conferences as invited speaker

[E1] Stochastic Partial Differential Equations (SPDEs). Isaac Newton Institute. Cambridge. Angleterre. March/April 2010. https://www.newton.ac.uk/event/spdw02

[E2] Stochastic Partial Differential Equations (SPDEs) : Approximation, Asymptotics and Computation. Isaac Newton Institute. Cambridge. Angleterre. June/July 2010. https://www.newton.ac.uk/event/spdw04

[E3] 9th international symposium at University of Tokyo, organized by T. Funaki, H. Osada, and Y. Otobe (Satellite meeting of SPA2010). Japon. September 2010.

[E4] Workshop ICMS : Dissipative PDEs in Bounded and Unbounded Domains and Related Attractors. Edinburg. écosse. September 2010.

[E5] International Conference on Stochastic Analysis and Applied Probability. SAAP. Hammamet. Tunisie. October 2010. http://www.saap2010.org/

[E6] Maximum principles, fractional diffusion and differential or integral inequalities for deterministic and stochastic PDEs. Université d'évry. January 2011. https://www.maths.univ-evry.fr/web/MaxPrinciple.html

[E7] Nonlinear Wave and Dispersive equations. Kyoto. Japon. February 2011. http://www.math.is.tohoku.ac.jp/~fukuizumi/110214.pdf

[E8] Foundations of Computational Mathematics. FoCM. Budapest. Hongrie. July 2011. http://www.damtp.cam.ac.uk/user/na/FoCM11/

[E9] Numerical Analysis of Stochastic Partial Differential Equations. NASPDE. Rennes. France. September 2013. https://www.lebesgue.fr/content/sem2013-NASPDE

[E10] International Conference on Applied Mathematics. ICAM. Heraklion. Grèce. Septembre 2013. http://www.acmac.uoc.gr/ICAM2013/index.php

[E11] The 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications. Madrid. Espagne. July 2014. http://www.aimsciences.org/conferences/2014/

[E12] 19th International Congress on Insurance: Mathematics and Economics. IME. Liverpool. Angleterre. June 2015. https://www.liverpool.ac.uk/ime2015

[E13] The International Conference on Approximation Methods and Numerical Modelling in Environment and Natural Resources. MAMERN. Pau. France. June 2015. https://mamern15.sciencesconf.org/

[E14] BIRS Workshop. Free-Energy Calculations. A Mathematical Perspective. Oaxaca. Mexique. July 2015. https://www.birs.ca/events/2015/5-day-workshops/15w5128

[E15] Numerical Analysis of Stochastic Partial Differential Equations. NASPDE. Sophia Antipolis . France. Septembre 2015. https://naspde2015.inria.fr/

[E16] AMS Sectional Meeting Program. Fall Southeastern Sectional Meeting. University de Memphis. Memphis. états-Unis. October 2015. http://www.ams.org/meetings/sectional/2226_program.html

[E17] Stochastic PDE's, Large Scale Interacting Systems and Applications to Biology. Orsay. France. March 2016. https://www.math.u-psud.fr/~gtanl/readinet/eventSPDE.html

[E18] The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications. Orlando. états-Unis. July 2016. http://www.aimsciences.org/conferences/2016/

[E19] Numerics for Stochastic Partial Differential Equations and their Applications. Special Semester on Computational Methods in Science and Engineering. Linz. Autriche. December 2016. https://www.ricam.oeaw.ac.at/specsem/specsem2016/

[E20] International Conference in Analysis en hommage au Professeur Robert Janin. ICA. Poitiers. France. March 2017.

[E21] Numerical Analysis of Stochastic Partial Differential Equations. NASPDE. Linz. Autriche. June 2017. http://www.jku.at/stochastik/content/e141094/e318674

[E22] Conference of Computational Management Science. CMS . Trondheim. Norvège. May 2018. https://www.ntnu.edu/cms2018/

[E23] The 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications. Taipei. Taiwan. July 2018. http://aimsciences.org/conferences/2018/

[E24] International Conference on Scientific Computation and Differential Equations, University of Innsbruck, Autriche, July 2019. https://scicade2019.uibk.ac.at/

[E25] Advances in Financial Mathematics 2020. Paris. France. January 2020. https://fin-risks2020.sciencesconf.org/